Identity and Social Transformation in the

Prehispanic Cibola World: A.D. 1150-1325

by

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ABSTRACT

This dissertation explores the interrelationships between periods of rapid social change and regional-scale social identities. Using archaeological data from the Cibola region of the U.S. Southwest, I examine changes in the nature and scale of social identification across a period of demographic and social upheaval (A.D. 1150-1325) marked by a shift from dispersed hamlets, to clustered villages, and eventually, to a small number of large nucleated towns. This transformation in settlement organization entailed a fundamental reconfiguration of the relationships among households and communities across an area of over 45,000 km^2.

This study draws on contemporary social theory focused on political mobilization and social movements to investigate how changes in the process of social identification can influence the potential for such widespread and rapid transformations. This framework suggests that social identification can be divided into two primary modes; relational identification based on networks of interaction among individuals, and categorical identification based on active expressions of affiliation with social roles or groups to which one can belong. Importantly, trajectories of social transformations are closely tied to the interrelationships between these two modes of identification.

This study has three components: Social transformation, indicated by rapid demographic and settlement transitions, is documented through settlement studies drawing on a massive, regional database including over 1,500 sites. Relational identities, indicated by networks of interaction, are documented through ceramic compositional analyses of over 2,100 potsherds, technological characterizations of over 2,000 utilitarian ceramic vessels, and the distributions of different types of domestic architectural features across the region. Categorical identities are documented through stylistic comparisons of a large sample of polychrome ceramic vessels and characterizations of public architectural spaces.

Contrary to assumptions underlying traditional approaches to social identity in archaeology, this study demonstrates that relational and categorical identities are not necessarily coterminous. Importantly, however, the strongest patterns of relational connections prior to the period of social transformation in the Cibola region largely predict the scale and structure of changes associated with that transformation. This suggests that the social transformation in the Cibola region, despite occurring in a non-state setting, was governed by similar dynamics to well-documented contemporary examples.

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TABLE OF CONTENTS

CHAPTER Page

CHAPTER Page

CHAPTER Page

CHAPTER Page

CHAPTER Page

LIST OF TABLES

Table | Page

Table Page

Table Page

Table Page

LIST OF FIGURES

Figure Page

Figure | Page

Figure Page

Figure Page

Figure Page

Figure Page

Figure Page

Figure Page

Figure Page

Figure Page

Chapter 1:

INTRODUCTION

This research is concerned with the interrelationships between periods of rapid social change and regional-scale, collective social identities. Using archaeological data from the Cibola region of the North American Southwest (ca. A.D. 1150-1325), I explore changes in the nature and scale of social identities across a major interval of demographic and social upheaval. The period considered here was marked by a well-documented shift from relatively dispersed hamlets, to clustered villages, and eventually, to a small number of large nucleated towns (Huntley and Kintigh 2004; Kintigh 1985a, 1996, 2007; Kintigh et al. 2004; Lekson 1996). The creation of larger settlements simultaneously concentrated populations in smaller portions of the region and created vast empty expanses (Peeples and Schachner 2008; Wilcox et al. 2007). These broad scale changes in settlement organization and location entailed a fundamental reconfiguration of the relationships among households and communities across the Cibola region and beyond. Importantly, the most jarring of these changes likely occurred within the span of a single generation. In this study, I draw on a large body of contemporary social theory focused on social movements and political mobilization to investigate how changes implicated in the *process* of social identification can, and do, influence the potential for and trajectories of such widespread and rapid social transformations.

Social Identity and Social Transformation

Despite considerable variation in specific definitions (see Brubaker and Cooper 2000), most contemporary researchers use the terms "identity" or "identification" to broadly refer to the ways that individuals relate themselves and others to larger groups based on perceived similarities and differences that are socially defined as important (e.g., Barth 1969:10; Calhoun 1995:193-197; Díaz-Andreu et al. 2005; Emberling 1997; Jenkins 2004:1-8; Jones 1997). Such similarities and differences may be discerned along a number of lines including, for example, gender, class, age, or ethnicity. Thus, individuals take on multiple identities simultaneously and at multiple social scales. From this perspective identities never really exist as things, but rather are in a constant state of negotiation, mediated through the interactions of people. At the same time, some social identities may maintain strong *perceptions* of permanence which can structure the actions of individuals through time (see Bentley 1987:24-27; Jenkins 2000; Jones 1997:84-105). The tensions between fluidity and permanence are thus palpable.

This study is specifically focused on the process of social identification among large groups of people at geographic and demographic scales well above the most common units of co-residence (i.e., scales larger than households, villages, or communities). Such large scales are typically defined as “regions” or “culture areas” in the archaeological literature, which are large areas characterized by some material homogeneity, usually assumed to represent a degree of shared cultural identity (Duff 2000; Kantner 2008). Historically, explorations of identity at regional scales have been fundamentally tied to anthropological perspectives on ethnicity (see Jones 1997:15-29; Shennan 1989; Veit 1989). Indeed, the terms ethnicity and identity have often been used interchangeably in regional scale archaeological research. The equation of patterns of material similarity with traditional anthropological models of ethnic identity presupposes a broad set of assumptions regarding political organization, the discreteness of social boundaries, and the nature of relationships with similar groups that have increasingly been called into question, particularly in non-state societies (see Comaroff and Comaroff 1992:49-69; Jones 1997; MacEachern 1998; Neitzel 2000; Smith 1986). In this dissertation, I instead argue that parsing the concept of social identity along different dimensions of variation may provide new insights into regional scales of identification that have not traditionally been the subject of anthropological research.

The theoretical perspective that I employ in this study builds on the work of historical sociologists and political scientists studying the relationships among collective action, social movements, and the formation of social identities involving large groups of people (e.g., Calhoun 1995, 1997; Diani 2003; Emirbayer and Goodwin 1994; Emirbayer 1997; Nexon 2009; Pachucki and Breiger 2010; Polleta an Jasper 2001; Somers 1994; Stokke and Tjomsland 1996; Tilly 1978, 2001, 2002, 2004, 2005; White 1992, 2008a, 2008b). The framework used here generally falls within the realm of what Mische (2011) has recently referred to as the "New York School" of relational sociology. Researchers working from this general perspective argue that the process of collective social identification generally takes place in two primary modes; relational identification and categorical identification. *Relational identification* refers to a process in which individuals identify with larger collectives, often informally, based on networks of interactions or relationships, such as exchange or kin ties. In contrast, c*ategorical identification* refers to a process through which individuals identify with more formal units such as political organizations, religions, states, or genders, based on perceived similarities with others in those groups. Categorical identities, unlike their relational counterparts, can be defined without reference to direct interaction and, thus, can include far greater numbers of individuals (Calhoun 1994:26).

Proponents of this relational/categorical approach argue that these distinct modes of social identification have too often been conflated (see Somers 1994; Tilly 2001), and that an explicit consideration of the interplay between relations and categories is essential for understanding how social transformations originate and spread (Somers and Gibson 1995:64-69; Nexon 2009; Stokke and Tjomsland 1996:27-31; Tilly 1978; White 2008a). For example, comparative studies of contemporary and recent historical instances of widespread social change suggest that mobilization and collective action are most effective and transformative among groups that are highly connected in terms of both relational and categorical identities (Stokke and Tjomsland 1996:29; Tilly 1978:63). Thus, the degree to which a group of individuals is defined by both strong relational networks and a high degree of categorical homogeneity provides a measure of the potential for larger scale collective action and the kinds of social transformations that are the focus of this study (Tilly 1978:62-69). By applying insights from this contemporary theoretical model to the prehispanic Cibola region case, my research provides new ways for thinking about the relationship between identity and social transformation in the Southwest, and a template for conducting similar comparative archaeological analyses focused on other times and places.

The Case Study

This study focuses on the greater Cibola region of the North American Southwest during the Pueblo III (A.D. 1150-1275) and the early Pueblo IV (A.D. 1275-1325) periods (Figure 1.1). This large region, which spans a territory on either side of what is now the Arizona/New Mexico border, has been the location of a number of long-term intensive excavation and survey projects for over a hundred years; including the first formal archaeological expedition in the Southwest (the Hemenway Southwestern Archaeological Expedition beginning in the 1880s; see Cushing 1890). From the very beginning, research in the study area has been regional in scope and directed towards issues of settlement, historical continuity, and social identity (e.g., Cushing 1890, 1896; Spier 1917, 1918, 1919). Archaeologists working in the Cibola region are also blessed with well-defined ceramic and dendrochronological sequences, which provide excellent chronological resolution for considerations of the pace of changes in settlement and material culture through time.

The period considered in this study hinges around a well-documented interval of regional scale social transformation occurring across the transition

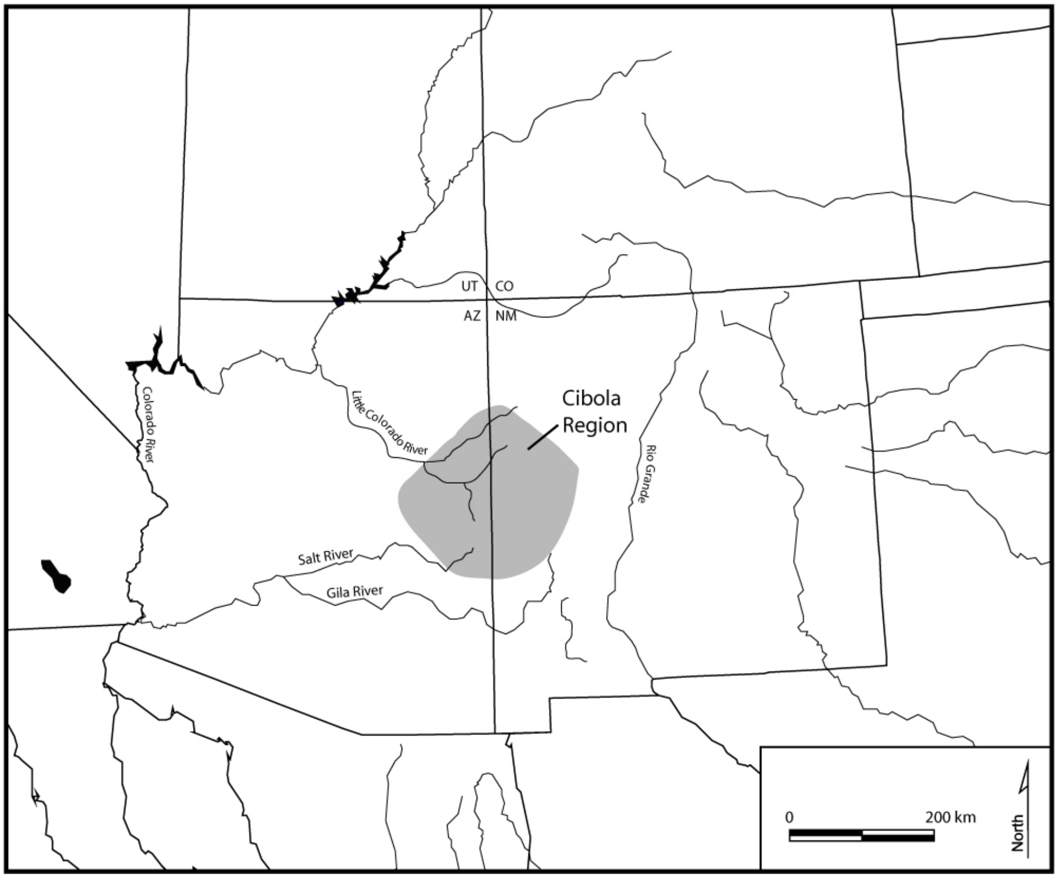


Figure 1.1. Map of the U.S. Southwest showing the location of the greater Cibola region.

from the Pueblo III to the Pueblo IV periods (ca. A.D. 1275). During the last quarter of the thirteenth century, the inhabitants of the greater Cibola region rapidly abandoned thousands of small pueblos and constructed a small number of massive, nucleated structures, the largest of which may have housed nearly a thousand residents. This settlement reorganization was associated with major changes in the technology and styles of material culture as well as the structure and organization of public architectural spaces, which further suggest changes in the nature and scale of social interaction and identification at this time.

The Pueblo III to Pueblo IV transition in the Cibola region was also embedded within a broader pattern of aggregation, nucleation, reorganization of public spaces, and massive scale population movement characterizing much of the U.S. Southwest during the thirteenth and fourteenth centuries (Adams 1991; Adams and Duff 2004). Importantly, the inhabitants of the greater Cibola region were arguably among the first to adopt new forms of social organization and settlement associated with the Pueblo IV period across this broader region. At least within the central portion of the Cibola region, this transition appears to have largely been a consolidation of the existing inhabitants of the region, not involving substantial immigration from outside of the greater Cibola region (Kintigh 1996; Kintigh et al. 2004). Thus, the Cibola region study area allows for a consideration of the organization and trajectory of a major social transformation largely separate from the consequences of long-distance population movement, which has been a primary focus of research in most other portions of the Southwest for this time period. In this study, I argue that the rapid and wide-spread changes characterizing the late thirteenth century in the Cibola region can be gainfully examined in relation to models of social transformation typically applied to contemporary or recent historic settings.

Chapter 2:

SOCIAL IDENTITY, COLLECTIVE ACTION, AND THE ORGANIZATION OF SOCIAL TRANSFORMATIONS

This chapter provides a detailed overview of the theoretical framework that forms the basis of this study. This discussion is divided into three sections. First, to provide a necessary background, I briefly describe traditional perspectives on social identification and ethnicity within anthropology and archaeology. I concentrate in particular on how these traditional models of social identification have been linked to explanations for social change at regional scales. I then provide an overview of several key concepts and terms derived from a body of contemporary social theory focused on social identity and widespread collective action which has not previously been applied to archaeological research. I argue that this model has the potential to offer new insights into the relationship between identity and social transformations in the Cibola region and beyond. Finally, I conclude this chapter by describing the methods and analyses used to operationalize the theoretical framework considered here through archaeological data.

Traditional Perspectives on Social Identity

Archaeologists have long been interested in exploring the nature and development of social groups in the prehistoric past, but the theoretical and methodological tools employed in such studies have changed dramatically over the last century. Early archaeological studies of social identity, beginning in the late nineteenth and early twentieth centuries, used the distributions of material culture to define the discrete territories of peoples. Often, the goal was to relate archaeological patterns to contemporary national or ethnic populations (see Veit 1989; Jones 1997:1-14; Meinander 1981; e.g., Fewkes 1891). Patterns in the distributions of pottery, lithics, house forms, or other objects provided the basis for delineating archaeological culture areas (or *Kulturkreis*) which were interpreted as the territories of bounded populations sharing a common culture, language, and identity (Childe 1929; Gladwin and Gladwin 1934; Kossina 1911:3; Kroeber 1939:2). Most archaeologists interpreted such archaeological cultures as past manifestations of contemporary cultures or ethnic groups. Thus, where patterns of material similarity were relatively consistent through time, it was assumed that there was a high degree of ethnic continuity (Jones 1997:16-17; Trigger 1989:163-167).

Ethnicity, as most contemporary researchers would define it, is one particular kind of collective social identity, based on a sense of shared culture, common history, and/or descent that is most often activated in contexts of interaction among groups of socially defined difference (Barth 1969; Cohen 1978; Jenkins 2000, 2004; Jones 1996, 1997; Kaufman 2004). Ethnicity is not the only basis for collective social identification among large groups of people (for example see Calhoun 1997; Comaroff and Comaroff 1992; Ekeh 1990; Emberling 1997:304-306; Pohl 2004), but it has been by far the most pervasive in the archaeological literature for more than 100 years (Curta 2007; Jones 1997; Shennan 1989; Stark and Chance 2008). Indeed, the terms ethnicity and identity have often been used interchangeably. In the following discussion, I provide a brief historical overview of changing perspectives on and uses of the concept of ethnicity and other closely related collective social identities in archaeology and anthropology. Although ethnic identity is not the specific focus of the current study, many of the concepts, debates, and methods that are described are relevant to the theoretical perspective which forms the basis of this study.

The focus on bounded ethnic groups in early archaeological studies of identity draws from broader trends in anthropological research where individual ethnic populations (i.e., The Nuer, The Yanamamo, The Zuni, etc.) were long considered the proper units of study, even in multi-ethnic settings (see Lewis 1991; Veit 1989). Throughout most of the early twentieth century, ethnicity was seen by most anthropologists as a fundamental property of both individuals and social groups, understood to be based on a deep psychological and emotional sense of shared heritage that varied little through time (Geertz 1963; Shils 1957; see Jones 1997:24, 65-72). This view is sometimes called the primordialist or essentialist perspective on ethnicity. Relying on these relatively static concepts of collective identities, archaeologists most often interpreted abrupt and widespread changes in material culture as the products of external forces such as migration, diffusion, or invasion rather than internal social processes (see Shennan 1989). Eric Wolf (1982:6) calls this the "billiard ball" model of social change in which discrete and well-bounded groups of people, each characterized by a common culture, language, and identity, are seen as continually bumping up against each other on a global scale while somehow maintaining their internal coherence.

By the 1960s, such static models of social identity increasingly came under attack on multiple fronts. First, through influential work by several anthropologists and sociologists including Barth (1969), Moerman (1967), and Narroll (1964), a consensus began to emerge that ethnicity and other similar collective social identities are not unchanging, primordial properties of groups, but rather are situational constructs used by individuals as a means to bind people together based on common interests and, often, to mobilize them towards common goals (see also Cohen 1974). From this perspective, social identities are not simply attributes of individuals but are instead created and maintained through interactions. This view is known as the instrumentalist or constructivist perspective on ethnicity. Beginning about the same time as these instrumentalist critiques of ethnicity, many archaeologists also began to question the often assumed relationships between patterns in material culture and ethnic or cultural identity in general. Early critics of cultural historical approaches to archaeology such as Binford (1962, 1965; see also Clarke 1968) argued that variation in material culture could relate to a number of factors other than culture or ethnicity including the intended function of objects, material availability, or the distribution of activities across space and time (cf., Bordes 1973). Due in large part to the shift in focus in archaeology towards systematics and general processes during the 1960s, studies of identity waned as many saw such efforts as the descriptive project of the old guard (Jones 1997:5-6).

As is often the case with theoretical debates, after swinging between two seemingly dichotomous extremes (primordialist vs. instrumentalist perspectives) the pendulum eventually began to settle somewhere in the middle. The recognition of the fluid and situational nature of social identities by instrumentalist scholars was an important step forward, but this perspective did not address the deep attachments of individuals to historically persistent social identities recognized by the primordialist scholars. The question that remained then is, how can social identity be, at once, a situational construct and have the durable qualities that allow individuals to recognize similarity and difference across generations? By the 1980s, a number of researchers made headway towards addressing this question by bridging the key insights of both the primordial and instrumental perspectives (e.g., Bentley 1987; Geary 1983; Jenkins 2000, 2004; Jones 1997; McKay 1982; Smith 1981, 1984). In one influential example, Bentley (1987) attempted to address the problems associated with traditional concepts of ethnicity and other collective identities with reference to Bourdieu's (1977) theory of practice. Bentley argued that Bourdieu's concept of *habitus*, defined as habitual dispositions that both constitute and are constituted by the actions of individuals, provides the necessary linking argument between the situational and durable qualities of identity. Bentley interprets ethnic groups as social units that are mobilized around common experiences that tend to generate similar *habitus* among individuals (1987:27-29). From this perspective, ethnic identification is situational in that it is driven by the specific practices of individuals. At the same time, however, similar habitual experiences tend to reproduce similar practices among individuals giving ethnic identity an historical quality.

Drawing on these new theoretical advances, in particular practice-based approaches to identity, studies of social identification at regional scales once again began to regain popularity in archaeology in the 1980s (see Jones 1997; Pruecel 2005; Shennan 1989). Stone (2003; see also Lyons and Clark 2008) argues that these more recent studies of ethnicity and social identity fall into two general approaches. The first approach, which she calls the interactionist approach, sees ethnic and other kinds of social boundaries as outgrowths of social interaction between groups socially defined as distinct (e.g., Cohen 1978; Duff 2002; Emberling 1997). From this perspective, ethnicity is a politically and socially negotiated identity that cannot be sustained outside of inter-ethnic relations. The second approach, which Stone (2003) calls the enculturationist approach, focuses on cultural aspects of specific ethnic or cultural groups rather than the interactions between them (Clark 2001; Dietler and Herbich 1998; Jones 1997; Shennan 1989; Stark et al. 1998). Proponents of this approach argue that ethnic identity is built out of shared notions of habitual practice (i.e., *habitus*) learned through the process of enculturation. Although both positions are quite complex, in general, interactionist perspectives are focused on identifying the differences between groups whereas enculturationist perspectives are focused on identifying the similarities within groups.

The divergent approaches toward ethnicity within archaeology characterized by Stone (2003) have fundamentally influenced the kinds of analyses that have been directed towards studies of social identity in general (Lyons and Clark 2008). Interactionist scholars have largely focused on evidence for interaction among bounded groups, particularly in the form of exchange, as the basis of ethnicity and other kinds of collective social identities (i.e., tribal, cultural, etc.). Working within this perspective, researchers most often use artifact distributions, stylistic analysis, or compositional data to infer the directionality of exchanges and the establishment, maintenance, or dissolution of social boundaries through time (e.g., Asouti 2006; Braun and Plog 1982; Duff 2002; Emberling 1997:319-325; Plog 1980, 1983; Upham 1982). This approach usually entails an active definition of stylistic variation in material culture (e.g., Plog 1980; Wiessner 1983, 1984; Wobst 1977; Wyckoff 1990; see also Hegmon 1992; Lyons and Clark 2008) in that stylistic differences are seen as active and conscious efforts at communicating social difference and marking social boundaries (e.g., Braun and Plog 1982:512-513; Duff 2002:187-192; Wells 1998).

Conversely, scholars working from the enculturationist perspective make a distinction between the kinds of boundary marking and purposeful ethnic signaling entailed in the interactionist perspective and enculturation, which is seen as a largely unconscious process of social learning. Enculturationist studies are most often focused on identifying groups of people characterized by common learning frameworks, particularly in terms of the production of objects, which may reflect frequent interaction and shared *habitus* or enculturative backgrounds (e.g., Clark 2001, 2004; Dietler and Herbich 1998; Lyons 2003; Stark et al. 1995). Although the relationships between material culture, identity, social learning, and interaction are complex (see Croes 1989; Dietler and Herbich 1989, 1998; Fennell 2000; Gosselain 1998, 2000; Hegmon 1998; Herbich 1987; Hodder 1982;

Lechtman 1977; Lemonnier 1986; Jones 1997; MacEacheren 1998; Wright 2005), a number of recent archaeological and ethnoarchaeological studies suggest that similarities in stylistic attributes of material culture that are of low physical or contextual visibility (e.g., subtle differences in ceramic forming techniques, interior domestic architecture, etc.) are infrequently imitated or used as active expressions of social identity (see Carr 1995; Clark 2001). From this, enculturationist scholars argue that commonalities in low visibility attributes of material culture or spaces, often termed technological aspects of style, suggest shared learning frameworks and common enculturative backgrounds among producers.

The enculturationist approach does not preclude the possibility of active expressions of identity through material culture, but rather suggests that high visibility objects, attributes, or spaces are more likely to be used for active and conscious efforts at signaling similarity and difference than less visible ones (Clark 2001:6-22). Groups of people characterized by common enculturative backgrounds do not necessarily constitute an ethnic group, but shared culture may provide the raw material from which ethnicities are built (see Dietler and Herbich 1998). The enculturationist approach has most frequently been used to identify groups characterized by divergent learning frameworks, suggesting distinct enculturative backgrounds, especially in contexts characterized by immigration and the co-residence of multiple social groups (e.g., Clark 2001; Stark 2006).

Although the interactionist and enculturationist approaches to social identity have provided useful insights, both also have limitations for explorations of the process of social identification and social change at the broad geographic and demographic scales that are the focus of this study. For example, studies of interaction focus on the boundaries between ethnic and other social groups, but do not necessarily address the nature of social identification outside of contexts of direct interaction where such identities may be less salient. Studies of enculturation focus on identifying groups with different enculturative backgrounds, but are most frequently applied to contexts where multiple social groups characterized by sufficiently different material cultural traditions closely interact. Although the degree to which social divisions defined through either approach are explicitly treated as ethnic or cultural distinctions varies among researchers, both approaches are fundamentally based on the premise that discrete and encompassing social groups, representing the scale at which interactions were concentrated and at which identities were expressed, always exist (see discussion in Hegmon 1998:271-273). In other words, the question is typically not whether large-scale, bounded social groups were important in a particular context, but rather at what spatial and social scales such groups or boundaries were defined. Although efforts at combining aspects of both the interactionist and enculturationist approaches have proven profitable (e.g., Burmeister 2000; Eckert 2008; Jones 1997; Lyons and Clark 2008; Parkinson 2006; Stone 2003), these models of the process of social identification, heavily influenced by contemporary anthropological perspectives on ethnicity, may not be appropriate for considerations of large-scale collective social identities that are not necessarily ethnic in nature.

Alternative Perspectives on Social Identity, Collective Action, and Social Transformations

Researchers studying the trajectories and development of contemporary and historical social movements or other instances of sustained collective action within sociology and political science have developed alternative theoretical perspectives for characterizing the creation and maintenance of social identities at large social scales. Although these perspectives have been informed, in part, by anthropological research on ethnicity and identity, they have varied in emphasis in several important ways. In particular, such studies are not as directly concerned with defining social boundaries or identifying discrete groups, but rather on the general modes through which the process of identification occurs. Within this framework, social identification is seen as operating in terms of two related processes referred to as *relational identification* and *categorical identification*, both of which are described in detail below. Importantly, the relationship between these two modes of social identification is a key factor in the organization of the kinds of widespread collective actions and social transformations that are the focus of this study.

In this section, I provide definitions and discussions of several key terms and concepts emerging from this body of contemporary social theory. In light of these theoretical concepts, I then present an alternate model linking the organization of social transformations to the process of social identification.

Relational Identification

Relational identification refers to a process through which individuals identify themselves and others with larger social groups based on their positions within networks of interpersonal interaction. Relational networks are built out of social ties which can be defined as routine and regular transactions between individuals or larger collectives which entail specific socially recognized rights and obligations (see discussions in Nexon 2009:25; Tilly 2002:80). Relational networks may include, for example, groups of people linked through regular face-to-face interaction in contexts of co-residence or people linked through somewhat more formal social ties such as kin ties. Within any relational network, some people are more closely related than others (i.e., more directly connected), however, indirect connections are still considered structurally equivalent rather than a different type of relationship (at least across a limited number of removes [see White 2008a:1-2]). Groups of people linked through relational connections can sometimes comprise named entities, such as lineages, but a key feature of relational identities is that they are forged out of direct and indirect connections among people rather than out of their common membership in some social category which could be defined external to individual relationships.

The character of social ties along which relational networks are built can influence the salience of relational identities in a given social context. In general, networks based on frequently activated social ties will tend to be more fundamental to the constitution of broader social structures than networks built out of less regularized interactions. In this way, the importance of a given relational identity could be conceptualized as the frequency with which that identity is taken into account, by oneself or by others, in the sum of all social actions (e.g., Tilly 1978:64). Relations based on kinship or common historical origins, for example, are often closely tied to many other relationships and are major organizing factors for formal and informal social interactions. Relations forged through somewhat more limited contacts, such linkages mediated through the public exchange of goods, may have somewhat less influence on other social interactions. At the same time, such “weak ties” are often important as they connect distinct social settings that would otherwise be wholly separate (see Granovetter 1973).

Relational networks and the structural position of individuals within them are often described using formal tools developed by social network analysts (e.g., Emirbayer and Goodwin 1994; Scott 1991). Social network analysis refers to a set of related approaches, derived from the mathematical field of graph theory, focused on characterizing and visualizing the relationships among individuals or larger social entities (see Wasserman and Faust 1994). Although social network analyses have long been important in the social sciences, such approaches have only recently gained a foothold in archaeology (see Brughmans 2010; Knappett et al. 2008; Mills et al. 2010). In its simplest form, a social network refers to a set of formally defined social ties or relationships among a set of actors (often called "nodes"). These ties can be used to describe or visualize the structure of a given social setting.

The formal description of social networks provides a basis for cross-context comparisons on the basis of factors such as network density (the proportion of all possible social ties that are active in a given context) or the centrality of a particular actor (how well a node is connected to the rest of the network). In contexts where only limited information is available, as is most often the case when considering archaeological data, it is not always possible to formally describe the structure of a relational network with such a high degree of resolution. It is, however, often possible to identify and describe the strongest overlapping patterns of interaction in aggregate, even if the positions of individual units within relational networks cannot be fully articulated. In this study, I use several lines of archaeological evidence to characterize relational social networks among individuals and larger social groups across the Cibola region at a variety of scales using both formal and informal methods of social network analysis.

Categorical Identification

Categorical identification is the process through which individuals identify themselves and others with larger groups based on perceived similarities with socially defined categories or social roles to which one can belong. This includes membership in formal organizations such as states, religions, political parties, or ethnic groups but also other broad social categories such as genders or age-sets. An important distinction between relational and categorical identities is that categorical identities can be defined without reference to interactions among individuals or larger social units. For example, a person may be a "Catholic" or a "Protestant" irrespective of their kin ties or interactions with others. Membership in a categorical entity is not arbitrary, however. Members of a categorical group must recognize their own common characteristics and, in most cases, those characteristics must also be recognized by other members of a particular group. Because categories are not directly built out of relations, however, they need to be symbolized in order to facilitate such recognition (Calhoun 1993, 2001:49). Thus, categorical identities are usually named social entities, often with specific material markers of membership or participation.

Although some categorical identities may overlap considerably with patterned relational connections among individuals, categories are not simply an extension of relations. For example, as discussed above, ethnic identities are collectives based on a sense of common origins or descent most frequently activated in contexts of interaction among similarly defined groups (see Barth 1969; Cohen 1978; Jenkins 2000; Kaufman 2004). Ethnic groups are often constituted among people linked in complex relational networks and characterized by other, smaller categorical divisions. At the same time, at the boundary between ethnic groups, each is as seen as a unitary whole characterized by an "us" and a "them" (Calhoun 1997:40-41). In other words, although they are often made up of people sharing overlapping relational connections, ethnic groups are categorical identities because they are defined through a process of boundary making that occurs without direct reference to the internal structure of relations among members (see discussions in Stokke and Tjomsland 1996:27; Tilly 2004a).

As categorical identities are socially constructed and not directly built from relationships among people, they are subject to manipulation and strategic use by individuals. Thus, the boundaries of a given category or the salience of a categorical identity may change depending on the social context. For example, Hodder (1979, 1982; Kimes et al. 1982) argues, based on his ethnoarchaeological research in the Baringo district of Kenya, that the active signaling of ethnic identities may be more pronounced in contexts characterized by severe economic stress and competition. Not all categorical identities are so easily manipulated, however. As Jenkins (2000:14-15, 2004) argues, certain categorical distinctions deeply embedded in the earliest process of socialization and learning (e.g., personhood, gender, ethnicity) may become "primary identities," which are both extremely robust to change and almost entirely taken for granted by individuals. Such robust categorical identities often maintain strong perceptions of persistence for both members and non-members of categorical groups.

Some scholars (Calhoun 1993, 1997:36-38; Foster 1974; Roosens 1989; Shennan 1989) argue that, in the relatively recent historical context of nation building, such robust "primary" categorical identities have taken on an increased importance that they probably never had in the past. From this perspective, the increasing importance of categorical identity in recent history is seen as a response to the creation of inequalities and the deconstruction of preexisting social relations through the process of state expansion. As Stone (2003:39-41) points out, however, such a perspective denies the existence of inequalities and factions in non-state societies; something that has largely has been rejected by contemporary anthropologists and archaeologists (see Brandt 1994; Brumfiel and Fox 1994; Flanagan 1989; McGuire and Saita 1996; Paynter 1989). I agree with

Stone and argue that there is no compelling reason to believe that relatively robust categorical identities, ethnic or otherwise, did not exist in the prehistoric past, even within non-state societies.

Collective Action, Social Movements, and Social Transformation

The relational and categorical modes of identification described above provide more than a taxonomy for describing variation in the multiple complex processes involved in the creation, maintenance, and dissolution of collective identities. A number of researchers have linked these general modes of social identification to the potential for and organization of widespread trajectories of collective action, social movements, and social transformations in many contemporary and recent historical contexts. In this section, I define and describe the relationships among these closely related concepts (collective action, social movements, and social transformation) as a baseline for further delineation of a model linking the pathways of social change to social identification more generally. Importantly, I argue that, although the specific political strategies or consequences may differ, contemporary accounts of the trajectory of social transformations can be gainfully applied to social transformations in the prehistoric past.

The term "collective action" refers to the wide variety of social processes through which large numbers of individuals cooperate towards a common outcome, usually seen as some sort of public good (see Baldassarri 2009). Research on the development of and motivations for collective action in the social sciences has been extremely broad. Many have approached this topic from an evolutionary perspective, focusing on the processes through which groups of people overcome the rational economic obstacles to cooperation among individuals through repeated interactions (see Kollack 1998; Ostrom 2000, 2010). Such models of collective action have recently been applied to archaeology in a series of published arguments by Blanton, Fargher, and colleagues (Blanton 2010, 2011; Blanton and Fargher 2008, 2009; see also Feinman 2011). Many other scholars have focused on explaining the emergence of seemingly spontaneous collective and public behaviors such as crazes, mobs, riots, or panics (see Rudé 1981). Among relational sociologists, collective action has most frequently been considered within the realm of research on political mobilization and social movements (see Polleta and Jasper 2001). From this perspective, the primary question shifts from why collective action occurs to how dispersed populations are able to coordinate action across time and space to successfully negotiate fundamental changes within a particular social setting (e.g., Diani 1992; McAdam et al. 2001; Tarrow 1998; Tilly 1978). It is this final approach that provides the inspiration for the current study.

Social movements can be defined as sustained collective actions that are embedded in local contexts and carried out by individuals linked together through both direct interaction and shared social identities (both relational and categorical). Importantly, social movements are built out of groups that share common identities which can extend beyond any specific action or protest (see Diani 1992, 2003; see also Stokke and Tjomsland 1996:10-21; Tilly 1998). It is the extension through time and across space of a common identity among members that distinguishes groups involved in a social movement from similar groups such as temporary coalitions. The ultimate goal of a social movement is to fundamentally reorganize a particular social setting in line with the needs and desires of those involved. For the purposes of this study, I define a relatively rapid but lasting change brought about through such concerted collective action as a *social transformation*. Social movements and associated social transformations may be prompted by either internal or external forces, but invoke new or altered social identities while at the same time reconfiguring the social, economic, and political relationships among people (see Hegmon et al. 2008; Kristiansen and Rowlands 1998; Van Dyke 2008 for recent archaeological examinations of the process of social transformation).

Not all social movements are organized in relation to the same forces. Researchers studying contemporary social movement processes often make a distinction between conflictual social movements and non-conflictural or consensus social movements (Della Porta and Diani 2006:22-23; Diani 2003:301-302; McCarthy and Wolfson 1992; Schwartz and Shuva 1992). The primary difference is that conflictual movements are organized in direct opposition to a specific social group or organization whereas non-conflictual movements are either broadly supported or are not directed towards a distinct and identifiable opponent. Conflictual movements tend to be focused on specific political aims such as the abolishment of slavery, the extension of civil rights to a segment of society, or even armed rebellion. Well known examples of conflictual movements include the American Civil Rights Movement of the 1950s and 1960s (McAdam

1999) and the Pueblo Revolt of 1680 (Liebman 2008). Non-conflictual movements, on the other hand, are most often focused on the transformation of social attitudes or practices towards somewhat broader issues such as environmental degradation, education, or religion. Examples include environmental movements developing across the world in the last 60 years (Michaelson 1994) or even religious movements such as the development and spread of Mormonism in the nineteenth century (Michaelson 1977). Conflictual and non-conflictual varieties of social movement processes are not entirely distinct nor are they mutually exclusive, however, and movements may oscillate between conflict and consensus depending on internal or external circumstances (e.g., Kuran 1989; McCarthy and Wolfson 1992:276-278).

Perhaps not surprisingly, the vast majority of contemporary movement studies have focused on conflictual movements. Recent research suggests, however, that non-conflictual movements are common and powerful forces for social transformation driven by similar dynamics, and often employing many of the same political and social strategies as conflictual movements (e.g., Michaelson 1994). Conflictual movements may be somewhat more common in contexts marked by substantial institutionalized inequality or well established political hierarchies, which probably accounts for the near ubiquity of conflict in contemporary examples. Importantly, however, the commonalities in the processes and trajectories of change associated with both conflictual and non-conflictual movements suggest that it is still possible to track the dynamics of social movements and associated social transformations without being able to directly characterize specific motivations of participants.

Some scholars of movement processes and social transformations limit their definitions of social movements to contentious political practices occurring in the relatively recent past, in particular in the wake of the expansion of democracy and market capitalism over the last few hundred years (e.g., Tarrow 1998; Tilly 2004a, 2004b).[1] I argue, however, that although the formal political or economic relevance of social movements may increase in relation to the consolidation of state authority, many of the same general movement processes are also important in non-state and non-democratic settings as well. For example, Wiessner and Tumu (1998; see also Wiessner 2002) provide a wonderfully detailed historical and ethnographic account of the establishment of the Tee ceremonial exchange system among the Enga of Papua New Guinea over the last 300 years after the arrival of the sweet potato. Before the sweet potato arrived in the Enga territory through their nearby neighbors, Enga tribes were relatively egalitarian and subsisted primarily through hunting and gathering or small-scale shifting horticulture. After the sweet potato, many Enga groups increasingly began to subsist as sedentary agriculturalists and some were able to raise large surpluses of pigs fed on the production of potatoes. The establishment of sedentary communities and the expansion of potato and pig farming involved massive population relocations and intensified exchange among previously distinct groups. Within a relatively short period, this intensified exchange formed the foundation for a series of complex ceremonial exchange systems, the largest of which was known as the Tee cycle. The establishment of these ceremonial exchange systems was associated with newly invigorated regional scale social identities and ancestor cults defined, in part, through common participation in public ceremonial gatherings. These changes eventually led to the development of an entrenched regional social hierarchy based on wealth accumulated through exchange and pig production, which extended across generations through specific lineages.

All of the changes within the Enga region described above happened prior to contact with and without intervention from colonial state powers, but this change was marked by many of the same processes that characterize contemporary social movements and social transformations. Specifically, the establishment of the Tee cycle involved broad scale and sustained collective action directed at creating social change (i.e., settlement reorganization and relocation in relation to new economic opportunities) as well as the consolidation of newly important social identities defined in relation to this trajectory of collective action (the establishment of ceremonial exchange systems and ancestor cults that cross-cut previous social boundaries). These processes brought about a fundamental and permanent reconfiguration of Enga society in a relatively short period of time. As this example suggests, although the degree of formal politicization and some of the specific mechanisms may differ when compared with contemporary social movements, many of the same social movement processes documented in contemporary nation-states are arguably at work in non-state settings as well. This suggests that models of social movement processes may also be generally relevant to examinations of periods of rapid social change in pre-modern archaeological contexts as well.

Although the concept of the social movement has long been important in the social sciences, few archaeologists have attempted to directly explore the nature or trajectories of movements in the archaeological record. Notable exceptions include a few recent attempts at applying Anthony Wallace's (1956) influential model of the origin and spread of "social revitalization movements" to archaeological cases (see Bradley 1996; Glowacki n.d.; Liebmann 2006, 2008; Turnbaugh 1979; see also McGuire 1989). For example, Liebmann (2006, 2008) used the concept of the social revitalization movement to explore the processes of culture change that occurred during the Pueblo Revolt of 1680 and its aftermath in the U.S. Southwest. By combining the concept of revitalization with a practice based, semiotic approach to material culture, Liebmann argues that archaeological explorations of social revitalization movements provide a useful explanatory framework for understanding rapid transformations in material culture and social organization that are frequently seen in the archaeological record. In the context of this study, I argue that many other rapid transitions in the archaeological record can be considered in light of theoretical models derived from the broader body of social movement theory beyond Wallace's (1956) seminal ethnological work on revitalization.

There are certainly limitations to studying social movements and social transformations in the archaeological record. Features of movements that are key dimensions of study in the context of contemporary social transformations, such as the specific motivations of participants, the specific strategies employed, and broader perceptions of social change, are not likely to be accessible through material remains alone. At the same time, I argue that it is still useful to track the dynamics of social transformations in the archaeological record in relation to models of contemporary movement processes, as there are commonalities in the trajectories of social transformations which are strongly influenced by the nature of social identities among those involved.

Linking Relations and Categories to the Organization of Social Transformation

In any particular social context, the two general modes of social identification described above are complementary rather than mutually exclusive. Social identities, from the perspective of the individual, are always cross-cutting and complex. However, these two idealized modes of social identification provide a means for exploring variation in the relationship between identity and social transformations in general, particularly at broad scales. It is also important to note that relational and categorical dimensions of identity are not binary concepts. Thus, one may speak of the strength of relational connections in terms of the number of consistently overlapping social ties or the strength of categorical identities in terms of the homogeneity of shared public expressions of similarity among groups of people.

Charles Tilly (1978:62-69), building on earlier unpublished work by Harrison White (later published as White 2008a), perhaps illustrates the relationship between relations and categories best by conceptualizing both as separate dimensions of a whole (see Figure 2.1). Tilly uses the four extremes of

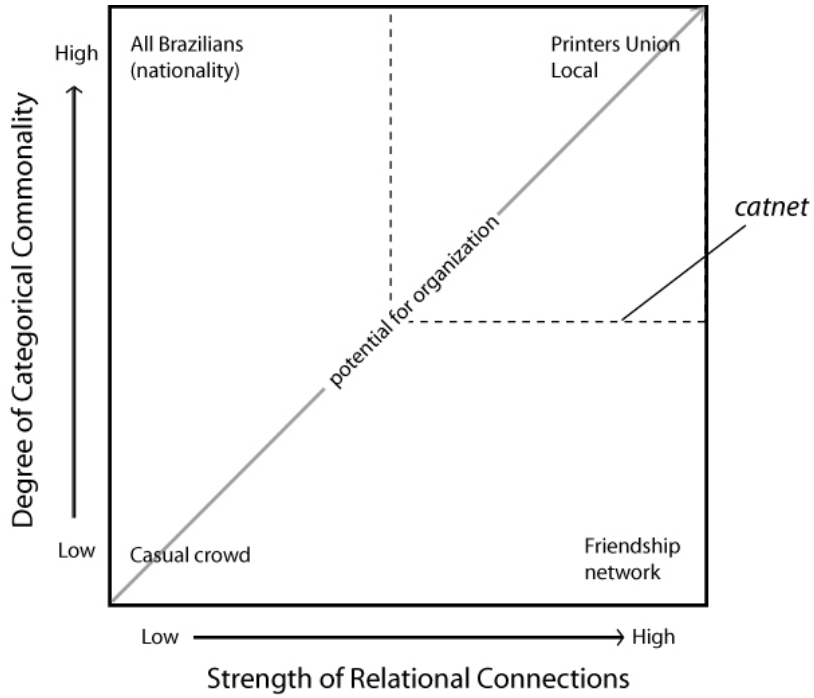


Figure 2.1. Charles Tilly's schematic model for the relationships among relational connections, categorical identities, and the organization of collective action (Redrawn and modified from Tilly 1978:Figure 3-3).

this two dimensional diagram to characterize certain idealized configurations of social connections among individuals. For example, a casual crowd would be characterized by weak relational connections among members as well as a low level of shared categorical identity. The much larger group of "All Brazilians" would include large numbers of people who all share a categorically defined national identity but are, in aggregate, weakly connected in terms of relational social ties. At another extreme, a friendship network includes individuals who interact on a regular basis and, thus, are characterized by strong and overlapping relational connections, but not necessarily shared categorical identities. Finally, Tilly describes the "Printer's Union Local" group as a collection of people who share a high degree of categorical commonality through their membership in a formal organization, and who are also linked by strong relational connections based on frequent interpersonal interaction. Harrison White (1992, 2008a, 2008b) refers to groups of individuals falling within this idealized fourth quadrant as "*catnets*," a term combining category and network.

Empirical studies of historical incidences of social movements, political mobilization, and sustained collective action presented by Tilly (1978, 1998, 2002, 2004a, 2004b, 2005) and a number of other researchers (see Baldasarri 2009; Diani 2003, 2007; Diani and McAdam 2003; Gould 1995; McAdam and Paulson 1993; Nexon 2009; Tarrow 1998) suggest that the particular configuration of relations and categories among large groups of people has an enormous impact on both the potential for organized collective activity as well as the specific form and trajectory it may take. By way of an example, I describe here the general kinds of collective actions (and hindrances to collective action) that these studies suggest are likely to characterize each of the four idealized extremes of Tilly's (1978) diagram. This discussion draws heavily on Nexon's (2009; see also Stokke and Tjomsland 1996) thorough characterization of Tilly's key insights.

Among large groups of people who are weakly linked by relational connections and characterized by a low level of shared categorical identity, sustained collective action is rare. Under such circumstances cooperation is subject to the kinds of constraints often placed under the rubric of collective action problems such as the classic "prisoner's dilemma" or "the tragedy of the commons" (see Kollock 1998). In such situations, where individual actors have few established connections to structure interaction and few cues of shared categorical identities to provide an indication of expected behaviors, there are substantial roadblocks to sustained collective action (Oliver and Marwell 1988; Ostrom 2010). Individuals will tend to respond to their own interests and carefully guard against exploitation by others. Nexon (2009:49-50) notes that this position is often incorrectly assumed to be the default situation from which all incidences of collective action emerge.

In social contexts characterized by groups of people linked together in dense relational networks but with little categorical commonality, collective action is considerably more likely to arise than in the situation described above. Dense networks of interaction provide pre-defined pathways for cooperation among individuals, which can substantially lower the transaction costs associated with collective activity (Gould 1995; Kim and Bearman 1997; Siegel 2009). At the same time, the lack of significant shared categorical identities may create a situation where collective action is limited to dense sub-groups of actors within more expansive relational social networks (divided along the lines of distinct categories) rather than spreading across a broader array of actors. If new and more inclusive categorical identities associated with a particular trajectory of collective action do not eventually emerge, collective action within such strong relational network/low categorical commonality situations may be relatively limited in scope and duration (see Nexon 2009:52).

At another extreme in Tilly's diagram are groups that share strong categorical identities but lack dense relational network ties. Such groups can often be quite large, as is the case with national or religious organizations, and may include many more individuals than could reasonably interact on a regular basis (Calhoun 1997:42-44). In situations characterized by such weak relational connections but strong categorical identities, collective action usually emerges in response to a specific stimulus, whether internal or external, which in turn activates a specific shared categorical identity. Nexon (2009:51) provides the example of the broad array of collective activities and public categorical expressions occurring in the wake of the attacks of September 11th, 2001 (e.g., flag flying, public demonstrations, etc.). However, lacking dense relational networks, such categorically based collective actions tend to be relatively ephemeral, often declining as the original stimulus to action declines in relevance.

The final idealized position, which conforms to White's (2008a) definition of a *catnet*, is characterized by groups linked in dense relational networks of interaction that also share strong categorical identities. In such a situation, the costs of cooperation and collective action are low due to the strength of overlapping network ties. There are well established vectors for interaction that tend to promote continued collective action. At the same time, the high degree of categorical commonality discourages the sub-division of cooperative relational networks. Few social situations probably fit squarely within this realm as cross-cutting social identities among individuals will always exist. Where a social situation approximates such a configuration of strongly overlapping relational and categorical identities, however, sustained and successful collective action of the kind that is often truly transformative may be expected (Nexon 2009:50-51; Tilly 1978:81-90).

Importantly, many social transformations are associated with the creation of social contexts approximating *catnet* systems from other positions along the continuum of relations and categories. Empirical studies of the process of social transformation suggest that such strong connections between relational and categorical identities can emerge through a number of distinct social processes. For example, McAdam and others (2001:331-340, McAdam 1999; 2003:293-296; Tarrow and McAdam 2005; see also Yeo 2009) argue that social transformations tend to originate as movements in local contexts organized among frequently interacting individuals (i.e., groups with strong relational connections). For social transformations to solidify or spread beyond their local origins, however, they often go through a process of scale shift, defined as "an alteration in the range of sites engaging in coordinated action" (Tilly 2001:26), in which categorical identities become increasingly important, distinct, and widespread within a given social context (McAdam 2003). Although the specific mechanisms involved in this processes may vary, a large body of comparative research focused on contemporary or recent historic instances of social transformations suggests that such transformations are usually associated with the creation of new and more pronounced categorical distinctions among social groups (e.g., Aunio and Staggenborg 2011; McAdam et al. 2001, 2008; Tarrow and McAdam 2005). Importantly, however, most scholars focused on social transformation in the recent past or in the present assume that such dynamics, including the increasing importance of categorical distinctions, are a product of modern political realities, and thus, are limited to modern, state-level societies (e.g., Calhoun 1997:42-48; Stokke and Tjomsland 1996; Tilly 2004b).

Overall, the discussion above suggests that social transformation often follows a particular trajectory of change through time marked by an increasing consolidation of relational social ties followed by the creation, elaboration, and spread of new and more distinct categorical identities. In this study, I track changes in the configuration of and interplay between relational connections and categories through time in order to determine if such a trajectory of change characterized the late thirteenth century social transformation in the Cibola region. If such a general trajectory could be demonstrated in the Cibola region (a non-state, non-democratic, and non-commercial social context) it would suggest the need to expand the scope of cases typically considered in comparative research focused on the dynamics of social transformation.

Key Principles

From the body of theory focused on the relationships between social transformation and the process of social identification outlined above, I derive a few principles that I argue are useful in evaluating the process of social transformation in the Cibola region and in the archaeological record in general. These general points frame much of the discussion in the remainder of this study:

1) The broad array of processes involved in collective identity formation and maintenance can be characterized in terms of the strength of relational connections and the shared categorical identities among groups of

individuals. Importantly, groups characterized by strong relational connections or a high degree of categorical homogeneity are not necessarily coterminous. This observation stands in contrast to many traditional accounts of social identity at broad spatial and social scales in archaeology, which often conflate relations and categories in favor of debates over the specific kind of collective identity a particular social setting entails (i.e., tribal vs. cultural vs. ethnic, etc.) or the demographic/geographic scale at which discrete and bounded groups can be identified. In this study, I argue that an explicit consideration of both relations and categories independently can provide new insights into the process of regional scale social transformation in the Cibola region and other archaeological cases.

2) Sustained collective actions that are truly transformative tend to be organized around groups of individuals that are highly connected relationally and that also share strong categorical identities (i.e., *catnets*). Importantly, strong relational connections among groups of people often precede the establishment of formal categorical identities. As Miche (2011) puts it, categorical identities often develop from "an emerging awareness of structural equivalence in network position." From this, it follows that networks of frequent interaction or common historical ties prior to a period of transformation may often predict the structure and scale of that social transformation. Thus, the strongest patterns of relational connections prior to the Pueblo III to Pueblo IV transition

should provide an indication of the lines along which categorical social boundaries form through the process of social transformation.

3) Related to the point above, many contemporary social transformations are characterized by a trajectory of change through time in which collective actions and social transformations either spread beyond their original contexts or become more deeply entrenched as categorical identities become increasingly important and well defined at a given scale. This is not a simple diffusion of change through an existing relational network; rather, this process involves a fundamental reconfiguration of the social identification through the creation of new, broader, and more distinct categorical distinctions among individuals. This process has typically been seen as a product of contemporary political realities, but if such a general process could be demonstrated in a pre-modern, non-state archaeological context, it would suggest broader similarities in the trajectories of major social transformation across a wider variety of social contexts than have typically been considered.

Organization of the Study

In order to explore the role that social identification plays in the constitution of major transformations, three primary tasks must be completed. First, it is important to demonstrate that a given transition in the archaeological record can be reasonably considered in relation to the dynamics of social movement processes and social transformation described here. The next step is to document the primary patterns of relational connections and categorical commonality both before and after this transformation. Finally, it is necessary to consider the divergent trajectories and pace of the social transformation through time in relation to different configurations of overlapping relational connections and patterns of shared categorical identities. In this final section, I outline the organization of the remainder of this study, including a brief description of the methods and analyses that will be used to carry out each of these steps. The specific methods and data are described in greater detail in each analytical chapter and are summarized in Table 2.1.

As defined for this study, a social transformation is a relatively rapid and lasting social change occurring through a period of concerted and sustained collective action. Such a social transformation in the archaeological record can be identified as a period of rapid and widespread reorganization of settlement location, size, or structure, often associated with other abrupt changes in multiple domains of material culture (see Hegmon et al. 2008; Nelson et al. 2011). Such changes suggest a fundamental reconfiguration of the relationships among people in a given social context. In Chapter 3, I provide the cultural historical background on the Cibola region necessary for this study based on an analysis of a regional database of large settlements and major full coverage surveys across the region. Through this discussion, I document a massive shift in settlement organization, size, and location along with numerous associated changes in material culture occurring across the Pueblo III to Pueblo IV transition. Based on this overview, I argue that this period of rapid and widespread social change represents a social transformation as I have defined it here which likely involved

Table 2.1. Variables, data, and analyses used in the analytical portion of this study.

Social Variable	Data	Analyses	Chapter(s)
Nature/Scale of Social Transformation	Regional settlement database	Analysis of settlement distribution and organization through time	3
Strength of Relational Social Ties	NAA ceramic compositional database	Analysis of the regional patterns of ceramic circulation through time	4-5
	Measurements/attributes of utilitarian ceramic vessels	Analysis of patterns of similarity in pottery production methods	6
	Measurements/attributes of domestic architectural spaces and features	Analysis of patterns of similarity in domestic architectural spaces	7
Degree of Categorical Commonality	Whole/partial vessel photographs; Ceramic ware/type counts	Stylistic analysis of polychrome serving bowls; Analysis of regional ceramic ware frequencies	8
	Architectural feature database	Analysis of the distribution and form of public architectural spaces	9

the active participation (or opposition) of the entire population of the greater Cibola region.

Relational connections are forged out of networks of interpersonal interaction among individuals and larger groups. Archaeologists have developed a number of methods for documenting patterns of direct and indirect interaction at various scales, which are relevant for the current study. In the context of this dissertation, I use three types of analyses to assess the strength and directionality of relational connections/networks among the inhabitants of the Cibola region: ceramic compositional characterizations, technological characterizations of utilitarian pottery production, and technological characterizations of domestic architectural spaces and features.

The first analysis, presented in Chapters 4 and 5, consists of a compositional characterization of a large sample of ceramic sherds and vessels from across the Cibola region using Neutron Activation Analysis (NAA). NAA is a radioisotopic method of chemical characterization that quantifies numerous major, minor, and trace element concentrations in ceramic pastes, raw clays, or other materials (Glowacki and Neff 2002). These data can be used to identify groups of ceramics that are compositionally similar, which in turn can be attributed to geographic production sources through comparisons with local geology, clay samples, local abundance, or other archaeological data (Bishop et al. 1988; Neff 2002). Through the analysis of NAA data, it is possible to trace the movement of ceramic vessels among areas with distinct geological resources. By tracking the movement of ceramics across the study area, I argue that settlements or groups of settlements involved in common spheres of ceramic circulation likely represent groups of individuals who were interacting on a regular basis, suggesting strong relational connections. I further argue that the circulation of different kinds of ceramics (utilitarian vs. decorated) represent different kinds of social ties among the inhabitants of the Cibola region.

The next analysis, presented in Chapter 6, consists of detailed technological characterizations of utilitarian pottery production from settlements across the Cibola region. In this chapter, I describe and apply a new quantitative method for identifying groups of vessels produced by individuals who shared similar production practices. Numerous recent archaeological and ethnographic studies have focused on the potential of technological characterizations of material culture for assessing interactions, cultural origins, and social identities (e.g., Carr 1995; Clark 2001; Dietler and Herbich 1998; Huntley 2008; Gosselain 1998, 2000; Lyons 2003; Neuzil 2008; Sassman and Rudolphi 2001; Stark et al.

1998; see also Lechtman 1977, Lemonnier 1986). An ever growing body of research suggests that attributes of material culture that are either invisible in the final product or are located in contexts of low visibility (often called technological style) more often vary in relation to the degree of interaction among producers in contrast to processes such as emulation (see Carr 1995; Clark 2001:6-22). In this study, evidence for shared technological practices related to pottery production will be interpreted as evidence of frequent interaction, common historical ties, and strong relational connections among producers. I explore patterns of relational connections across the study area through time using both traditional measures of similarity as well as formal methods of social network analysis.

Next, in Chapter 7, I explore patterns of technological similarity in terms of domestic architectural spaces and features. As with the analysis of utilitarian ceramic production described above, I argue that similarities and differences in the design and placement of domestic architectural features provide information relating to the degree and directionality of frequent interactions and relational connections among the inhabitants of the Cibola region. My expectation is that patterns of technological similarity and difference in domestic architecture will be similar to patterns documented in terms of the technology of ceramic production as both technologies involve processes that were likely learned through face-to-face interaction.

Categorical identification is built from perceived similarities with social roles or groups to which one can belong. Categorical identities do not depend on direct connections among individuals. Thus, categorical social groups require symbolization in order to facilitate the recognition of members vs. non-members (Calhoun 1995:193-230). The process of symbolization includes the kinds of active expressions of identity through material culture often referred to in archaeology as "emblemic" aspects of styles (Wiessner 1983, 1984, 1985). In this study, I present two analyses directed at identifying patterns of shared categorical identities and such active expressions across the Cibola region through time: a stylistic analysis of certain decorated ceramic vessels and characterizations of the forms and locations of public architectural spaces across the region through time.

In the Cibola region, bold designs on the exteriors of large serving bowls have been suggested to be active signals of social identities (Mills 2007a, 2007b). A recent study by Mills (2007a) demonstrates that the size and boldness of the designs on these vessels in one portion of the study area tend to vary in relation to the sizes of the settlements and public spaces at these settlements through time. These large, polychrome serving bowls are frequently found in settlements associated with evidence of communal feasting events (Mills 2007a, 2007b; Potter 2000; see also Spielmann 1998). Furthermore, specific communities also appear to have produced large numbers of vessels characterized by certain iconic designs and color combinations on bowl exteriors. The repeated use of design elements, the boldness of these designs, and their association with public ritual together suggest that visual information potential was an important consideration in their production and use. Thus, I argue that patterns of similarity and difference in designs associated with these polychrome bowls can be used as one indication of patterns of shared categorical identities among the inhabitants of settlements across the Cibola region. Detailed stylistic analyses of a large sample of whole and partial bowls, along with a regional analysis of ceramic ware distributions are presented in Chapter 8.

Public architecture can be defined as highly visible built spaces with evidence for simultaneous use by large groups of individuals. Cross-culturally, the largest forms of public architecture are associated with public ritual or other specialized activities (Adler and Wilshusen 1990). Although public architecture is not inherently integrative, the scale of activities assumed to take place in these spaces brings large numbers of individuals into close proximity, fostering opportunities for other interactions (Hegmon 1989; Varien 1999:22-23). There are a variety of common types of public architecture in the Cibola region, often with multiple types appearing in individuals settlements (e.g., Kintigh et al. 1996; Martin and Rinaldo 1950; McGimsey 1980). In Chapter 9, I explore the patterned distributions of public architectural features across the greater Cibola region. Shared forms and attributes of public architectural spaces are interpreted as common contexts for public rituals. It is often the case that communities with similar public architectural spaces engage in similar kinds of public rituals (see Adams 1991; Adler and Wilshusen 1990). The public nature of these spaces further suggests that such features provide contexts for active expressions of social identities and social boundaries among individuals and larger groups at different scales. Thus, settlements or groups of settlements characterized by similar public structures are interpreted as areas occupied by people sharing common categorical identities.

Finally, in Chapter 10, the results of the various analyses described above are combined in order to determine where they converge or diverge and to identify changes in the scales at which the relational and categorical modes of social identification operated across the Cibola region through time. This diachronic perspective allows for a consideration of the pace of organizational change in different portions of the study area to determine whether the transformations across the Cibola region were characterized by the general social movement processes described in this chapter.

I argue that the Pueblo III to Pueblo IV transition in the Cibola region does constitute a major social transformation that was similar in both structure and trajectory to many well studied contemporary examples. Furthermore, patterns of relational connections prior to this period of transformation provide strong indications of the organization of social change across the region as a whole along this transition. I argue that the changes associated with the Pueblo III to Pueblo IV transition in the Cibola region fits many aspects of the general dynamics of social transformation as described for many contemporary social movements. Overall, this suggests broad similarities in the patterned processes between the thirteenth century in the Cibola region and contemporary transformations. These similarities have major implications for considerations of the historical ubiquity of social movement processes in general.

Chapter 2 Notes

[1] The association of social movements with contemporary politics can largely be attributed to the concentration on conflictual social movements in sociology and political science. Modern state power structures tend to engender conflictual dynamics (McAdam et al. 2001). It is likely the case that non-conflictual movements may have been more common in the past.

Chapter 3:

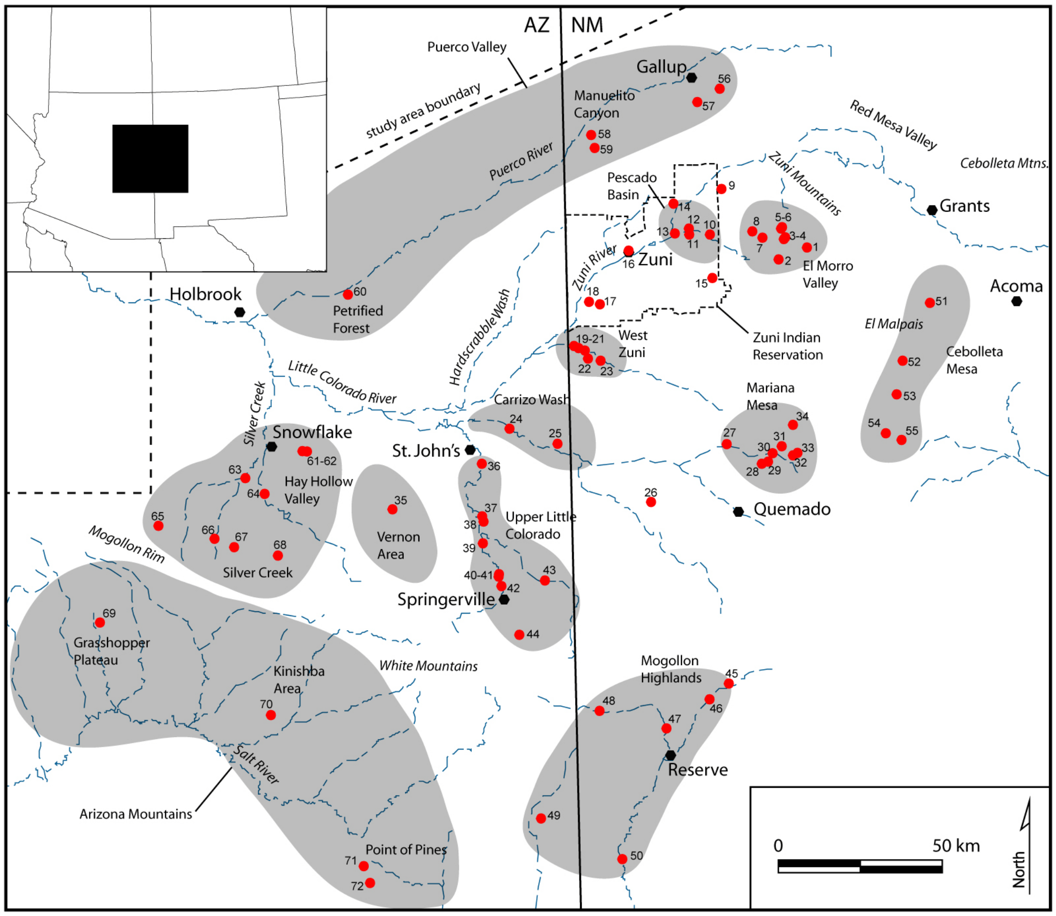
SOCIAL TRANSFORMATION IN THE CIBOLA WORLD

For more than a century, the greater Cibola region, centered on the contemporary Pueblo of Zuni, has been a location of interest for research focused on issues of cultural identity (e.g., Cushing 1896; Ferguson and Hart 1985; Fewkes 1891; Green 1990; Mindeleff 1891; Spier 1917, 1918, 1919; Woodbury 1956). The core of the Cibola region has long been seen as the ancestral homeland of the contemporary Zuni (A:shiwi) people (e.g., Kintigh 1985a, 2007; Woodbury 1956). Further, the traditional area of Zuni sovereignty and the vast majority of the named locations mentioned in Zuni migration traditions (e.g., Cushing 1896; Ferguson and Hart 1985; Ferguson 2007; Frisbie 1984) fall within the broadest definitions of this region. At the same time, the greater Cibola region also spans areas that have traditionally been placed within two distinct archaeological culture zones; the Anasazi culture area to the north and Mogollon culture area to the south. The complexity of cross-cutting material distributions and social connections across the Cibola region make this a particularly interesting context within which to explore the relationships between social identification and major social transformations at broad scales. The goal of this chapter is to provide an overview of the physical environment, previous research, and culture history of the Cibola region as a background to the remainder of this study. Through the discussion below, I argue that the massive shift in settlement location and organization that characterized the late thirteenth century in the Cibola region fits the definition of a social transformation established in the previous chapter.

Defining the Cibola Region

There has never been a set of consistently agreed upon boundaries for the Cibola region. Many studies that focus on the later prehistory of the Southwest (ca. A.D. 1300-1540) have used relatively restricted definitions, limited to the lands in and around the Zuni Indian Reservation in New Mexico (e.g., Huntley and Kintigh 2004; Kintigh 1985a, 2007). Researchers focusing on the thirteenth century and earlier have often employed much broader definitions including large swaths of east-central Arizona and west-central New Mexico (e.g., Duff and Schachner 2007; Gladwin 1934; Kintigh 1996; Peeples et al. n.d.; Schachner et al. n.d.; Woodbury 1956). LeBlanc (1989) argues that one of the key features of the areas most often subsumed under various designations of the Cibola region is that they are marked by frequently fluctuating social boundaries. Thus, what may appear as a discrete region characterized by relatively homogenous material remains at one point in time can be divided into several distinct regions at another.

For the purposes of this study, I define the greater Cibola region in a broad sense using several major geographic features (Figure 3.1). I view this delineation of the region as a useful archaeological construct but not necessarily a meaningful cultural designation. The northern and eastern boundaries of the region are defined by the Rio Puerco of the West and Cebolleta Mesa respectively. The western boundary is more difficult to place but is defined here by a north-south line extending roughly from Holbrook, Arizona to the Forestdale Valley and surrounding areas below the Mogollon Rim. The southern edge of the region



1	Tinaja	El Morro Valley	25	Garcia Ranch Pueblo	Carrizo Wash	49	Foote Canyon Pueblo	Mogollon Highlands
2	Atsinna	El Morro Valley	26	Cox Ranch	Carrizo Wash	50	WS Ranch	Mogollon Highlands
3	Mirabal	El Morro Valley	27	Cerro Prieto	Mariana Mesa	51	Los Pilares (Calabash)	Cebolleta Mesa
4	Cienega	El Morro Valley	28	Hubble Corner	Mariana Mesa	52	Citadel (North Pasture Site)	Cebolleta Mesa
5	Scribe S	El Morro Valley	29	UG481	Mariana Mesa	53	Dittert	Cebolleta Mesa
6	Pueblo de los Muertos	El Morro Valley	30	UG494	Mariana Mesa	54	Rattail Ruin	Cebolleta Mesa
7	Los Gigantes	El Morro Valley	31	Horse Camp Mill	Mariana Mesa	55	Newton	Cebolleta Mesa
8	Kluckhohn	El Morro Valley	32	Techado Spring Pueblo	Mariana Mesa	56	Fort Wingate	Puerco Valley
9	Box S	Upper Nutria	33	Tri-R Pueblo	Mariana Mesa	57	Fenced Up Horse Canyon	Puerco Valley
10	Lower Pescado Ruin	Pescado Basin	34	Veteado Pueblo	Mariana Mesa	58	Atsee Nitsa	Puerco Valley
11	Heshotauthla	Pescado Basin	35	Mineral Creek	Vernon Area	59	Big House	Puerco Valley
12	Spier 81 Cluster	Pescado Basin	36	Table Rock Pueblo	Upper Little Colorado	60	Puerco Ruin	Puerco Valley
13	Yellowhouse	Pescado Basin	37	Rattlesnake Point	Upper Little Colorado	61	Broken K Pueblo	Hay Hollow Valley
14	Village of the Great Kivas	Pescado Basin	38	Baca Pueblo	Upper Little Colorado	62	Carter Ranch	Hay Hollow Valley
15	Archeotekopa II	Southeast Zuni	39	Sherwood Ranch Ruin	Upper Little Colorado	63	Fourmile Ruin	Silver Creek
16	Halona:wa (Zuni)	Central Zuni	40	Hooper Ranch Pueblo	Upper Little Colorado	64	Shumway Ruin	Silver Creek
17	Kechiba:wa	Central Zuni	41	Rim Valley Pueblo	Upper Little Colorado	65	Bailey Ruin	Silver Creek
18	Hawikku	Central Zuni	42	Casa Malpais	Upper Little Colorado	66	Pinedale Ruin	Silver Creek
19	Jaralosa Pueblo	West Zuni	43	Coyote Creek Pueblo	Upper Little Colorado	67	Pottery Hill	Silver Creek
20	Ojo Bonito	West Zuni	44	Rudd Creek Pueblo	Upper Little Colorado	68	Showlow Ruin	Silver Creek
21	Hinkson Ranch	West Zuni	45	Aragon	Mogollon Highlands	69	Grasshopper Pueblo	Arizona Mountains
22	H-Spear	West Zuni	46	Apache Creek Pueblo	Mogollon Highlands	70	Kinishba Pueblo	Arizona Mountains
23	Spier 170	West Zuni	47	Higgins Flat	Mogollon Highlands	71	Turkey Creek Pueblo	Arizona Mountains
24	Platt Ranch	Carrizo Wash	48	Hough 70	Mogollon Highlands	72	Point of Pines Pueblo	Arizona Mountains

Figure 3.1. Map of the Cibola region study area showing major geographic features, sub-regions, and sites mentioned in the text.

includes Martin’s (1979) Cibola branch of the Mogollon in the Mogollon Highlands along the San Francisco and Blue River valleys.

The greater Cibola region, as I have defined it here, essentially corresponds to what LeBlanc (1989:338) considers the maximal extent of the region during the eleventh through the mid thirteenth centuries. This definition of the Cibola region also includes the bulk of the areas within what Lekson and others (Lekson 1996:174-175; Lekson et al. 1992:Figure 3.3) have termed the "Tularosa Horizon;" a widespread ceramic horizon marked by the distribution of Tularosa Black-on-white ceramics. Overall, this regional designation consists of a geographically diverse area marked by a common suite of painted ceramic types as well as certain other similarities in architecture, settlement patterns, and economic strategies. As the following chapters illustrate, however, there are also key differences among specific portions of this large area.

In order to highlight somewhat more fine-grained regional similarities and differences, I divide the Cibola region into a number of smaller sub-regions. These sub-regions generally coincide with clusters of major sites (> ca. 50 rooms) across the Cibola region for which data are available but also generally conform to archaeological districts that are commonly used in the regional literature (e.g., Adler 1996; Adams and Duff 2004; Duff 2002). The eight central sub-regions are considered the core portion of the study area and provide the vast majority of the data discussed in the following chapters (Figure 3.2). The remaining sub-

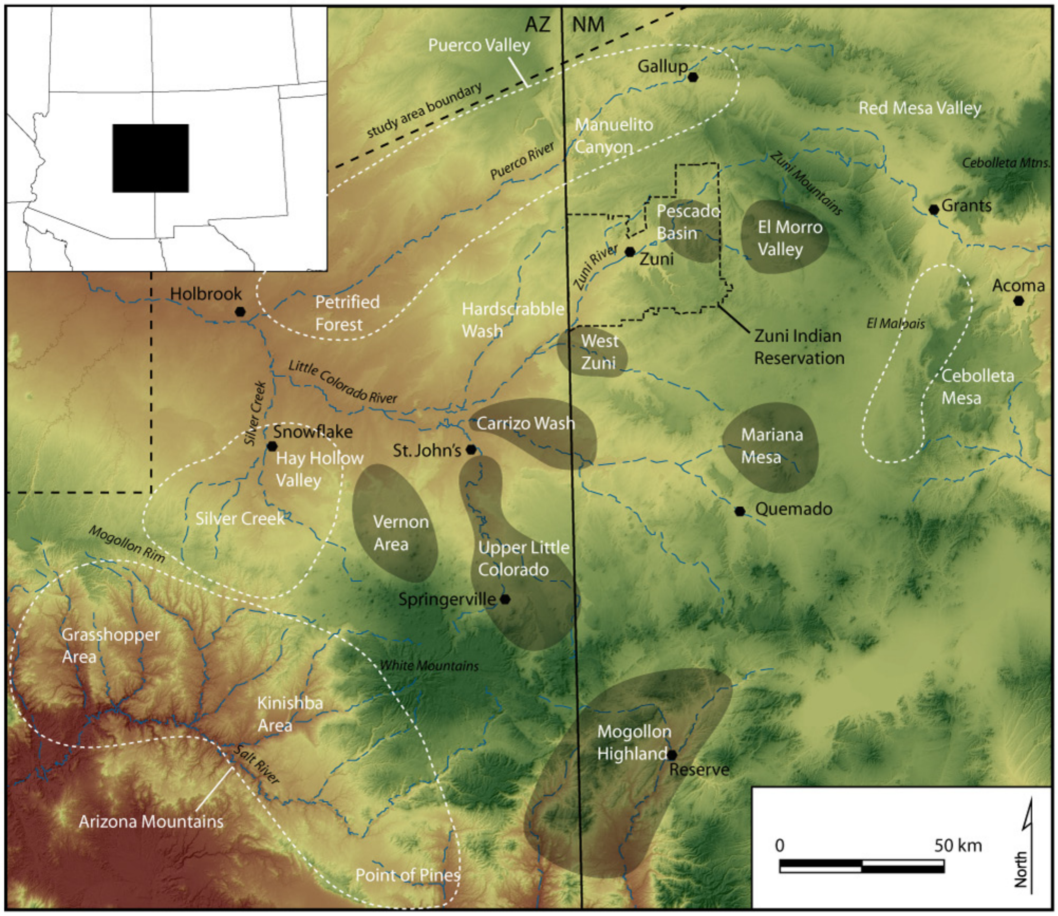


Figure 3.2. Map of the study area showing core (shaded) and expanded study area sub-regions as well as other major geographic designations used in this study.

regions along the edges of the Cibola region are incorporated where possible using published data. I have also labeled a few additional locations on this map to which I will refer at various points in this study. All of these spatial designations are seen as just that and are not necessarily meant to represent the territories of social groups unless explicitly stated otherwise.

Although the Cibola region is a useful analytical unit, this area is also cross-cut by another set broad archaeological constructs. Specifically, the Cibola region falls along the traditionally defined boundary between the Anasazi culture area to the north and the Mogollon culture area to the south (Figure 3.3). The nature of culture areas has long been a topic of debate in the archaeology of the greater Southwest (see discussion below). The Cibola region has played a major part in this debate as it has been noted that some archaeological sites within the region contain a combination of material attributes that are typically associated with both the Mogollon and Anasazi areas (Clark et al. 2006; Danson 1957; Haury 1936; Martin et al. 1957). I return to this issue at the end of this chapter.

The Physiographic and Environmental Context

The Cibola region is a large and physiographically diverse area that extends across the southern edge of the Colorado Plateau and into the central mountain highlands of Arizona and New Mexico. Elevation ranges from just over 5,000 feet along the western boundary of the study area near Holbrook to over 9,000 feet in the Zuni, White, and Mogollon Mountains (with some peaks as high as 11,000 feet). The vast majority of formative period land use was focused at elevations below 7,000 feet. As in most other portions of the semi-arid U.S. Southwest, elevation and local land forms are both major determinants of other environmental factors that would have been important to agricultural populations in the region including precipitation, temperature, and the availability of various resources.

Although there is substantial spatial variability, annual precipitation within the densest zone of agricultural settlement across the Cibola region ranges from about 11 to 17 inches with higher elevation areas generally receiving somewhat more moisture (Kintigh 1985a:92-93; Maker et al. 1972:6). Much of the Cibola

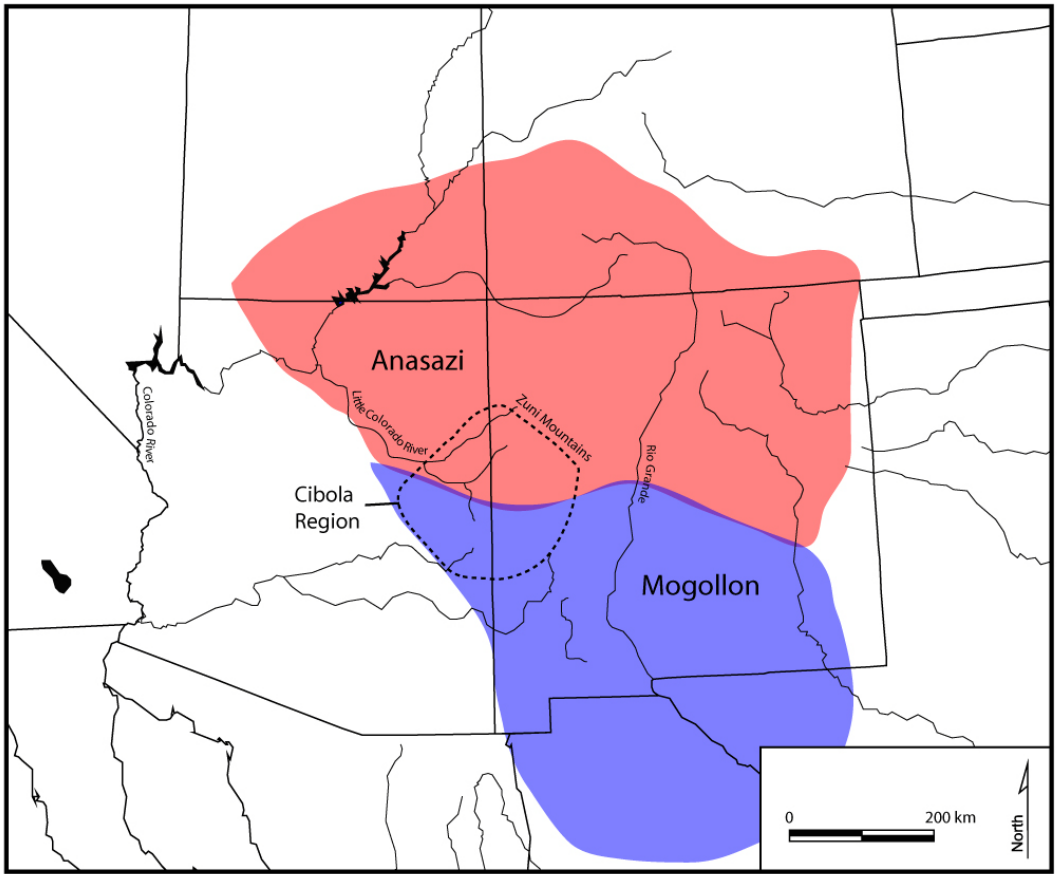


Figure 3.3. Map of the Cibola region showing the traditional boundaries of the Anasazi and Mogollon archaeological culture areas (based on Cordell 1997).

region falls within the unimodal, summer dominant precipitation regime of the semi-arid southwest with about 50% or more of precipitation occurring during the summer months (Cordell et al. 2007:Figure 2). Summer rains are typically intense, but of short duration. The summer rainy season spans from mid June or early July through August. Gentle winter rains and snows fall between about November and March (Ferguson and Hart 1985:13). Winter precipitation is important for both maintaining soil moisture and raising the water table. Additionally, during the drier spring months, snow melt feeds intermittent streams across many portions of the Cibola region, which may have been important sources of moisture and domestic water during the driest part of the year. Winter precipitation is generally greater in the northern and western portions of the Cibola region, especially in the Zuni and Puerco River Valleys (VanWest and Greenwald 2005:1.17-1.19).

In an average year, most portions of the Cibola region do not receive enough direct precipitation during the growing season for agricultural production without some form of water management (Muenchrath et al. 2002). Numerous methods of water capture were employed in the region prehistorically including the strategic placement of fields along the bases of slopes (Norton et al. 2003), the construction of terraces, check dams, or other features designed to slow the flow of water and increase soil moisture (Cushing 1920; Homburg et al. 2005), as well as the construction of small spring and stream fed irrigation canals in the locations where such features were feasible (see Damp et al. 2002; Kintigh 1985a:96-102).[1] Many of the methods of water capture used by the inhabitants of the Cibola region would have had the added benefit of replenishing nutrients to field systems by catching and retaining soil runoff from upland areas during rain storms (Homburg et al. 2005; Sandor et al. 2007). The continuous use of agricultural fields in the areas around Zuni for non-industrial farming for perhaps 3,000 years or more is testament to the long-term success of these methods.

Temperature is another important consideration for agricultural settlement in the Cibola region. Freezes are possible in most places during almost any month of the year (VanWest and Greenwald 2005:1.17-1.19). As would be expected, elevation strongly influences mean annual temperatures as well as the length of the growing season. Across the Cibola region, the average growing season can range from a maximum of about 180 days in low elevation areas to as short as about 90 days in occupied areas above 7,000 feet in elevation. Even assuming that fast maturing varieties of maize (80-120 days) were preferred, many high elevation portions of the Cibola region may have experienced killing frosts on a periodic basis. In addition, both rainfall and temperature are locally sporadic and unpredictable, meaning that shortfalls in one area may not have coincided with shortfalls in another nearby area. Such spatial variability may have promoted interaction among the inhabitations of different portions of the Cibola region and beyond as a means to buffer the risks for local shortfalls (sensu Cordell et al. 2007; Rautman 1993).

As the discussion above suggests, the greater Cibola region is characterized by an extremely diverse physical landscape. Rather than describing all of the geographic features of the region in detail, I instead offer a few brief comments on the primary physiographic zones found across the study area. Specific publications cited below provide more detailed treatments of particular areas.

Most of the northern portions of the Cibola region including the upper reaches of the Zuni River Valley, the El Morro Valley, Cebolleta Mesa, and the eastern Rio Puerco Valley are characterized by deeply incised canyons and forested mesa tops, cross cut by several perennial and intermittent streams. Local elevation changes from valley bottoms to mesa tops may be several hundred feet. Much of this area consists of alternating pinyon-juniper woodland savannahs and open grassland areas (Ferguson and Hart 1985:17; Schutt and Chapman 1997:37-39). Areas to the south and west around Mariana Mesa and Carrizo Wash are similar, but rather than being characterized by extensive, deeply incised canyons, these areas are dotted with several high, isolated mesas and somewhat broader valleys. In many areas, these mesas and cuestas are associated with rolling lowlands and waterways. Open grasslands are somewhat more extensive along the southern edge of the Colorado Plateau than in areas to the north (VanWest and Greenwald 2005). The southeastern boundary of the study area is marked by the Mogollon-Datil volcanic field, which consists of a relatively mountainous volcanic landscape along the transition zone between the Colorado Plateau and the southern basin and range physiographic province. There is little evidence for agricultural habitation in this area.

To the west, the Upper Little Colorado area is characterized by gently sloping lowland areas surrounded by hills and extensive basalt badlands. The Little Colorado River Valley itself is narrow in most places but is lined by lush riverine vegetation in the lowlands and grasslands dotted with small woodland areas in the uplands. In general, areas away from the Little Colorado River or other major tributaries are relatively dry and characterized by little woody vegetation and little arable land. Elevation decreases from the south to north with the occupied valleys at the base of the White Mountains averaging about 7,000 feet in elevation and lands near St. Johns averaging approximately 5,700 feet. Although there is quite a bit of variation across the length of the Little Colorado River, the floodplain is generally broader to the north near St. Johns as the river meanders west towards its confluence with the Zuni and Puerco Rivers (Duff 2002:63-64).

The mountainous highlands in the southern and western portions of the region, including the Silver Creek, Arizona Mountains, and Mogollon Highlands sub-regions, span a large zone on either side of the extensive Mogollon, San Francisco, and Tularosa Mountains. This broad zone is actually quite diverse with extensive grasslands, deep canyons, and densely forested areas. Alpine forests mark the highest elevations within this zone. Major streams start in the mountainous uplands and are often deeply incised for quite some distance before passing through arable lands (Oakes and Russell 1999:20-23; Triadan 1997:7-8). Although there is variation from place to place, this mountainous area is treated together because it is cooler, higher, and wetter than most other portions of the Cibola region and the Southwest in general.

The brief discussion above suggests that the Cibola region was diverse in terms of both local geographic features as well as climate. Many factors that would have been particularly important for agricultural populations residing in the area (precipitation, temperature, growing season) differ dramatically from place to place. As in the rest of the semi-arid southwest, climatic variability and unpredictability were relatively high across the Cibola region as a whole. This diversity and unpredictability likely promoted interaction among individuals and larger social groups residing in different ecological zones across this broad study area.

Previous Research in the Greater Cibola Region

I cannot cover the entire long history of archaeological research across the greater Cibola region with a substantial degree of detail in the context of this chapter. Instead, the approach I take here is to very briefly discuss several major projects and a few broader trends that have characterized research in the region over the last century. The history of research described below is focused mainly on work conducted within the core of the study area.

The lands in and around the contemporary Zuni Indian Reservation were the setting for some of the earliest formal archaeological projects in the Southwest. In the 1880s, the Hemenway Southwest Archeological Expedition, then directed by Frank Hamilton Cushing (Cushing 1890; Fewkes 1891; Hinsley and Wilcox 2002), conducted excavations at two large late prehistoric towns on the Zuni Indian Reservation (Halona:wa and Heshot uła [or Heshotauthla]). The goal of this project was to better understand the origins of the contemporary Zuni people. In many ways, the Hemenway Expedition was ahead of its time in that it was driven by an explicit research question (not a common feature of nineteenth century archaeological projects) and in that it was broadly anthropological, combining archaeological, ethnographic, bioanthropological, linguistic, as well as historical data towards a single research agenda (see Cushing 1890). It is certainly notable that the first formal anthropological research conducted in the Cibola region was explicitly focused on issues of cultural identity and continuity.

The early twentieth century saw another major pulse of research in the greater Cibola region, including several extensive reconnaissance surveys, which located many of the largest settlements across the region. Leslie Spier's (1917, 1918, 1919) surveys of the Zuni, El Morro, Upper Little Colorado, and Arizona Mountains areas and Walter Hough's (1907, 1914) surveys in the Arizona Mountains and other lands into the far southern and western portions of the Cibola region still provide important baseline data on late prehistoric settlement patterns in many areas. About the same time that these regional scale surveys were being conducted, the Hendricks-Hodge Expedition began excavations at the protohistoric and historic village of Hawikuh (or Hawikku; Hodge 1918, 1937; Smith et al. 1966) and Cambridge University researchers excavated at Kechiba:wa (or Kechipawan; Hodge 1920). Like the earlier pioneering Hemenway Expedition, these early twentieth century projects were focused on tracking the cultural relationships between prehistoric populations and contemporary Puebloan people in the Zuni region and beyond.

Beginning in the 1920s, issues of chronology and cultural taxonomy became the primary foci of research in the Cibola region. Excavations by Roberts (1931, 1932, 1939) as well as the Gladwins (Gladwin 1945) were important for both developing relative chronologies of ceramic and architectural change as well as for the delineation of archaeological cultures, branches, and regions across the greater Southwest. Indeed, the desire to define and verify archaeological culture areas drove much of the research in the Cibola region from the 1920s into the 1960s. Haury's (1936) definition of the "Mogollon" as a cultural group distinct from Basketmaker-Pueblo (Anasazi) and Hohokam populations, set off a long series of debates which still influence concepts of cultural identity in the

Southwest (see Reid and Whittlesey 2010). Importantly, the research sparked by the debate over the validity of the Mogollon concept included a series of regional scale surveys and intensive excavations conducted by Paul S. Martin, John B. Rinaldo and others at the Chicago Natural History Museum in the Upper Little Colorado and Mogollon Highlands areas (e.g., Hill 1970; Martin 1961; Martin et al. 1952, 1956, 1957, 1962; Martin and Rinaldo 1950, 1960), as well as surveys and excavations conducted by the Upper Gila Expedition from the Harvard Peabody Museum in the southern Cibola region (Bullard 1962; Danson 1957; McGimsey 1980).

While the battles over cultural taxonomy raged on along the edges of the Cibola region, excavations conducted by Richard and Natalie Woodbury at Atsinna in the El Morro Valley (Woodbury 1954; Woodbury and Woodbury 1956) and by Dittert (1959) and Ruppé (1990) in the Cebolleta Mesa area provided new and important data in portions of the Cibola region which had previously been known only through surface information. These early excavations in the Cebolleta Mesa area still provide much of the information available from the far eastern periphery of the study area (see also Forrester 1964, 1965). In addition, the 1950s and early 1960s witnessed the beginning of development-driven archaeological research in the Cibola region. The Highway Salvage Archaeology programs of Arizona and New Mexico documented and excavated numerous small sites across the Cibola region, in particular in the Mogollon Highlands and along the Puerco Valley (e.g., Wasley 1957; Wendorf 1954, 1956).

These salvage projects set a strong precedent for the research potential of development-driven archaeological projects.

In the last several decades, research in the Cibola region has focused increasingly on synthesis and regional scale processes. The push towards synthetic research arguably began with the Cibola Archaeological Research Project (CARP) in the early 1970s. This project entailed large-scale excavations at several major habitation sites as well as large-scale full coverage surveys in the El Morro Valley (Watson et al. 1980), which provided a wealth of primary data that have been incorporated into a number of subsequent studies (e.g., Duff 1996, 2002; Huntley 2008; Kintigh 1985a; LeBlanc 1975, 2001; Marquardt 1978; Potter 1997, 2000; Schachner 2007; Stone 1992) including this one. The survey and excavation work conducted by CARP also formed the backbone of Kintigh's (1985) synthesis of late prehistoric settlement across the Zuni area in New Mexico, which provided maps and chronological information on almost all known sites dating from the last half of the thirteenth century through the contact period (ca. A.D. 1250-1540).

Beginning shortly after CARP, there was a florescence of large-scale survey projects across the Cibola region. This work included several long-term university field schools and research programs (e.g., Accola 1981; Duff 2005; Kintigh et al. 1996, 2004; Kintigh 2007; Mills et al. 1999; Reid and Whittlesey 1999; Schachner and Kintigh 2005), and surveys conducted as a result of development as well as state and federal lands assessments (Bernard-Shaw 1993; Camilli et al. 1988; Elyea 1990; Fowler 1980; Hogan 1985; Holmes and Fowler

1980; Hunter-Anderson 1977; Kintigh 1980; Marshall 1979; Wozniak and Marshall 1991; Powers and Orcutt 2005; Schutt 1997). Major excavations have been somewhat less frequent in the core portion of the study area since the 1970s, but several large-scale cultural resource projects (e.g., Bradford 1980; Damp et al. 2001; Damp and Waseta 2004; Doyel and Debowski 1980; Howell 2000; Gilpin et al. 2004; Gratz 1977; Huber and Van West 2005; Oakes and Zamora 1999; Stebbins et al. 1986; Varien 1990, 2000) and a smaller number of long term university research programs (e.g., Duff 2005; Kintigh et al. 1996; Mills et al. 1999; Reid and Whittlesey 1999; Schachner and Kintigh 2005) have supplemented these surveys. Importantly, much of the recent primary fieldwork conducted in the Cibola region, especially in the Zuni area, has been conducted by the Zuni Archaeology Program (later the Zuni Cultural Resource Enterprise), a tribally owned and operated heritage management program established in 1974.

The Cibola Region: A.D. 1000-1540

The period considered in this study (ca. A.D. 1150-1325) was particularly dynamic in terms of settlement organization in the Cibola region. Over the course of just under 200 years, the inhabitants of the region went from residing in thousands of dispersed hamlets, to dozens of large aggregated communities, and eventually into a small number nucleated towns, many of which housed several hundred individuals (see Duff 2002; Huntley and Kintigh 2004; Kintigh 1996; Lekson 1996). The establishment of nucleated settlements across the Cibola region towards the end of the period considered here was relatively rapid and

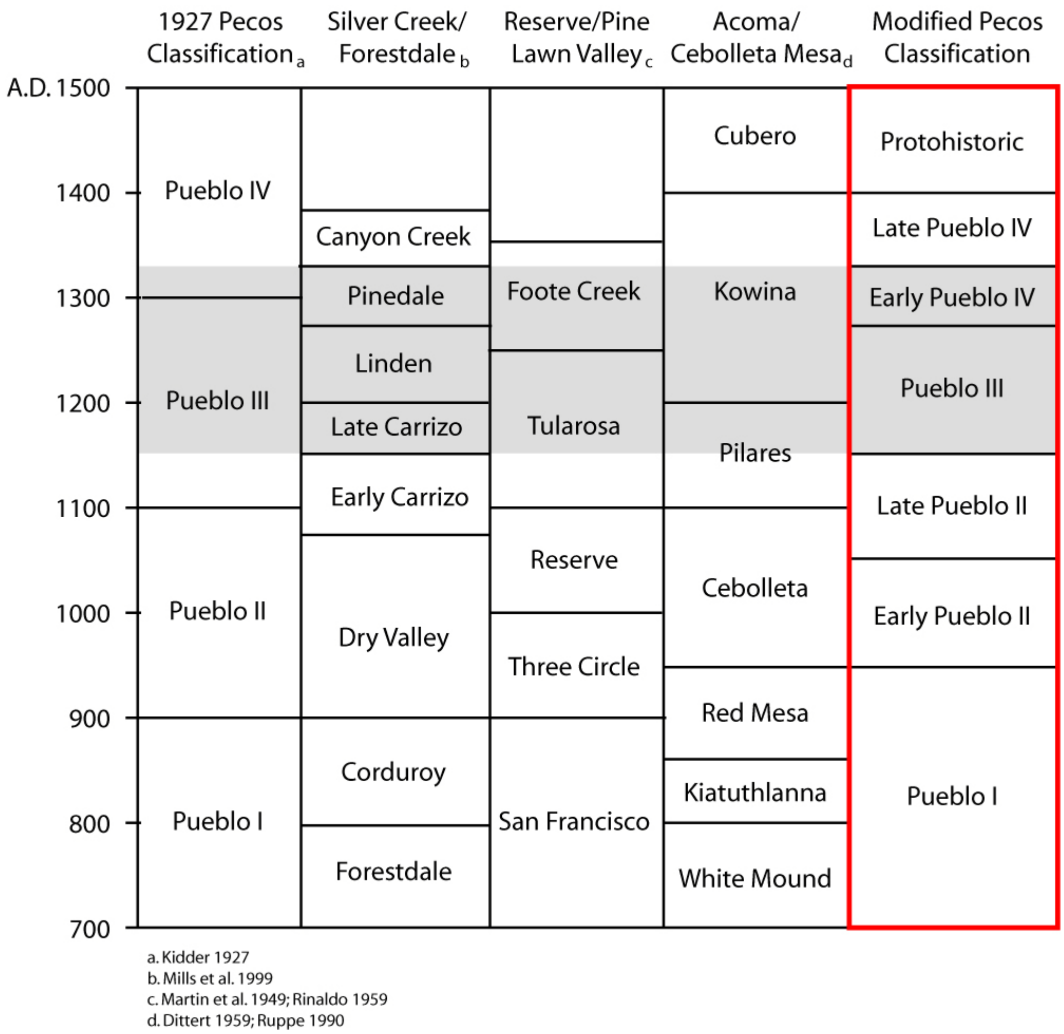


Figure 3.4. Various chronological schemes used across the greater Cibola region.

likely entailed fundamental changes in social organization (see Kintigh 1985a, 1994). At a regional scale, the establishment of increasingly larger settlement aggregates also both concentrated populations in smaller portions of the region and created vast empty expanses (Peeples and Schachner 2008; Wilcox et al. 2007).

In this section, I provide a brief overview of the major trends in settlement patterns and organization across the Cibola region through time ca. A.D. 1000-

1540. Although this interval is somewhat longer than the period directly considered in the bulk of this study, many of the patterns of settlement organization and regional interaction established at least by the eleventh century (and probably earlier; see Peeples et al. n.d.; Schachner et al. n.d.) continued to influence social developments in the Cibola region throughout the prehistoric period. For consistency, I use a modified version of the Pecos classification to refer to specific periods throughout this study, though this temporal scheme has not been consistently applied to all portions of the study area in the literature (Figure 3.4). The summary below is based on both published information as well as a detailed analysis of a large database of settlements from full coverage survey projects that I compiled as part of the Long Term Vulnerability and Transformation project at Arizona State University (PI Margaret Nelson; NSF BCS# 0508001; see Peeples and Schachner 2008).

A.D. 1000-1150: Late Pueblo II

The period from about A.D. 1000-1150 across the Cibola region, corresponding with the late Pueblo II period in the Pecos classification, was characterized in most areas by the occupation of relatively small hamlets that likely housed one or a few related nuclear families or households. The vast majority of settlements occupied at this time consisted of between 1 and 10 masonry rooms, and in areas above the Mogollon Rim perhaps 1 or 2 associated pit structures or kivas (e.g., Beeson 1966; Danson 1957; Dittert 1959; Howell 2000; Kintigh 2007; Longacre 1964; Varien 1990). The beginning of this period in the southern reaches of the study area in and around the Mogollon Highlands marks the transition from pithouse villages to above ground masonry pueblos. Some interpret this transition as a relatively gradual local development while others suggest that this change may have been brought about by the arrival of migrant populations from north of the Mogollon Rim (e.g., Duff and Lekson 2006; Haury 1985; Martin et al. 1956; Oakes 1999). Although the transition to above ground masonry structures did begin somewhat earlier north of the Rim (ca. A.D. 750-900), pithouse villages were still prevalent in many portions of the Cibola region well into the thirteenth century (Anyon 1984; Reid 1989). Differences in architecture may reflect differences in the degree of residential mobility in portions of the study area through time.

The eleventh century also saw the maximum spatial extent of settlement across the greater Cibola region. Thousands of small sites dotted the landscape, primarily along major drainages and other well watered areas. Although settlement density varied from place to place, most settlements were relatively dispersed (Peeples and Schachner 2008). There were, however, major gaps in this expansive regional distribution of settlements. Notably, the El Morro Valley in the northeastern portion of the Cibola region was virtually unoccupied at this time, despite becoming the major center of population in later decades (Watson et al. 1980).

In addition to the extensive distribution of small habitation sites across the region, there were several somewhat larger settlements occupied at this time, with different forms seen in different parts of the region. A number of large architectural complexes with strong similarities to the massive constructions in

Chaco Canyon within the San Juan Basin[2] were located in the portions of the Cibola region on the Colorado Plateau. These complexes include Chacoan style great houses (massively built room blocks usually of about 20-30 rooms; see Chapter 9) as well as other features such as circular great kivas, road segments and earthen berms. Some of these Chacoan architectural complexes were associated with clusters of small habitation sites (Duff 2005; Fowler et al. 1987; Mahoney et al. 1995; Roberts 1932, 1939; Stein and Lekson 1992). Several Chacoan great house complexes are found along the Puerco and Zuni River Valleys, around Cebolleta Mesa, and between the Quemado area and the Arizona/New Mexico border (Duff and Lekson 2006; Duff and Schachner 2007). Although no Chacoan great houses have been identified in the western portion of the study area around Silver Creek, circular great kivas of a form similar to those associated with great houses were constructed at this time. Herr (2001) argues that these great kiva sites provide evidence for the extension of developments associated with Chaco, and perhaps population movement into the Silver Creek area.

In the southern portions of the Cibola region, including the Mogollon Highlands, the Arizona Mountains, and the southern reaches of the Upper Little Colorado Valley, Chacoan architectural features are largely absent (but see discussions in Chapter 9; Duff 2002:67-69; Lekson 1991). In these areas there are, however, a few somewhat larger settlements consisting of masonry room blocks of about 15 to as many as 40 rooms (e.g., Danson 1957:36, 43, 54, 61-62; Rinaldo 1959). Some of these larger pueblos are associated with rectangular great kivas, a form of public architecture with a long history in the mountainous southern portions of the Cibola region (see Danson 1957:81-82; Haury 1950:29-39; Hough 1907:54; Oakes 1999; Olson 1960).

Despite the differences in the form of public architectural spaces in the northern and southern portions of the Cibola region, there is evidence for extensive interaction across these areas and likely some degree of population movement. Cibola White Ware was the dominant decorated ceramic ware across the Cibola region at this time even though it was likely not produced in some portions of the study area (Mills 2007b:223-225; Wilson and Severts 1999; Wilson 1994, 2007). The widespread distribution of a common suite of decorated ceramics suggests a substantial amount exchange or population circulation among the inhabitants of the northern and southern portions of the study area. Although migration has sometimes been an unpopular explanation for shifts in architecture and ceramics seen in the southern Mogollon region (e.g., LeBlanc 1983), many authors have recently moved back towards explanations that include a substantial role for the movement of people in the rapid changes occurring across the late Pueblo II period in the Mogollon Highlands and nearby areas (e.g., Duff and Lekson 2006; Herr 2001; Oakes and Zamora 1999).

A.D. 1150-1275: Pueblo III

The Pueblo III period represents the beginning of the interval explicitly considered in this study (Figure 3.5). This was a period of increasing aggregation across the Cibola region as well as much of the greater Southwest (see chapters in Adler 1996). Unfortunately, the beginning of this period is still fairly poorly

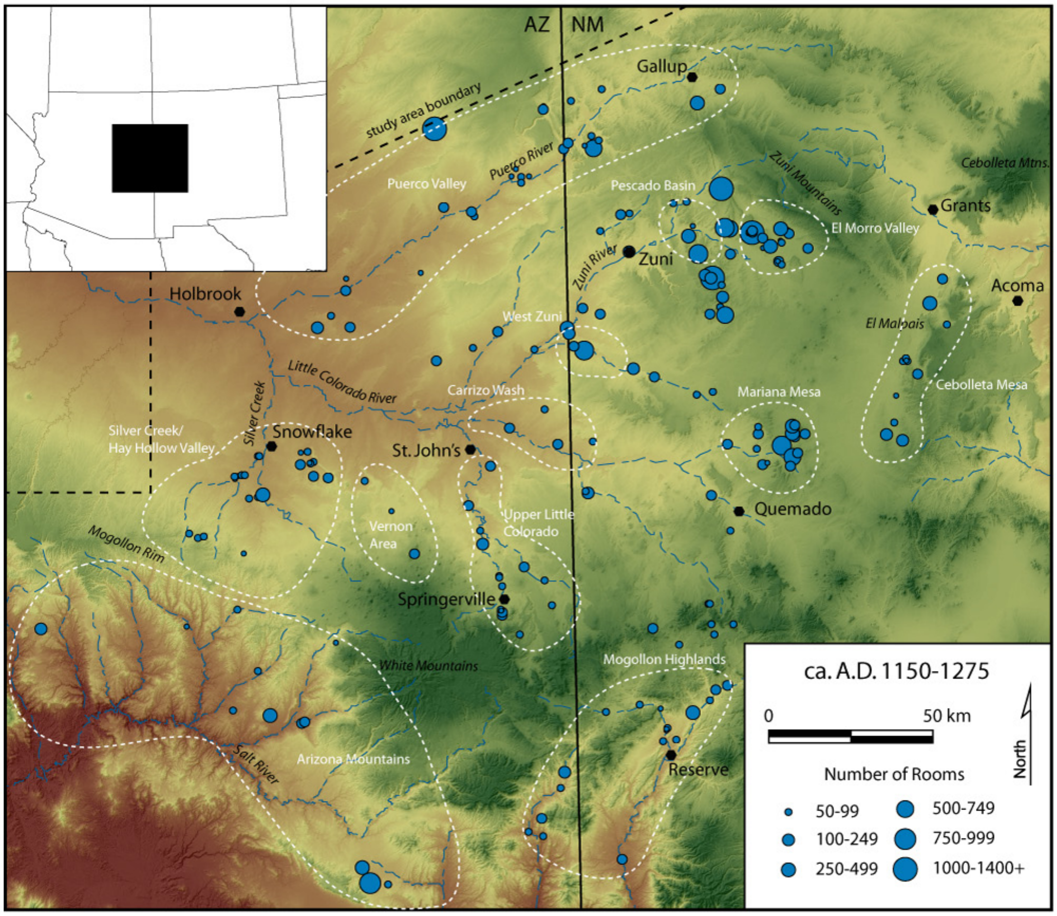


Figure 3.5. Distribution of major settlements during the Pueblo III period.

understood. Absolute dates between about A.D. 1150 and 1200 are rare across the Cibola region as a whole, and with a few exceptions (e.g., Anyon et al. 1983; Eckert 1995; Martin et al. 1964; Westfall 1981) sites that likely fall within the early Pueblo III period are known primarily through surface information. This poorly understood interval coincides with a major hiatus in construction in Chaco Canyon and the San Juan Basin (Marshall et al. 1979; Powers et al. 1983; Windes and Ford 1996) as well as a prolonged dry and warm climatic interval (c.a., A.D. 1131-1192; Van West and Grissino-Mayer 2005:33.18), both of which may have had far-reaching effects across the Southwest.

There is limited evidence that some Chacoan great house settlements in the Cibola region that were first established in the eleventh century may have continued into the early Pueblo III period (based on ceramics present; see Roberts 1932; Schutt and Chapman 1997; Wozniak and Marshall 1991), but the nature of later occupation at Chacoan era settlements is currently unclear. In the southern Cibola region, especially in the Mogollon Highlands, there is also evidence for some continuity in settlement location across the 1100s and into the 1200s (e.g., Martin et al. 1956, 1957), but populations appear to have been increasingly concentrated into fewer and larger settlements through time (Lekson 1996; Oakes 1999). Early Pueblo III period settlements may have been somewhat more common in the expanded study area, such as along the Puerco Valley (Fowler et al. 1987; Schutt and Chapman 1997) and perhaps in the areas near Cebolleta Mesa (Danson 1957; Dittert 1959; Elyea 1990; Ruppé 1990; Wozniak and Marshall 1991) though sites potentially dating to this period have not been examined in great detail. As these brief comments suggest, more research is needed on issues of settlement and continuity in the early Pueblo III.

By the beginning of the thirteenth century, patterns of regional settlement are much clearer. There are numerous well-dated sites with tree ring dates in the 1200s across most portions of the Cibola region (e.g., Duff 1999:Appendix A; Schachner 2007:Figure 5.5; Zier 1976). Major full coverage surveys (e.g., Anyon et al. 1983; Hogan 1985; Hunter-Anderson 1977; Kintigh et al. 2004; Kintigh 1980, 2007; Lightfoot 1984) as well as broad reconnaissance projects (Beeson 1966; Danson 1957; Hough 1903, 1907; Spier 1917, 1918, 1919) suggest that this was a period of population growth across the Cibola region as a whole. Importantly, this era was marked by a large influx of population into the El Morro Valley, an area that was not intensively occupied prior to about A.D. 1225 or 1250 (Schachner 2007; Watson et al. 1980), as well as dramatic increases in population in many other high elevation areas along the eastern edge of the Cibola region including the Mariana Mesa and Cebolleta Mesa sub-regions (Danson 1957; Dittert 1959; Ruppé 1990). Interestingly, the shift of population into the El Morro Valley does not appear to have been associated with major depopulations in other portions of the Cibola region. The massive number of rooms constructed in such a short period in the El Morro Valley may instead reflect the extremely high degree of residential mobility practiced by the inhabitants of the Zuni area at this time (Schachner 2007, 2008).

Settlement organization during this period differed from place to place, and was likely quite diverse, even at a local level. In general, however, there was a marked increase in site size from the Pueblo II period both in terms of individual structures and communities. In the northern Cibola region including the Zuni area, Mariana Mesa, Cebolleta Mesa, and the Puerco Valley, a number of large communities were constructed at this time consisting of closely spaced clusters of small room blocks (Figure 3.6; e.g., Fowler et al. 1987; Kintigh et al. 1996, 2004; Marshall and Wozniak 1991; McGimsey 1980; Saitta 1994). These clusters typically ranged form about 100 to over 500 rooms within a small area. Some of these settlement clusters were centered around large structures with many architectural features harkening back to the Chacoan era, including massive

Figure 3.6. Examples of Pueblo III period settlements from the northern (top) and southern (bottom) Cibola region. Note differences in scale.

construction, blocked-in kivas, and circular great kivas (see Duff and Lekson 2006; Fowler et al. 1987; Kintigh et al. 1996; McGimsey 1980; Schachner and Kintigh 2005). These architectural complexes are often referred to as Post-Chacoan great houses, and are seen as extensions of Chacoan architectural symbolism into the thirteenth century. Interestingly, there appears to have been some innovation in the form of Chacoan inspired architecture as great kivas constructed during this period are larger than Chacoan era structures and unroofed. These large, open structures may have been designed to accommodate the increased size of residential communities (Kintigh 1994; Kintigh et al. 1996).

The construction of Chacoan inspired structures after the decline of Chaco Canyon as a regional center emphasizes the local importance of great house architecture in the Cibola region (Cameron and Duff 2008). In the south, along the Upper Little Colorado, the Arizona Mountains, the Vernon area, Silver Creek, and the Mogollon Highlands, there are also a few closely spaced clusters of apparently contemporaneous small sites, but the total number of rooms in clusters tends to be smaller; usually about 15 to 100 rooms. These groups of small sites are often also somewhat less spatially consolidated than northern aggregated clusters (e.g., Accola 1981; Danson 1957; Lekson 1996; Longacre 1964; Peckham 1969; Oakes 1999; Reid et al. 1996). Perhaps slightly later in time (ca. A.D. 1200), larger structures with about 50 to as many as 100 rooms are constructed in some areas in the southern Cibola region (Lekson 1996). These larger room blocks, often referred to as Tularosa phase pueblos within the Mogollon Highlands area, appear to have grown accretionally over time and typically have irregular layouts (see Figure 3.6). Many of these large, irregular pueblos are also associated with a nearby or attached rectangular great kiva (DeGarmo 1975; Martin et al. 1956, 1957). The largest communities in the southern Cibola region, such as the 300 room Delgar Ruin, consist of a few closely spaced Tularosa phase pueblos (Rinaldo 1949). By the end of the Pueblo III period, much of the population of the southern Cibola region was residing in one of these relatively large Tularosa phase pueblos and most other small sites had been residentially abandoned (Lekson 1996:171).

As the discussion above highlights, settlement organization was quite diverse across the study area at this time at both the local and regional scales. Overall, however, this period is marked by an increasing consolidation of the regional population into both larger structures and aggregated clusters of structures that likely formed residential communities. The increase in both the size of individual structures and the number of structures in close association with one another suggest that the scale of residential communities may have been greatly expanded compared to the previous century. The processes described here ultimately culminated in the emergence of a new form of settlement consisting of nucleated villages or towns, which encompassed an entire community within a single structure. Although nucleated villages appeared prior to the Pueblo IV period in some portions of the region (see below), this new form of settlement organization dominated the entire region during the last quarter of the thirteenth century.

A.D. 1275-1325: Early Pueblo IV

The Pueblo III to Pueblo IV transition represents an interval of widespread change across the Cibola region as a whole. As described above, in the Pueblo III period, most people lived in small room blocks, many in tightly spaced clusters. By the end of the thirteenth century, however, virtually everyone in the Cibola region lived in one of about 40 large nucleated towns (Figure 3.7). Unlike the clustered communities of the Pueblo III period, nucleated towns comprised an

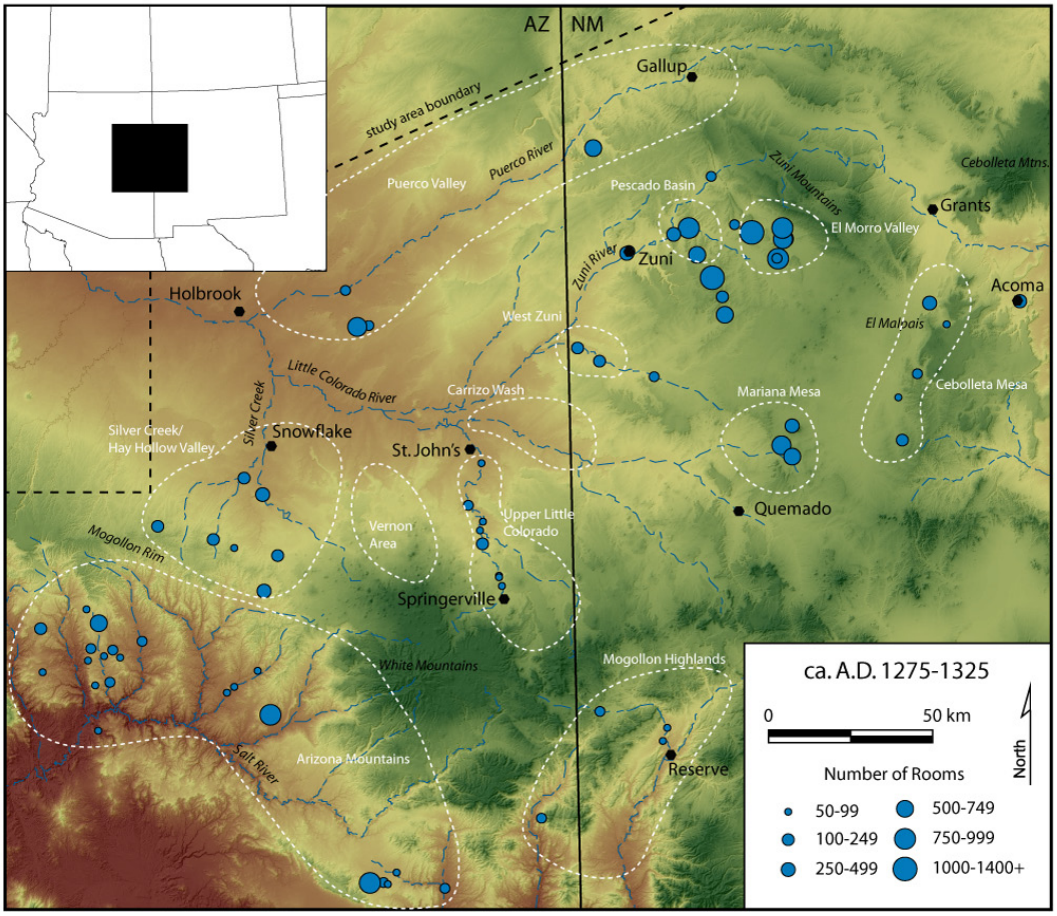


Figure 3.7. Distribution of major settlements during the early Pueblo IV period.

entire residential community within a single structure. The consolidation of population into these towns was also associated with the depopulation of many other portions of the region likely including the Vernon area, the lower Carrizo Wash area, and much of the upper Puerco Valley, although those areas may have continued to be used in limited ways. In portions of the Cibola region that continued to be occupied, new settlements were established around the beginning of this period, but in some areas along the periphery of the Cibola region such as the Mogollon Highlands, this period saw the continued occupation of a few of the largest villages (e.g., Lekson 1996; Rinaldo 1962; Robinson 1992).

The earliest large nucleated communities actually probably date to the final decades of the Pueblo III period (ca A.D. 1240-1250 [Duff 2002:35-40; Duff and Schachner 2007; Lowell 1991]), but this community form did not begin to characterize the bulk of the region until after A.D. 1275. Importantly, the forms of large, nucleated communities differed dramatically across the region as a whole. In the Zuni River Valley, the El Morro Valley, and along the Puerco, early nucleated pueblos were rapidly constructed, planned structures indicating a high level of labor coordination (Figure 3.8; see Fowler et al. 1987; Huntley and Kintigh 2004; Kintigh 1985a; Kintigh et al. 2004). Additionally, a few of the earliest nucleated towns had over 1,000 rooms, suggesting they were formed through the consolidation of multiple, smaller aggregated settlement clusters (e.g., Kintigh et al. 2004).

Many of the nucleated settlements in the northern Cibola area consist of distinctive oval and rectangular room blocks (some combining both forms), which some have suggested may represent different social groups or other underlying cosmological principals (Huntley and Kintigh 2004:70-71; Potter 1997). The majority of these villages were constructed around a large central plaza, completely enclosed by the walls of the village. In the nearby Mariana Mesa (McGimsey 1980; Smith et al. 2009) and Cebolleta Mesa (Dittert 1959; Ruppé 1990) areas, similar large and apparently planned nucleated towns were constructed, but they are generally somewhat smaller and appear to have not been formally built in the distinctive geometric forms of many Zuni area towns. Despite their planned layouts and rapid construction, most of the first nucleated

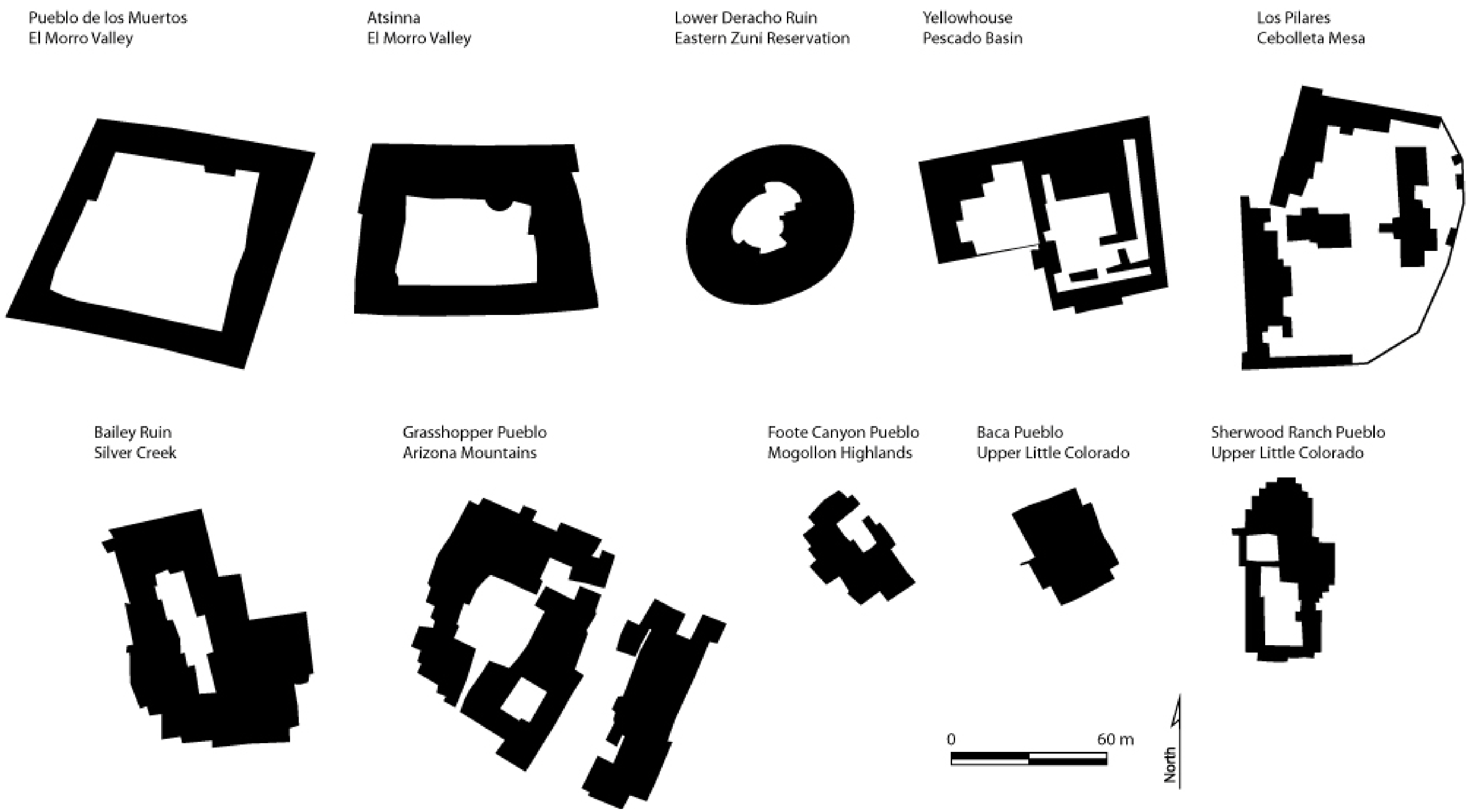


Figure 3.8. Examples of Pueblo IV period settlements from the northern (top) and southern (bottom) Cibola region.

pueblos were depopulated within a single generation. Kintigh (1985:115-117) argues that the short-lived nature of the early nucleated towns may suggest that the inhabitants of the Zuni area had not yet developed the mechanisms for social organization and control necessary for life in these unprecedentedly large communities.

To the south, large nucleated pueblos established at this time were similar to the Tularosa phase structures described above (irregular agglomerations of rooms), but they were somewhat greater in size and began to incorporate open plazas and courtyards into their layouts (see Figure 3.8). In some portions of the region, such as the southern Upper Little Colorado area, the size of these nucleated structures did not differ dramatically from the constructions of earlier decades (Duff 2002:39). Other settlements such as the 250 room Bailey Ruin along the Silver Creek drainage (Mills et al. 1999) were considerably larger than any earlier communities in the area. The transition to nucleated settlement may have been somewhat more gradual in the southern and western Cibola region than in areas near Zuni. Where good data are available, plaza-oriented nucleated communities in the Silver Creek, Arizona Mountains, Upper Little Colorado, and Mogollon Highlands areas appear to have grown accretionally rather than being planned and rapidly constructed (see Mills 1998). Furthermore, early nucleated pueblos in these portions of the Cibola region appear to have been somewhat longer lived than the massive nucleated communities of the Zuni area. These differences in the form of early nucleated communities and the pace of their construction in the northern and southern portions of the Cibola region may suggest differences in the nature or scale of social integration among populations prior to the construction of nucleated communities.

In addition to changes in the nature and organization of settlements, the Pueblo III to Pueblo IV transition was also marked by several major changes in ceramic technology and design. In particular, this was a period of experimentation with glaze paint technologies. Early glaze painted Cibola White Ware and White Mountain Red Ware ceramics, probably first produced in the mid A.D. 1200s, may have been an unintentional product of increased firing temperatures and various minerals incorporated into paint recipes. After about A.D. 1275, however, relatively homogenous and distinct recipes for glaze paint, which represent intentional manipulations of paints and fluxes, were established (Fenn et al. 2006; Huntley 2006, 2008:44-59).

The transition to glaze painted ceramics coincided with a divergence in the painted designs on polychrome vessels found across the Cibola region. The widespread White Mountain Red Ware ceramics found across much of the Cibola region during the Pueblo III period diverged into two distinct series; the White Mountain and the Zuni series (often called Zuni Glaze Ware; Carlson 1970). These two distinct traditions have certain features in common, but vary quite dramatically in terms of the painted designs (see Chapter 8). Zuni Glaze Ware is primarily associated with areas along the Zuni River Valley and in the El Morro Valley, whereas the late White Mountain series is most common in the Silver Creek and Arizona Mountains areas to the west.[3] The areas in between including the Mogollon Highlands, the Upper Little Colorado, and Mariana Mesa areas are characterized by varying proportions of both wares (Duff 2002; McGimsey 1980; Rinaldo 1962). Although late White Mountain series and Zuni Glaze Ware vessels were both painted with glaze paints, the recipes of the paints were distinct (Fenn et al. 2006; Huntley 2006). The divergence between these ceramic traditions in terms of both design and technology may suggest the emergence of somewhat more distinct boundaries between the eastern and western portions of the Cibola region at this time.

A.D. 1325-1400: Late Pueblo IV

The late Pueblo IV period is characterized by many of the same patterns documented in the early Pueblo IV period (Figure 3.9). Several large pueblos first established during the previous interval continued to be occupied across much of the fourteenth century, although many were substantially remodeled (Duff 2004; Huntley and Duff 2004; Kaldahl et al. 2004). At a regional scale, settlement continued to be dominated by large, nucleated towns and the total occupied area continued to decrease through time. A few areas in the southern portions of the Cibola region including the Mariana Mesa, Cebolleta Mesa, and the Mogollon Highlands areas were probably not occupied after A.D. 1325 or perhaps 1350 (see Dittert 1959; McGimsey 1980; Rinaldo 1962; Roney 1996; Wozniak and Marshall 1991). A small number of new settlements were established in the portions of the region that continued to be occupied, including areas along the Zuni River, the Upper Little Colorado, and the Silver Creek area. There are very few tree ring dates anywhere outside of the protohistoric Zuni villages post-dating

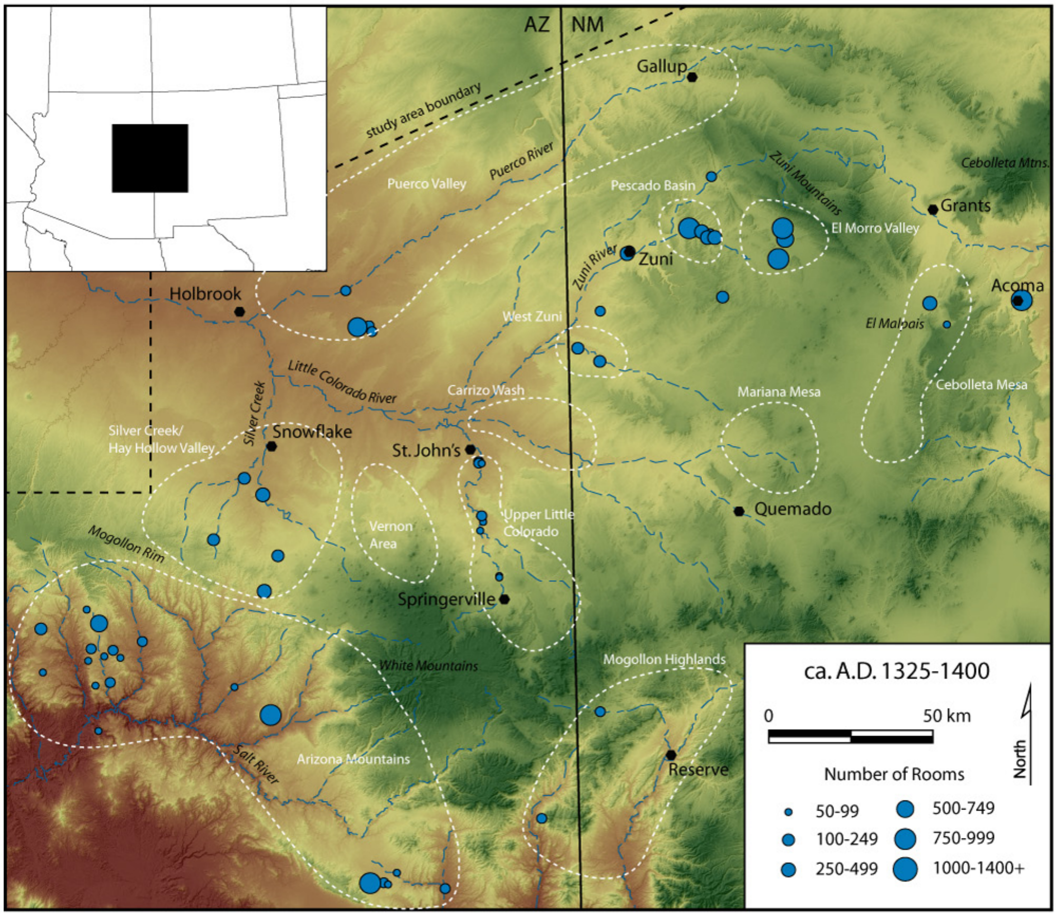


Figure 3.9. Distribution of major settlements during the late Pueblo IV period.

the 1370s and none from the 1390s. It is likely that vast majority of the Cibola region, excluding the Zuni and Acoma areas, was depopulated before the end of the fourteenth century (Duff 2002:42).

The Arizona Mountains may represent an exception to the pattern of continued nucleated settlement across this period. In the Grasshopper area, the period after A.D. 1325 (or perhaps 1300) is marked by the establishment of a number of somewhat smaller dispersed sites in the areas surrounding Grasshopper Pueblo, and a substantial reduction in construction activity at Grasshopper itself (Reid 1989; Reid and Whittlesey 1999:148-158; Riggs 2001). Riggs (2005:340) has suggested, based the timing of architectural transitions in other portions of the Arizona Mountains, that a similar pattern of dispersion may have also characterized the Kinishba and Point of Pines areas, but the data necessary to evaluate this possibility are not currently available.

Across the Cibola region as a whole, there is a gradual reduction in the number of occupied rooms over the course of the fourteenth century (e.g., Kintigh 1985a; Wilcox et al. 2007:Figure 12.23). The decline in population is apparently not associated with a period of emigration, and may instead represent gradual declines in population growth rates. During the Pueblo IV period, regional settlement was increasingly spatially restricted as populations moved into the protohistoric Pueblo towns (e.g., Hill et al. 2004). As population declined in some portions of the Cibola region, movement into the few areas that persisted into the protohistoric period may have accelerated.

A.D. 1400-1540: Protohistoric Period

The protohistoric transition represents another major hinge point in the history of settlement in the Cibola region. The timing of this transition is difficult to determine, but the best available data suggest that around the end of the fourteenth century or the beginning of the fifteenth century, nine large pueblos were established or greatly expanded along the Zuni River Valley in an area that was probably not extensively occupied during most of the previous century. At approximately the same time, other portions of the Cibola region were depopulated (Figure 3.10; see Kintigh 1985a; Smith et al. 1966).[4] Unlike the

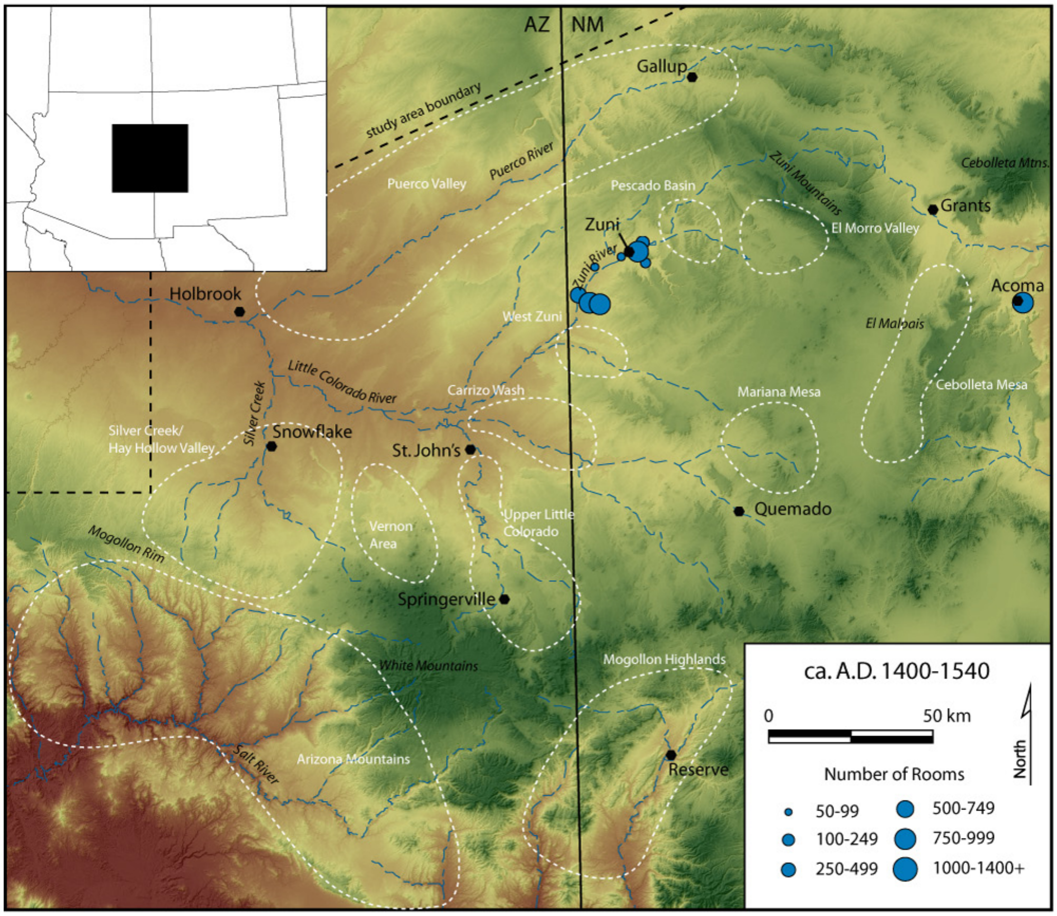


Figure 3.10. Distribution of major settlements during the Protohistoric period.

earlier nucleated settlements in the Zuni area, these newly established towns were not planned constructions, but instead appear to have been massed clusters of room blocks (Figure 3.11). This transition in settlement was also marked by numerous other changes in ceramic design, domestic architectural features, and burial practices which many argue suggest the presence of substantial numbers of immigrants from outside of the Zuni area proper at these new villages (Cushing 1890; Peeples 2010; Rinaldo 1964; Schachner 2006; Smith et al. 1966). Most of the villages established at the beginning of the protohistoric period were still occupied at Spanish contact in the sixteenth century and up until the Pueblo

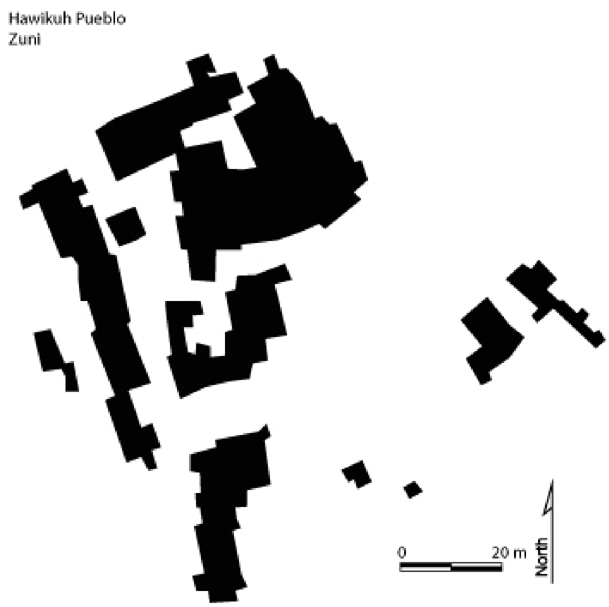


Figure 3.11. Map of the protohistoric town of Hawikuh.

Revolt of 1680 (Bandelier 1892; Hodge 1937; Kintigh 1985a). The process of immigration and population consolidation marking the establishment of the protohistoric town has also been documented to the west along the Hopi Mesas (Adams et al. 2004). The protohistoric transition in the Acoma area likely also entailed similar processes, but there is currently little information available on the fourteenth and fifteenth centuries in this area (Dittert 1998; Minge 1991:1-9).

Social Transformation across the Cibola Region

As the brief regional overview above suggests, the Pueblo III to Pueblo IV transition was one of the most widespread and massive transformations in the entire prehistory of the Southwest. In a relatively short period, the inhabitants of the Cibola region abandoned the thousands of small hamlets and settlement clusters dispersed across the region and established a small number of nucleated towns. By the end of the thirteenth century, essentially the entire population of the Cibola region was residing in one of these large, nucleated towns.

At an even broader spatial scale, the late thirteenth century was a turbulent period across the Southwest as a whole. This period was marked by the depopulation of the Northern San Juan (Mesa Verde) region and most of northeastern Arizona as well as major influxes of population into other areas to the south (Hill et al. 2004). Although the core of the Cibola region around Zuni does not appear to have been a major destination for people leaving regions to the north at this time (Kintigh 1985a), there is substantial evidence for migration into many areas along the periphery of the study area including but probably not limited to the Silver Creek area, the Arizona Mountains, Cebolleta Mesa, and the Mogollon Highlands (see Kaldahl et al. 2004; Lyons 2003; Mills 1998; Wilcox et al. 2007). The scale of this population movement likely had dramatic consequences across the entire region even for the inhabitants of areas that did not see large numbers of new arrivals.

The pace of the Pueblo III to Pueblo IV settlement transformation across the Cibola region has been a topic of much debate, particularly in the Zuni area. Some argue that nucleation in the Zuni area was extremely rapid, occurring around ca. A.D. 1275-1280, perhaps even within a single year (LeBlanc 2001:30). LeBlanc (1999, 2001; see also Watson et al. 1988) suggests that the transition to nucleated settlements was driven largely by increased conflict associated with regional climatic instability and large-scale population movements. While the available tree ring cutting dates from the El Morro Valley certainly do support the notion of a rapid transition (LeBlanc 2001:Table 2.2), other researchers have used seriations of dated ceramic types to argue that several nucleated pueblos may have been constructed somewhat earlier (ca. A.D. 1225-1250; Huntley and Kintigh 2004; Kintigh 1985a:77-89; Schachner 2007:160-171). Unfortunately, there are no tree ring dates available for any of the nucleated pueblos in the Zuni area that are most likely to predate A.D. 1275. However, among the proposed early nucleated towns are all of the sites with more than 1,000 rooms and three sites associated with unroofed great kivas, a form of public architecture which likely fell out of use around A.D. 1275.[5] If a few nucleated towns in the Zuni area were constructed prior to A.D. 1275, as the limited available evidence suggests, this would mean that they were contemporaneous with the Post-Chacoan great houses and clustered communities described above for a short period in the mid thirteenth century. The earliest nucleated settlements in the Cibola region were likely constructed in the El Morro Valley and nearby areas to the west which were essentially unpopulated prior to the mid to late Pueblo III period (see Schachner 2007:160-171). From this, Schachner (2008; see also Duff and Schachner 2007) argues that the diversity of community forms in the El Morro Valley at this time was indicative of experimentation with different forms of social organization. Shortly after about A.D. 1275-1280, however, only nucleated towns remained across the entire Zuni area.

When considering the Cibola region as a whole, similar processes to those described for the Zuni area have been documented in many other areas, but the scale and timing are somewhat different from place to place. There are certainly some large communities in portions of the Cibola region first established prior to A.D. 1275, such as Turkey Creek Pueblo in the Point of Pines area which was probably initially constructed in the 1240s (Lowell 1991). There are also a few pre-A.D. 1275 tree ring dates at other nucleated sites across the region (e.g., Casa Malpais, Horse Camp Mill, Los Pilares, Pinedale Ruin), but it is unclear if these dates represent earlier small sites which formed the core of nucleated villages, the initial establishment of nucleated villages, or the reuse of old wood. The available dates from the entire Cibola region suggest, however, that the scale of construction increased rapidly in almost every portion of the study area between A.D. 1275 and 1279 (see Bannister et al. 1970; Duff 1999:Table A.1; Kaldahl et al. 2004:Figure 9.4; LeBlanc 2001:Table 2.2; Riggs 2001:Figure 2.5). The transition to nucleated, plaza-oriented settlements was probably complete before A.D. 1300. Thus, although the transition may have been more abrupt in some places and more gradual in others, the available evidence suggests that this regional scale transformation in settlement organization probably occurred within a single generation.

LeBlanc (1999, 2001) has previously argued that the establishment of nucleated pueblos in the El Morro Valley and other areas across the northern Southwest along the Pueblo III to Pueblo IV transition may have been a response to increased warfare or, at least, the threat of conflict at this time. LeBlanc argues that conflict may have been driven by increasing climatic instability in the last half of the thirteenth century. Other researchers argue, based on reassessments of the nature and timing of the abandonment of Pueblo III period clustered communities, the establishment Pueblo IV period towns, and the scale of burning at excavated sites, that direct evidence for conflict in the central Cibola region is lacking (Huntley 2008:76-77; Schachner 2007:240-242). The strong direct evidence for violence that does exist is from two nucleated sites along the edges of the Cibola region in the Mariana Mesa area (Techado Spring Pueblo [Smith et al. 2009]; and Horse Camp mill [McGimsey 1980]), but likely dates to the fourteenth century, ca. A.D. 1325. This evidence includes intense burning, *de facto* floor assemblages in numerous rooms, and unburied human remains with substantial evidence for skeletal trauma. The extent of conflict across the entire Cibola region in the late 1200s is currently unclear, but it is certainly likely that the inhabitants of this region were at least aware of conflict in areas to the north (e.g., Haas and Creamer 1996; Kuckelman et al. 2000, 2002) that were emptying out during the mid to late thirteenth century. However, as I argue above, nucleated towns and aggregated site clusters were likely occupied contemporaneously for at least a few decades during the last half of the thirteenth century suggesting that the nature and pace of this transition differed among communities. Overall, the available data suggest that although conflict or fear of conflict at both the local and regional scales may have played a role in the establishment of nucleated towns in the Cibola region, the transition was likely more complex than LeBlanc (2001) has previously suggested.

The transition in settlement size and layout likely also entailed fundamental changes in social organization. Unlike earlier centuries where the building blocks of most communities were small room blocks which likely housed one or a few related households, nucleated settlements placed hundreds or in some cases over a thousand people within a single structure, cheek to jowl. To illustrate the magnitude of this transition further, Figure 3.12 shows histograms of room block size before and after the establishment of nucleated pueblos in the Zuni area.[6] Although there were a few somewhat larger room blocks during the Pueblo III period, the bulk of the population still lived in small structures which may have housed one or a few households. Even where these small room blocks were part of larger clusters, the maintenance of distinct habitation structures suggests some degree of household autonomy. After the transformation, however, only large nucleated settlements remained, and most of these are substantially larger than the largest structures occupied prior to nucleation. In areas to the south including the Mogollon Highlands, the Arizona Mountains, the Upper Little Colorado, and the Silver Creek areas, the transition to larger settlements may have been somewhat less dramatic, but Pueblo IV period sites are still often three to four times larger than Pueblo III period clustered communities and other large pueblos in these areas. Once the transition to nucleated settlement was complete, household autonomy was likely restricted as communal mechanisms for social monitoring and control were established and institutionalized (e.g., Bernardini 1998). Some suggest that the apparent architectural invisibility of individual households in these nucleated communities may indicate an intentional masking of distinctions among small social groups in favor of the community (Duff and Lekson 2006:324-325; Duff and Schachner 2007:194).

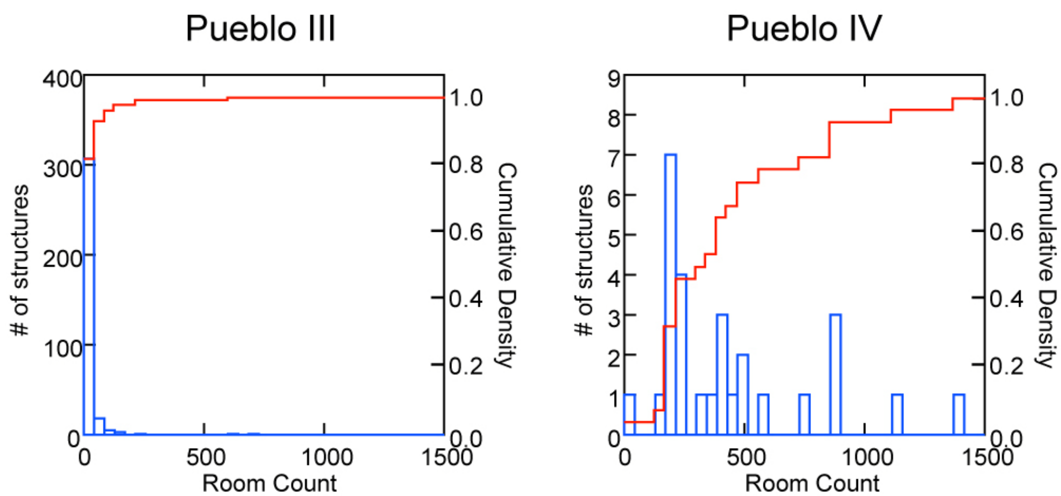


Figure 3.12. Histograms of room block size before (Pueblo III) and after (Pueblo IV) the transition to nucleated settlements (red lines show cumulative density).

The Pueblo III to Pueblo IV transition also saw a major reorganization of public spaces. Prior to the Pueblo IV period, rectangular and circular great kivas and Chacoan great houses were the primary foci of ritual activity across the region. Over the course of the period considered here, public architectural spaces may have become somewhat more inclusive in portions of the region. In the Zuni area, roofed Chacoan great kivas were largely replaced by oversized, unroofed great kivas in the late 1100s or early 1200s. These structures would have allowed more people to participate in events within their walls, and also likely would have made the events visible to more members of a community (Kintigh et al. 1996). The beginning of the Pueblo IV period saw another shift in public architecture as enclosed plaza spaces become more common and great kivas declined in most portions of the study area. Plaza spaces were probably used for both daily activities as well as periodic ceremonies (e.g., Adams 1991). As nucleated structures housed entire communities, the ubiquity of plazas may suggest increasing integration and inclusiveness in community-scale ceremonies. At the same time, the creation of plazas completely enclosed by the walls of the community may have also limited the access of those outside of the residential community. This shift in the use of space may have been an active expression of newly developing notions of community boundedness.

Finally, the Pueblo III to Pueblo IV transition was also associated with major changes in the technology and design styles of painted ceramics. Glaze painted ceramics rapidly replaced matte painted types after about A.D. 1275 across most of the Cibola region. At the same time, ceramic design traditions and the recipes used in glaze paints diverged between the eastern and western portions of the Cibola region. This divergence may suggest the emergence or increasing importance of regional-scale social boundaries among the inhabitants of different portions of the greater Cibola region. This is a trend that characterizes much of the Southwest during the late thirteenth and early fourteenth centuries (Duff 2000).

Overall, the late thirteenth century transformation described above (Pueblo III to Pueblo IV transition) entailed the depopulation of many portions of the Cibola region, a rapid increase in community size, dramatic changes in public space, a fundamental reformulation of the relationship between households and communities, and an apparent increase in the importance of social boundaries at a regional scale. Although the timing and magnitude of this transformation may have differed somewhat from place to place, it appears that many of the most jarring changes probably occurred within a single generation. The widespread and rapid nature of this transition suggests that these changes likely involved the active participation (or opposition) of most of the inhabitants of the region. From this, I argue that this transition can be profitably considered in light of the theoretical models of collective action, social movements, and social transformation described in the previous chapter.

Anasazi and Mogollon in the Cibola Region

Students first learning about the archaeology of the Southwest are often taught that the Anasazi were the people who lived on the Colorado Plateau, produced gray ware pottery, and made circular great kivas. The Mogollon people, on the other hand, lived in the mountainous highlands along the Mogollon Rim as well as in the Chihuahuan Desert, produced brown ware pottery, and built rectangular great kivas. This simple dichotomy belies the enormous amount of ink spilled in the debate over the nature of the archaeological constructs which have come to be known as Anasazi and Mogollon. In this section, I provide a few brief comments on past and present thinking regarding the nature of archaeological “cultures” and their analytical and social meaning in the Cibola region. This discussion provides context for the analyses and interpretations in subsequent chapters as archaeological culture concepts continue to structure research and training in the Cibola region. For those interested in a more detailed discussion of the specific issues covered here, Reid and Whittlesey (2010) have recently published a fascinating historical account of the controversy.

The term "Anasazi" has been abandoned by many Southwestern archaeologists in recent years because it has negative connotations to many contemporary Puebloan people. This term has often been replaced by the more general term "Ancestral Pueblo," which is usually seen as a broader designation including the inhabitants of many areas that would be traditionally defined as both Anasazi and Mogollon in older schemes (e.g., Mills et al. 1999:3-4). In the context of this study, however, I use the terms Anasazi and Mogollon because I am referring to the specific historical archaeological concepts. I do not attribute any specific cultural or ethnic meaning to these concepts in general, although I do argue that these designations likely capture certain aspects of social interaction and identity at regional scales.

The debate over the nature and validity of distinct culture areas in the Cibola region began in earnest with the publication of Emil Haury's 1936 report, *The Mogollon Culture of Southwestern New Mexico*. In this influential publication, Haury argued that the pithouse dwellers of two villages in the highlands of Southwestern New Mexico were culturally distinct from both Basketmaker-Pueblo (Anasazi) populations to the north and Hohokam populations to the west. He argued for the creation of a third major archaeological culture in the Southwest, which he named the Mogollon after the type site in the Mogollon Mountains along the Arizona-New Mexico border. Importantly, Haury also argued that Mogollon developments (i.e., pottery, pithouses, basketry, etc.) were at least as old as those documented in the Anasazi region to the north, but that due to cultural mixing with Anasazi groups, Mogollon populations were somewhat less distinct after A.D. 1000 (see also Haury 1985).

Haury's designation of the Mogollon as a distinct archaeological culture before A.D. 1000 set off a series of debates which fueled a great deal of primary archaeological research and published theoretical arguments in the Cibola region and other nearby areas for decades to come (e.g., Bullard 1962; Danson 1957; Haury 1985; Martin 1943, 1961; Martin et al.1952, 1956, 1957, 1962; Martin and Rinaldo 1950, 1960; McGimsey 1980; Nesbit 1938; Rinaldo 1941, 1959; Wendorf 1953; Wheat 1955). Much of the disagreement centered on whether Mogollon populations were demonstrably distinct from Anasazi populations through time and across space. Some early critics argued that the suite of material traits which Haury and others had used to define the Mogollon culture were merely derivative of Anasazi traits, and thus the Mogollon region should be seen as the periphery of the Anasazi world rather than a separate cultural development (e.g., Nesbit 1938; Kidder 1939). Others argued that Mogollon traits were not only distinct, but that they could be traced in time well past A.D. 1000 despite evidence for increasing Anasazi influence and "mixing" (e.g., Danson 1957; Martin and Rinaldo 1950; Wheat 1955). By the 1960s, once the dust had settled on the debate, the Mogollon concept was, in general, fairly uncontroversial. However, the Mogollon culture area of the mid twentieth century was far larger in spatial extent and was applied to broader temporal interval than Haury's original designation.

Although the Mogollon culture as an archaeological concept was no longer controversial by the 1960s, varying interpretations of the *cultural* nature and the analytical utility of this and similar archaeological constructs remain a source of disagreement even to this day. Some argue that designations like Anasazi and Mogollon should be abandoned because they tend to push researchers away from questions that span the traditional boundaries of archaeological cultures, and because such constructs probably do not reflect cultural designations that would have had meaning in the past (e.g., Dean 1988; Lekson 1996; Mills et al. 1999; Speth 1988; Tainter and Plog 1994; Wilcox 1988). Others argue that these archaeological cultures, which parse variability in material culture at regional scales, do have an underlying behavioral basis that may reflect patterns of social interaction and identity at some level (e.g., Reid 1989, 2001; Reid and Whittlesey 2010; Riggs 2005). Through the analyses presented in this study, I suggest that both of these arguments have merit.

Even within the brief regional overview provided in this chapter, it is immediately apparent that there are numerous differences between the northern and southern portions of the Cibola region, representing areas traditionally seen as falling within the Anasazi and Mogollon regions respectively. At a very basic level, the apparently persistent distinctions between these areas may suggest that the culture areas defined so long ago do capture real differences in material culture and settlement, which almost certainly had some basis in patterns of social interaction and possibly identity in the period considered here. At the same time, I present data in the following chapters that suggest that differences across space were often gradational, rather than being marked by discrete and well defined boundaries. Indeed, I agree with many other researchers who suggest that the distinctions between these archaeological culture areas, which have structured archaeological research to a substantial degree (i.e., many researchers self identify as Anasazi or Mogollon archaeologists), have sometimes hindered our ability to understand broader trends across the Southwest as a whole (see also Lekson 1996:175). Through this study, I argue that archaeological constructs like Anasazi and Mogollon are useful, but only to the extent that they are understood as heuristics for describing broad patterns in the continuous regional variation of material culture rather than as models for cultural or ethnic designations.

Chapter 3 Notes

[1] There is evidence for the construction and use of irrigation canals along the Zuni River Valley and it's primary tributaries as early as 1,000 B.C. continuing until about A.D. 1,000 (Damp et al. 2002). Throughout this interval, irrigation agriculture appears to have been relatively small scale and a minor component of the regional agricultural system. With the construction of the protohistoric Zuni towns in the fourteenth century, however, irrigation agriculture may have taken on a new importance. The construction of these towns was marked by a shift in settlement from the upper reaches of the Zuni River and the El Morro Valley to the areas in and around the modern Pueblo of Zuni. Kintigh (1985) argues that this settlement shift was associated with a transition from runoff agriculture to an agricultural economy dominated by irrigation.

[2] Chaco Canyon was a major center in northwestern New Mexico, from the late ninth through the mid twelfth centuries, associated with large-scale architectural complexes including multi-storied masonry pueblos, great kivas, roads, and other features. By the mid eleventh century, Chaco style great house complexes were constructed in many portions of the northern southwest including the Cibola region. There are numerous competing theories regarding what the regional distribution of Chacoan great houses may have represented in social and political terms (see Lekson 2006), but there is little doubt that developments in Chaco Canyon reverberated across much of the northern southwest at this time.

[3] There is also an Acoma series of Glaze Ware which was produced along the eastern edge of the Cibola region near Acoma and perhaps Cebolleta Mesa. Acoma Glaze Wares are closely related to Zuni Glaze Wares, but differ in terms of the dominant surface colors and certain aspects of design style (Eckert 2006:43-47; Seventh Southwestern Ceramic Seminar 1965).

[4] There is evidence for fourteenth century occupation in at least one Zuni town (Halona:wa; [see Scholnick 2003b]) but the nature of this earlier occupation is largely obscured by the historic component at that village.

[5] One of these unroofed great kivas is located in the area between the nucleated Mirabal and Cienega sites in the El Morro Valley. Although both of these nucleated pueblos certainly do contain components which post date A.D. 1275, Mirabal is the only excavated nucleated village with any tree ring cutting dates prior to A.D. 1279. The very small ceramic collection obtained from the unroofed great kiva itself included no glaze painted ceramics, providing some additional evidence that the structure likely pre-dates A.D. 1275. Other possible unroofed great kivas have been recorded at the nucleated Box S and Kluckhohn sites in the Upper Nutria and El Morro Valley areas respectively. Although both of these sites probably have post A.D. 1275 components, they contain considerably less Zuni Glaze Ware than nucleated pueblos with absolute dates after A.D. 1275.

[6] For the purposes of this plot, all nucleated towns in the Zuni area are placed in the later interval although a few may actually be contemporaneous with smaller clustered communities between about A.D. 1250 and 1275.

Chapter 4:

DEFINING CERAMIC COMPOSITIONAL GROUPS THROUGH NEUTRON ACTIVATION ANALYSIS

One way to explore changes in patterns of social interaction through time is to document the movement of objects across the greater Cibola region. In this study, I use ceramic chemical compositional data produced through neutron activation analysis (NAA) to identify likely ceramic production zones across the region and track the circulation of ceramic vessels. This chapter describes the methods used to analyze the NAA compositional database and define compositional groups. Interpretations of these results are provided in Chapter 5.

Ceramic Chemical Characterization Using NAA

Recent archaeological studies of ceramic circulation have relied upon numerous methods, both chemical and mineralogical (i.e., low or high power optical petrography, LA-ICP-MS, XRF, NAA, PIXE), for identifying the likely production sources of ceramic materials at various spatial scales (for recent overviews see Bishop et al. 1982; Glowacki and Neff 2002; Speakman and Neff 2005). Different methods are more or less well suited for use in particular contexts depending on the diversity of clays and tempering materials used to produce vessels, the total number of samples to be analyzed, and the scale at which source determinations are required to address specific research questions. For regional studies focused on ceramic circulation, NAA has proven to be a particularly powerful method for defining groups of ceramic vessels that are compositionally similar. Further, through considerations of archaeological context and comparisons with raw materials, compositional groups defined through NAA can often be inferentially related to production sources at relatively small geographic scales.

Several additional features of NAA make this method particularly appropriate for considerations of ceramic circulation across the Cibola region. First, NAA is a bulk method of chemical characterization, meaning that it provides element concentrations of the entire ceramic paste including both clay and temper particles (but excluding slips and paints; see Arnold et al. 1991; Neff and Glowacki 2002:7-9). This could be considered problematic in a context where non-plastic tempering materials make up a large proportion of ceramic pastes (Heidke et al. 2002; Sterba et al. 2009). However, the vast majority of vessels produced in the Cibola region during the period considered here were tempered with small amounts of crushed sherd and quartz sand. Bulk characterization provides an advantage, in this case, as it allows for the consistent comparison of samples among different wares across the study area. In addition to this, NAA is a particularly sensitive method of chemical characterization allowing for the measurement of a large number of elements, including many trace elements that frequently occur below the detection limits of other methods (Corliss 1963). These trace elements can sometimes be important in discriminating between closely related compositional groups. Finally, NAA has been extensively applied across the greater Cibola region, providing a large existing database of ceramic chemical compositional data to which newly generated samples can be compared. For these reasons, NAA was selected for this study.

A comprehensive description of the mechanics of NAA is beyond the scope of this study. Instead, I provide an extremely brief overview of the NAA process, and direct interested readers to published resources covering the more technical aspects of the method (Glascock 1992; Neff and Glowacki 2002). All ceramic samples included in this study were analyzed at the Archaeometry Laboratory of the Missouri University Research Reactor (MURR) with the exception of a small number of clay samples from existing datasets that had previously been analyzed at the Smithsonian Center for Materials Research and Education and the National Institute of Standards and Technology (SCMRE-NIST). The two facilities measure the same element abundances and use the same methods for sample preparation described below.

Ceramic samples to be analyzed by NAA are first prepared by mechanically removing the exterior surface using a tungsten carbide burr. Thus, the analyzed sample includes only the constituents of the ceramic paste, and not exterior features such as slip clays, paints, or any other surface contaminants. The remaining sample is then washed, dried, and ground into a fine, homogenous powder. Two samples of the powder are then exposed to irradiations of different lengths (5 seconds and 24 hours). During these irradiations, samples are bombarded with neutrons generated in a nuclear reactor, producing radioactive isotopes which emit gamma rays. Gamma rays are instrumentally measured once for the short irradiation sample and at two different intervals for the long irradiation sample in order to measure the gamma ray emissions of elements with widely varying half lives. Finally, gamma ray spectra are analyzed in order to determine the abundance of elements in each sample, reported in parts per million (ppm). The MURR facilities measure 33 elements (Table 4.1).

The Cibola Region NAA Sample

Due in large part to the geological diversity of the area, NAA has been a particularly successful method for tracking the circulation of ceramics across the greater Cibola region. Several studies focused on the Pueblo III and Pueblo IV periods in the core portion of the study area (Duff 1999, 2002; Huntley 2004, 2008; Schachner 2007; Schachner et al. 2011) have produced a regional sample of over 1,400 analyzed ceramic sherds as well as dozens of raw clay and temper samples. In addition, ceramics and clays have been analyzed for the expanded Cibola region study area (e.g., Ferguson and Glascock 2008; Triadan 1997, Triadan et al. 2002; Zedeno 1994, 2002). For the purposes of this study, this large existing regional database was expanded by submitting an additional 600 ceramic samples for NAA characterization (Table 4.2; Figure 4.1). All together, there are over 2,000 ceramic samples available for the core portion of the study area and over 2,600 samples including those from the expanded study area, making this one of the largest regional NAA ceramic compositional databases anywhere in the world.[1]

The regional NAA sample considered in this study includes several different wares and types. Sample selection criteria were somewhat different among the projects that produced the bulk of the existing data incorporated into this analysis. In general, however, all previous projects included both decorated

Table 4.1. Element concentrations measured by MURR facilities.

Al	Aluminum	Eu	Europium	Ni	Nickel	Ti	Titanium
As	Arsenic	Fe	Iron	Rb	Rubidium	U	Uranium
Ba	Barium	Hf	Hafnium	Sb	Antimony	V	Vanadium
Ca	Calcium	K	Potassium	Sc	Scandium	Yb	Ytterbium
Ce	Cerium	La	Lanthanum	Sm	Samarium	Zn	Zinc
Co	Cobalt	Lu	Lutertium	Sr	Strontium	Zr	Zirconium
Cr	Chromium	Mn	Manganese	Ta	Tantalum		
Cs	Cesium	Na	Sodium	Tb	Terbium		
Dy	Dysprosium	Nd	Neodymium	Th	Thorium		

and utilitarian wares, and specific types were usually selected at each site roughly based on the proportions of individual types at the site as a whole (Duff 1999:7.2-7.7; Huntley 2004:70-76; but see Schachner 2007:107-112). Samples from individual sites in the core portion of the study area range from 22 to 134 sherds and archaeological clays, roughly equally divided between painted and unpainted vessels. The vast majority of samples come from excavated contexts, but surface sherds were also included where other materials were not available. The 600 new samples analyzed for this study come primarily from the southern portion of the Cibola region, which had not been extensively sampled in the past, but also include additional sherds from previously sampled areas for wares that were underrepresented in the existing data.[2] Brief descriptions of the wares and types included in this study along with their production dates are provided in Table 4.3.

The vast majority of sherds in the ceramic compositional sample are derived from contexts dating to the period directly considered in this study (ca. A.D. 1150-1325), but two projects from the core portion of the study area also included ceramics from settlements dating somewhat later (ca. A.D. 1325-1400; Duff 1999; Huntley 2004). Although these later samples were not produced

Table 4.2. NAA ceramic samples included in this study.

Sub-Region/Site	Period	Existing Samples	New Samples	TOTAL
El Morro Valley				
Los Gigantes	PIII	120	15	135
Togeye Canyon	PIII	122		122
Scribe S	PIII	119	15	134
Tinaja	PIII	120	5	125
Pueblo de los Muertos	PIV	36	5	41
Cienega	PIV	22		22
Mirabal	PIV	22	5	27
Atsinna	PIV	33	5	38
Subtotal		*594*	*50*	*644*
Upper Nutria Area				
Box S	PIV	30		30
Subtotal		*30*		*30*
Pescado Basin				
Spier 81 cluster	PIII	50	15	65
Heshotauthla	PIV	36	10	46
Lower Pescado Village	PIV	35		35
Subtotal		*121*	*25*	*146*
West Zuni				
Hinkson Ranch Pueblo	PIII	20	30	50
Jaralosa	PIII	10	30	40
Ojo Bonito	PIV	34	20	54
Spier 170	PIV	35		35
Subtotal		*99*	*80*	*179*
Carrizo Wash				
Platt Ranch Pueblo	PIII		30	30
Garcia Ranch Pueblo	PIV		40	40
Subtotal		*0*	*70*	*70*
Mariana Mesa				
Tri-R Pueblo	PIII	7	42	49
Hubble Corner	PIII		30	30
UG481	PIII		20	20
Techado Springs	PIV	30	50	80
Horse Camp Mill	PIV		30	30
Subtotal		*37*	*172*	*209*
Upper Little Colorado				
Rim Valley Pueblo	PIII		25	25
Coyote Creek Pueblo	PIII		35	35
Rudd Creek Ruin	PIII		38	38
Casa Malpais	PIV	37	20	57
Hooper Ranch	PIV	69		69
Baca Pueblo	PIV	136		135
Sherwood Ranch Pueblo	PIV	45		45
Table Rock	LPIV	100		100
Rattlesnake Point	LPIV	149		149
Subtotal		*536*	*118*	*654*
Mogollon Highlands/South				
Apache Creek	PIII		30	30
Higgins Flat	PIII		30	30
Foote Canyon Pueblo	PIV		25	25
Subtotal		*0*	*85*	*85*
All Core Areas Subtotal		***1417***	***600***	***2017***
Expanded Study Area				
Manuelito Canyon*	PIII	30		30
Cebolleta Mesa*	PIII	30		30
Cañada Alamosa*	PIII	55		55
Silver Creek**	PIII/PIV	161		161
Arizona Mountains**	PIII/PIV	346		346
Subtotal		*622*		*622*
TOTAL		***2039***	***600***	***2639***

* Expanded study area samples included in primary compositional analysis, ** Expanded study area samples compared to final group configurations but not included in primary compositional analysis (see Appendix A)

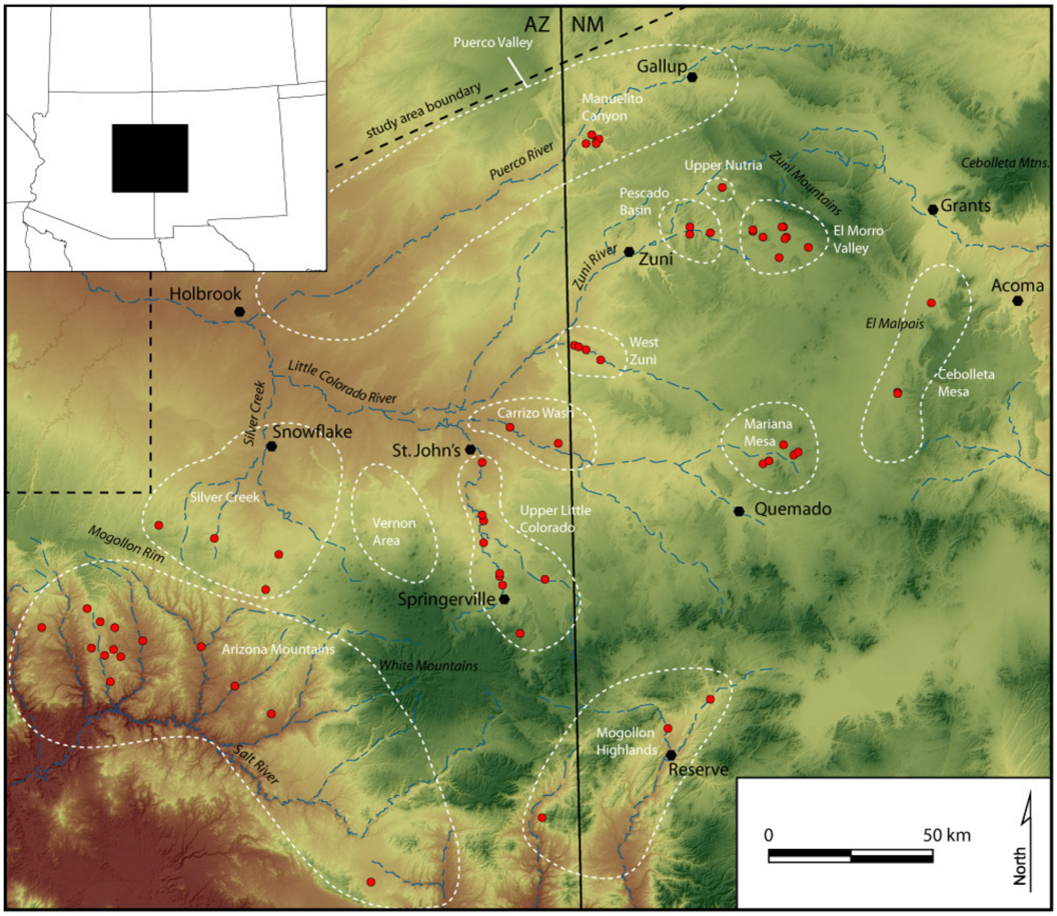


Figure 4.1. Locations of sites with NAA data included in this study.

Table 4.3. Production dates for major wares and types included in this study.

Ware/Type	Production Dates (A.D.)
White Mountain Red Ware	
Wingate B/R and Polychrome	1050-1200
St. John's B/R and Polychrome	1200-1300
Pinedale B/R and Polychrome	1275-1325
Cedar Creek Polychrome	1300-1350
Fourmile Polychrome	1325-1400
Cibola White Ware	
Reserve and Tularosa B/W	1100-1300
Pinedale B/W	1275-1325+
Zuni Glaze Ware	
Heshotauthla B/R and Polychrome	1275-1450
Kwakina Polychrome	1275-1450
Late Zuni Glazeware	1350-1450
Other Painted Wares/Types	
Tularosa White-on-Red	1200-1350
McDonald Painted Corrugated	1150-1280
Roosevelt Red Ware	1280-1450
Unpainted Wares/Types	
Cibola Gray Ware	500-1450+
Tularosa Fillet Rim	1100-1300
Mogollon and Other Brown Wares	500-1450+

during the period explicitly considered in this study, their inclusion in the initial analysis of the compositional database allows for a comparison of earlier ceramics with the compositional profiles of later assemblages. Since there are far fewer late Pueblo IV settlements and they are found in fewer locations across the Cibola region, such a comparison may help to relate compositional groups to probable production zones at a somewhat finer geographic scale. Further, the inclusion of late Pueblo IV ceramic materials also increases the total sample size allowing more robust statistical methods to be used to evaluate compositional groups.

Geology and Clay Availability

The major geological features of many portions of the Cibola region have been described in detail in previous publications focused on smaller portions of the region (Duff 1999; Huntley 2004; Mills 1995; Schachner 2007; Triadan 1997; Zedeño 1994). I cannot cover the geology of the massive greater Cibola region with a similar level of detail in the context of this study. Instead, I provide a brief discussion of the major geological zones within the core portion of the study area in a note at the end of this chapter and direct readers to the cited references for more detailed information.[3] To guide this discussion, I produced a simplified composite geological map of the study area (Figure 4.2). This map was compiled based on digital data (1:500,000 scale geological maps) published by the USGS and helps to highlight the major geological divisions across the region (Green and Jones 1997; Hirschberg and Pitts 2000; RS/GIS Laboratory 2004).[4]

The geology of the Cibola region is particularly well suited to the identification of production zones through NAA. As Figure 4.2 illustrates, the

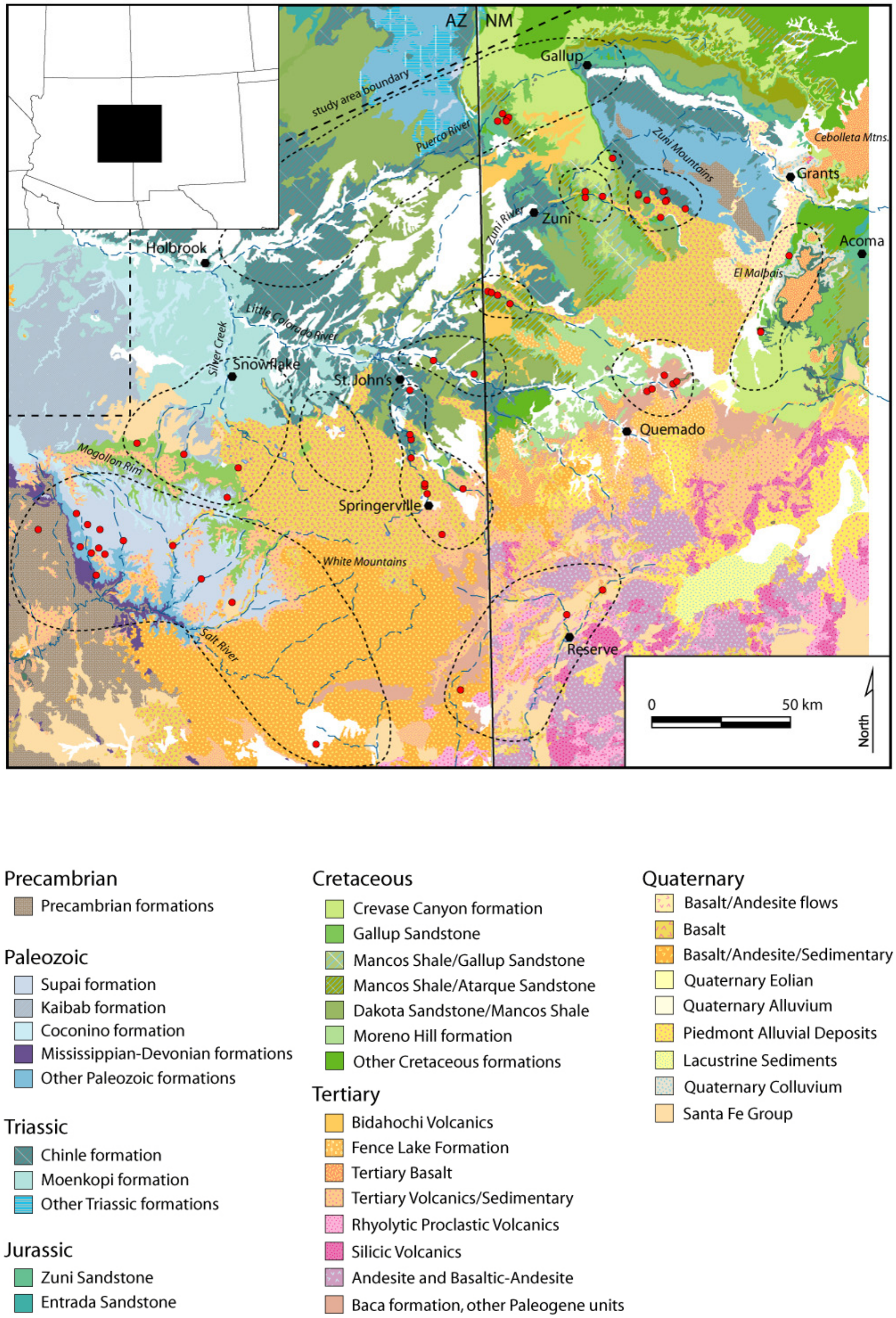


Figure 4.2. Map of major geologic units across the study area showing all sampled sites and major sub-regions.

region is geologically diverse with discrete strata of varying geologic ages exposed within limited geographic areas. Many geological features of the region were created by faults, folds, and uplifts which produced discrete zones of varying geomorphological properties that influence the arability of the landscape. Due in large part to the co-association of geological features and arable land, areas of relatively dense prehistoric settlement are often strongly associated with discrete geological features. This makes attributions of ceramic compositional groups to specific areas somewhat stronger than would be the case in an area characterized by less geological diversity.

There is also a great deal of diversity in the clay resources selected for ceramic production. Previous clay resource surveys and technological studies of clay workability suggest that the clays used to produce different ceramic wares within the greater Cibola region were likely derived from different geological contexts (see Duff 1993; Mills 1995:208-214; Wilson and Severts 1999; Wilson 1994, 2007; see also Triadan 1997; Zedeño 1994). Specifically, most light paste ceramic wares produced during the period considered here, including Cibola White Ware, White Mountain Red Ware, Zuni Glaze Ware, and Cibola Gray Ware, were produced from sandstone or shale-derived clays weathered from several major geologic formations probably including the widespread Triassic Chinle formation, various Cretaceous formations, and possibly the Tertiary Baca and Bidahochi formations (see also Mills 1995). Dark paste Mogollon Brown Ware and Roosevelt Red Ware ceramics have substantially higher iron concentrations than the light paste wares and were probably produced from volcanic-derived alluvial and colluvial clays. Volcanic-derived clays would have been readily available to the inhabitants of settlements across most of the Cibola region, in particular below the Colorado Plateau, but appear to have been used more extensively in some areas than others.

As this brief discussion suggests, at a local level, there is a great deal of diversity in the specific materials that likely would have been available to potters. At the same time, there are also some broad regional trends that would have influenced the production and distribution of ceramics across the study area. Sandstone and shale outcrops that would have provided clay resources appropriate for producing light paste ceramic wares within the core portion of the study area are available almost exclusively on the Colorado Plateau. This includes all of the areas along the Zuni River Valley, the El Morro Valley, the Mariana Mesa area, as well as the Silver Creek, Cebolleta Mesa and Puerco Valley sub-regions within the expanded study area. Tertiary and Quaternary volcanic flows cover much of the southern portion of the study area including the southern Upper Little Colorado, the Mogollon Highlands, and the large Arizona Mountains sub-region (Fitzsimmons 1959; Sirrine 1958). Importantly, outcrops of Triassic and Cretaceous sandstone and shale that likely provided clays appropriate for producing light paste wares were also present within a short distance of most settlements in the Upper Little Colorado region as I have defined it here. Within the large Mogollon Highlands sub-region in the far southern reaches of the study area as well as across much of the Arizona Mountains, however, the materials available for pottery production would have been largely limited to dark firing clays primarily of volcanic origin (Triadan 1997; Wilson 1994; Wilson and Severts 1999; Zedeño 1994). One important implication of the distribution of clay resources across the Cibola region is that the inhabitants of the large Mogollon Highlands sub-region and other nearby areas would not have had the appropriate resources within a reasonable catchment to produce the light paste decorated wares recovered from sites dating to the period considered here.

Defining Ceramic Compositional Groups

The goal of this analysis is to define statistically verifiable groups of sherds characterized by similar chemical compositions, and identify where they were probably produced by relating the groups to specific geographic zones. In this section, I describe the methods used to create and assess ceramic compositional groups for this study. The analyses presented here were conducted primarily using a series of GAUSS statistical routines written by MURR researchers.[5] The basic procedures involved in compositional group formation include: 1) data normalization and missing data replacement, 2) initial reference group construction, 3) an assessment of the probabilities of group membership including an iterative process of sample reassignment, 4) the attribution of unassigned samples to core compositional groups, 5) the creation of provisional groups among the remaining unassigned samples, and 6) the division of compositional groups into somewhat smaller sub-groups where possible. Each of these steps in the process is described in detail below.

Data Pretreatment

The first step in this analysis was to prepare the raw element data produced through NAA for quantitative assessment. Of the 33 elements measured by MURR facilities, the element nickel (Ni), consistently fell below detection limits, so it was removed from further consideration. This is common for NAA studies in the American Southwest. Next, the remaining 32 elements concentrations were transformed to base 10 logarithms in order to normalize and standardize the concentrations of major, minor, and trace elements (Bishiop and Neff 1989:63; Glascock 1992:16; Neff 2002:16-17). This procedure produces transformed element concentrations that closely approximate multivariate normality (a requirement of several of the statistical methods used here) and also prevents the formation of compositional groups that are driven primarily by the most abundant elements. Finally, any remaining missing values, meaning element concentrations less than the minimum detection limits, were replaced by temporarily adding a value that minimizes the multivariate Mahalanobis distance (see discussion below) to the centroid of the dataset as a whole. At the group formation stage described below, missing values are estimated at each stage by assigning a value that minimizes the distance to the centroid of the group in which a sample is placed.

Defining Initial Reference Groups

The next step is to define initial ceramic reference groups that can then be statistically assessed. There are a number of contextual and multivariate methods that can be employed at this initial grouping stage. For example, samples can be grouped by ware/type, design style, geographic location of recovery, or by other non-compositional data and compositional data can be used to test these groups (Bishop and Neff 1989:68; Neff 2002:18). Alternatively, previous interpretations of existing data, visual assessments of variable biplots, or statistical methods of ordination and cluster analysis can also be used to define initial configurations. Importantly, however, initial groupings based on both contextual and statistical methods should be considered exploratory rather than confirmatory. Neff (2002:27-28) notes that there are numerous potential pitfalls to relying strictly on particular methods of group formation and suggests that the best approach is to apply multiple methods and treat initial group configurations as hypotheses that can be evaluated independently. The initial goal is to develop groups of samples that are strongly associated across multiple methods of assessment.

Following Neff's heuristics, a number of different techniques were employed to define initial groups using both GAUSS and R. The most successful methods included hierarchical (average linkage and Wards method) and non-hierarchical (K-means and K-medoids) cluster analyses performed on a Euclidean distance matrix of the log-transformed element concentrations or on standardized principal components scores. These methods of ordination and cluster analyses are discussed in detail elsewhere (Baxter 2003; Kaufman and Rousseeuw 1990; Everitt et al. 2001; Kintigh and Ammerman 1982) and will not be described here. In general, several of these procedures provided comparable groupings for a large number of the samples included in this analysis. Several of these initial groups conformed to the most recent assessments of existing data included in this study

(Duff 1999, 2002; Huntley 2004, 2008; Schachner 2007; Schachner et al. 2011) with alterations and refinements due to the inclusion of new samples. A number of new groups were also defined consisting primarily of samples from portions of the study area that had not previously been extensively sampled. Most initial groups were dominated by samples from particular portions of the study area or particular wares/types further suggesting the validity of the group configuration.

Core Group Evaluation

After initial groups have been formed, it is necessary to statistically assess the distinctiveness of each group. Neff (2002:28-35; see also Bishop and Neff 1989; Glascock 1992) describes a method for evaluating groups and the placement of particular samples within groups using Mahalanobis distances and Hotelling's T^2 statistic. Mahalanobis distances, based on the correlation between variables, are used to calculate the distance in multivariate space between a sample and the centroid of the group to which it is assigned. Hotelling's T^2 statistic, which is closely related to squared Mahalanobis distance, can then be used to calculate the probabilities of membership of each sample in every group.[6] Probabilities are calculated based on jackknifed Mahalanobis distances, meaning that the sample being considered is not included in the group to which it is being compared. Thus, this method provides a conservative assessment of the probabilities of group membership for every sample in every group. Importantly, group membership probabilities are calculated independently and thus, do not sum to 100% across all test groups.

The calculation of jackknifed Mahalanobis distances requires that the groups being evaluated contain at least two more members than the number of variables included in the dataset (Neff 2002:30). Thus, since the compositional data include 32 elements, the minimum group size for statistical evaluation using the method described above is 34 samples. Groups containing fewer samples can be assessed using principal components analysis (PCA). PCA is a method of ordination designed to reduce the dimensionality of a dataset by creating a set of non-correlated axes which account for a substantial proportion of the variability present in the data as a whole (Baxter 2003:73-82). Jackknifed probabilities of group membership can be calculated based on some number of principal components at least two less than the number of members in the smallest group. In the dataset considered here, the first 10 to 15 principal components typically account for more than 90% of the variation present in the data as a whole. The large NAA database considered in this study allows for the calculation of initial group membership probabilities using the log-transformed element data, but PCA scores are used in a few cases to evaluate subdivisions of larger groups and to attribute additional samples to groups. Importantly, groups are most robust when the number of members included substantially exceeds the number of elements or principal components considered.

There are no set rules for evaluating group membership using the procedures described above. However, because jackknifed probabilities calculated based on Mahalanobis distances are conservative estimates of group membership probabilities, it is common to use relatively low thresholds for assigning samples to specific groups (e.g., Baxter 2003; Bernardini 2005:129-130; Duff 1999:6.32; Neff 2002:33). The primary concern is that groups are distinct from one other. In this study, I used a set of criteria for group membership that are designed to produce relatively discrete and conservative groupings. First, I used a threshold of greater than approximately 2.5% probability of membership in the assigned group coupled with less than 0.5% probability of membership in any other group, or greater than 10% probability of membership in the assigned group with more than five times greater probability of membership in the assigned group than in any other group. Additionally, I did not allow any sample to have greater than a 10% probability of membership in any group other than the one into which it was assigned (i.e., if a sample had a 99.9% probability of membership in group A and a 10.1% probability of membership in group B, the sample would remain unassigned). In the final classification of samples considered here, the vast majority only had high probabilities of membership in their assigned group.

The classification of samples into groups is an iterative process. First, probabilities of group membership were calculated for all members of the initial groups defined in the previous step. A majority of samples had the highest probability of membership in the group to which they were originally assigned. However, many samples did not meet the strictest criteria for group assignment described above. At this stage, samples with low probabilities of group membership or equivocal probabilities for more than one group were removed and classified as unassigned. Probabilities of membership were then recalculated and the membership of samples in groups was reevaluated until no samples needed to be removed. After groups meeting the criteria defined above were obtained, all of the unassigned samples (including those removed during this step) were projected against the existing groups. Samples which merited inclusion in each group were added and the process continued until group membership stabilized.

Following Duff's (2002:103) terminology, the stable groups defined at this point are referred to as "core groups." Core groups represent sets of sherds with similar chemical compositions which are analytically distinct and can usually be related to ceramic production at some geographic scale. In this analysis, 13 core groups large enough to be assessed using log-transformed element concentrations were defined. Because of the relatively conservative rules for core group assignment used in this study, approximately 41% of sherds could not be assigned to any core group. This percentage of unassigned samples is not unusual for the most conservative methods for group assignment (e.g., Neff 2002). The remaining unassigned samples consist of samples with low probabilities of membership in any of the core groups or samples with probabilities of membership in multiple groups.

Non-Core Group Assignment

Many of the samples that remained unassigned after the core group analysis described above were compositionally similar to samples in the more rigorously defined core groups. Relaxing the statistical rules for group assignment can have the effect of boosting the total number of samples attributable to specific production zones without fundamentally altering the patterns documented through core group analysis. In this study, I follow the procedures for non-core group assignment outlined by Duff (2002:103-105; see also Bernardini 2005:128-130).

The first method for assigning non-core members to compositional groups involves PCA. PCA scores were calculated for the core group samples, and then the remaining unassigned samples were projected against the core groups using principal components, which accounted for a large percentage of the total variation in the dataset (see Appendix A). Probabilities for group membership were then calculated using Mahalanobis distances based on principal components as described above for the log-transformed element data. The use of a sub-set of principal components rather than element data can sometimes increase the probabilities of group membership for some samples by eliminating the influence of minor differences in chemical composition that do not account for a substantial amount of variation in the dataset a whole. Samples were considered non-core members of core compositional groups if their probability of membership in one group was at least five times higher than their probability of membership in any other group. Importantly, non-core members of compositional groups were not added into the core groups for recalculation of membership probabilities as this would have a tendency to unnecessarily expand groups and reduce the discrimination among core groups overall (Neff et al. 2006:61-65).

An additional method used for non-core assignment involved the calculation of membership probabilities using canonical discriminant function analysis (CDA). CDA is a method of group assessment which assumes that groups are discrete and that all samples included are members of those groups.

Based on this assumption, CDA then creates a number of linear functions, equal to one less than the number groups considered, which maximize the differences between the groups. Unassigned samples can then be projected against the discriminant functions and probabilities of membership can be assessed. In this study, samples were considered non-core members of groups if the probability of membership for a sample in a single core compositional group was greater than the probability of membership in any other group by an order of magnitude or more (i.e., if a sample had a 80.0% percent probability of membership in group A and a 7.9% membership in group B, the sample would be assigned a non-core member of group A). The higher probability threshold used for defining non-core membership through discriminant functions was used to avoid spurious assignments as group assignments based on discriminant functions are somewhat less statistically rigorous than assignments made using either element concentrations or principal components (Bernardini 2005:128-130; Neff 2002).

Non-core group assignments include an additional level of uncertainty as these samples display somewhat weaker similarities to the samples within core groups than core members themselves. Furthermore, assessments of core groups using PCA scores and CDA functions often lead to a certain number of misclassifications in the original core groups (up to 1-2%) and thus, somewhat weaker group discrimination overall. Despite these complications, the assignment of non-core samples maximizes the number of samples that can be attributed to specific geographic locations, extending the patterns documented in core group analyses rather than altering them. For this reasons, the additional uncertainty associated with non-core group assignment is considered acceptable. Additional details regarding the assignment of non-core members of groups are provided in Appendix A.

Provisional Group Assignment

After all of the core and non-core group assignments were made, there were still some small groups of these unassigned samples that consistently clustered together on element biplots as well as plots of PCA scores. Some of these small groups share other characteristics, including sherds from one portion of the study area or one particular ware/type. Although groups fewer than about 15-20 samples cannot usually be adequately evaluated statistically, they still may represent real groupings. For the purposes of this analysis, such small groups were considered provisional compositional groups. In some cases, these provisional groups could be statistically evaluated using a sub-set of the total compositional dataset. The specific procedures used to define provisional groups are provided in Appendix A. Although considerably less analytical weight is put in provisional group assignments due to the small sample sizes, these groups may still be important in documenting patterns of ceramic circulation across the study area.

Sub-Groups

After core groups were constructed, some groups still displayed a tendency towards division in terms of the concentrations of particular elements suggesting that they could potentially be split into somewhat smaller units. The creation of sub-groups can be important in the attribution of sherds to more specific geographic areas of production (e.g., Duff 2002:107-137). For this study, samples were divided into sub-groups using procedures similar to those described above for the construction of core groups (i.e., cluster analysis, probability assessment and reassignment). The exception is that, at this stage, individual groups were considered independently. This approach is warranted as core groups are demonstrably distinct from one another. Sub-groups were defined first among the core members of the group and non-core members were then projected against these core sub-groups in a process similar to that for initial group formation. In some cases, several non-core members of a compositional group could not be attributed to any sub-group and remain assigned only to the larger core group designation. Sub-group analyses for specific compositional groups are described in detail in the Appendix A.

Unassigned Samples

After all of the procedures described above were applied to the compositional dataset, there were still samples which were not assigned to any core, non-core, or provisional members of any group. Samples may remain unassigned for a number of reasons including anomalous materials or paste preparation techniques, the small number of samples from an as of yet unidentified compositional group, or equivocal membership in multiple distinct compositional groups. As Schachner notes (2007:129), equivocal membership probabilities in multiple groups may be exacerbated in the Cibola region as most ceramics are sherd tempered. Thus, ceramic pastes may actually contain ground up pieces of non-local vessels, producing a matrix that is compositionally transitional between multiple distinct paste recipes. In this study, a total of 455 sherds (21.3% of the sample included in the primary analysis) could not be confidently assigned to any compositional group. These results are comparable to previous studies in the Cibola region and nearby areas (e.g., Duff 2002; Huntley 2004; Schachner 2007; Triadan 1997). Importantly, none of the unassigned samples are far outliers within the dataset as a whole, suggesting that they fall within the range of variation seen in the regional compositional sample. These samples could potentially be grouped through additional sampling.

Relating Compositional Groups to Production Sources

It is important to note that identifying chemical compositional groups based on element concentrations is not the same as identifying discrete production sources. The chemical composition of a ceramic vessel is related to a number of complex factors including the composition of the clay and tempering materials incorporated into the ceramic paste, how those materials were processed, as well as possible chemical alterations due to firing and diagenetic processes (see Arnold et al. 1991, 2000; Blackman 1992; Neff et al. 2003, 2006:65-67; Neff and Glowacki 2002:5-9; Sterba et al. 2009; Stoltman and Mainfort 2002:16-18). Discrete compositional groups defined based on element data may represent groups of ceramic vessels that were produced using distinct materials, different techniques for paste preparation, or some combination of both of these and other factors. Thus, it is important to consider other archaeological and geological contextual information when attempting to attribute a compositional group to production in a specific geographic area.

One method for defining the likely geographic production area associated with a chemical compositional group is to compare the composition of archaeological materials to the compositions of raw materials of known provenience using the statistical methods described above. In practice, however, raw tempers and clays are difficult to match to the compositional profiles of archaeological materials because they have not been processed and prepared in the same ways that ceramic pastes likely were. None of the available raw clay and temper samples were compositionally similar enough to any ceramic compositional groups to merit inclusion within a specific group (see Appendix A). This result is in line with previous studies in the Cibola region (see Schachner et al. 2011). In a few locations within the current study area, however, finished but unfired ceramic vessels as well as tempered and prepared clays cached by prehistoric potters have been recovered in archaeological contexts. Several of these archaeological clays were assigned to specific compositional groups. These unfired materials can be extremely useful in assessing the geographic production loci of compositional groups because unfired vessels and prepared clays are extremely fragile and are unlikely to have been moved over any great distance.

Another general principle commonly used to help link compositional groups to production in specific locations is known as the "criterion of abundance" (Bishop et al. 1982; Neff and Glowacki 2002:6), which proposes that ceramics will be most common in the areas in which they were produced. Thus, compositional groups can be inferentially related to production loci based on their distribution across the study area. There are, of course, a number of social processes which could potentially complicate this assumption (i.e., exchange, long distance movement of raw materials, major migrations, etc.), so it is also important to consider regional geology. Ethnoarchaeological studies of traditional potting communities suggest that the materials used for ceramic production almost always come from a relatively small catchment near where ceramics are produced (ca. 7 km radius; see Arnold 1985:20-60). So potters living in nearby settlements are likely to obtain materials from similar, perhaps overlapping, resource zones. Thus, the attribution of a compositional group to a geographic area based on abundance is strongest when multiple settlements within a particular geological zone have elevated proportions of that compositional group. It is also sometimes possible to use characterizations of regional geology to determine whether ceramic compositions vary in some way that might be predicted based surface geology (e.g., Steponaitis et al. 1996). For the purposes of this study, all of these general principles were used to guide the attribution of compositional groups to specific loci of production. The details relating to each group are provided in Appendix A.

Summary of Results

The analysis described above placed 1,681 sherds (79% of the primary compositional sample) into 13 core compositional groups and 5 provisional groups, each of which could be attributed to production in a specific portion of the Cibola region. Figure 4.3 displays the relationships among the core compositional groups defined here on the first two canonical discriminant functions. Several of the core groups could also be split into somewhat smaller sub-groups,

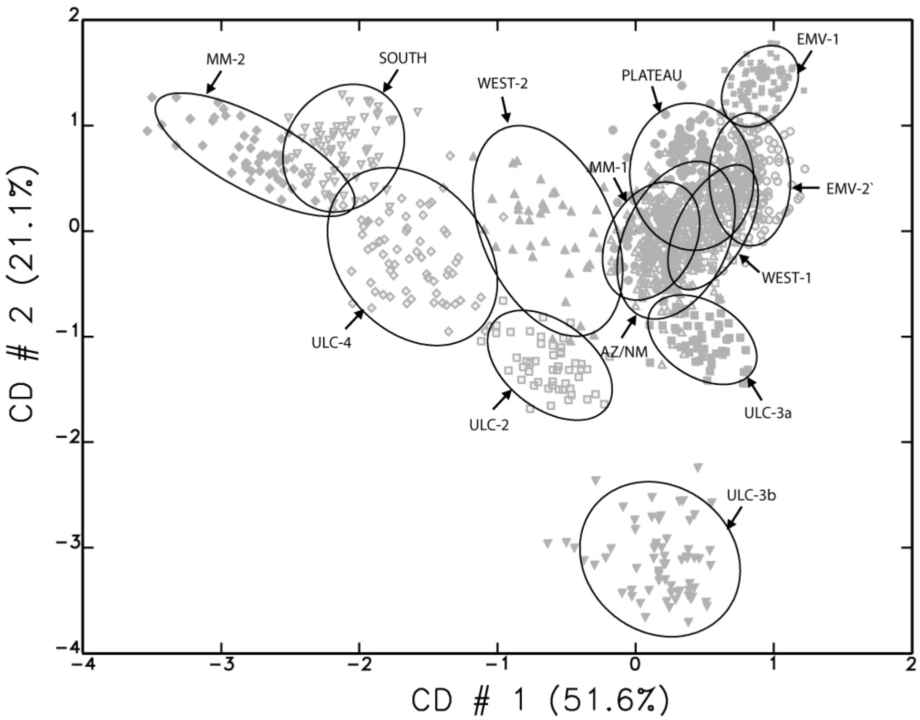


Figure 4.3. CDA plot of all 13 core compositional groups defined for this study.

representing production at a more specific geographic scale. Finally, a small number of initially unassigned samples from the core portion of the study area were attributed to two compositional groups previously defined by Triadan (1997; Triadan et al. 2002) from the Silver Creek area in the expanded study area. In total, sherds within the primary NAA sample were placed into 26 distinct groups (Table 4.4). Figure 4.4 shows the presumed production areas for each of these compositional groups along with the production zones for a few additional compositional groups previously defined by Triadan, Zedeño, and other researchers for sites in the Arizona Mountains (see Mills 1999; Triadan 1997; Triadan et al. 2002; Zedeño 1994, 2002). As this map illustrates, in many cases,

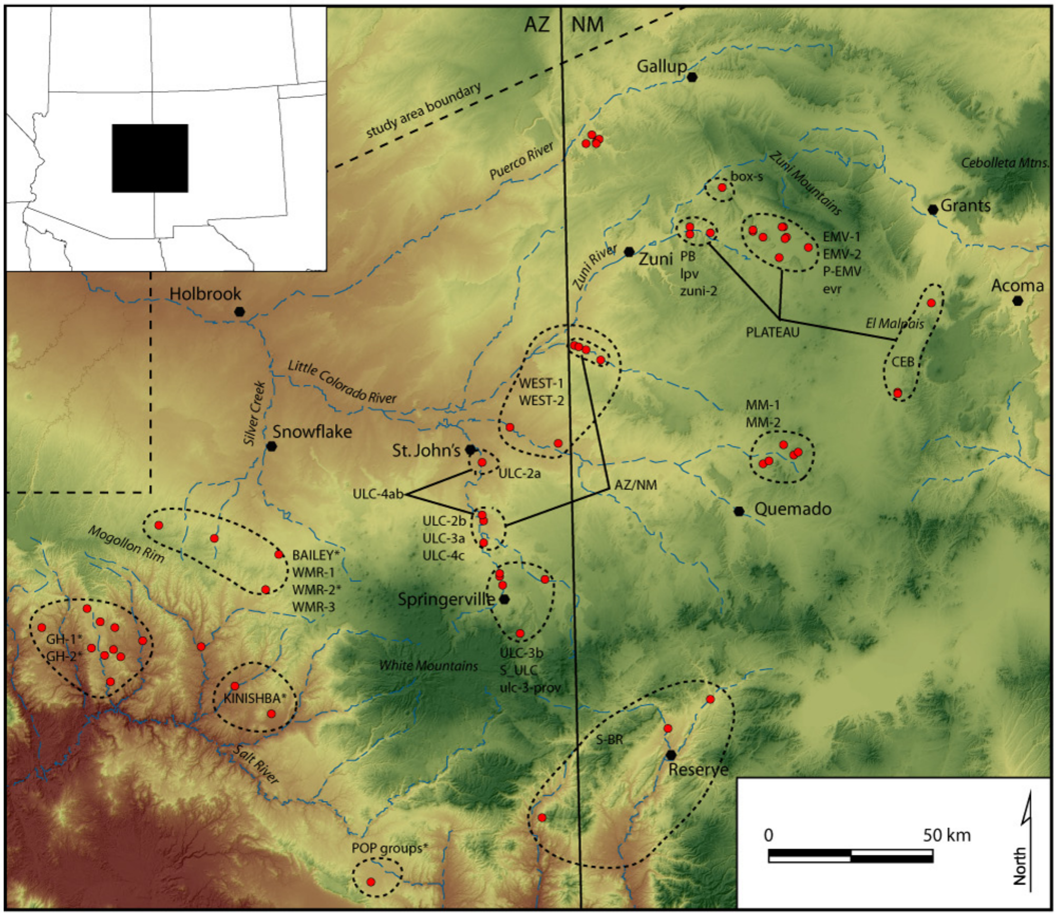


Figure 4.4. Map showing the probable production locations for all compositional core groups, sub-groups, and provisional groups defined or used in this study.[7]

multiple chemically distinct compositional groups were attributed to production the same geographic area.

Table 4.5 provides the final counts of sherds and archaeological clays within each compositional group by site. Table 4.6 provides these same data grouped by ceramic ware and type. As these tables show, ceramic compositional groups defined for this study tend to cluster by area and type, further validating the group assignments described above. Detailed descriptions of individual groups along with the criteria used to attribute them to a specific production zone are relegated to Appendix A. Appendix A also provides all of the statistical documentation for all of the quantitative analyses described above.

Table 4.4. All compositional core groups, sub-groups, provisional groups, and other non-local groups included in this study.

Alias	Sub-groups	Group #	Probable Production Zone	# of Samples	Duff (2002)	Huntley (2008)	Schachner (2007)
Core Groups							
EMV-1		1	El Morro Valley (east)	120	El Morro	1	EVC
EMV-2		2	El Morro Valley (west)	210	Ojo Bonito 2	2b	EVD
EMV		1/2	El Morro Valley	31			EVC/EVD
PLATEAU	PB	3	Pescado Basin	312	East	2a	PB, ZN
	CEB	4	Cebolleta Mesa	47			
	P-EMV	5	El Morro Valley	9			
	PLATEAU	3/4/5	Pescado Basin/El Morro/Cebolleta Mesa	52			
MM-1	MM-1a	6	Mariana Mesa	36			TEC
	MM-1b	7		25			
MM-2		8	Mariana Mesa	76			
WEST-1		9	West Zuni/Carrizo Wash	55			Zuni 1
WEST-2		10	West Zuni/Carrizo Wash	50	Ojo Bonito 1	2b	OBC
AZ/NM		11	West Zuni & Central ULC	169	ULC-1, Ojo Bonito 2	4	OBD
ULC-2	ULC-2a	12	Northern ULC	48	ULC-2a		
	ULC-2b	13	Central ULC	14	ULC-2b		
	n/a	12/13	Northern/Central ULC	3	ULC-2		
ULC-3a		14	Central ULC	65	ULC-3a		
ULC-3b		15	Southern ULC	90	ULC-3b		LC
ULC-4	ULC-4ab	16	Central/Northern ULC	94	ULC-4a, ULC-4b		
	ULC-4c	17	Central ULC	6	ULC-4c		
SOUTH	S-ULC	18	Southern ULC	29			
	S-BR	19	Below Mogollon Rim	38			
Provisional Groups							
box-s		20	Box S area	16		2c	BS
emv-3		21	El Morro Valley	13			EVR
lpv		22	Pescado Basin	9			LPV
zuni-2		23	Pescado Basin	17			Zuni 2
ulc-3-prov		24	Southern ULC	19	ULC-3b		
Other Non-Local Groups							
WMR-1		25	Silver Creek	5	SC-1		
WMR-3		26	Silver Creek	23	SC-3		

Table 4.5. Counts of sherds and archaeological clays in each compositional group by site.

				PLATEAU				MM-1						ULC-2					ULC-4		SOUTH		Provisional Groups					Silver Creek			
	EMV-1	EMV-2	EMV	PLAT	P-EMV	PB	CEB	MM-1a	MM-1b	MM-2	WEST-1	WEST-2	AZ/NM	ULC-2ab	ULC-2a	ULC-2b	ULC-3a	ULC-3b	ULC-4ab	ULC-4c	S-ULC	S-BR	zuni-2	lpv	evr	box-s	ulc-3-prov	WMR-1	WMR-3	Unk	TOTAL
EMV PIII																															
Los Gigantes	14	37		4	1	35	6				4		1										1		2					30	135
Togeye Canyon	6	52		1	2	24	3				7		1										1		3					22	122
Scribe S Cluster	37	25	6	6		24	2				4												3	1	2	1				23	134
Tinaja Cluster	39	42	16	1	2	13	2				1		2												1					6	125
EMVPIV																															
Atsinna	10	8	1	4		6																		1	1					7	38
Cienega	4	7	2			4																		1						4	22
Mirabal	3	7	3	1		5	1																			4				3	27
Pueblo de los Muertos	4	13	1	1		15																								7	41
PB PIII																															
Spier 81 Cluster		2		5	2	25	3				2		1										6		4					15	65
PB PIV																															
Heshotauthla				4		30	1						1										2	1						7	46
Lower Pesc. Village		1	1	1	1	17							1											5						8	35
UN PIV																															
Box S			3	4		10																				11				2	30
MM PIII																															
UG481						8				8									1											3	20
Tri-R		1		2		4		6	6	17																				13	49
Hubble Corner						10	1	4	1	9									1											4	30
MM PIV																															
Horse Camp Mill						4		7	1	12									1											5	30
Techado Spring	1	6		1		6	2	11	12	24							2	2												14	81
WZ PIII																															
Hinkson Ranch				2		11	1			1	14	7	1					1					2							10	50
Jaralosa				1		13	2				7	8						2												7	40
WZ PIV																															
Ojo Bonito				2		1					5	9	18					1					1							19	56
Spier 170											1	9	18																	7	35
CW PIII																															
Platt Ranch Settlement				1		6	1			1	4	4											1							12	30
Garcia Ranch				2		2	2	1		2	4	11						5	1											10	40
ULC PIII																															
Coyote Creek																	1	17	5		5	2								5	35
Rim Valley																	4		2		3	4								12	25
Rudd Creek																		19			17									2	38
ULC PIV																															
Baca Pueblo						1						1	28	1	5	3	22		28	4									3	39	135

				PLATEAU				MM-1						ULC-2					ULC-4		SOUTH		Provisional Groups					Silver Creek			
	EMV-1	EMV-2	EMV	PLAT	P-EMV	PB	CEB	MM-1a	MM-1b	MM-2	WEST-1	WEST-2	AZ/NM	ULC-2ab	ULC-2a	ULC-2b	ULC-3a	ULC-3b	ULC-4ab	ULC-4c	S-ULC	S-BR	zuni-2	lpv	evr	box-s	ulc-3-prov	WMR-1	WMR-3	Unk	TOTAL
Casa Malpais						1							2				4	12	13		3	1					4			17	57
Hooper Ranch						1							13				2	10	12		1						15		3	12	69
Sherwood Ranch						1							15		3		2	3	5			1						1	6	8	45
Rattlesnake Point											1	1	40	1	7	9	17		21	2								1	8	42	150
Table Rock													26	1	33	2	7		4									3	3	21	100
MH PIII																															
Apache Creek				1		3		1									2	1				15								7	30
Higgins Flat						3											2	3				9								8	25
MH PIV																															
Foote Canyon Pueblo						1				2								14				6								7	30
Other PIII																															
Manuelito Canyon				4		6	1				1		1																	17	30
Cebolleta Mesa	1	3	1	1	1	8	8																							7	30
Cañada Alamosa	1	3		3		14	11	6	5																					13	56
TOTALS	***120***	***207***	***34***	***52***	***9***	***312***	***47***	***36***	***25***	***76***	***55***	***50***	***169***	***3***	***48***	***14***	***65***	***90***	***94***	***6***	***29***	***38***	***17***	***9***	***13***	***16***	***19***	***5***	***23***	***455***	***2136***

Table 4.6. Counts of sherds and archaeological clays in each compositional group by ware/type.

				PLATEAU				MM-1						ULC-2					ULC-4		SOUTH		Provisional Groups					Silver Creek			
Ceramic Ware/Type	EMV-1	EMV-2	EMV	PLAT	P-EMV	PB	CEB	MM-1a	MM-1b	MM-2	WEST-1	WEST-2	AZ/NM	ULC-2ab	ULC-2a	ULC-2b	ULC-3a	ULC-3b	ULC-4ab	ULC-4c	S-ULC	S-BR	zuni-2	lpv	emv-3	box-s	ulc-3-prov	WMR-1	WMR-3	Unk	TOTAL
Plain/Corrugated Wares																															
Cibola Gray Ware	86	93	24	15		30	24	1			9	42	3										12	3	10	4				106	462
Mogollon/Other Brown Ware										76				2	12	14	6	2	80	6	27	27								75	327
Gray-Brown Ware												4																			4
Cibola White Ware																															
Reserve/ Tularosa B/W	4	5	1	9	1	33	19	9	18		25						12	19					2		3		1			56	217
Pinedale B/W						2						1	1				35	3	2								3			14	61
Indet. Cibola White Ware	4	4				10	1				2																			5	26
Early White Mountain RW																															
Wingate B/R and Polychrome		3		4		17		1									1	3												7	36
St. John's B/R and Polychrome	22	83	5	15	8	150	3	19	5		16	1	6				3	28					2			7				80	453
Springerville Polychrome		3	1			7		3															1							2	17
Techado Polychrome		2				1		3	1									3												3	13
Late White Mountain RW																															
Pinedale B/R and Polychrome						2							1				2	5	1								3			4	18
Cedar Creek Polychrome													1					1												1	3
Fourmile Polychrome													1				1		1								3	5	23	21	55
Indet. WMRW						1					1							2												3	7
Zuni Glaze Ware																															
Heshotauthla B/R and Polychrome	3	11		7		41					1	1	44		1		4	16						1		1	3			33	167
Kwakina Polychrome		4		2		18					1		74					3	1					5		4	4			20	136
Late Zuni Glaze Ware	1											1	38				1	1												9	51
Other Wares/Types																															
Roosevelt RW														1	32				8											10	51
Tularosa Fillet Rim																						7									7
White on Red															3																3
McDonald Corrugated																			1		2	4								2	9
Kinishba Polychrome																														1	1
Misc.																															
Unfired Vessel/Prepared Clay		2							1									4									2			3	12
TOTAL	**120**	**210**	**31**	**52**	**9**	**312**	**47**	**36**	**25**	**76**	**55**	**50**	**169**	**3**	**48**	**14**	**65**	**90**	**94**	**6**	**29**	**38**	**17**	**9**	**13**	**16**	**19**	**5**	**23**	**455**	**2136**

Chapter 4 Notes

[1] The primary compositional group formation procedure conducted for this study included a total of 2,136 sherds and archaeological clays from sites in the core study area as well as a much smaller number of samples from the Cebolleta Mesa, Manuelito Canyon, and Cañada Alamosa areas in the expanded study area. Additional samples from the Silver Creek drainage and the Arizona Mountains were not included in the primary compositional group formation procedures described below because fewer elements (30) were measured for these samples. These samples were later projected against groups formed within the primary compositional sample as described in Appendix A.

[2] Schachner's (2007) study focused on the El Morro Valley sampled White Mountain Red Ware and Cibola Gray Ware but did not analyze any samples of Cibola White Ware. Although it was not possible to analyze enough additional samples of Cibola White Ware from the El Morro Valley to equal the site wide proportions of this ware, the results presented here suggest that Cibola White Ware was compositionally similar to existing samples from the El Morro Valley and that this ware circulated along similar lines to the much larger White Mountain Red Ware sample.

[3] As Figure 4.2 illustrates, there are major spatial trends in the geologic ages and major rock types of exposures across the Cibola region. The entire Cibola region and much of the Colorado Plateau is underlain by a series of Precambrian and Paleozoic igneous and metamorphic strata (Anderson and Maxwell 1991; Baars 2000:45-112). These strata are only exposed in a few places across the region including the Zuni Mountains on the eastern edge of the study and in the Mogollon Rim area of Arizona. The high elevation Zuni Mountains were not major areas of prehistoric agricultural settlement and thus, Paleozoic and older strata were likely not major sources of clays for pottery production within the core portion of the study area. These sediments may have been used in the expanded study area, however, particularly in the Silver Creek and Mogollon Rim sub-regions.

Triassic Chinle deposits (variously including sandstone, shale, conglomerate, and clays) are widespread across the Cibola region, extending from the slopes of the Zuni Mountains in the east to the Petrified Forest area along the Puerco in the West in several distinct northwest to southeast trending bands. Exposures of Chinle strata are associated with several major areas of prehistoric settlement during the period considered here including the El Morro Valley, the Western Zuni region, and especially the Upper Little Colorado area. Importantly, the surface availability of different types of rocks and clays within Chinle deposits vary with location and elevation across the region in ways that likely would have influenced the compositions of clays and temper resources across the study area (see discussion in Duff 1999:7.61; see also Sirrine 1958).

Jurassic deposits are relatively rare in most parts of the Cibola region and, within areas extensively occupied during the period considered here, are limited to a few small exposures of Zuni sandstone west of the Pescado Basin and in the El Morro Valley in the core portion study area, as well as near Cebolleta Mesa and Manuelito Canyon in the expanded study area. Zuni sandstone strata likely do not include major clay bearing deposits (Anderson 1983, 1987), but weathered sandstone may have been incorporated into ceramic pastes in the form of temper.

Cretaceous deposits are common across the southern edge of the Colorado Plateau in many of the areas that were major centers of population during the period considered in this study. Along the Zuni River and in the El Morro Valley, the lowest Cretaceous geologic strata consist of Dakota Sandstones overlain by the Mancos Shale, Gallup Sandstone, and Crevasse Canyon formations (Anderson 1987; Hackman and Olsen 1977). In the south, near the Mariana Mesa settlement cluster, exposures of the Moreno Hill-Atarque Sandstone formation are common. The coal bearing Moreno Hill formation is roughly equivalent in age to the Gallup and Crevasse Canyon formations along the Zuni River valley (Arkell 1984a, 1984b, Cook and Arkell 1987). Importantly, all of these major strata are differentially exposed across the region along fault lines that also largely conform to clusters of prehistoric settlements. These Cretaceous sandstone, siltstone, and shale strata include clay bearing deposits that likely provided materials used for pottery production prehistorically, in particular for the production of Cibola Gray Ware, White Mountain Red Ware, Cibola White Ware, and Zuni Glaze Ware (see Duff 1993, 1999; Mills 1995; Huntley 2004).

Tertiary and Quaternary geologic strata within the core portion of the study area are far more common to the south than in areas along the Zuni River valley. These relatively recent geological strata likely provided clay and temper resources used to produce pottery in several portions of the study area. Light-firing clays from the Baca formation sandstone and shale are potential sources of materials used for pottery production by the inhabitants of the Mariana Mesa settlement cluster. Further, the inhabitants of the areas of the West Zuni and Carrizo Wash sub-regions along the Arizona/New Mexico border would have had access to Tertiary Bidahochi formation sandstone and conglomerates (Anderson 1982). Most Tertiary and Quaternary strata found in the southern reaches of the study area are igneous, however, and were likely used to produce Mogollon Brown Ware ceramics recovered in areas south of the Colorado Plateau. In addition to this, Tertiary and Quaternary material may have been incorporated into ceramic pastes either through intentional inclusion as temper, or through alluvial process that mixed volcanics with other materials.

[4] It is important to note that the published geological maps of the Cibola region are not entirely consistent across Arizona and New Mexico. For the maps presented here, I attempted to combine major geological strata using published descriptions in order to minimize the inconsistencies between the states and to simplify the map so that it is more interpretable at a regional scale.

[5] The analyses presented here were conducted working closely with MURR researchers, in particular Jeff Ferguson.

[6] Hotelling's T^2 statistic is converted into an F-value which can be used to approximate probability of group membership through comparison with the F-distribution.

[7] Groups marked by a * in Figure 4.4 represent groups defined by previous researchers to which no new samples were assigned in the analyses presented here. These groups were all originally defined by Mills (1999), Triadan (1997; Triadan et al. 2002), and Zedeño (1994, 2002) for sites in the Arizona Mountains and Silver Creek areas.

Chapter 5:

CERAMIC CIRCULATION AND REGIONAL NETWORKS OF INTERACTION

In this chapter, I describe several related analyses designed to both characterize the movement of ceramic vessels in the Cibola region and to trace changes in such movement across the Pueblo III to Pueblo IV transition. Overall, results suggest that ceramic vessels were widely circulated among far flung communities across the greater Cibola region, but that there were several major differences in the scale and context of production for different ceramic wares. This variation illustrates the complex and cross-cutting nature of regional social ties across the Cibola region at this time. Through the discussion below, I link the movement of ceramic vessels to changing patterns of relational connections among individuals and groups at various scales through time. Specifically, I argue that settlements involved in common spheres of ceramic circulation likely represent groups of individuals who were interacting on a regular basis, suggesting strong relational connections. I further argue that the circulation of different kinds of vessels (utilitarian vs. decorated) likely represents different kinds of social connections among the inhabitants of the region. The analyses and results presented below build upon methods and interpretations from previous studies of ceramic circulation in the Cibola region and other nearby areas (in particular Duff 2002; Huntley 2008; Mills 1995; Schachner 2007; Triadan 1997; Triadan et al. 2002; Zedeño 1994, 2002).

The discussion presented in this chapter relies on the compositional group assignments and production area ascriptions defined in the previous chapter. In order to simplify the presentation of these data for the purposes of this chapter, the twenty-six distinct compositional groups described in Appendix A were collapsed into eleven somewhat larger sets representing distinct production zones (Figure 5.1). Although a few of these production zones overlap in space, these designations provide a more easily interpretable picture of social relationships across the Cibola region through time than individual compositional groups.

Ceramic Circulation as a Proxy for Patterns of Interaction

The exchange and circulation of ceramic vessels across the American Southwest have been topics of frequent and varied research over the last several decades. Some researchers have focused on tracking the flow of ceramics through regional exchange networks in order to characterize the organization and complexity of prehistoric economies (e.g., Adams et al. 1993; Braun and Plog 1982; Plog 1977; Upham 1982). Research in this vein has been broad, including characterizations of ceramic exchange as a risk buffering strategy (Braun and Plog 1982; Rautman 1993) or as the result of the formation of regional alliances maintained by managerial elites (Plog and Upham 1983; Upham 1982). More recently, many researchers have turned to explorations of ceramic circulation as a means to track other processes such as population movement, changes in social organization, and economic specialization (e.g., Abbott 2000; Bernardini 2005; Bishop et al. 1988; Clark 2006; Crown 1994; Duff 2002; Huntley 2008; Triadan 1997; Zedeño 1994, 1995). These studies vary widely in their specific

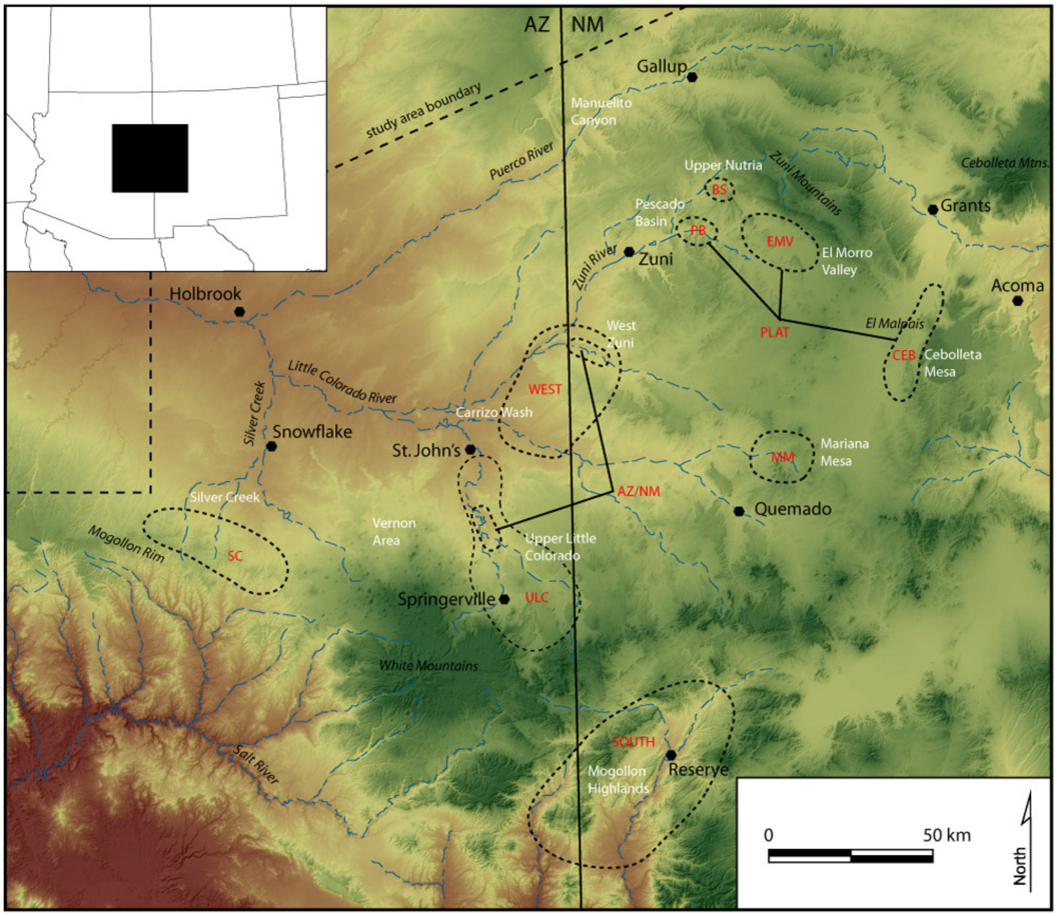


Figure 5.1. Major production zones defined based on compositional group assignments.

perspectives and goals, but all consider the exchange of ceramics to be both an economic and a social process.

The underlying assumption of this study is that the circulation of ceramic vessels can be used as a proxy for various kinds of social relationships among the inhabitants of the greater Cibola region. I argue that the social transactions involved in the circulation of decorated and utilitarian ceramics likely differed, due in large part to the variable social values placed on these goods (e.g., Duff 2002:25-28; see also Abbott 2000:133-140; Graves 1991). Furthermore, I argue that the spheres of interaction that fostered the movement of different kinds of vessels can be inferentially related to different kinds of relational social ties at multiple social and spatial scales.

In the American Southwest, most types of unpainted ceramics are interpreted as utilitarian goods, assumed to have moved most frequently among relatively close relations such as kin groups (Abbott 2000:139-140; Brunson 1985; Duff 2002:25-26; Reid and Montgomery 1998; Zedeño 1994). Indeed, previous studies of ceramic circulation in the Cibola region suggest that the movement of utilitarian ceramics was relatively frequent within major river valleys, but rare between valleys suggesting that the kinds of transactions involving the movement of utilitarian vessels were primarily local in nature (Duff 2002:159-167). The movement of utilitarian vessels over vast distances indicates particularly close relationships among the inhabitants of distant areas, including the kinds of relationships that may be forged through frequent and regular interaction and perhaps inter-marriage (e.g., Zedeño 1994, 1995). Alternatively, the long distance movement of utilitarian vessels may also suggest migration (Zedeño 1998). Migrants into a new area may have maintained relationships with the inhabitations of the area which they left, leading to the continued reciprocal circulation of vessels across vast distances. Although it is difficult to separate exchange from migration through compositional data alone, if the movement of utilitarian vessels is largely unidirectional, population movement rather than exchange among groups residing in different areas may be more likely (see Zedeño 1998:15-21). All of these potential processes involve the kinds of sustained, informal relationships and shared historical connections which form the basis for strong and tight-knit relational connections among individuals and social groups. Thus, I interpret the movement of utilitarian ceramics across the study area as one measure of the degree and directionality of the most frequently activated relational social ties among groups across the study area.

Decorated ceramic vessels are often moved across much larger geographic scales than utilitarian vessels. The most common painted ceramic type considered in this analysis, St. Johns Polychrome, is one of the most widely distributed ceramic types in the prehispanic Southwest. It is found from southern Colorado to the north all the way to the Paquimé area in northern Mexico in the south, and from western Arizona to far eastern New Mexico (Carlson 1970:Figure 14). The spatial scale of this distribution alone suggests that such decorated ceramic vessels likely did not circulate only through informal transactions among frequently interacting individuals or social groups.

Several researchers have suggested that decorated ceramics were imbued with a higher relative social value than unpainted vessels, due in part to their higher visibility in social settings and their use in public ceremonies (e.g., Duff 2002; Graves and Eckert 1998; Mills 1999, 2007a, 2007b; Ortman and Potter 2004; Potter 2000; Spielmann 1998; Van Keuren 2004). As discussed in more detail in Chapter 8, the color combinations and bold exterior designs of some decorated ceramics in the Cibola region vary through time in relation to the sizes and configurations of public spaces (Mills 2007a). This suggests many vessels were produced with a fundamental concern for visual communication. Furthermore, several decorated wares, in particular polychrome bowls, appear to have been used in contexts associated with public food consumption (see Mills 2007a; Peeples 2006; Potter 2000). Because of their high visibility and association with public ceremonial contexts, decorated vessels likely also served as common vehicles for the active and public expression of social identities (see Mills 2007a:220-228).

Duff (2002:26-27) argues that the long-distance circulation of painted vessels represents exchange among members of different communities taking place in public settings, perhaps as a means to formalize social connections and reciprocal obligations among the participants in ceremonial gatherings. The formal and public nature of decorated ceramic exchange, as well as the association of decorated vessels with the active expression of identities, suggests that the circulation of decorated vessels may provide an indication of patterns of long-distance, perhaps somewhat less frequently activated relational connections across the Cibola region. Beyond this, the formal and public nature of decorated ceramic exchange, as well as the association of decorated vessels with the active expression of identities (see also Chapter 8), suggests that the circulation of decorated vessels may also provide an indication of patterns of shared categorical identities across the Cibola region. Stated another way, communities that were involved in common spheres of decorated ceramic circulation were also likely involved in common spheres of public ceremonialism, providing contexts where categorical identities could have been expressed and contested.

Local vs. Non-Local Pottery

Not surprisingly, most pottery included in this study was recovered from the general location where it was produced. Of all samples which could be confidently assigned to a particular production zone during both the Pueblo III and Pueblo IV periods in the core portion of the study area, approximately 74% were local. As Table 5.1 illustrates, however, there are substantial differences in the percentages of local and non-local ceramics for decorated and utilitarian vessels in the sample as well as major changes through time.[1]

In general, utilitarian vessels are rarely recovered outside of the broad areas were they were produced during both the Pueblo III and Pueblo IV periods, and when they are, they are most frequently found in adjacent areas. This fits my general expectations outlined above as utilitarian vessels were presumably produced and consumed at the household level and exchanged primarily among close relations. The relatively low level of circulation of utilitarian vessels suggests that such transactions occurred most frequently among groups of people living in proximity to one another.

Unlike utilitarian vessels, decorated ceramics are frequently found outside of the areas where they were produced. Indeed, for the Pueblo III period sample, nearly half the decorated vessels in the sample were recovered outside of their production zones. This number is perhaps somewhat inflated as some areas included in the study (i.e., Mogollon Highlands) were likely importing all of the decorated wares included in the current NAA sample. Still, the much higher percentage of decorated vessels that were transported over vast distances suggests

Table 5.1. Counts and percentages of local and non-local sherds.

Ware	Period	Local	Non-local	Total
Utilitarian	PIII	311 (85%)	52 (15%)	363
	PIV	164 (91%)	17 (9%)	181
Decorated	PIII	217 (52%)	200 (48%)	417
	PIV	203 (79%)	55 (21%)	258
Combined	PIII-PIV	895 (74%)	324 (26%)	1219

that very different social processes were involved in the circulation of painted vessels. Consideration of the forms of decorated vessels suggests that bowls were transported out of their production zones more frequently and over greater distances than painted jars (~39% of decorated bowls were found outside of their production zone vs. ~19% of decorated jars). The frequent long distance transport of decorated vessels, in particular polychrome bowls, may have been associated with public ceremonial gatherings involving food consumption and exchanges marking these public events (e.g., Duff 2002:26-27; Mills 2007a). Furthermore, as I argue below, some communities may have specialized in the production of certain decorated wares and vessel forms that were widely circulated across the region during both the Pueblo III and Pueblo IV periods. The specialized production of vessels for exchange may have accrued certain communities a position of influence within regional networks of ceramic circulation.

Finally, as Table 5.1 shows, the percentage of non-local vessels, both utilitarian and decorated, decreased across the Pueblo III to Pueblo IV transition. This decrease in ceramic circulation is also associated with a contraction in the total occupied area across the Cibola region. Across the Pueblo III to Pueblo IV transition, populations were increasingly concentrated into larger villages found in fewer places on the landscape. These large, nucleated villages formed closely spaced clusters of settlements surrounded by largely uninhabited areas (see Chapter 3). The relative reduction in long distance ceramic circulation suggests that interactions may have become increasingly internally focused across this transition (see Duff 2002; Huntley 2008; Schachner et al. 2011).

Settlement Clusters and External Relationships

Given the nature of chemical compositional groups and the degree of geological diversity across the Cibola region, it is not possible to directly consider the amount of ceramic circulation that may have occurred within the broad production zones and settlement clusters defined here. It is, however, possible to consider similarities among sites within a single production zone in terms of the relative frequencies of pottery sources using the Brainerd-Robinson (BR) coefficient of similarity (Brainerd 1951; Robinson 1951). The BR coefficient is a city block metric of similarity (*S*) calculated as:

$$S = 200 - \sum_{k=1}^{p} | P_{ik} - P_{jk} |$$

where, for all variables (*k*), *P* is the total percentage in assemblages *i* and *j* (Shennan 1997:233). This measure ranges from 0, indicating no similarity, to 200, indicating perfect similarity. For the analyses presented here, BR values were calculated among all sites divided by time period using the proportions of samples within distinct compositional core, provisional, and sub-groups rather than the broader production zones described above.[2]

Tables 5.2 and 5.3 present the BR similarity values among all sites divided by time period with comparisons for sites within the same production zone highlighted. In general, these two tables suggest that proportions of compositional groups are most similar among sites within the same production zone or settlement cluster. The Upper Little Colorado sub-region appears, at first, to be an exception to this general pattern as similarity values among sites within this zone vary quite a bit. The differences among sites in the Upper Little Colorado are, however, related to the scale at which production zones can be identified. Compositional groups attributed to the Upper Little Colorado area can actually be divided into three distinct zones; northern, central, and southern. As the underlined pairs on table 5.2 and 5.3 illustrate, comparisons among sites within these smaller spatial divisions are all high in relation to comparisons among sites in different zones along the Upper Little Colorado valley.

Because the sizes of the samples available from sites across the region vary so widely, it is also important to assess the possibility that the differences among sites suggested by the BR tables above are the result of sampling error. For this analysis, I follow the procedures described by DeBoer and others (1996; see also Huntley 2008; Bernardini 2005) for assessing the probability of obtaining a BR value as low as or lower than a given comparison by chance using a Monte Carlo simulation procedure. Specifically, 1,000 random samples of a specified sample size (based on the actual number of samples in each two-way comparison) are drawn with replacement from a population with proportions defined by the actual number of samples in each compositional group across all sites. The

Table 5.2. Brainerd- Robinson similarity coefficients based on all compositional groups for Pueblo III period sites.

	LG	Tog	ScS	Tin	S81	U481	TriR	Hubb	Hink	Jara	Plat	Gar	Coy	Rim	Rudd	ApCr
Los Gigantes Cluster																
Togeye Canyon Cluster	158															
Scribe S Cluster	145	129														
Tinaja Cluster	138	134	159													
Spier 81 Cluster	108	86	80	50												
UG481	69	48	48	25	94											
Tri-R Pueblo	29	29	29	29	29	118										
Hubble Corner	77	55	53	29	85	154	131									
Hinkson Ranch	75	72	67	35	87	63	29	68								
Jaralosa Pueblo	89	69	61	31	103	81	24	85	149							
Platt Ranch Settlement	91	71	67	31	103	82	35	90	163	173						
Garcia Ranch Pueblo	34	34	26	20	37	36	36	51	95	118	113					
Coyote Creek Pueblo	0	0	0	0	0	12	0	8	5	13	0	43				
Rim Valley Pueblo	0	0	0	0	0	12	0	8	0	0	0	7	84			
Rudd Creek Pueblo	0	0	0	0	0	0	0	0	5	13	0	36	**139**	46		
Apache Creek Pueblo	27	27	27	25	27	27	33	36	33	36	27	31	29	80	9	
Higgins Flat Pueblo	35	35	35	25	35	35	24	35	41	48	35	50	55	85	35	160

Note: Comparisons within the same production zone are shaded. Bold-underlined comparisons indicate comparisons for sites in the Upper Little Colorado in the same cluster.

Table 5.3. Brainerd-Robinson similarity coefficients based on all compositional groups for Pueblo IV period sites.

	ATS	CIEN	MIR	PdM	Hesh	LPV	BoxS	HCM	TS	OB	S170	Baca	CMal	Hoop	Sher	RSn	TabR
Atsinna																	
Cienega	165																
Mirabal	138	150															
Pueblo de los Muertos	133	156	145														
Heshotauthla	52	56	56	94													
Lower Pescado Village	62	71	58	102	147												
Box S Pueblo	46	50	90	94	95	95											
Horse Camp Mill	32	32	32	32	32	32	32										
Techado Spring Pueblo	39	39	45	39	24	26	18	155									
Ojo Bonito	6	6	6	6	17	14	6	6	11								
Spier 170	0	0	0	0	6	8	0	0	0	161							
Baca Pueblo	2	2	2	2	8	10	2	10	8	63	61						
Casa Malpais	5	5	5	5	11	13	5	13	17	21	10	91					
Hooper Ranch Pueblo	4	4	4	4	9	12	4	12	16	55	46	103	**121**				
Sherwood Ranch	5	5	5	5	11	13	5	13	18	92	81	**116**	74	110			
Rattlesnake Point	0	0	0	0	6	8	0	8	6	79	79	**159**	69	102	**143**		
Table Rock Pueblo	0	0	0	0	6	8	0	8	6	67	67	109	38	71	117	123	
Foote Canyon Pueblo	9	9	9	9	9	9	9	26	32	11	0	2	70	39	27	0	0

Note: Comparisons within the same production zone are shaded. Bold-underlined comparisons indicate comparisons for sites in the Upper Little Colorado in the same cluster.

proportion of random samples that produce BR values less than or equal to an actual comparison provides an indication of the probability that an observed difference may be due to sampling error. For example, a probability value of p=0.005 means that in only 5 out of 1,000 random runs was a BR value less than or equal to the observed obtained. Such a low probability suggests that the differences between the sites being compared are extremely unlikely to have been the result of sampling error. The R code used to conduct this analysis is provided in Appendix E.

Tables 5.4 and 5.5 show the calculated probabilities of obtaining a BR value less than or equal to each actual comparison with comparisons among sites within the same production zone highlighted. All probabilities greater than 0.150 are underlined and in bold. As these tables show, probabilities associated with comparisons between sites in different production zones are all low and, indeed, none of the differences among sites in different settlement clusters are likely the result of chance. Conversely, the majority of comparisons among sites within the same settlement cluster are associated with relative high probabilities. This suggests that minor differences among sites within a particular settlement cluster are potentially products of sampling error rather than real differences in the sources of pottery represented. Again, there is a great deal of variability for comparisons among sites in the Upper Little Colorado area due to the multiple distinct production areas combined for this analysis.

A few comparisons among sites in the El Morro Valley for the Pueblo III period also display low probabilities, perhaps suggesting important differences

Table 5.4. Probabilities of obtaining a BR similarity coefficient less than or equal to the observed by chance for all Pueblo III period sites

	LG	Tog	ScS	Tin	S81	U481	TriR	Hubb	Hink	Jara	Plat	Gar	Coy	Rim	Rudd	ApCr
Los Gigantes Cluster																
Togeye Canyon Cluster	**0.372**															
Scribe S Cluster	0.042	0.002														
Tinaja Cluster	0.007	0.001	**0.380**													
Spier 81 Cluster	<0.001	<0.001	<0.001	<0.001												
UG481	<0.001	<0.001	<0.001	<0.001	0.039											
Tri-R Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	**0.442**										
Hubble Corner	<0.001	<0.001	<0.001	<0.001	0.001	**0.974**	**0.443**									
Hinkson Ranch	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001								
Jaralosa Pueblo	<0.001	<0.001	<0.001	<0.001	0.013	0.016	<0.001	<0.001	**0.828**							
Platt Ranch Settlement	<0.001	0.001	<0.001	<0.001	0.088	0.076	<0.001	0.055	**0.997**	**0.999**						
Garcia Ranch Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.193**	**0.354**					
Coyote Creek Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
Rim Valley Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.060			
Rudd Creek Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.595**	<0.001		
Apache Creek Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.066	<0.001	
Higgins Flat Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.135	<0.001	**0.996**

Note: Comparisons within the same production zone are shaded. Probabilities > 0.15 are bold-underlined.

Table 5.5. Probabilities of obtaining a BR similarity coefficient less than or equal to the observed by chance for all Pueblo IV period sites.

	ATS	CIEN	MIR	PdM	Hesh	LPV	BoxS	HCM	TS	OB	S170	Baca	Cmal	Hoop	Sher	RSn	TabR
Cienega	**1.000**																
Mirabal	**0.912**	**0.992**															
Pueblo de los Muertos	**0.759**	**0.998**	**0.972**														
Hesotauthla	<0.001	0.003	<0.001	0.018													
Lower Pescado Village	<0.001	0.027	0.001	0.148	**0.958**												
Box S Pueblo	<0.001	0.003	0.145	0.088	0.093	0.126											
Horse Camp Mill	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001										
Techado Spring Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.979**									
Ojo Bonito	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001								
Spier 170	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.999**							
Baca Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						
Casa Malpais	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					
Hooper Ranch Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.132				
Sherwood Ranch	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	<0.001	0.033	<0.001	0.029			
Rattlesnake Point	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.695**	<0.001	<0.001	**0.602**		
Table Rock Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.054	0.001	
Foote Canyon Pueblo	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001

Note: Comparisons within the same production zone are shaded. Probabilities > 0.15 are bold-underlined.

among these sites. The comparisons characterized by low probabilities are between pairs of sites in the eastern (Scribe S and Tinaja) and western (Los Gigantes and Togeye Canyon) portions of the valley. As described in detail in Appendix A, there are geological differences across the El Morro Valley and discrete compositional groups that may be derived from different parent materials available in the eastern and western portions of the area respectively. These geological differences may be partially responsible for the observed differences noted here but differential import of non-local vessels is also likely a factor (see Schachner 2007:267-274). Importantly, however, the BR similarity values for all sites within the El Morro Valley during the Pueblo III period are still all higher than those for comparisons with sites in any other sub-region

Overall, the analyses presented above suggest that sites within distinct settlement clusters had quite similar external relationships, as measured by the proportional representation of local and non-local ceramics. Furthermore, these external relationships often differed dramatically from those of the inhabitants of nearby settlement clusters. These results complement the patterns documented in similar analyses conducted by Huntley (2008) for the Pueblo IV period focused exclusively on the Zuni area as well as in Schachner's (2007) fine-grained analysis focused on differences among sites and individual room blocks within the El Morro Valley. The analyses above extend the results of these previous studies across a broader area and further back in time. From these results, I argue that similarities in the relative proportions of ceramic compositional groups at closely spaced Pueblo III and Pueblo IV period settlements suggest that the inhabitants of settlements across the Cibola region likely maintained long distance ties most similar to those of their nearest neighbors. These results support the inference that patterns of interaction within settlement clusters were relatively well established prior to the construction of nucleated settlements across much of the Cibola region across the Pueblo III to Pueblo IV transition.

Regional Patterns of Ceramic Circulation through Time

As the analyses in the previous sections illustrate, non-local pottery was present in small amounts at almost every site considered in this study, and sites within the same area typically had non-local vessels from the same production zones. The purpose of this section is to explore the specific relationships suggested by the patterned movement of vessels across the study area through time. I consider the circulation of utilitarian and decorated ceramics separately. For the sake of brevity, this discussion is organized at the scale of sub-regions, but the tables presented below also provide data for individual sites. The discussion below is primarily focused on the compositional sample from settlements that date to the period prior to A.D. 1325, but I also consider late Pueblo IV ceramic exchange documented in more detail by Duff (2002).

Utilitarian Ceramics

Figure 5.2 shows the distribution of utilitarian vessels from each production zone for all Pueblo III period sites by sub-region (see also Table 5.6). As this map illustrates, all well sampled sub-regions within the core portion of the study area are strongly dominated by utilitarian vessels that are presumably locally produced, but a small number of vessels were also recovered some distance from

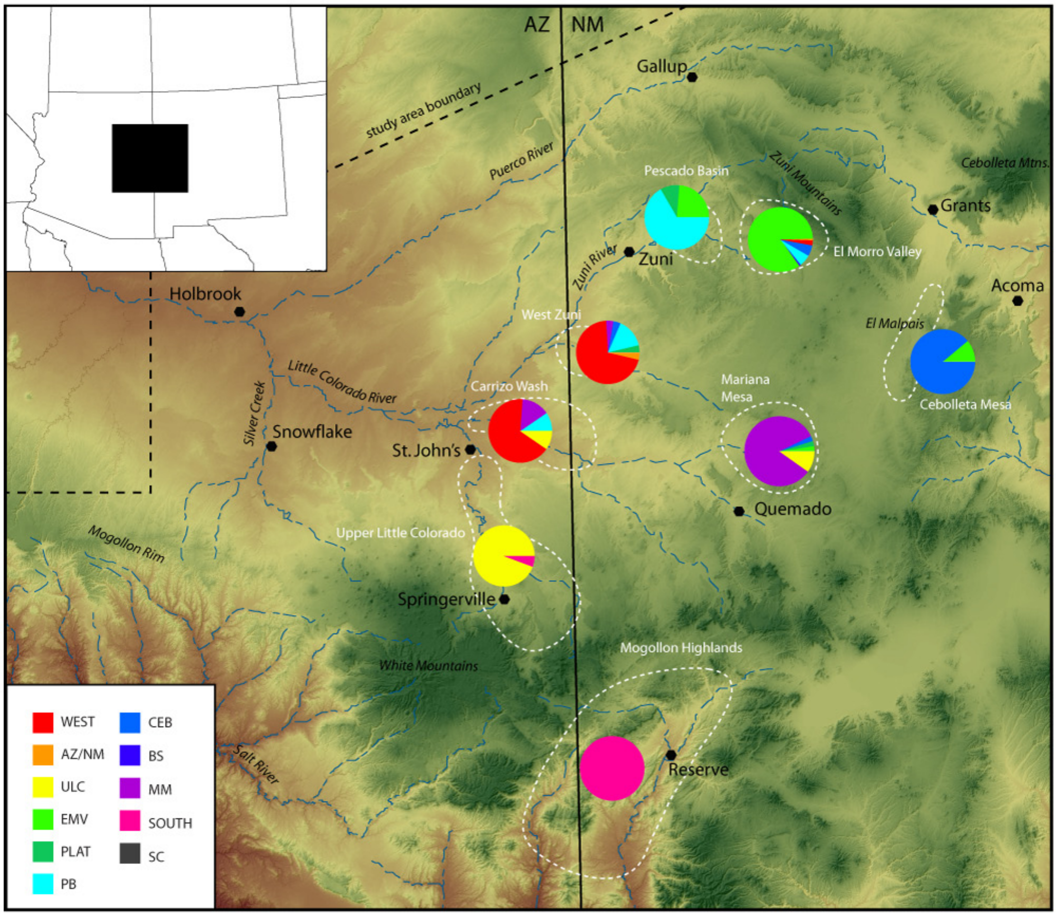


Figure 5.2. Proportions of utilitarian vessels from each production zone by sub-region for the Pueblo III period.

their production zones. There are numerous complex and overlapping patterns apparent in this map and I cannot hope to cover all of them. I limit my discussion here to a few trends that are most relevant to the current study.

First, there is a strong north/south component to the distribution of utilitarian vessels produced in different zones across the core portion of the study area. Utilitarian vessels produced in the Pescado Basin are found in moderate frequencies in all sub-regions along the Zuni River valley and nearby drainages including the El Morro Valley, the West Zuni area, and along Carrizo Wash, but

Table. 5.6. Production zone assignments by site and sub-region for all utilitarian vessels.

Region/Settlement	EMV	PLAT	PB	CEB	BS	MM	WEST	AZ/NM	ULC	SOUTH	SC	Unk	TOTAL
El Morro Valley PIII													
Los Gigantes Cluster	38	1	4	5			1	1				10	60
Togeye Canyon Cluster	34	1	3	3			4					15	60
Scribe S Cluster	44		4	1	1							10	60
Tinaja Cluster	57		1	2								0	60
Known Sources %	***84.4***	***1.0***	***5.9***	***5.4***	***0.5***		***2.4***	***0.5***					
El Morro Valley PIV													
Atsinna	9		1									1	11
Cienega	6											0	6
Mirabal	6											1	7
Pueblo de los Muertos	7											4	11
Known Sources %	***96.6***		***4.4***										
Pescado Basin PIII													
Spier 81 Cluster	5	2	14									4	25
Known Sources %	***23.8***	***9.5***	***66.7***										
Pescado Basin PIV													
Heshotauthla		2	4					1				5	12
Lower Pescado Village	1		4									5	10
Known Sources %	***8.3***	***16.7***	***66.7***					***8.3***					
Upper Nutria PIV													
Box S Pueblo	1	4	2		3							2	12
Known Sources %	***10.0***	***40.0***	***20.0***		***30.0***								
Mariana Mesa PIII													
UG481						8			1			1	10
Tri-R Pueblo	1	1				17						7	26
Hubble Corner				1		9			1			4	15
Known Sources %	***2.6***	***2.6***		***2.6***		***87.2***			***5.1***				
Mariana Mesa PIV													
Horse Camp Mill						13			1			1	15
Techado Spring Pueblo	3	1		2		24						6	36
Known Sources %	***6.8***	***2.3***		***4.5***		***84.1***			***2.3***				
West Zuni PIII													
Hinkson Ranch		1	2	1		1	11	1				3	20
Jaralosa Pueblo			2				8					5	15
Known Sources %		***3.7***	***14.8***	***3.7***		***3.7***	***70.4***	***3.7***					
West Zuni PIV													
Ojo Bonito			1				9					5	15
Spier 170							8					2	10
Known Sources %			***5.6***				***94.4***						
Carrizo Wash PIII													
Platt Ranch Settlement			1			1	4					9	15
Garcia Ranch Pueblo			1			2	10		1			6	20
Known Sources %			***10.0***			***15.0***	***70.0***		***5.0***				
Upper Little Colorado PIII													
Coyote Creek Pueblo									12	1		2	15
Rim Valley Pueblo									2			0	2
Rudd Creek Pueblo									18			0	18
Known Sources %									***97.0***	***3.0***			
Upper Little Colorado Early PIV													
Baca Pueblo									35			14	49
Casa Malpais									16	1		4	21
Hooper Ranch Pueblo									14			1	15
Known Sources %									***98.5***	***1.5***			
Upper Little Colorado Late PIV													
Sherwood Ranch Pueblo									5	1		4	10
Rattlesnake Point Pueblo									32			19	51
Table Rock									14			6	20
Known Sources %									***98.1***	***1.9***			
Mogollon Highlands PIII													
Apache Creek Pueblo										15		0	15
Higgins Flat Pueblo										9		1	10
Known Sources %										***100.0***			
Mogollon Highlands PIV													
Foote Canyon Pueblo						2				6		4	12
Known Sources %						***25.0***				***75.0***			
Expanded Study Area PIII													
Manuelito Canyon Sites		2	1	1								11	15
Cebolleta Mesa Sites	1			8								6	15

in no areas further to the south. Conversely, pottery produced in the Upper Little Colorado area is found at sites in both the Carrizo Wash and Mariana Mesa areas, but in no sites further north. Utilitarian vessels likely produced in the Mariana Mesa area were recovered from sites in the West Zuni area and along Carrizo Wash in small amounts, potentially suggesting ties from east to west across the region.

A few vessels recovered from sites in the Mariana Mesa district were likely produced in the El Morro Valley, Cebolleta Mesa, and potentially in other areas to the north along the Zuni River Valley. Although the number of vessels from northern sources is relatively small, this number is also probably severely inflated. All of the vessels in question are Cibola Gray Ware sherds. Cibola Gray Ware vessels account for 0.5-3% of utilitarian vessels recovered from the sampled sites in the Mariana Mesa area during the period considered here, but account for approximately 19% of the NAA dataset from the Mariana Mesa area due to the large number of Cibola Gray Ware sherds sampled by Schachner (2007) in a previous study. Furthermore, there are limited data suggesting that some Cibola Gray Ware may have been locally produced in the Mariana Mesa area (Appendix A).[3] Thus, the apparent strength of connections between the Mariana Mesa area and settlements to the north along the Zuni River and Cebolleta Mesa is likely greatly exaggerated.

Figure 5.3 shows the distribution of utilitarian vessels by production zone for the early Pueblo IV period (see also Table 5.6). Again, each sub-region is strongly dominated by locally produced vessels. During the early Pueblo IV

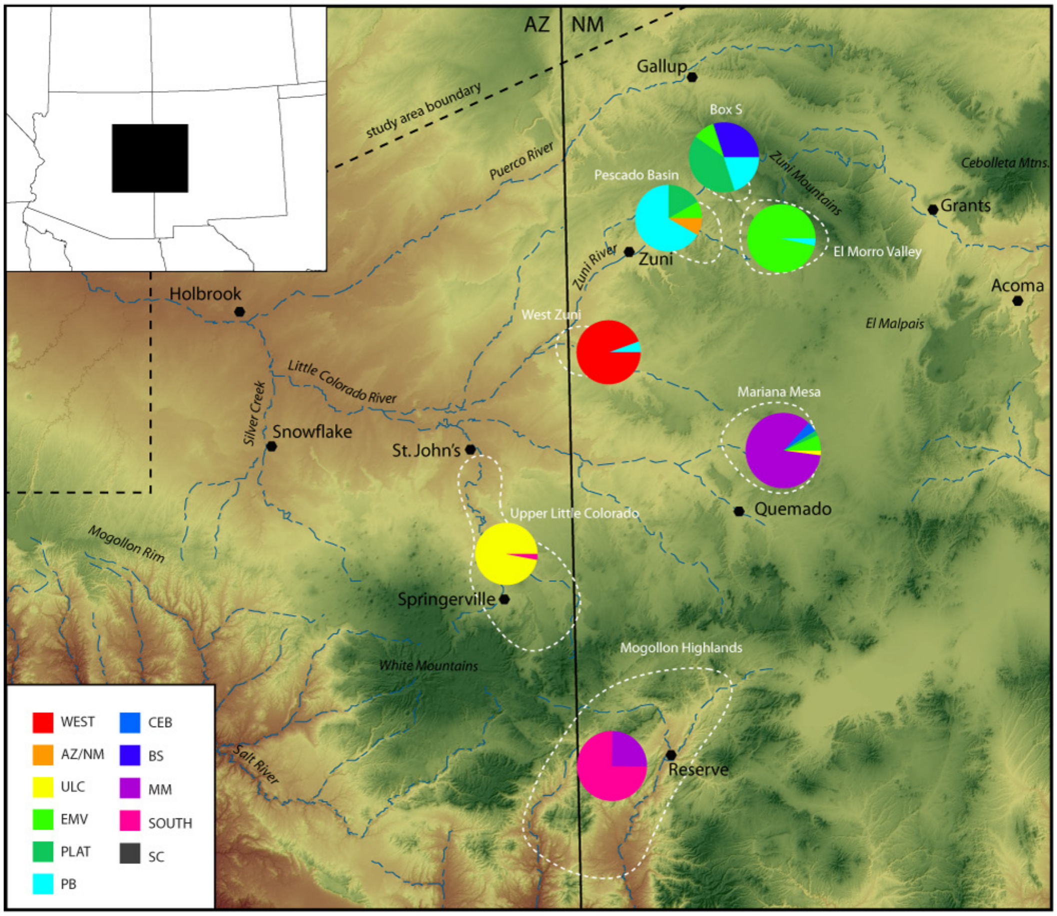


Figure 5.3. Proportions of utilitarian vessels from each production zone by sub-region for the early Pueblo IV period.

period, there is substantially less evidence for the circulation of utilitarian vessels among the inhabitants of different settlement clusters.[4] The few vessels that were transported out of their production zones suggest, however, that there was still a strong north/south division in the movement of vessels at this time. The circulation of vessels is most evident among sites in the core of the Zuni area (El Morro Valley, Pescado Basin, and Box S) and to a far lesser extent including the West Zuni area. There was also a small amount of movement of vessels among the Mariana Mesa, Upper Little Colorado, and Mogollon Highlands areas to the south. As was the case during the Pueblo III period, several vessels produced in the north were recovered from the Mariana Mesa area, but this relationship is likely dramatically exaggerated due to the overrepresentation of Cibola Gray Ware in the NAA dataset.

The patterns described above suggest that utilitarian vessels in the Cibola region circulated primarily in two relatively distinct spheres; the first including settlements along the Zuni River Valley and the Carrizo Wash area in the north and the second including settlements along the edge of the Colorado Plateau and in the mountainous highlands further south. Perhaps not surprisingly, these two spheres of ceramic circulation coincide with the distributions of Cibola Gray Ware to the north and Mogollon Brown Ware to the south which have sometimes been interpreted as the markers of the Anasazi and Mogollon archaeological culture areas. However, the data presented here demonstrate that utilitarian ceramic assemblages from sites along the edges of these two spheres of ceramic circulation were somewhat more diverse in terms of the geographic sources of non-local utilitarian vessels and included small numbers of non-local vessels produced both to the north and south. Overall, this suggests that there was a fairly consistent division between the northern and southern portions of the Cibola region through time, but the boundaries between the two overarching spheres of ceramic circulation were also somewhat permeable.

With the exception of the movement of vessels between the El Morro Valley and the nearby Pescado Basin, most utilitarian ceramic circulation during both the Pueblo III and Pueblo IV periods was largely unidirectional, or at least heavily weighted in one direction, rather than reciprocal. This suggests that the long distance movement of utilitarian vessels may be partially attributable to regional scale population movements rather than sustained patterns of interaction among distinct groups continually residing in different areas. Conversely, the consistent reciprocal circulation of utilitarian vessels among the inhabitants of the El Morro Valley and the Pescado Basin suggests particularly strong relational connections and frequent interaction among the inhabitants of these nearby areas.

Decorated Ceramics

Figure 5.4 shows the distribution of decorated vessels by production zone for the Pueblo III period (see also Table 5.7). This map illustrates that there was a great deal of reciprocal circulation of ceramic vessels among the inhabitants of settlements along the Zuni River Valley including the El Morro Valley, Pescado Basin, West Zuni, and Carrizo Wash areas as well as the Cebolleta Mesa area outside of the core study area. Decorated ceramics produced in the Pescado Basin are also quite common in most other portions of the region. In fact, decorated vessels from the Pescado Basin production zone are found at almost every sampled site across the study area with the exception of sites in the Upper Little Colorado sub-region. Upper Little Colorado area sites are dominated by locally produced decorated vessels along with a small number of non-local painted corrugated ceramics (McDonald Painted Corrugated) likely produced to the south or west below the Mogollon Rim. Decorated vessels produced in the Mariana Mesa area were primarily recovered locally, but were also found in small amounts

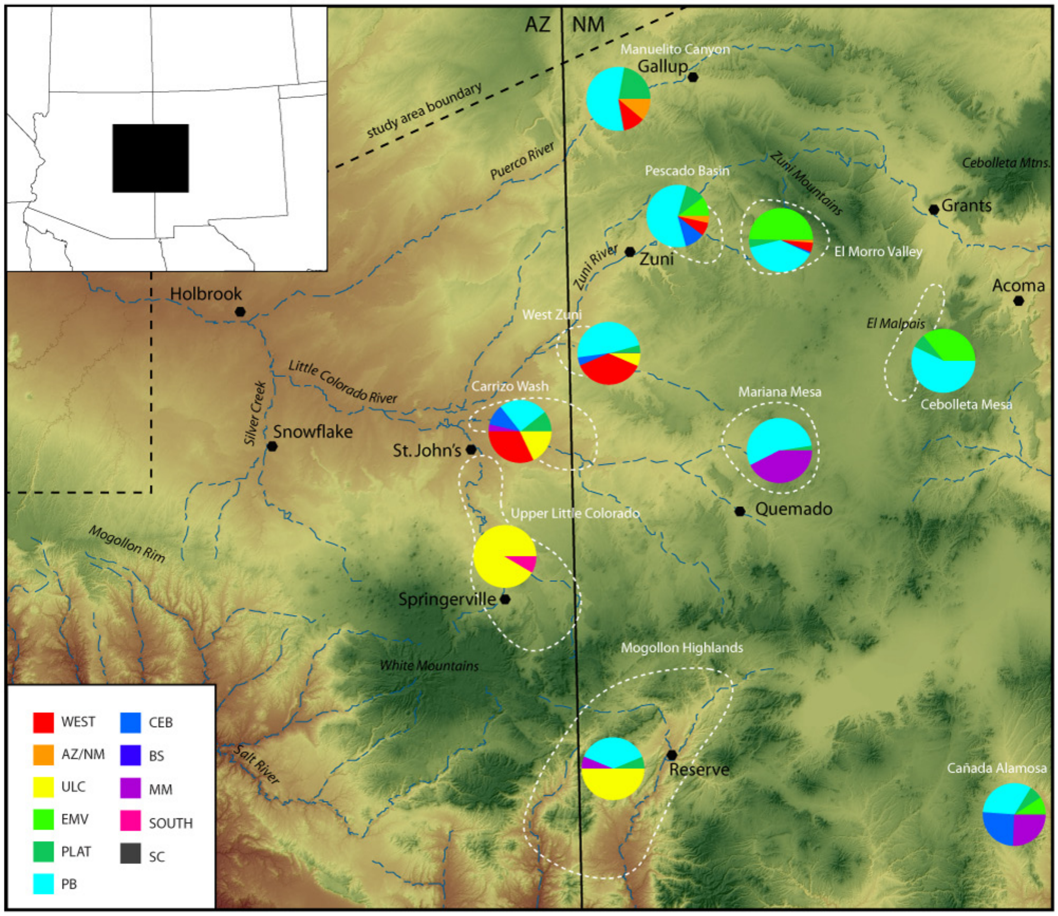


Figure 5.4. Proportions of decorated vessels from each production zone by sub-region for the Pueblo III period.

in the Carrizo Wash and Mogollon Highlands areas and in much higher frequencies in the Cañada Alamosa area outside of the study area to the southeast.

Although the patterns of circulation documented here for decorated ceramics during the Pueblo III period are quite different than the patterns documented for the circulation of utilitarian vessels, there are also a few overarching similarities. First, there still appears to have been a strong division between the Upper Little Colorado area and areas further north and east along the Zuni River. As with the utilitarian ceramics, settlements between the Upper Little

Table 5.7. Production zone assignments by site and sub-region for all decorated vessels.

Region/Settlement	EMV	PLAT	PB	CEB	BS	MM	WEST	AZ/NM	ULC	SOUTH	SC	Unk	TOTAL
El Morro Valley PIII													
Los Gigantes Cluster	16	3	32	1			3					20	75
Togeye Canyon Cluster	29		22				3	1				7	62
Scribe S Cluster	26	6	24	1			4					13	74
Tinaja Cluster	43	1	12				1	2				6	65
Known Sources %	***49.6***	***4.3***	***39.1***	***0.9***			***4.8***	***1.3***					
El Morro Valley PIV													
Atsinna	11	4	6									6	27
Cienega	7		5									4	16
Mirabal	7	1	5	1	4							2	20
Pueblo de los Muertos	11	1	15									2	29
Known Sources %	***46.2***	***7.7***	***39.7***	***1.3***	***5.1***								
Pescado Basin PIII													
Spier 81 Cluster	3	3	17	3			2	1				11	40
Known Sources %	***10.3***	***10.3***	***58.6***	***10.3***			***6.9***	***3.4***					
Pescado Basin PIV													
Heshotauthla		2	29	1								2	34
Lower Pescado Village	2	1	18					1				3	25
Known Sources %	***3.7***	***5.6***	***87.0***	***1.9***				***1.9***					
Upper Nutria PIV													
Box S Pueblo	2		8		8							0	18
Known Sources %	***11.1***		***44.4***		***44.4***								
Mariana Mesa PIII													
UG481			8									2	10
Tri-R Pueblo		1	4			12						4	21
Hubble Corner			10			5						0	15
Known Sources %		***2.5***	***55.0***			***42.5***							
Mariana Mesa PIV													
Horse Camp Mill			4			7						4	15
Techado Spring Pueblo	4		6			23			4			8	45
Known Sources %	***8.3***		***20.8***			***62.5***			***8.3***				
West Zuni PIII													
Hinkson Ranch		1	11				10		1			7	30
Jaralosa Pueblo		1	11	2			7		2			2	25
Known Sources %		***4.3***	***47.8***	***4.3***			***37.0***		***6.5***				
West Zuni PIV													
Ojo Bonito		2	1				5	18	1			14	41
Spier 170							2	18				5	25
Known Sources %		***4.3***	***2.1***				***14.9***	***76.6***	***2.1***				
Carrizo Wash PIII													
Platt Ranch Settlement		1	6	1			4					3	15
Garcia Ranch Pueblo		2	1	2		1		5	5			4	20
Known Sources %		***10.7***	***25.0***	***10.7***		***3.6***	***14.3***	***17.9***	***17.9***				
Upper Little Col. PIII													
Coyote Creek Pueblo									18			2	20
Rim Valley Pueblo									7	4		12	23
Rudd Creek Pueblo									18			2	20
Known Sources %									***91.5***	***8.5***			
Upper Little Col. Early PIV													
Baca Pueblo			1				1	28	28		3	25	86
Casa Malpais			1					2	20			13	36
Hooper Ranch Pueblo			1					13	27		3	10	54
Known Sources %			***2.3***				***0.8***	***33.6***	***58.6***		***4.7***		
Upper Little Col. Late PIV													
Sherwood Ranch Pueblo			1					15	8		7	4	35
Rattlesnake Point Pueblo							2	40	25		9	23	99
Table Rock								26	33		6	15	80
Known Sources %			***0.6***				***1.2***	***47.1***	***38.4***		***12.8***		
Mogollon Highlands PIII													
Apache Creek Pueblo		1	3			1			3			7	15
Higgins Flat Pueblo			3						5			7	15
Known Sources %		***6.3***	***37.5***			***6.3***			***50.0***				
Mogollon Highlands PIV													
Foote Canyon Pueblo			1						14			3	18
Known Sources %			***6.7***						***93.3***				
Expanded Study Area PIII													
Manuelito Canyon Sites		2	5				1	1				6	15
Cebolleta Mesa Sites	5	1	8									1	15
Cañada Alamosa Sites	4	3	14	11		11						13	56

Colorado and the central Zuni area have decorated vessels from diverse sources to both the north and south. Unlike the patterns documented for utilitarian vessels, however, ceramic assemblages for some settlements in the Mariana Mesa area are dominated by decorated vessels produced in the Pescado Basin. This pattern is notable because, although the inhabitants of the Mariana Mesa area were apparently obtaining substantial amounts of decorated pottery from the Pescado Basin, vessels exported from Mariana Mesa are primarily found in areas further south. This may suggest that non-ceramic items were being exchanged among the inhabitants of the Mariana Mesa and Pescado Basin areas or possibly, that settlements in the Mariana Mesa area were somewhat peripheral to the sphere of exchange involving ceramics produced in the Pescado Basin. Considering the Mogollon Highlands area in the south, decorated vessels in the sample are roughly equally split between those produced in the Pescado Basin and those produced in the Upper Little Colorado, although there are major differences in the wares represented by each production source. Decorated vessels obtained from the Upper Little Colorado area are mostly Cibola White Ware jars (75%) whereas vessels obtained from the Pescado Basin area are mostly White Mountain Red Ware bowls (83%). Although the current sample is small, the differences suggest that the red ware bowls and white ware jars were been obtained in different ways, possibly because jars would have been more difficult to transport than bowls. The number of vessels moving from the Pescado Basin into the Mogollon Highlands is likely somewhat overemphasized in the data presented here, however, as White Mountain Red Ware vessels are somewhat less frequent in site-wide ceramic assemblages than in the current small compositional dataset (White Mountain Red Ware typically makes up 5-30% of the decorated ceramic assemblage at Pueblo III sites in the region and 43% of the current compositional dataset). Overall, the available data suggest that, although White Mountain Red Ware was relatively rare at sites in the Mogollon Highlands, much of it may have been produced in the Pescado Basin area.

The patterns documented here for the Pueblo III period suggest that the inhabitants of a large portion of the Cibola region were involved in a broad sphere of decorated ceramic exchange possibly centered on the Pescado Basin area. Reciprocal exchange relationships were strongest among the inhabitants of settlements in the Zuni area between Carrizo Wash and the El Morro Valley. Settlements to the south, in the Mariana Mesa and Mogollon Highlands areas obtained pottery produced in the Pescado Basin, but if this movement of vessels represents exchange, it was likely not exchange in kind. At the same time, the Upper Little Colorado area appears to have been almost wholly isolated from this sphere of decorated ceramic circulation. Although vessels produced in the Upper Little Colorado area did end up in nearby areas in small numbers, very few non-local decorated vessels could be identified in the available compositional sample. This division suggests the maintenance of a relatively strong and persistent boundary between the inhabitants of the Upper Little Colorado and areas to the north and east.

As Figure 5.5 illustrates, patterns of decorated ceramic circulation changed considerably across the Pueblo III to Pueblo IV transition. For the early

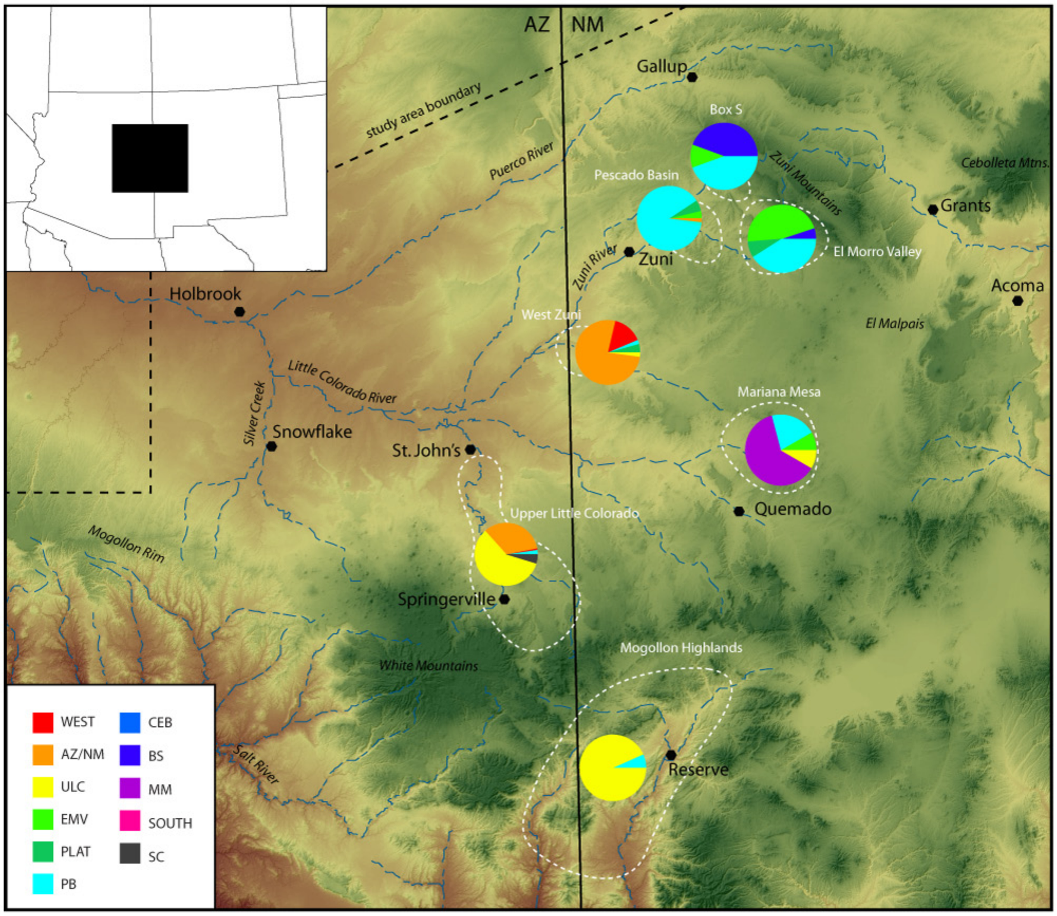


Figure 5.5. Proportions of decorated vessels from each production zone by sub-region for the early Pueblo IV period.

Pueblo IV period sample, most areas are dominated by locally produced painted vessels. It is important to note that, although the Upper Little Colorado and the West Zuni region share a common compositional group/production source (AZ/NM), most vessels within this group are likely local products where they were recovered (see Appendix A). In addition, all but one of the non-local samples recovered from the Mariana Mesa area were examples of types that potentially date to the late Pueblo III period (Tularosa Black-on-white and St. Johns Polychrome). Thus, the relative rarity of ceramic circulation among distant settlement clusters may have been even more pronounced after the transition to ceramic assemblages dominated by glaze-painted wares shortly after A.D. 1275.

By far, the largest numbers of vessels found outside of their production zone during the Pueblo IV period were Zuni Glaze Ware bowls moving from the Pescado Basin area into the El Morro Valley and the Box S area. After about A.D. 1275, the El Morro Valley was a major demographic center across the greater Cibola region and one of the most densely occupied areas in the northern Southwest. The largely unidirectional movement of vessels into the El Morro Valley may have been due to either population movement or intensified public ceremonialism associated with the establishment of the massive nucleated communities at this time (Huntley 2008:42-43; Schachner et al. 2011; see also Potter 1997, 2000). Either way, it appears that ceramic exchange in the Zuni area was increasingly focused on this newly developing demographic center.

The decorated wares in the current sample recovered from the Mogollon Highlands area were also likely imports. All but one sample could be placed in a single compositional group attributed to production in the southern Upper Little Colorado area. This pattern, very different from that seen in the Pueblo III period, suggests that social relationships changed as interaction became increasingly localized. Alternatively, the changes between the two time periods also may relate to differences in the external relationships of the inhabitants of specific portions of the large Mogollon Highlands area. The Pueblo III sample was derived from sites in the Tularosa River/Apache Creek area whereas the later Pueblo IV sample comes from Foote Canyon Pueblo (ca. A.D. 1250-1350) along the Blue River in

Arizona. Most settlements in the Tularosa River/Apache Creek area were likely uninhabited by or shortly after the transition to the Pueblo IV period. There may have been a great deal of variability in the production sources represented among late sites in the Mogollon Highlands as the latest ceramic wares and types present at individual sites differ quite a bit from place to place (cf., Rinaldo 1959:Table 2; Robinson 1992:Table 6.1; Zamora and Oakes 1999:Table 2.5). Although additional sampling could improve the picture, the currently available data do suggest an increasing focus on nearby production sources through time similar to the trend seen across the Cibola region as a whole.

Despite the relative isolation of settlement clusters during the Pueblo IV period, there is also some evidence for the long distance transport of decorated ceramics. A small number of vessels from the Pescado Basin area were present in all of the other sampled sub-regions. Furthermore, a few Zuni Glaze Ware and White Mountain Red Ware vessels produced in the central and southern Upper Little Colorado were transported to relatively distant settlements in the West Zuni area and Mariana Mesa sub-regions. The rarity of the movement of vessels across great distances during the early Pueblo IV period suggests that the social contexts in which decorated vessels were being exchanged were primarily organized among the inhabitants of proximate settlements. The demographic center of the Cibola region between the Pescado Basin and the El Morro Valley appears to have been particularly isolated in terms of long-distance ceramic exchange.

This picture of isolation may not have characterized all portions of the Cibola region equally, however, at least by the late Pueblo IV period (ca. A.D.

1325-1400). A small number of Fourmile Polychrome vessels, a late White Mountain Red Ware type produced after A.D. 1325 largely in the Silver Creek area, were recovered from sites in the Upper Little Colorado area. A comparison of early and late Pueblo IV sites in the Upper Little Colorado area suggests that non-local Fourmile Polychrome from the Silver Creek area became somewhat more common through time (see Table 5.7). In addition, small numbers of Roosevelt Red Ware vessels likely produced in the Arizona Mountains, and Hopi Yellow Ware vessels produced in the Hopi area, were also recovered from a few late Pueblo IV sites in the Upper Little Colorado drainage. Triadan (1997; Triadan et al. 2002) has also documented substantial amounts of White Mountain Red Ware moving among different portions of the Silver Creek area and the Arizona Mountains. Available data suggest that, at least by A.D. 1325, the Upper Little Colorado area was part of an extensive western sphere of ceramic circulation involving sites in the Silver Creek drainage and the Arizona Mountains.

Duff (2002:166-167) argues that the inhabitants of this western zone, many of whom were relatively recent immigrants into the greater Cibola region, may have shared some level of common identity built upon the establishment of culturally diverse communities in a new land. Not all settlements were equally connected across this broad area. Different wares were present in varying proportions at individual settlements in the Upper Little Colorado, Arizona Mountains and the Silver Creek area which likely reflect the varying historical ties among the inhabitants of distinct communities (Duff 2000). Despite this variability, the available data suggest that at least by the late Pueblo IV period, the

Cibola region could roughly be divided into an eastern zone centered on the Zuni area and characterized by relative isolation and internally focused interaction, and a western zone marked by more extensive regional exchange relationships (Duff 2002:Chapter 7).

As decorated vessels were likely used, and perhaps exchanged, in the context of public gatherings, these two largely distinct spheres of ceramic exchange may also represent separate spheres of broad scale relational connections or shared categorical identities among communities. Importantly, there is some evidence for an emerging boundary between the eastern and western portions of the study area as early as the Pueblo III period. The Upper Little Colorado area was largely isolated from the sphere of decorated ceramic exchange focused on the Zuni area throughout the period considered in this study. Although additional sampling of earlier sites in the Silver Creek and Arizona Mountains areas could help to address this issue further (especially for St. Johns Polychrome bowls), the consistent separation between the Upper Little Colorado sub-region and areas to the east may suggest that the distinct spheres of ceramic circulation characterizing the Pueblo IV period may have emerged several generations earlier. Intriguingly, a small number of samples of Cibola White Ware (Tularosa Black-on-white) submitted for NAA characterization by Zedeño (2002) from the Point of Pines area meet the criteria for membership in compositional groups attributed to the Upper Little Colorado, perhaps suggesting that ties to the mountainous western portions of the Cibola region may have also emerged somewhat earlier in time.

Community Specialization in Ceramic Production

Although ceramics in the North American Southwest are often assumed to have been produced for consumption primarily at the household level, there are also several notable and well documented examples of specialized production (e.g., Abbott 2000; Bishop et al. 1988; Clark 2006; Habicht-Mauche 1993; Harry 2003; Hegmon et al. 1995, 1997; Lyons 2003; Shepard 1936; Warren 1969). Specialized production can take a number of different forms, but can generally be defined as the limited provision of a product by a small number of individuals in relation to the number of consumers (cf., Costin 1991; Stark 1995). Most archaeologically identifiable specialized production in the northern Southwest falls under the rubric of community specialization, in which groups of producers residing in the same general area produce a surplus of some item for regional scale circulation (see Hegmon et al. 1995:33; Spielmann 1998; Stark 1995; Van der Leeuw 1977). Community specialization can be recognized, in part, through evidence for the spatially limited production of a widespread product. Identifying and characterizing specialization is important as communities engaged in the production of widely circulated decorated ceramics may have accrued special positions within the regional spheres of public ceremonialism where these vessels were likely used and exchanged.

A few previous studies focused on the Zuni area have suggested the possibility of community specialization for the production of certain ceramic wares. Mills (1995) argues that during the early historic period in the Zuni area, Zuni Glaze Ware vessels (Hawikuh Glaze-on-red and Polychrome) were produced using a restricted range of clay resources only available near the eastern cluster of Zuni towns. However, Zuni Glaze Ware vessels are found in roughly equal frequencies across all of the Zuni towns, even though some settlements are more than 30 kilometers from the clays likely used to produce these vessels. Mills argues that this distribution may indicate that the inhabitants of the eastern cluster of Zuni towns specialized in the production of Zuni Glaze Ware for exchange. In addition, Huntley (2004, 2008) and Schachner (2007; Schachner et al. 2011) have both previously noted that the widespread distribution of ceramics produced in the Pescado Basin area during both the Pueblo III and Pueblo IV periods may also indicate some level of specialized production by the inhabitants of this area during the prehispanic period. The increased size of the regional NAA sample and the inclusion of additional wares in the current study provide new data which are useful in evaluating this possibility further.

During the Pueblo III period, vessels produced in the Pescado Basin area make up a substantial proportion of the decorated ceramic assemblages of almost every portion of the study area except for the Upper Little Colorado sub-region. By the Pueblo IV period, vessels produced in the Pescado Basin were apparently somewhat less common across most of the region, but were still being brought into the El Morro Valley and the Box S area in substantial numbers. The vast majority of vessels produced in the Pescado Basin (especially those classified as part of the PB compositional group) and recovered outside of the production zone are polychrome bowls (~84% of all non-local samples). Importantly, the association of the PB group with the Pescado Basin is well established as sites in the Pescado Basin are the only sites in the study area with consistently high frequencies of sherds in the PB compositional group for both decorated and utilitarian vessels as well as for all vessel forms (see Appendix A). The consistency of types and vessel forms (red ware bowls) moving out of the Pescado Basin through time suggests some level of specialization in the production of early White Mountain Red Ware (Wingate and St. Johns Polychrome) and Zuni Glaze Ware (Heshotauthla and Kwakina Polychrome) by the residents of settlements in the Pescado Basin and possibly nearby areas with similar geology.

It is also instructive to consider the relative frequencies of red ware and white ware vessels across the region through time. If red ware and polychrome vessels were being produced through community specialization, we might expect to find higher relative frequencies of these vessels at settlements within the Pescado Basin production zone due to the increased intensity of production. In order to consider this possibility, ceramic type and ware counts were compiled from a number of excavated or thoroughly collected Pueblo III and Pueblo IV period sites or groups of sites across the greater Cibola region (see Table 5.8). It is important to note that the relative frequencies of red ware and polychrome vessels have been shown to increase through time (e.g., LeBlanc 1975). Thus, differences in the ratio of red to white ware may variously relate to differences in the intensity of production, the amount of import, or time. To partially ameliorate this complication, only typed examples of White Mountain Red Ware and Zuni Glaze Ware produced during the period considered in this study were included in these

Table 5.8. Counts and percentages of typed red ware/polychrome (White Mountain Red Ware and Zuni Glaze Ware) and Cibola White Ware sherds for excavated or extensively collected sites/survey areas across the Cibola region.

Site	Region	Period	# Red.	# White	% Red	% White	Source
Los Gigantes	EMV	PIII	459	113	**80.2%**	**19.8%**	EMVPP notes
Togeye Canyon	EMV	PIII	224	66	**77.2%**	**22.8%**	EMVPP notes
Scribe S	EMV	PIII	5062	1600	**76.0%**	**24.0%**	CARP notes
Tinaja	EMV	PIII	463	148	**75.8%**	**24.2%**	CARP notes
Mirabal	EMV	PIV	5011	807	**86.1%**	**13.9%**	CARP notes
Cienega	EMV	PIV	2072	225	**90.2%**	**9.8%**	CARP notes
Atsinna	EMV	PIV	697	226	**75.5%**	**24.5%**	CARP notes
Pueblo de los Muertos	EMV	PIV	12512	2130	**85.5%**	**14.5%**	CARP notes
CS142	EMV	PIII	277	55	**83.4%**	**16.6%**	CARP notes
Day Ranch	EMV	PIV	98	36	**73.1%**	**26.9%**	Kintigh 1985a
Box S	UPN	PIV	112	76	**59.6%**	**40.4%**	CARP notes
Archeotekopa II	SE ZUNI	PIV	177	87	**67.0%**	**33.0%**	Kintigh 1985a
HARP Survey	PB	PIII	495	101	**83.1%**	**16.9%**	HARP notes
NA11527	PB	PIII	778	188	**80.5%**	**19.5%**	Zier 1976
NA11530	PB	PIII	2954	798	**78.7%**	**21.3%**	Zier 1976
Heshotauthla	PB	PIV	2130	368	**85.3%**	**14.7%**	HARP notes
Yellowhouse Survey	PB	PIII	88	12	**88.0%**	**12.0%**	Hunter-Anderson 1977
Pescado; Upper, Lower, West	PB	PIV	1029	268	**79.3%**	**20.7%**	Kintigh 1985a
Jaralosa	WZ	PIII	253	319	**44.2%**	**55.8%**	OBAP notes
Hinkson Ranch	WZ	PIII	1634	2120	**43.5%**	**56.5%**	OBAP notes
Ojo Bonito	WZ	PIV	259	27	**90.6%**	**9.4%**	OBAP notes
Spier 170	WZ	PIV	94	21	**81.7%**	**18.3%**	OBAP notes
Seven Springs	WZ	PIII	141	171	**45.2%**	**54.8%**	Beeson 1966
Garcia Ranch	CW	PIII	54	66	**45.0%**	**55.0%**	Beeson 1966
Platt Ranch	CW	PIII	804	1195	**40.2%**	**59.8%**	Westfall1981
UG481	MM	PIII	941	2782	**25.3%**	**74.7%**	McGimsey 1980
Hubble Corner	MM	PIII	405	532	**43.2%**	**56.8%**	McGimsey 1980
Sandstone Hill	MM	PIII	870	1439	**37.7%**	**62.3%**	Barnett 1974
Fischer Site	MM	PIII	753	1929	**28.1%**	**71.9%**	Bice 2004
Horse Camp Mill	MM	PIV	2034	5720	**26.2%**	**73.8%**	McGimsey 1980
Techado Spring	MM	PIV	9392	10350	**47.6%**	**52.4%**	Smith et al. 2009
Baca Pueblo	ULC	PIV	215	184	**53.9%**	**46.1%**	ULCPP notes
Hooper Ranch	ULC	PIV	1687	1940	**46.5%**	**53.5%**	Martin et al. 1962
Rudd Creek	ULC	PIII	962	412	**70.0%**	**30.0%**	Clark et al. 2006
Rattlesnake Point	ULC	PIV	3969	690	**85.2%**	**14.8%**	ULCPP notes
Coyote Creek	ULC	PIII	172	80	**68.3%**	**31.7%**	DeGarmo 1975
Tularosa River Sites	MH	PIII	159	900	**15.0%**	**85.0%**	SWSN
Higgins Flat	MH	PIII	27	417	**6.1%**	**93.9%**	Martin et al. 1957
Apache Creek	MH	PIII	49	201	**19.6%**	**80.4%**	Martin et al. 1957
Foote Canyon Pueblo	MH	PIV	1334	1065	**55.6%**	**44.4%**	Rinaldo 1959
WS Ranch	MH	PIV	82	198	**29.3%**	**70.7%**	Robinson 1992
Hough's 70	MH	PIV	98	425	**18.7%**	**81.3%**	Oakes and Zamora 1999
Mineral Creek	VA	PIII	39	691	**5.3%**	**94.7%**	Martin et al. 1961
Manuelito Canyon Survey	PUE	PIII	357	361	**49.7%**	**50.3%**	Weaver 1978
Atsee Nitsa	PUE	PIII	51	59	**46.4%**	**53.6%**	Weaver 1978
Big House	PUE	PIII	125	175	**41.7%**	**58.3%**	Weaver 1978
Fort Wingate Survey	PUE	PIII	59	92	**39.1%**	**60.9%**	Schutt et al. 1997
Armijo Canyon Survey	CEB	PIII	76	141	**35.0%**	**65.0%**	Eleya et al. 1994
Cebolla Canyon Survey	CEB	PIII	232	323	**41.8%**	**58.2%**	Wozniak and Marshall 1990
Los Pilares	CEB	PIV	1573	1025	**60.5%**	**39.5%**	Ruppé 1990
Broken K	SC/HH	PIII	2052	4724	**30.3%**	**69.7%**	Hill 1970
Bailey Ruin	SC/HH	PIV	972	834	**53.8%**	**46.2%**	Scholnick 2003a
Bryant Ranch	SC/HH	PIII	94	482	**16.3%**	**83.7%**	Scholnick 2003a
Roundy Pueblo	SC/HH	PIII	12	899	**1.3%**	**98.7%**	Scholnick 2003a
Pottery Hill	SC/HH	PIII	87	608	**12.5%**	**87.5%**	Scholnick 2003a
Shumway Ruin	SC/HH	PIV	479	122	**79.7%**	**20.3%**	Van Keuran 2006

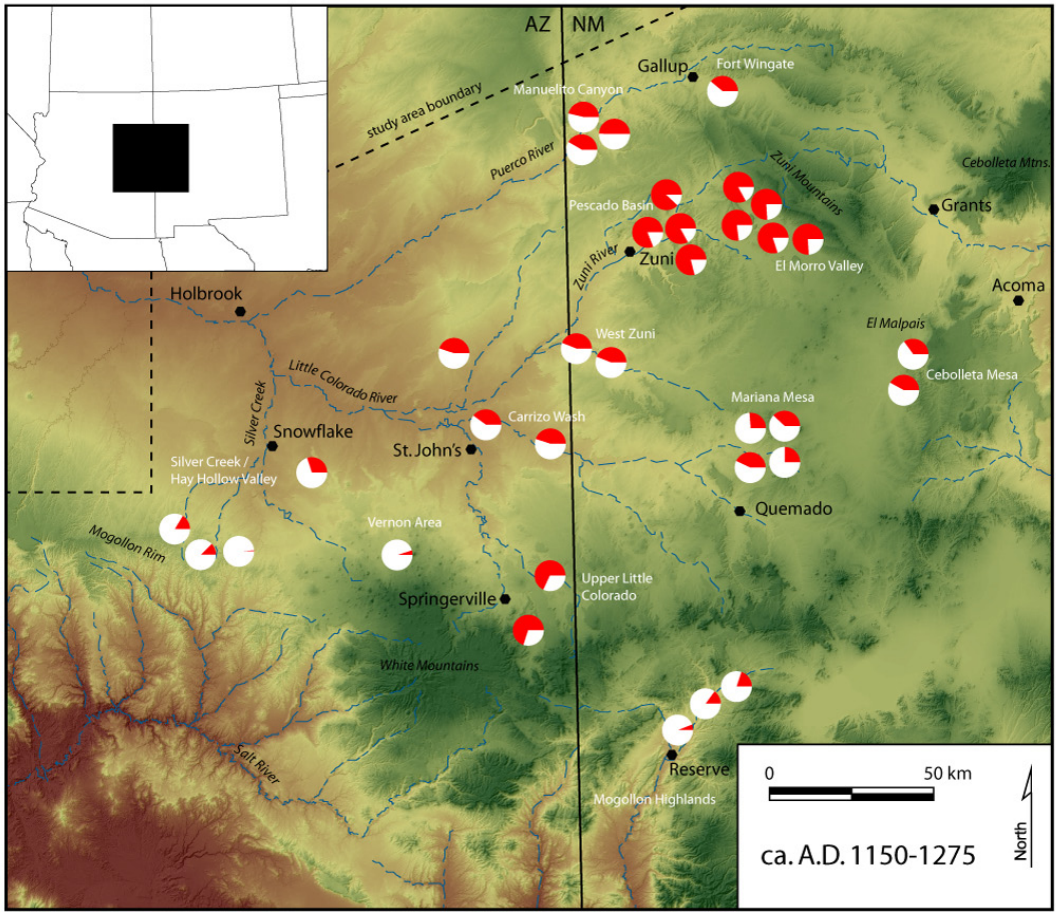


Figure 5.6. Proportions of red/polychrome ware and white ware for Pueblo III sites.

tabulations. Un-typed red and white ware sherds could potentially lower red to white ware ratios for sites with earlier components or longer occupation spans.

Figure 5.6 shows the proportions red/polychrome and white ware sherds for sites dating to the Pueblo III period. As this map illustrates, White Mountain Red Ware and Zuni Glaze Ware strongly dominate the ceramic assemblages of sites in the Pescado Basin and nearby areas, the El Morro Valley, as well as the southern Upper Little Colorado area, but all other sites have higher relative frequencies of Cibola White Ware. Some of the variation in this map may relate to temporal differences among sites as several sites in the El Morro Valley and Pescado Basin may date somewhat later in time than many outside of the central Zuni area. A few settlements in the Pescado Basin area which likely pre-date A.D. 1200 (i.e., sites with Wingate Polychrome but without St. Johns Polychrome), however, still show higher relative proportions of red ware than some sites tree ring dated late thirteenth century sites in areas to the south. Thus, the Pescado Basin does appear to consistently be among the areas with the highest relative frequencies of red ware vessels, as would be expected if this area were a center of intense production.

The elevated red ware frequency for the sites in the Upper Little Colorado is also interesting. This pattern may partially reflect time as two of the sites shown here are late enough to include small amounts of glaze painted pottery (ca. A.D. 1225-1275). At the same time, the demonstrated isolation of the Upper Little Colorado sites from the sphere of ceramic circulation centered on the Pescado Basin makes it tempting to speculate that the residents of the southern Upper Little Colorado area may have also been producing relatively high frequencies of red ware vessels, either for local consumption or exchange. Compositional characterizations of Pueblo III period White Mountain Red Ware types from sites in the Silver Creek area, Hay Hollow Valley, and Arizona Mountains would be particularly important to assess the role of exchange in this pattern because, although Cibola White Ware was produced in these areas at this time (Mills 1999; Triadan et al. 2002; Zedeño 1994, 2002), White Mountain Red Ware was likely

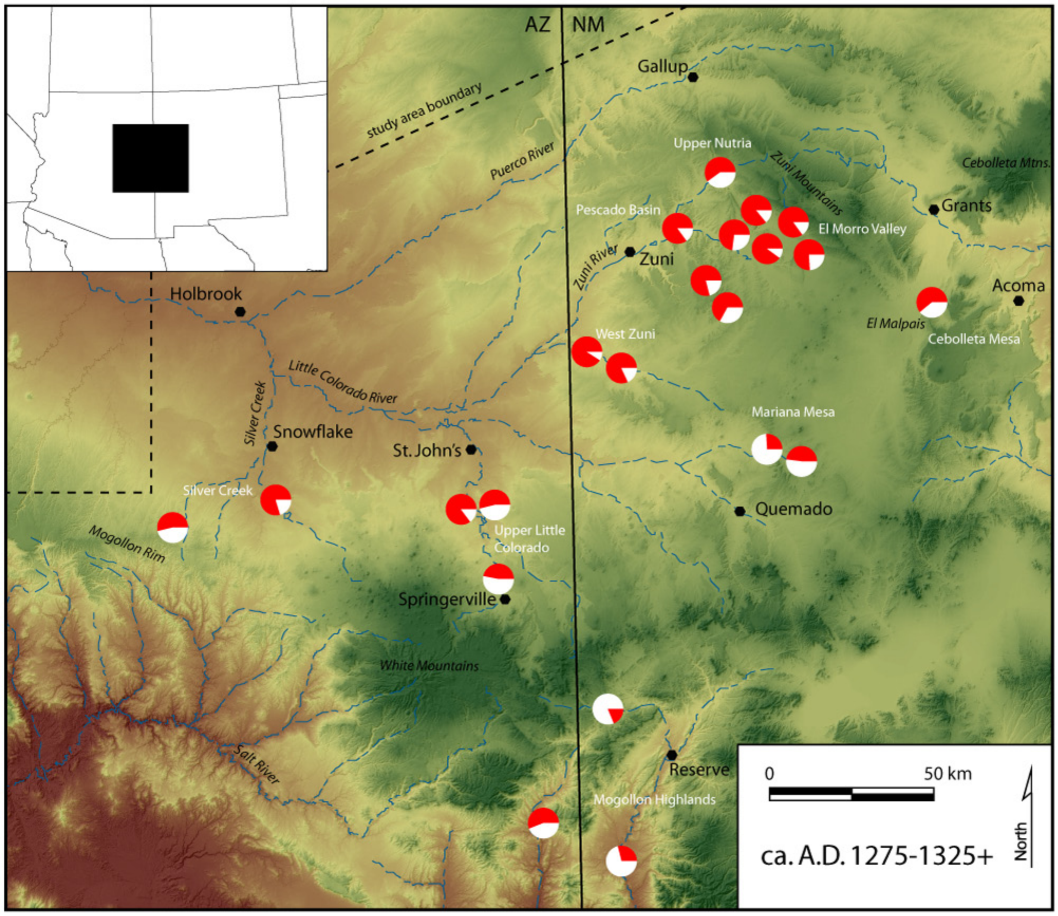


Figure 5.7. Proportions of red/polychrome ware and white ware for Pueblo IV sites.

not produced in the far western portion of the study area until the last quarter of the thirteenth century (see Mills 1999, 2007b).

Figure 5.7 shows proportions of red and white ware for sites dating to the Pueblo IV period. Almost all portions of the study area show a dramatic increase in the relative frequency of red ware across this transition. The compositional data considered above suggest, however, that this transition was largely due to increased local production of late White Mountain Red Ware and Zuni Glaze Ware vessels rather than increased import. Minor differences among sites in terms of the ratio of red to white wares are likely largely attributable to time as almost all of the sites with high relative frequencies of Cibola White Ware date to the early Pueblo IV period (pre A.D. 1325). After A.D. 1325, much of the late White Mountain Red Ware (Fourmile Polychrome) found across the Arizona Mountains and nearby areas including the Upper Little Colorado sub-region was likely produced in the Silver Creek area, based on the available compositional data (Triadan 1997; Triadan et al. 2002), perhaps suggesting the development of another network of specialized production and distribution in the western portion of the study area during the late Pueblo IV period.

Summary and Conclusions

The analyses presented above demonstrate that a large number of ceramic vessels were transported across the greater Cibola region during the period considered in this study. These patterns of ceramic movement are indicative of major vectors of social interaction and relational connections across the study area. In general, the inhabitants of individual settlements obtained non-local pottery from sources most similar to those of their nearest neighbors. Furthermore, although the volume of ceramics moving over long distances changed through time, specific regional relationships were relatively consistent across the Pueblo III to Pueblo IV period transformation. In both periods, utilitarian and decorated wares were circulated in quite different spheres, perhaps suggesting that the different kinds of social relationships were involved in the movement of these vessels.

Utilitarian vessels moved primarily in two relatively distinct spheres encompassing the northern (Carrizo Wash, West Zuni, Pescado Basin, and the El

Morro Valley) and southern (Mariana Mesa, Upper Little Colorado, and the Mogollon Highlands) portions of the core study area. This strong north-south division was maintained across the Pueblo III to Pueblo IV period despite massive population movements and changes in settlement organization. Importantly, however, the inhabitants of settlements along the edges of these two overarching spheres obtained pottery from somewhat more diverse sources including areas both to the north and south.

The results described above indicate that the most frequently activated relational connections were strongest among the inhabitants of spatially proximate areas both before and after the Pueblo III to Pueblo IV transition. Further, there was a persistent but also somewhat permeable boundary between the northern and southern Cibola region in terms of utilitarian pottery circulation which may represent the separation between two distinct relational social networks characterized by strong internal relationships and perhaps common historical ties. Interestingly, the two spheres of utilitarian ceramic circulation generally coincide with the traditional Anasazi and Mogollon archaeological culture areas.

Decorated vessels were frequently transported over much greater distances than utilitarian vessels. I argue that, during the Pueblo III period, much of the Cibola region was involved in a common and extremely widespread sphere of ceramic circulation centered on the Pescado Basin. The inhabitants of widely dispersed communities were linked through ceramic exchanges, many of which likely took place in the context of public gatherings. Thus, members of distant communities may have connected by broad relational connections based on their common participation in periodic public events. Importantly, the association of decorated ceramic exchange with public ceremonialism may also suggest that communities within similar spheres of decorated ceramic circulation may have also shared a level of common categorical identity. The evidence for community specialization noted in the previous section is an important addition to this picture. The inhabitants of some areas, in particular the Pescado Basin, produced ceramic vessels that were apparently widely sought after across much of the region. Ceramic producers may have accrued a special position within this network of regional exchange and ceremonialism through the creation of objects that were ritually charged (e.g., Spielmann 2002). Notably, the Upper Little Colorado area was isolated from the regional sphere of decorated ceramic exchange, perhaps suggesting an emerging categorical social boundary between the eastern and western portions of the study area during the Pueblo III period.

Across the Pueblo III to Pueblo IV transition, the circulation of decorated ceramics became increasingly locally focused within the central Zuni area (Pescado Basin, El Morro Valley, and the Box S area), whereas long distance exchange was somewhat more common among settlements in the western portion of the region (Upper Little Colorado, Silver Creek, and the Arizona Mountains). This transition also saw a major increase in the local production of red ware and polychrome vessels in many portions of the Cibola region as well as a divergence in the ceramic production technology and decorative style associated with different portions of the study area (see Chapter 8). The brief discussion above necessarily downplays a great deal of regional variation, but there is a substantial east-west component to the dominant patterns of decorated ceramic circulation at least by the Pueblo IV period. This suggests that the eastern (Pescado Basin, El Morro Valley, Box S, West Zuni, and Mariana Mesa) and western (Upper Little Colorado, Mogollon Highlands, Arizona Mountains, and Silver Creek) portions of the study area were increasingly involved in different spheres of public ceremonialism. I argue that this indicates not only changes in long-distance patterns of relational networks, but an increasing consolidation of distinct categorical social groups defined in relation to periodic public ceremonies. I return to this possibility in Chapters 8 and 9.

Chapter 5 Notes

[1] Samples that could only be attributed to the PLATEAU production zone were not included in calculations of local and non-local vessels.

[2] Compositional sub-groups considered interstitial between two or more distinct sources (i.e., EMV, PLATEAU and ULC-2ab) were excluded in this analysis (see Appendix A).

[3] The utilitarian ceramic assemblage from the Veteado site in the northern Mariana Mesa region (ca., A.D. 1250-1300) does include a substantially greater amount of Cibola Gray Ware pottery than other sites in the sub-region (~10%; see Peeples 2011). This site was not sampled for the current study but the relatively high frequency of Cibola Gray Ware vessels suggests that some gray ware may have been locally produced. In addition to this, as described in Appendix A, one Cibola Gray Ware sherd recovered from Techado Spring Pueblo could be confidently assigned to one of the two Mariana Mesa compositional core groups, and a few others were potential members.

[4] Within the Upper Little Colorado region, it is possible to track the movement of vessels between the northern, central, and southern portions of the drainage. Duff (2002) describes evidence for the differential movement of vessels within the Upper Little Colorado area during the Pueblo IV period, so this topic is not discussed in detail here. During the Pueblo III period, there was little occupation of the central and northern Upper Little Colorado area which fits with the virtual absence of compositional groups attributed to those areas at Pueblo III settlements across the region as a whole.

Chapter 6:

THE TECHNOLOGY OF POTTERY PRODUCTION AND RELATIONAL CONNECTIONS

In Chapter 2, I argued that the concept of technological style can provide a useful means of evaluating networks of relational connections among individuals and larger social groups. Specifically, attributes of material culture that are either invisible in the final product or are located in contexts of low visibility tend to vary in relation to the degree of interaction among producers in contrast to other processes such as emulation (see Carr 1995; Clark 2001:6-22). Strong patterns of similarity in such low visibility technological attributes provide important indicators of shared contexts of learning (e.g., Dietler and Herbich 1998; Gosselain 1998, 2000; Herbich 1987; Sassman and Rudolphi 2001; Stark et al. 1998). Analyses that reveal shared technological practices can thus provide insights into patterns of frequent interaction or historical connections at various scales.

In this chapter, I describe and apply a quantitative method for comparing the techniques used to produce utilitarian ceramic vessels across the Cibola region. This method produces a relative scale of ceramic technological similarity which is used as a proxy for the direction and strength of relational connections among settlements across the study area through time. In general, the analyses presented below suggest that the physical distance between settlements was a substantial factor influencing the frequency of interaction among potters. Furthermore, patterns of interaction appear to have been relatively consistent through time despite the massive reorganization of regional settlement across the Pueblo III to Pueblo IV transition. There are, however, several deviations from this general trend that may indicate population movement into or within the Cibola region through time.

Utilitarian Pottery in the Cibola Region

Utilitarian ceramic vessels produced across the Cibola region consist of unpainted and unslipped containers primarily used for food preparation and storage (e.g., Crown 1981; Hays-Gilpin and van Hartesveldt 1998; Rinaldo and Bluhm 1956). The vast majority of unpainted vessels produced during the period considered in this study have corrugated exterior surfaces, and thus retain easily observable evidence for many of the specific forming and finishing steps used to produce them.

Utilitarian corrugated and plain ware vessels are usually assumed to have been produced and consumed at the household level (Reid and Montgomery 1998; Zedeño 1994). Although these vessels did sometimes circulate, chemical characterizations demonstrate that they were most frequently deposited in the general locations where they were produced (see Chapter 5). This suggests that the technological attributes of plain and corrugated vessels recovered from a settlement provide a reasonable proxy for the technological decisions and practices of local potters. Shared technological attributes provide evidence of relational connections among groups of local potters at various scales (e.g., settlement, sub-region, etc.) and serve as a proxy for relational connections among the inhabitants of those areas more generally.

Although there is some regional and temporal variation, sites within the Cibola region are generally dominated by vessels within two major ware categories; Cibola (or Anasazi) Gray Ware and Mogollon Brown Ware. Cibola Gray Ware dominates assemblages at settlements along the Zuni River Valley and areas to the east and north whereas Mogollon Brown Ware dominates assemblages along the southern edge of the Colorado Plateau and in the areas along the Mogollon Mountains. Sites in the zone between the mountains and the Zuni River sometimes contain varying frequencies of both major wares, but most sites are still strongly dominated by a single ware (Figure 6.1; see also Clark et al. 2006; Crown 1981; Danson 1957; Duff 2005; Hagopian et al. 2004; Mills 2007; Spier 1918:342).

Both Cibola Gray Ware and Mogollon Brown Ware vessels were constructed by coiling, but differed in terms of the chemical characteristics of their pastes as well as the atmospheres in which they were fired (Colton 1939; Crown 1981:267; Hays-Gilpin and van Hartesveldt 1998). Cibola Gray Ware vessels were typically produced from clays with low iron content, tempered with quartz sand and/or sherds, and fired in a neutral to reducing atmosphere producing a grayish or whitish surface color. Mogollon Brown Ware vessels were constructed from iron-rich volcanic derived clays, tempered with quartz sand, and fired in an oxidizing atmosphere producing a reddish-brown or blackish-brown hue. Importantly, some vessels contain combinations of these common characteristics and distinctions between these broad ware categories are not always clear cut (see discussions in Crown 1981:267-269; Hays-Gilpin and van

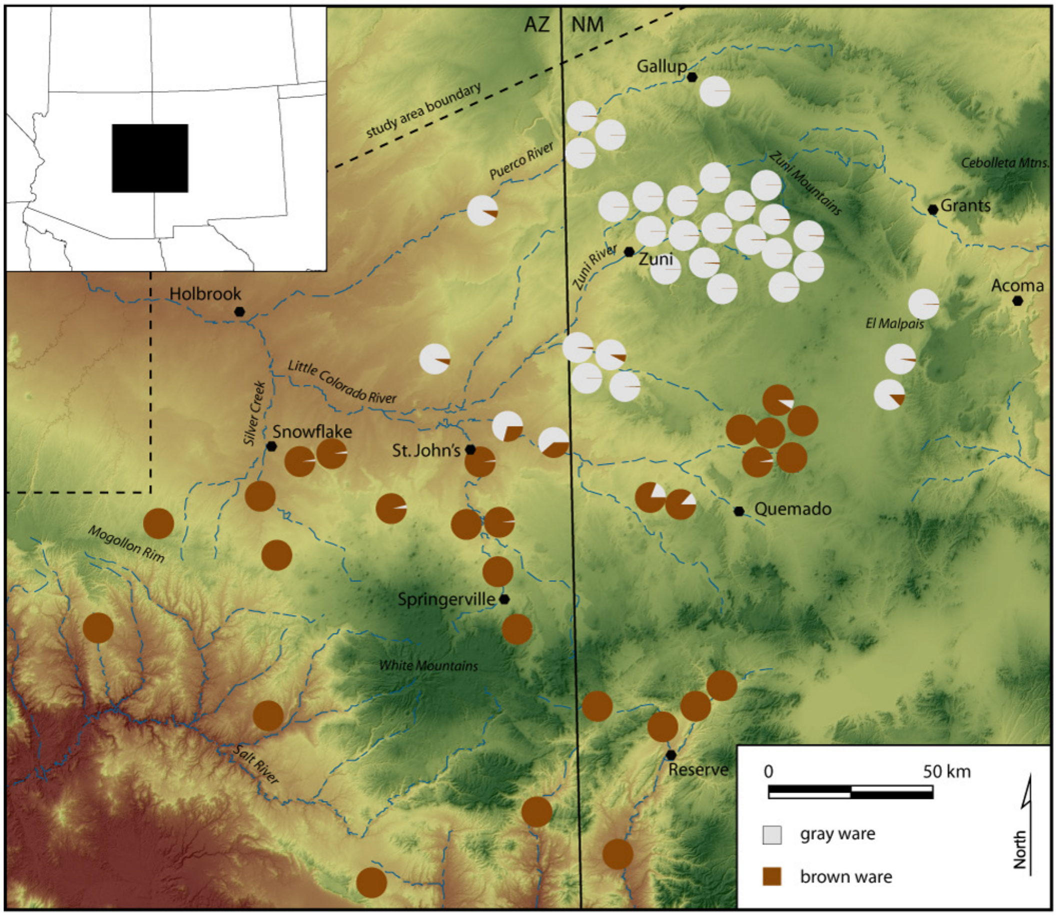


Figure 6.1. Map of the study area showing the relative proportions of brown and gray ware ceramics ca. A.D. 1050-1400 (see Appendix E for raw data).

Hartesveldt 1998:120-143). Table 6.1 provides general information on the most common unpainted ceramic wares from the core portion of the study area.

The relatively discrete distributions of Cibola Gray Ware and Mogollon Brown Ware have, in the past, been interpreted as markers of a distinct boundary between the Anasazi and Mogollon culture areas (Colton 1939; Danson 1957; Haury 1936; Gladwin and Gladwin 1934; Wheat 1955). However, opinions vary as to the extent to which differences between brown and gray ceramics are products of cultural distinctions or material availability. For example, Wilson

Table 6.1. Descriptions of most common utilitarian ceramic wares in the Cibola region.

Ware	Paste Color	Clay	Temper	Firing Atmosphere	Distribution	Additional Notes
Cibola Gray Ware	light gray to white	shale/sandstone derived clays with low iron content	crushed white sherd with small amounts of fine quartz sand	neutral to reducing	Cibola Gray Ware is most common on sites from the El Morro Valley, along the Zuni River Valley and in the areas northeast of St. John's, AZ.	Cibola Gray Ware is similar to Tusayan Gray Ware (which has almost exclusively sand temper) and Little Colorado Gray Ware (which has a dark gray paste with white sherd temper)
Mogollon Brown Ware	reddish-brown to blackish-brown	iron rich alluvial clays	multi-lithic sand and/or crushed igneous rock fragments, some may be self tempered	oxidizing	Mogollon Brown Ware is most common in the southern portion of the study area from the Silver Creek area to Mariana Mesa and all areas south of the Colorado Plateau.	Using a strict definition of Mogollon Brown Ware limits this ware to sand/igneous tempered vessels produced in the Mogollon Highlands and adjacent areas. For the purposes of this study this category is also applied more generally to vessels made from brown-firing alluvial clays tempered with sand and rock fragments (or self tempered) and fired in an oxidizing atmosphere.
Puerco Valley Gray Ware (Gray-Brown Ware)	gray-brown to yellowish-brown	shale/sandstone derived clays, Chinle formation?	fine quartz sand/other rounded minerals, crushed sherd fragments, and more rarely crushed sandstone	a wide range of firing atmospheres are suggested by the amount of variation in common surface colors	Puerco Valley Gray Ware is most common along the Puerco River Valley, particularly east of Holbrook, but also occurs in smaller quantities in the Carrizo Wash and northern Upper Little Colorado areas.	This ware has similar surface treatments to Cibola Gray Ware and paste characteristics that are similar to Mogollon Brown Ware. This category corresponds with ceramics that have often been classified as gray-brown ware in the past.

and others (Wilson 1994, 1999, 2007; Wilson et al. 1996) argue that the distributions of brown and gray vessels may be defined largely by the availability of different kinds of clays across the Southwest (see also Chapter 5; Colton 1953; Lekson 1996; Martin 1951:233). Other researchers argue that consistent distinctions in the technology and surface treatments of brown and gray ware vessels suggest that the potters producing these wares were operating within distinct technological frameworks (e.g., Crown 1981:269; Hays-Gilpin and van Hartesveldt 1998; Nauman 2007; Wichlacz 2009; Zedeño 1994:55-61). It is likely that both factors influenced the broad similarities and differences among vessels produced across the Cibola region, but no extensive regional scale assessment of corrugated ceramic technology has previously been attempted.

In practice, archaeologists working in the Cibola region group sherds and vessels by ware based on surface color and paste characteristics and then place them into type categories defined based on specific surface treatments (see Rinaldo and Bluhm 1956). Importantly, the most commonly used type categories have analogs in both Mogollon Brown Ware and Cibola Gray Ware (see Hays-Gilpin and van Hartesveldt 1998; Rinaldo and Bluhm 1956:150-155). Indeed, corrugated vessels do not fit well within the ware-type-variety system of classification that has long been used for painted ceramics across the greater Southwest (e.g., Colton 1953; Hays-Gilpin and van Hartesveldt 1998; but see Gifford and Smith 1978). Neuzil (2008:28-29; see also Pierce 2005) argues that corrugated and plain ware pottery should instead be seen as falling along a stylistic and technological continuum with a great deal of overlap in many of the attributes that could potentially be used to define types. The analyses presented here are specifically designed to characterize relative similarities and differences in ceramic production technology across the Cibola region, a continuum usually masked by traditional typological analyses. I argue that the methods of characterization described below provide a better proxy for social interaction and relational connections at regional scales than binary oppositions between wares.

Characterizing the Technology of Pottery Production

A number of recent studies from several regions across the Southwest have used technological assessments of plain ware and corrugated pottery to address questions relating to social interaction, population movement, and technological change (e.g., Brunson 1985; Clark 2001; Crown 1981; Hegmon et al. 2000; Kleinman 2010; Pierce 2005; McGarry 1975; McGimsey 1980; Nauman 2007; Neuzil 2001, 2005a, 2005b, 2008; Pierce 2005; Reid and Montgomery 1998; Schleher and Ruth 2005; Snow 1983; Stone 1986; Zedeño 1994). These studies have varied in their goals and emphasis but in general all suggest that characterizations of specific attributes of ceramic production technology can reveal much more than traditional typological analyses. These studies have also demonstrated that specific aspects of pottery production vary in socially meaningful ways that are observable in the material record.

Based on the recent ceramic technological studies cited above, a pilot study involving a detailed examination of whole vessels from the Cibola region, and experimental reproductions of corrugated pottery technology (Figure 6.2), I

Figure 6.2. John Olsen demonstrates the production of corrugated pottery at the 2009 Leupp Kiln Conference in Snowflake, Arizona.

developed a series of nominal, ordinal, presence/absence, and metric variables that can be consistently coded or measured on sherds and vessels of corrugated pottery from sites in the Cibola region. Table 6.2 lists all of the variables along with brief descriptions of their potential variable states. The specific guidelines and procedures used to code or measure all attributes are described in detail in Appendix B.

Table 6.2. Technological variables and variable states.

	Variable	Variable States
All Sherds	Ware/Type	traditional ware and type name
	Portion of vessel	body, rim, base, rim and body, rim and base, partial/whole vessel
	Vessel form	jar, bowl, ladle, other
	Sooting	Presence/absence of sooting on the vessel surface
	Type of surface indentations	finger, tool, multiple, none
	Direction of indentations	parallel, perpendicular, or oblique to direction of coils
	Indentation alignment	vertically aligned, diagonally aligned, unaligned
	Elaborations	scoring, punctations, appliqué, multiple, other, none
	Indentation Patterning	presence of zoned or patterned indentations
	Smudging	presence or absence of interior smudging
	Interior surface treatment	Ordinal scale from 1 (no polishing/limited smoothing) to 4 (highly polished)
	Vessel wall thickness	average thickness of sherd (not measured on rim or basal sherds)
	Coil width	average width from coil juncture to coil juncture (3 measurements per sherd)
	Indentation depth	average depth of indentations from surface (3 measurements per sherd)
	Indentation width	average width of indentations at coil juncture (3 measurements per sherd)
	Indentations per square cm	measured using a 3x3 cm cardboard template
	Obliteration	ratio of fully obliterated coils to total coils visible in 3x3 cardboard template
Rims	Rim diameter	measured using standard rim diameter template
	Distance to first coil	distance from the top of the rim to the first exposed corrugated coil
	Rim form	flaring, straight, collar, inverted, recurved, etc.
Bases	Coil direction	direction of coiling (clockwise, counterclockwise, undetermined)

Note: Only highlighted variables are included in the quantitative analyses described below

The coded variables were selected to include both the range of attributes typically considered in analyses of corrugated pottery as well as variables that likely relate to specific steps in the ceramic production process.[1] However, not all of the measured and coded attributes are appropriate for exploring variation in the techniques employed by groups of potters. Several of the coded variables may relate more to the materials available or household composition than to production decisions among functional equivalents. For example, although temper selection is a fundamental technological choice involved in the preparation of a ceramic paste, different temper types have varying performance characteristics that depend on the properties of locally available clays (e.g., Arnold et al. 2000;

Bronitsky and Hamer 1986; Sassman and Rudolphi 2001). Thus, a potter's decisions relating to tempering material are constrained, to a degree, by locally available clay resources (e.g., Roper et al. 2010). Further, vessel size and shape can relate to the intended use of a vessel (Hally 1986; Skibo 1992) but are also influenced by other social factors such as household size and the context of food preparation or consumption (Blitz 1993; Mills 1999; Lesure 1998; Shapiro 1984). While both material selection and vessel size/form are likely strongly influenced by the technological frameworks of groups of potters, these factors cannot be easily separated from other potential constraints. For the purposes of the quantitative analyses described below, the variables included were limited to those 13 which likely primarily relate to technological choices among functional equivalents. The variables selected for inclusion in the quantitative analyses are described further in Appendices B and C and are highlighted in Table 6.2.

Defining the Sample and Controlling for Bias

Because several of the technological variables considered in this study require relatively large sherds for consistent characterization, I rely primarily on excavated assemblages. Furthermore, the quantitative methods described below are specifically designed to deal with missing measurements. For each vessel or sherd, as many as possible of the selected variables were measured. For the purposes of this analysis, a random sample typically ranging from 25 to more than 100 sherds or whole vessels recovered from 31 excavated or extensively collected sites across the region were measured and coded (Table 6.3) and form the basis of the analyses presented here.[2]

Table 6.3. Numbers of sherds and whole vessels from each excavated or extensively collected site included in the ceramic technological study.

Site Name	Sub-Region	Excavated (E) or Surface (S)	Sherds	Partial/Whole Vessels	Total
Apache Creek Pueblo	MH	E	27	15	42
Atsinna	EMV	E	56	1	57
Baca Pueblo	ULC	E	40		40
Casa Malpais	ULC	E	92	1	93
Cienega	EMV	E	87	7	94
Coyote Creek	ULC	E	77	23	100
Foote Canyon Pueblo	MH	E	74	8	82
Garcia Ranch	CW	S	31		31
Heshotauthla	PB	E	90		90
Hinkson Ranch	WZ	E	90	2	92
Hooper Ranch	ULC	E	95	1	96
Horse Camp Mill	MM	E	82	24	106
Hubble Corner	MM	E	75		75
Jaralosa	WZ	E	39	2	41
Los Gigantes	EMV	E	77		77
Mirabal	EMV	E	98	5	103
Ojo Bonito	WZ	E	25	1	26
Platt Ranch Pueblo	CW	E	106		106
Pueblo de los Muertos	EMV	E	103	2	105
Rudd Creek Ruin	ULC	E	37	2	39
Scribe S	EMV	E	89	2	91
Spier 81 Cluster	PB	E	129		129
Spier 170	WZ	S	32		32
Techado Spring Pueblo	MM	E	66		66
Tinaja	EMV	E	33	2	35
Tri-R Pueblo	MM	E	63		63
UG481	MM	E	89	4	93
UG494	MM	E	18	7	25
Vernon area sites	VA	E	64	5	69
WS Ranch Pueblo	MH	E	77	24	101
Yellowhouse	PB	S	7		7
TOTAL			**2068**	**138**	**2206**

Note: CW = Carrizo Wash, EMV = El Morro Valley, MM = Mariana Mesa, MH = Mogollon Highlands, PB = Pescado Basin, ULC = Upper Little Colorado, VA = Vernon Area, and WZ = West Zuni

Many of the settlements included in this study are relatively large, but in most cases, the excavated samples come from a small number of contexts, limiting the potential for exploring intra-site patterns of ceramic technological similarity. Thus, settlements are the basic units in the analysis. Samples from each settlement were selected from as many different contexts as possible in an attempt to characterize the site-wide diversity of ceramics present. Additionally, vessels within each context were sorted by paste characteristics, surface treatment, vessel size, and other identifiable features. Any sherds that likely came from the same vessel were grouped and only a single example was coded and measured. Whenever possible, all whole or partial vessels from floor or roof contexts were also included.

All of the measurement and coding was conducted by a small number of individuals working closely together using a standardized set of instruments and coding criteria. Before beginning the general data recording, all analysts were trained and then required to code and measure a calibration sample of 100 sherds in order to assess inter-observer measurement reliability. After training, metric measurements among analysts on this calibration data set were highly correlated and nominal, presence/absence, and ordinal variables showed agreement in the great majority of cases (Table 6.4). Agreement among analysts was periodically re-tested over the course of the project with similar results. This suggests that the potential effects of inter-observer bias are likely minimal.

Finally, it is important to characterize the relationships among all of the variables included in the quantitative portion of the analyses described below to ensure that none of the coded or measured attributes are mechanically determined by or consistently correlated with other attributes. The inclusion of highly correlated variables would have the effect of essentially double counting the specific production decision that led to both associated attributes. In general, although there are a few moderate associations among specific pairs of variables, these associations are not strictly determined by the physical mechanics of ceramic production. For example, across all samples, the number of indentations per unit area is moderately negatively correlated with the average width of

Table 6.4. Comparisons of measurements among analysts for the calibration set of 100 sherds

	Thickness	Indentation Width	Indentation Depth	Coil Width	Indentations per sq cm
Pearson's *r* *	0.899	0.897	0.893	0.910	0.964
	Indentation Type	**Indentation Direction**	**Indentation Alignment**	**Smudging**	**Interior Surface**
% Agreement **	99%	93%	100%	99%	94%

* continuous variables, ** presence/absence, nominal, and ordinal variables

indentations (Pearson's $r = -0.63$). This relationship makes intuitive sense as the larger indentations get, the fewer will fit in a given space. At the same time, when considering individual settlements, the relationship between these variables is much more pronounced at some settlements than others. This suggests that potters were choosing to space indentations somewhat differently at settlements across the Cibola region. In other words, these two variables preserve the signatures of two distinct technological choices and both merit inclusion in the analyses presented below. A complete description of the procedures used to evaluate the appropriateness of each variable is provided in Appendix C.

Measuring Relative Technological Similarity

Each of the ceramic technological variables coded for this study provides information relating to specific steps in the production of vessels across the Cibola region. In order to characterize variation in the techniques of pottery production related to the degree of social interaction among potters in different portions of the study area, it is necessary to develop a procedure for measuring technological similarity across all variables simultaneously. The methods developed for this study are based on techniques used by quantitative morphologists and geneticists for defining groups among hybridized or closely related biological species (Dibble et al. 1998; Hawkins et al. 1999; Moeller and Schaal 1999; see also Edgar 2004). This section provides a detailed description of the analytical procedures. All analyses were performed using the R statistical package and the R code is provided in Appendix E.

The analyses presented below can be summarized in four basic steps. 1) First, the coded variables for all samples are converted into a matrix of distances between samples. 2) Next, the distance matrix is subjected to principal coordinates analysis to highlight strong relationships among cases. 3) Clusters of pottery produced using similar methods are then defined based on the principal coordinate scores for each case. 4) Finally, a relative scale of assemblage similarity is defined based on the proportions of each of the clusters created in step 3. Each of these steps is described in detail below.

(1) The first step in this analytical procedure is to construct a matrix of relative similarities of every sherd or vessel against every other sherd or vessel in the sample based on the measured and coded attributes. Gower's general coefficient of similarity was selected for this analysis because it can be calculated using multiple classes of data (presence/absence, nominal, ordinal, and continuous), and because it can incorporate cases with missing data (see Gower 1971; Howell and Kintigh 1996:547). For, each continuous and ordinal variable, Gower's coefficient G_{ij} between two cases (*i* and *j*) is defined as:

$$G_{ijk} = 1 - \frac{|\, x_{ik} - x_{jk} \,|}{r_k}$$

where r_k is the absolute range of values for the *k*th variable. For the presence/absence and nominal variables, the initial value of Gower's similarity coefficient is defined as the total number of included variables for which two cases have the same value (not including missing observations). All of the variables are then combined by summing the similarity contributions for each continuous and ordinal variable with the total number of co-occurrences in presence/absence and nominal variables. The final value of Gower's coefficient between two cases is obtained by dividing this sum by the total number of variables for which both cases have data. Calculating Gower coefficients across all included cases (sherds/vessels) creates a symmetrical n x n matrix of similarities between cases ranging from 0 (no similarity) to 1 (perfect similarity) where n is the total number of samples included in the analysis. For subsequent steps, this similarity matrix was converted into a distance matrix by inverting the scale (distance = 1 - similarity).

(2) Next, the distance matrix produced in the previous step is subjected to principal coordinates analysis (PCoA). PCoA is a mathematical method of ordination, similar to principal components analysis or correspondence analysis, except that it is calculated based on a matrix of distances rather than correlation or covariance matrices or raw data. PCoA can be used to reduce the dimensionality of a distance matrix by combining the correlated effects of all of the pair-wise interrelationships into a smaller number of principal axes that explain a large proportion of the variation present in the data a whole (Shennan 1997:345-350).

This allows for a low-dimensional representation of patterning in the distance matrix and highlights strongest associations among cases.

Figure 6.3 displays scatter plots of the first three axes of the PCoA for all variables selected for the quantitative analyses. Each point on the plot represents a single sherd or vessel. The distance between any two points on these plots is a graphical representation of the relative technological similarity between those sherds or vessels.

(3) Next, groups of vessels that are similar in terms of the coded and measured variables are defined by conducting cluster analysis on the PCoA scores for each case produced in step 2. For the purposes of this analysis, groups are defined using K-medoids cluster analysis on the first three PCoA axes defined above.[3] K-medoids cluster analysis is a divisive, non-hierarchical method of cluster analysis which defines clusters based on Euclidean distances so as to reduce the distance between individual cases and their cluster medoid (or center), while maximizing the distance between clusters. The K-medoids clustering algorithm is closely related to the K-means algorithm but is more robust for data sets with outliers or noise (Kaufman and Rousseeuw 1990; Zhang and Couloigner 2005; see also Everitt et al. 2001:100-5; Kintigh and Ammerman 1982:39; Kintigh 1990).

In K-medoids analysis, the number of clusters to be used must be defined by the analyst. Numerous methods of cluster evaluation were used in this analysis. Two methods that are particularly prevalent in archaeological analyses, both involving assessments of the sum of squared error (SSE), are described here. SSE

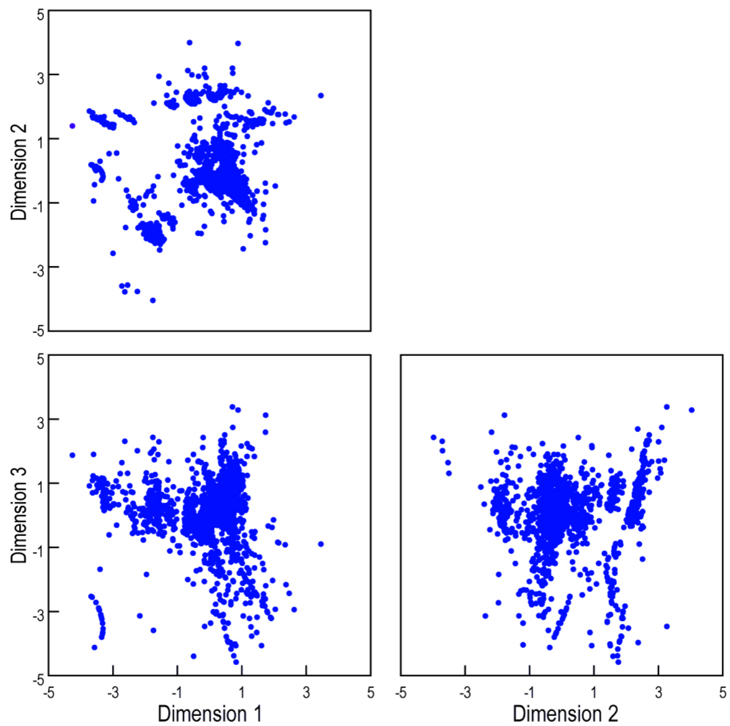


Figure 6.3. Principal coordinates plot based on the 13 included variables

is the sum of all squared distances between samples within each cluster, and thus, serves as a global measure of error which can be calculated for any number of clusters.[4] Following methods defined by Kintigh and Ammerman (1982; Kintigh 1990), clustering in a given data set can be evaluated by comparing SSE for the actual data with a number of randomized matrices based on the original data. For the purposes of this analysis, SSE was calculated for the first 15 cluster solutions on the original PCoA coordinates and on 250 randomized versions of the same coordinates. When substantial clustering is present, as the number of clusters increases, the SSE for the actual data should decrease more rapidly than the SSE of the randomized data. Any strong "elbows" in the SSE values as the number of clusters increases provides indications of potentially useful cluster solutions to consider (Baxter 1994:80-1). Figure 6.4 demonstrates that the rate of SSE reduction is greater for the actual data than for the random runs, and there are two potential inflection points at the 4 and 10 cluster solutions.

An additional method for choosing an appropriate cluster solution involves comparing the absolute difference between the actual and random SSE values across a number of cluster solutions. An appropriate cluster solution could be defined as a solution at which there is a relatively large difference between the actual SSE and the mean SSE of the randomized data sets. Figure 6.5 shows the absolute difference in SSE between the original and 250 randomized data sets against the first 15 cluster solutions. There are multiple peaks in the distribution of SSE differences, but there is little change in the difference between actual and randomized data after the 10 cluster solution. Thus, the 10 cluster solution was chosen for the analyses presented here. Figure 6.6 displays the 10 cluster solution assignments for each case on the first three dimensions of the PCoA.[5] These clusters represent groups of vessels that overlap substantially in terms of the inter-relationships with other vessels in the sample. The specific attributes of each ceramic technological cluster are described in detail in Appendix C.

At this point, it is possible to make an initial consideration of the broad patterns of similarity in techniques used by potters by examining the distributions of each of the technological clusters across the region as a whole. Figure 6.7 displays pie charts of the proportions of each of the ceramic technological clusters from each of the eight sub-regions across the core study area. Simple visual

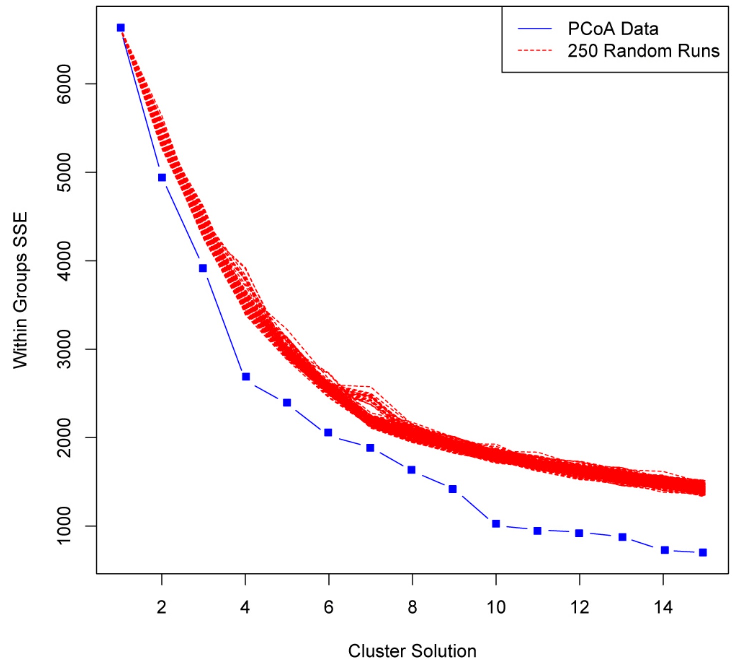


Figure 6.4. Plot of sum of squared error for actual and randomized data against the first 15 cluster solutions

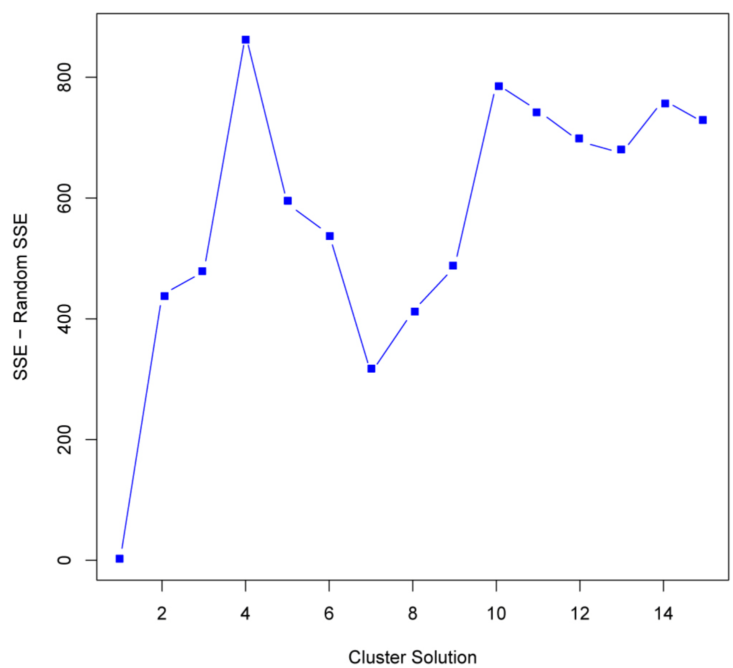


Figure 6.5. Plot of difference in sum of squared error between actual and randomized data for the first 15 cluster solutions

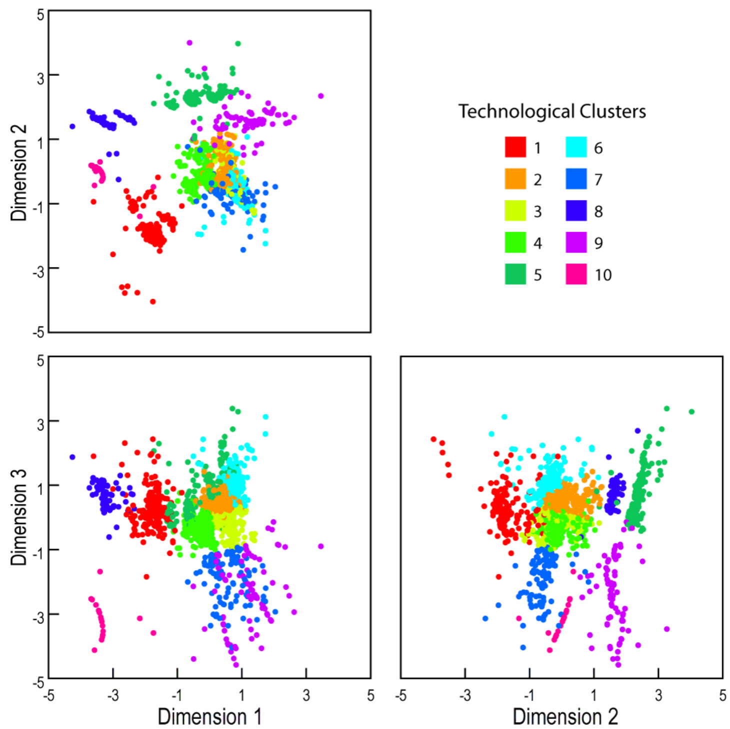


Figure 6.6. Principal coordinates plot showing cluster assignments

inspection of this map suggests a few spatial patterns in the distribution of the ceramic clusters. For example, technological clusters 2 and 3 appear to decline gradually from north to south and, in general, southern sub-regions are more diverse than the northern sub-regions. It is difficult, however, to evaluate similarities and differences in the distributions of these ceramic technological groups through visual means alone.

(4) The final step in this analysis is to create a relative scale of similarity among assemblages based on the technological clusters defined above. The Brainerd-Robinson (BR) coefficient was selected for defining this scale. As described in the previous chapter, BR is a city-block metric of similarity based on the sum of absolute differences in the proportional representation of individual

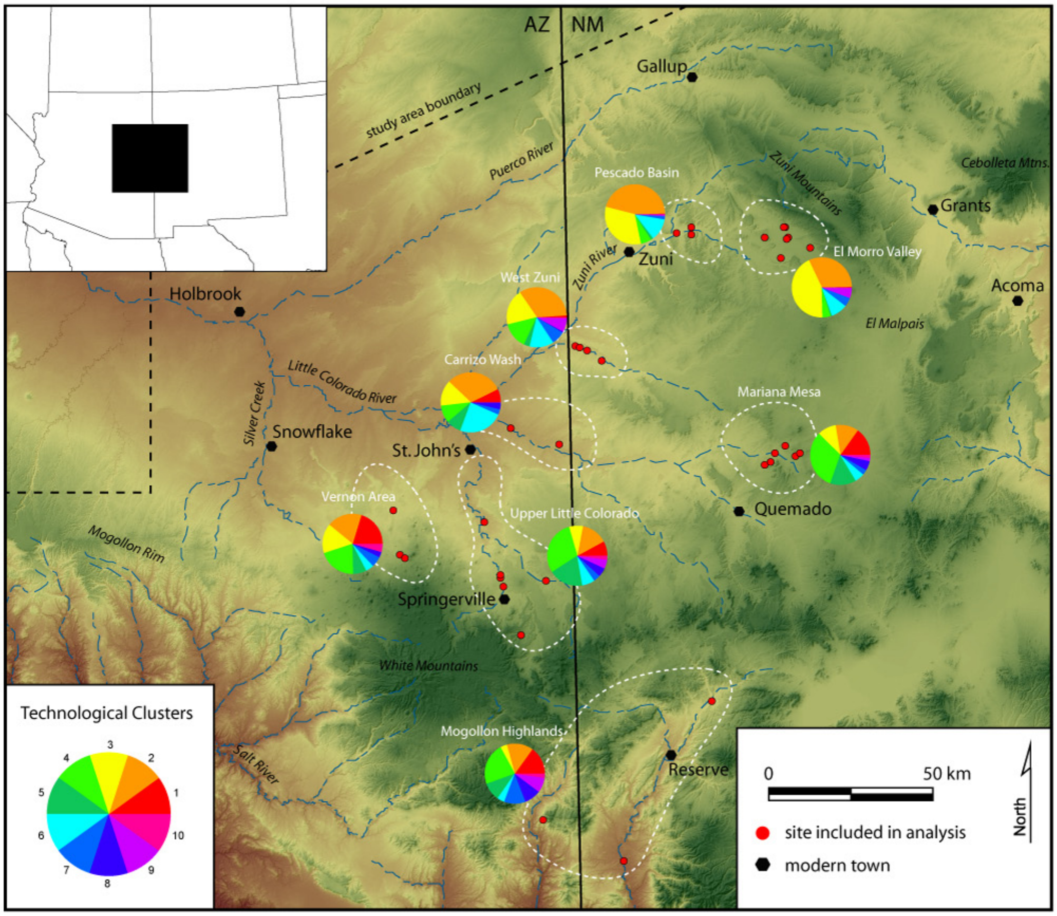


Figure 6.7. Map of the study area showing relative proportions of the 10 ceramic technological clusters by sub-region

categories. This measure ranges from 0-200 where 200 is perfect similarity and 0 is no similarity. The basic assumption of this final step in the analysis is as follows: *settlements with similar proportions of the ceramic technological clusters defined above represent settlements occupied by potters who shared similar suites of technological practices related to pottery production*. The BR coefficient values for comparisons among all sub-regions and individual settlements along with interpretations of the results of this analysis are discussed below.

Results

The procedures described above allow for the creation of a matrix of similarities between pairs of settlements and sub-regions which can be used as a proxy for the relative degree of social interaction among potters and other groups at different spatial and social scales. For a given unit of comparison (settlement, sub-region, etc.), higher BR coefficients suggest more frequent interaction and stronger relational connections among the inhabitants of those areas. Strong similarities in technological traditions may also suggest common historical origins among potters. In this way, this scale of technological similarity may provide evidence for population movement into or across the Cibola region.

It is first useful to directly examine the scale of ceramic technological similarity defined above. Tables 6.5 and 6.6 show the BR values for comparisons among all sub-regions and among sub-regions divided by time period, with relatively high values of similarity highlighted (≥ 140; i.e., 70% of possible similarity). An examination of the highlighted BR coefficients suggests that there are two strong groups of sub-regions characterized by consistently high similarity scores across both the Pueblo III and Pueblo IV periods; Group 1) El Morro Valley, Pescado Basin, West Zuni, and Carrizo Wash and Group 2) Mariana Mesa, Vernon Area, Mogollon Highlands, and the Upper Little Colorado. These two groups essentially conform to the northern (Group 1) and southern (Group 2) portions of the core study area (Figure 6.8). Importantly, these two groups are not entirely distinct as the West Zuni and Carrizo Wash sub-regions, along the edges of these two over-arching groups show reasonably strong similarities to sites in

Table 6.5. Brainerd-Robinson similarity coefficients for comparisons among sub-regions

	EMV	PB	WZ	CW	MM	ULC	VA
PB	162						
WZ	152	150					
CW	124	132	149				
MM	75	75	103	118			
ULC	85	77	112	120	175		
VA	99	97	129	134	154	140	
MH	76	64	112	106	157	155	151

EMV = El Morro Valley, PB = Pescado Basin, WZ = West Zuni, CW = Carrizo Wash, MM = Mariana Mesa, ULC = Upper Little Colorado, VA = Vernon Area, MH = Mogollon Highlands

Table 6.6. Brainerd-Robinson similarity coefficients for comparisons among sub-regions divided by time period

	EMV PIII	EMV PIV	PB PIII	PB PIV	WZ PIII	WZ PIV	CW PIII	MM PIII	MM PIV	ULC PIII	ULC PIV	VA PIII	MH PIII
EMV PIV	183												
PB PIII	175	162											
PB PIV	159	145	170										
WZ PIII	147	141	135	162									
WZ PIV	155	157	142	154	151								
CW PIII	128	120	120	144	156	126							
MM PIII	82	78	73	88	118	82	123						
MM PIV	71	68	59	76	108	72	109	162					
ULC PIII	70	66	64	77	106	70	112	166	172				
ULC PIV	84	93	72	91	126	97	122	163	166	169			
VA PIII	98	100	89	107	138	104	134	164	136	143	137		
MH PIII	51	63	39	58	94	88	89	148	141	136	147	135	
MH PIV	95	90	86	103	126	94	136	142	117	127	128	137	116

EMV = El Morro Valley, PB = Pescado Basin, WZ = West Zuni, CW = Carrizo Wash, MM = Mariana Mesa, ULC = Upper Little Colorado, VA = Vernon Area, MH = Mogollon Highlands

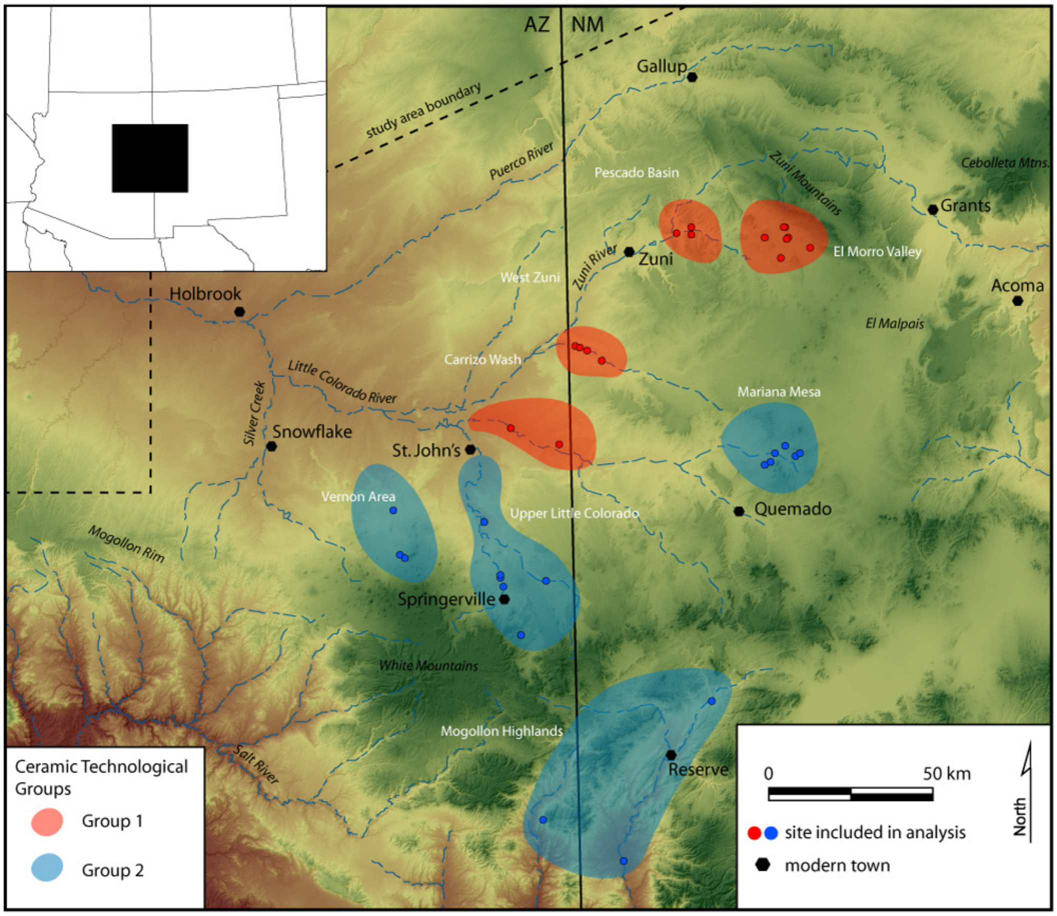


Figure 6.8. Map of the study area showing the two groups of sub-regions defined based on consistent patterns of ceramic technological similarity

both groups. The locations of these two groups also roughly correspond with areas which have traditionally been associated with Anasazi populations to the north and Mogollon populations to the south. I return to this issue briefly at the end of this chapter. The consistent similarities among the same spatially contiguous groups of sub-regions through time suggest that there was likely a spatial component to the strength of relational connections among potters across the study area.

In order to evaluate this spatial pattern further, it is instructive to consider the relationship between technological similarity and the physical distance between settlements. Figure 6.9 displays a scatter plot of the distances between all settlements included in this analysis (in kilometers) against the BR similarity coefficients among pairs of settlements. In general, this plot shows a weak negative relationship between physical distance and technological similarity (r = -0.54). There are, however, several outliers which have a substantial influence on the results. A detailed examination of the relationships among specific pairs of settlements suggests that the majority of the most extreme outliers involve settlements in the Mariana Mesa sub-region. Indeed, as Figure 6.10 demonstrates, the negative linear relationship between spatial distance and technological similarity (i.e., as one would expect, the farther apart sites are, the less similar they tend to be) is substantially more pronounced when comparisons involving the Mariana Mesa area are removed (r = -0.80).

Importantly, the spatial patterns documented among all settlements included in this study are equally strong when comparing only sites dating to the Pueblo III or Pueblo IV periods independently, as well as when comparing sites occupied in different time periods (Figure 6.11). This suggests that the physical distance between groups of potters may account for much of the variation in technological similarity seen across the region through time, but that other processes may have also been at work, in particular in the Mariana Mesa area.[6] The consistency of this pattern despite widespread population movement and major upheavals in the organization of communities is intriguing. The lack of

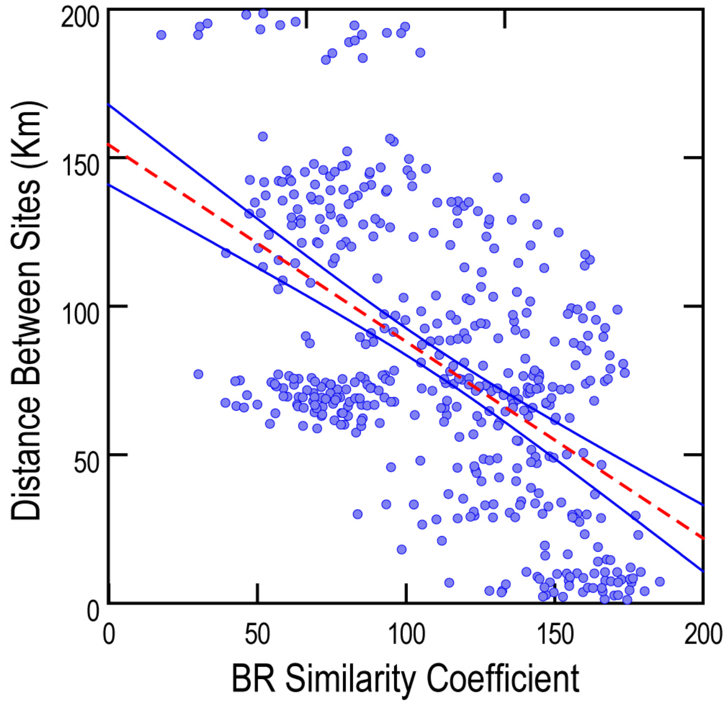


Figure 6.9. Plot of ceramic technological similarity (BR similarity coefficient) against the linear distance between sites (Km).

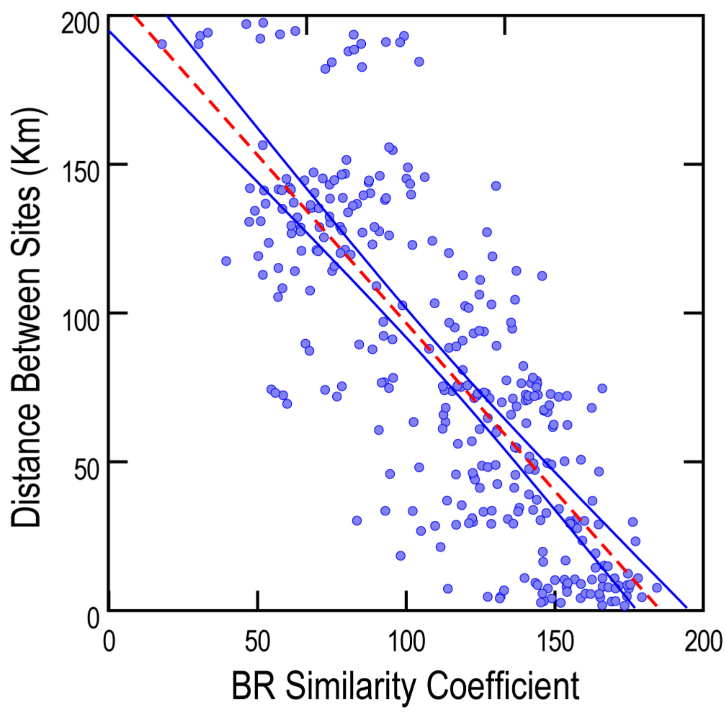


Figure 6.10. Plot of ceramic technological similarity (BR similarity coefficient) against the linear distance between sites (Km) with comparisons involving Mariana Mesa removed.

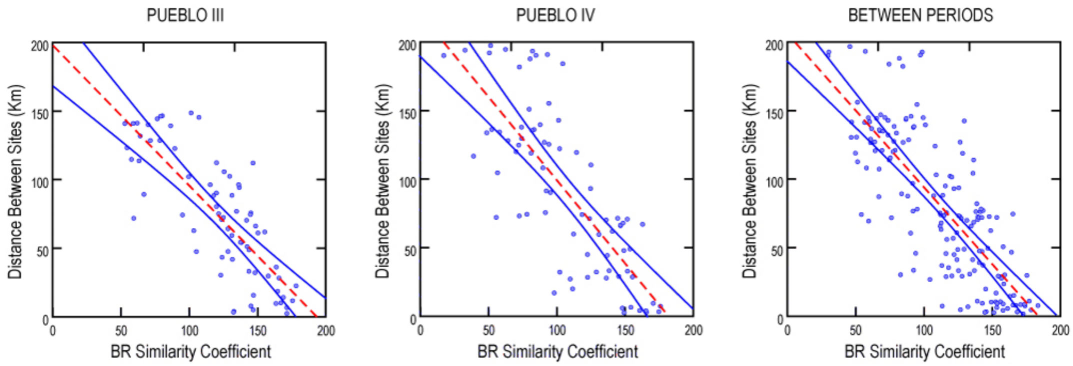


Figure 6.11. Plots of ceramic technological similarity (BR similarity coefficient) against the linear distance between sites (Km) for the Pueblo III and Pueblo IV periods and for comparisons between periods (Mariana Mesa sites removed).

major changes could be interpreted as evidence that the nucleated towns constructed across the Pueblo III to Pueblo IV transition in the Cibola region were occupied, in large part, by individuals and groups that were already interacting on a regular basis prior to the settlement reorganization (see Huntley and Kintigh 2004; Kintigh et al. 2004; Kintigh 2007). This finding has important implications for considerations of the scale of population movement associated with the late thirteenth century in the region.

The ceramic technological similarities between the Mariana Mesa sub-region and areas along the Zuni River Valley are lower than might be expected based on their spatial proximity alone. Further, the Mariana Mesa sub-region shows strong similarities with relatively distant areas in the Mogollon Highlands to the south and along the Little Colorado River to the west. These patterns of technological similarity are particularly interesting because there is substantial evidence for the circulation of decorated ceramics (Chapter 5) as well as strong similarities in public architectural features (Chapter 9) between Mariana Mesa and the nearby areas to the north along the Zuni River. The contasting patterns of utilitarian ceramic technological similarity and the frequency of decorated ceramic exchange documented here suggest that the inhabitants of the Mariana Mesa region maintained strong relational connections with relatively distant areas, likely indicating historical ties with those areas. As subsequent chapters illustrate, several other lines of evidence including unique wall construction styles and design layouts on painted vessels also suggest that the Mariana Mesa region was likely occupied by a diverse group of individuals likely including migrants from a number of areas in the western or southern portions of the Cibola region or even further afield (see also Smith et al. 2009). The data presented here provide additional support for such a scenario and demonstrate the potential utility of the method of ceramic technological characterization used here for identifying patterns of population movement in the archaeological record.

Relational Connections and Social Networks

The discussion of general trends in ceramic technological similarity so far suggests that 1) there is a spatial component to the strength of relational connections among the inhabitants of the region and 2) patterns of technological similarity are relatively consistent across the major transformation in settlement across the Pueblo III to Pueblo IV transition. At this point, it is necessary to consider how the relationships play out for particular settlements. This is important because previous studies in the Cibola region have demonstrated that even tightly clustered groups of sites sometimes exhibit diverse external connections (e.g., Duff 2000, 2002; Huntley 2008; Schachner 2007). For the purposes of this analysis, I apply methods from social network analysis to visually explore patterns of interaction and relational connections among settlements across the study area.

As discussed in Chapter 2, social network analysis (SNA) refers to a set of related approaches, derived from the mathematical field of graph theory, focused on formally characterizing and visualizing the relationships among social entities. SNA approaches have been widely used across the social sciences (see Wasserman and Faust 1994), but formal SNA approaches have only recently gained a foothold in archaeology (Brughmans 2010; Knappett et al. 2008; Mills et al. 2010, n.d.; Sindbæk 2007). In its simplest form, a social network refers to a set of formally defined connections or relationships (often called "ties") among a set of actors (often called "nodes"), which can be used to describe the structure of a given social setting. Nodes need not represent individuals but may be defined at a variety of relevant social scales (e.g., households, settlements, regions, etc.). For the purposes of this analysis, I use the relative measure of ceramic technological similarity defined above as the basis for a series of network graphs which efficiently summarize the strongest patterns of relational connections among settlements across the Cibola region through time.

In order to create a network, it is first necessary to formally define nodes and ties. For this study, individual settlements were designated as nodes. Ties among settlements were then assigned by defining a threshold similarity value for the Brainerd-Robinson (BR) scale of relative technological similarity created above (Table 6.7). The specific threshold value was selected using a Monte Carlo simulation of the expected range of BR values. One thousand column randomized

Table 6.7. Brainerd-Robinson coefficients for comparisons among sites.

Relatively high values (network connections) highlighted. Group 1 and Group 2 refer to the areas shown in Figure 6.8. Network connections between groups are shown in red.

		Group 2															Group 1														
		ApC	Baca	Cmal	Coy	Foot	Hoop	HCM	Hubb	RCr	TecS	TriR	U481	U494	VA	WSR	Ats	Cien	GarR	Hesh	Hink	Jar	LG	Mir	OB	Pesc	PR	PdM	ScS	S170	Tin
Group 2	ApC																														
	Baca	89																													
	Cmal	141	112																												
	Coy	155	106	165																											
	Foot	114	93	124	128																										
	Hoop	167	99	150	168	119																									
	HCM	173	111	160	169	118	164																								
	Hubb	161	105	150	168	144	157	155																							
	RCr	150	114	155	165	123	147	171	140																						
	TecS	169	97	141	161	111	155	166	141	162																					
	TriR	157	105	156	159	140	158	155	176	142	146																				
	U481	162	121	161	174	136	166	176	171	167	160	163																			
	U494	143	88	106	126	124	137	128	147	100	115	145	132																		
	VA	147	117	125	142	137	142	142	160	137	127	151	162	160																	
	WSR	118	126	96	115	110	125	115	118	118	120	121	128	117	128																
Group 1	Ats	69	115	75	65	75	65	83	72	79	54	65	86	85	102	81															
	Cien	61	95	84	65	94	59	78	75	72	50	72	84	81	101	63	155														
	GarR	120	93	**144**	**131**	**138**	123	**136**	124	131	105	121	**140**	117	**138**	79	108	127													
	Hesh	75	90	103	76	105	71	89	86	81	61	85	93	87	109	51	123	146	145												
	Hink	120	125	**143**	124	131	113	**136**	**134**	131	109	131	**143**	112	145	96	113	141	158	148											
	Jar	57	91	93	59	88	55	75	69	66	44	68	78	77	95	52	114	149	123	160	133										
	LG	52	70	75	54	83	47	69	64	62	39	63	73	64	86	31	144	167	118	160	128	148									
	Mir	57	73	82	62	85	49	72	72	66	43	70	76	66	88	33	149	167	123	156	133	142	185								
	OB	75	**131**	92	77	102	73	93	87	85	62	83	96	95	113	95	147	152	135	154	147	153	136	137							
	Pesc	58	68	80	63	86	50	69	75	64	43	70	75	67	89	30	129	161	121	170	128	144	178	177	131						
	PR	99	84	126	105	130	95	111	115	103	87	111	116	105	124	71	93	121	147	140	144	148	115	122	127	120					
	PdM	60	91	75	62	83	53	76	72	69	47	65	80	69	92	52	171	166	117	137	129	127	169	175	145	156	110				
	ScS	76	86	93	78	100	68	85	88	80	59	83	91	85	107	46	158	160	136	157	142	125	171	180	144	166	129	175			
	S170	59	113	79	60	88	56	76	70	68	46	69	79	78	96	80	141	163	122	150	134	151	150	147	176	142	119	149	138		
	Tin	70	90	94	71	98	62	85	81	79	56	81	90	79	101	58	154	173	136	145	145	134	169	175	140	164	125	179	167	155	
	YH	48	57	82	52	73	40	57	64	51	30	57	62	56	78	18	103	139	116	161	117	166	158	152	123	163	143	130	138	138	137

Note: ApC – Apache Creek, Baca – Baca Pueblo, CMal – Casa Malpais, Coy – Coyote Creek, Foot – Foote Canyon Pueblo, Hoop – Hooper Ranch, HCM – Horse Camp Mill, Hubb – Hubble Ranch, RCr – Rudd Creek, TecS – Techado Spring, TriR – Tri-R Pueblo, U481 – UG481, U494 – UG494, VA – Vernon Area, WSR – WS Ranch, Ats – Atsinna, Cien – Cienega, GarR – Garcia Ranch, Hesh – Heshotauthla, Hink – Hinkson Ranch, Jar – Jaralosa Pueblo, LG – Los Gigantes, Mir – Mirabal, OB – Ojo Bonito, Pesc – Spier 81 Cluster, PR – Platt Ranch, PdM – Pueblo de los Muertos, ScS – Scribe S, S170 – Spier 170, Tin – Tinaja, YH - Yellowhouse matrices of the actual proportions of each of the technological clusters at each settlement were created and BR values were calculated for each random matrix. Because the ceramic technological clusters were randomized by column, every cluster has the same mean and standard deviation in each of the randomized matrices. The distribution of BR similarity values for the randomized data sets provides an estimate of the range and frequency of BR values that we might expect by chance given the number of clusters and the overall frequency of each cluster. It is then possible to compare this random distribution to the values obtained from the actual data (Figure 6.12).

As Figure 6.12 illustrates, BR similarity values for the randomized data are normally distributed whereas the BR values for the original data are multi-modal. Not surprisingly, this suggests that the underlying structure of relationships among settlements is substantially different from what might be expected by chance. For the purposes of this analysis, a tie between two settlements (nodes) is defined as a BR value greater than one standard deviation above the mean BR value for the randomized data sets (BR=130.35). The selection of this threshold is somewhat arbitrary, but the value used here falls in the upper mode in the BR values for the original data. Additional analyses not described here suggest that the general relationships among settlements are similar across a range of potential thresholds, although the density of the network (total proportion of all possible ties that are active) does vary.

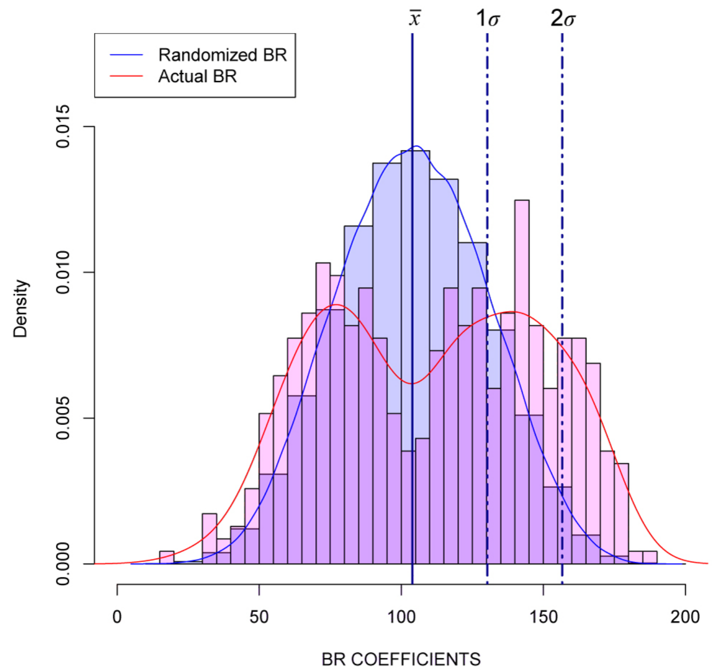


Figure 6.12. Distribution of Brainerd-Robinson similarity values for actual (red) and randomized (blue) data sets

It should be noted that the network graphs displayed below are simply an efficient means of visually displaying the complex relationships among the settlements included in this study. I do not argue that a particular threshold BR similarity value represents a particular kind of social relationship that was absent between two settlements that do not share a tie. By using a common criterion for defining ties among settlements for various combinations of variables, however, the most robust relationships among settlements and groups of settlements across the region can be evaluated using network graphs.

Figure 6.13 shows the network graph for all sites included in this analysis. The relative size of each node is determined by the total number of ties involving that settlement (i.e., degree centrality in SNA terminology). Point locations are determined using an algorithm which attempts to make as many of the ties as possible approximately the same length while limiting the number of crossing ties.[7] The overall effect of this algorithm is that highly connected groups of nodes will cluster together in the network graph. As this network graph shows, there are two strong groups of settlements with numerous overlapping ties, which I designate simply Group 1 and Group 2. These groups are characterized by far more internal ties than external ties. Interestingly, the sub-regions within which settlements in these two groups are located largely coincide with the groups defined above at the sub-regional scale (see Figure 6.8). At the same time, there are several cross-cutting ties between these groups, in particular among sites in the Upper Little Colorado, Carrizo Wash, West Zuni, and Vernon sub-regions. This suggests that the relational connections among the inhabitants of settlements in areas along the edges of these two overarching groups of sub-regions may have been somewhat more diverse than in areas within the core of these groups. To further illustrate this pattern, Figure 6.14 displays the same network graph with sites shown in their actual locations. In both Figures 6.13 and 6.14, the two sites (Hinkson Ranch and Garcia Ranch) with the most diverse connections including sites in both the northern and southern overarching groups of sites are labeled in red. I return to a discussion of the importance of these cross-group connections below.

Possible exceptions to the general spatial pattern of relationships noted above include Baca Pueblo in the Upper Little Colorado sub-region and WS Ranch in the Mogollon Highlands area. Baca Pueblo is not strongly similar to other sites in the Upper Little Colorado area and shares only a single tie with Ojo

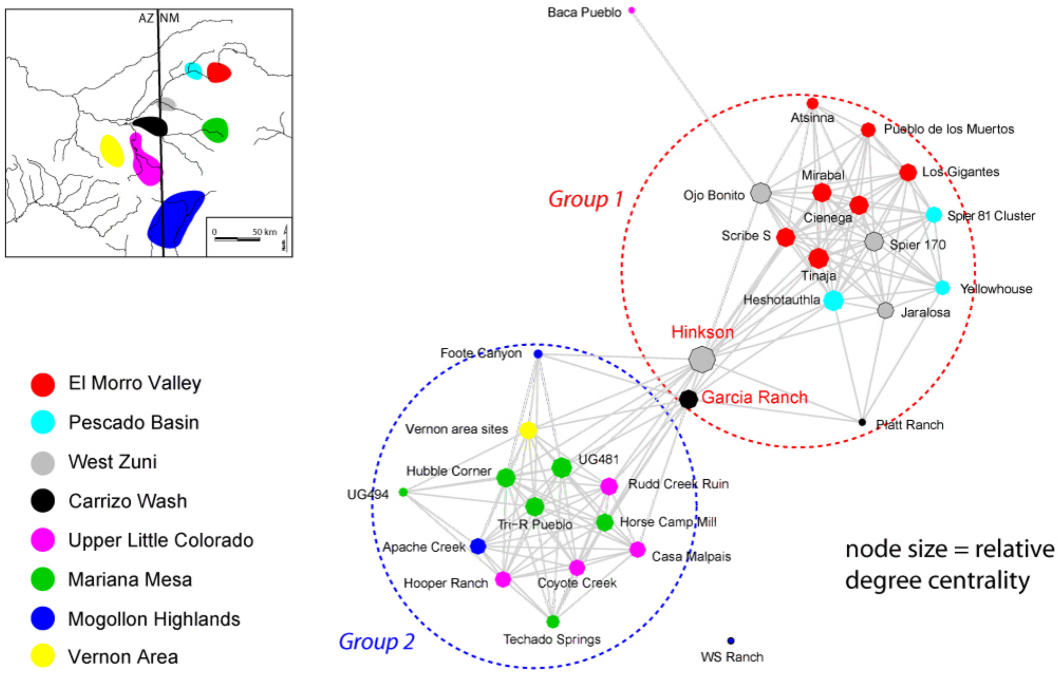


Figure 6.13. Network graph for all settlements.

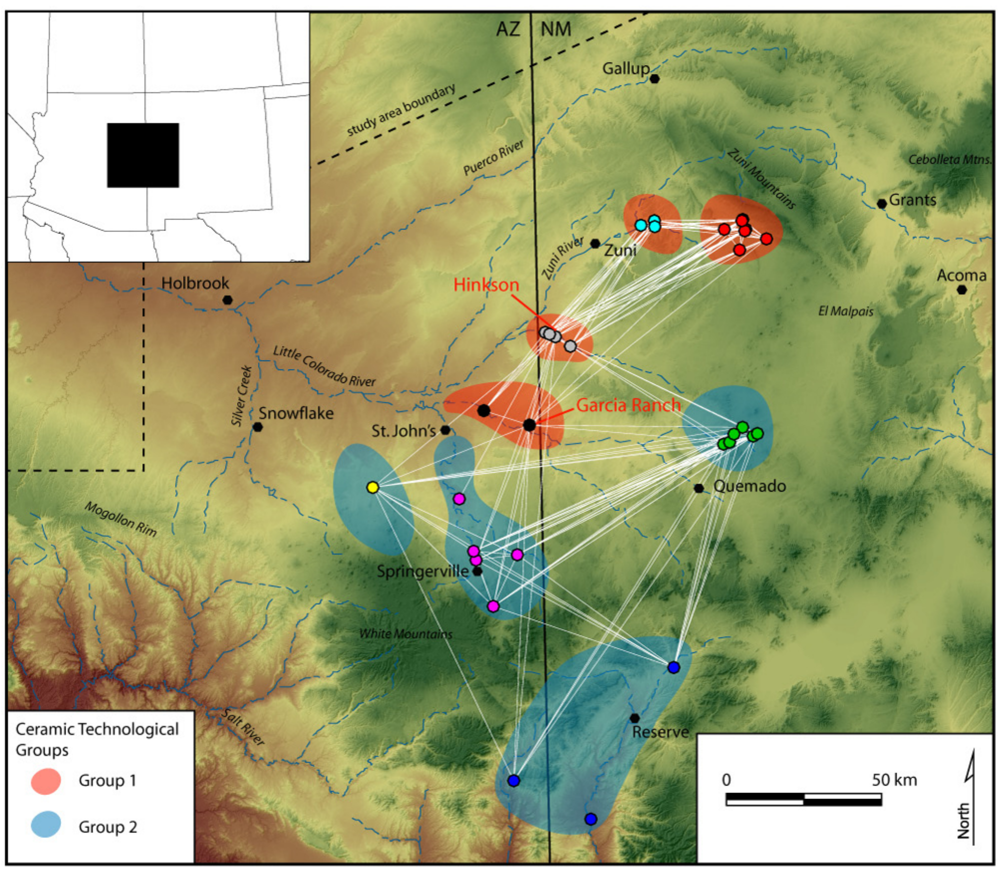


Figure 6.14. Map of the study area showing network ties among all sampled settlements.

Bonito in the West Zuni sub-region. Interestingly, Baca Pueblo is the only site in the sample with substantial amounts of Roosevelt Red Ware (ULCPP field notes); a painted ware which some have suggested may have been produced primarily by migrants from the Kayenta area in northeastern Arizona (Lyons 2003; see also Crown 1994).[8] The presence of migrants from outside of the Cibola region could potentially explain the relatively weak similarities between Baca Pueblo and all other sites considered in this study. In addition to this, the WS Ranch site, near Glenwood, New Mexico in the far southern reaches of the study area does not show particularly strong similarities to any other site in the sample considered here. The WS Ranch site has a somewhat longer occupation than most other sites included in this study (ca. A.D. 900-1350; see Robertson 1980). Although efforts were made to limit the ceramic sample to vessels from late thirteenth and early fourteenth century contexts, it is possible that some of the variation in this sample is due to the inadvertent inclusion of vessels produced in earlier periods.

When settlements are divided by time period, similar patterns of strong relational connections among sites from different portions of the study area are apparent. As Figure 6.15 illustrates, in both the Pueblo III and Pueblo IV periods, there are two fairly discrete groups of settlements with many inter-connections, which roughly conform to Group 1 and Group 2 defined above. Interestingly, although Baca Pueblo in the central Upper Little Colorado area shares a single tie with Ojo Bonito in the West Zuni sub-region, there are no particularly strong similarities between sites in the two groups of sub-regions during the Pueblo IV period. Further, sites in the Mogollon Highlands are not strongly similar to any

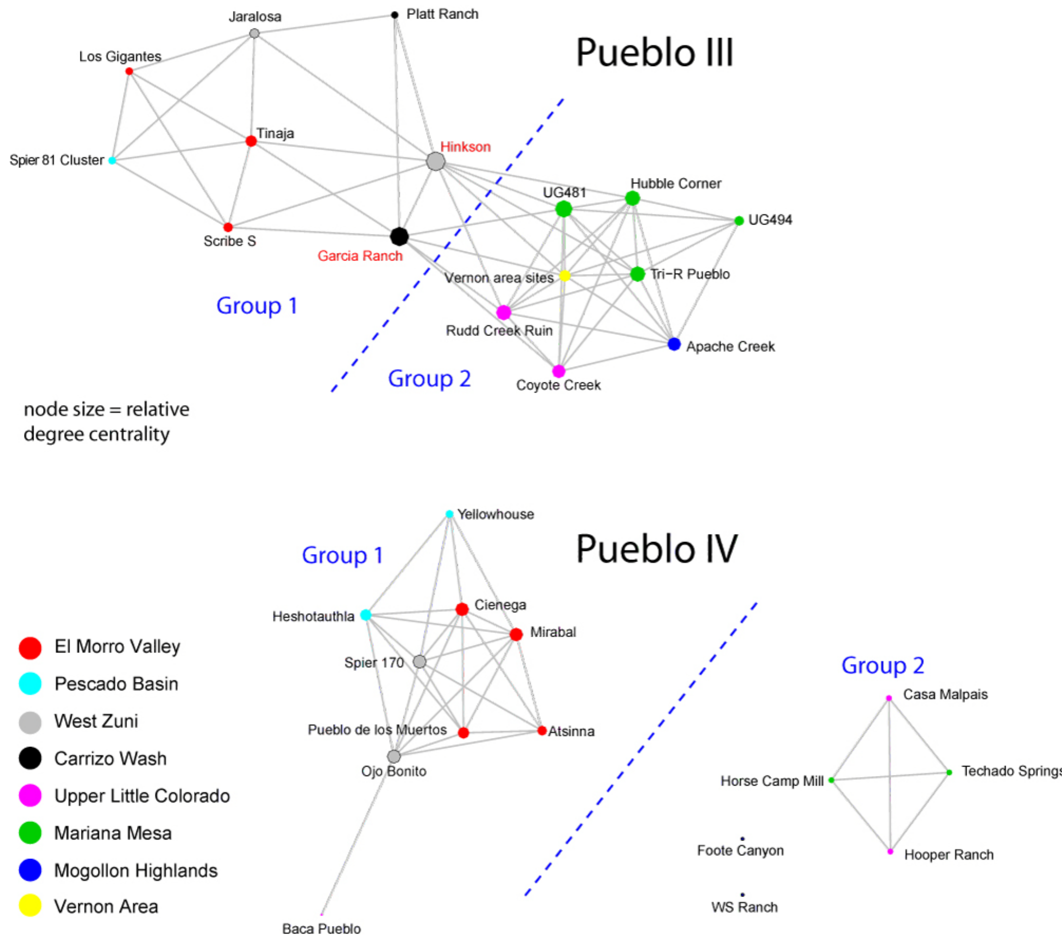


Figure 6.15. Network graphs for all settlements divided by time period. The relative size of each node represents the number of ties for that settlement.

other sites considered here (although the strongest relationships are with sites in the southern group).[9] The widening divide between the northern and southern groups of settlements through time is not necessarily surprising, as many of the areas along the edges of these two areas were depopulated across the Pueblo III to Pueblo IV transition. Overall, the patterns described above may suggest that as clusters of settlements became increasingly spatially isolated across the Pueblo III to Pueblo IV transition, there was less interaction and weaker relational connections among the inhabitants of these two broad areas. This finding is in line with the increasingly restricted patterns of ceramic circulation documented in the previous chapter.

Although there are certain exceptions, the results presented here suggest that at both the sub-regional and settlement level, utilitarian ceramic vessels produced across the Cibola region were most similar among spatially proximate settlements. This pattern persists through the Pueblo III to Pueblo IV transition, despite major changes in population and settlement organization. As the plain and corrugated vessels included in this study were likely primarily produced and consumed at the household level, it is likely that the kinds of social interactions which led to such similarities were most frequently enacted among individuals living in relatively close proximity to one another. Overall, this suggests that relational connections among the inhabitants of the study area were substantially influenced by distance as well as regional patterns of population movement through time. This further suggests that the scale of population movement associated with this transition may have been smaller than has often been assumed.

As noted above, several sites spatially located along the edges of the two overarching groups of settlements defined at the sub-regional level have somewhat more diverse network connections (including sites in both groups) than sites further away from the edges of these zones. These sites, which mediate connections among settlements within the network that would otherwise be entirely unconnected, play an important role in defining overall network structure and topology. Beyond this, it may be settlements in such intermediate positions within regional networks of interaction may have controlled or facilitated interaction among somewhat more socially distant settlements. Researchers focused on formal approaches to SNA have developed a quantitative measure, known as betweenness centrality, for describing the degree to which a node mediates connections among other unconnected nodes. Betweenness centrality is calculated as the sum of the number of shortest paths between all nodes that pass through that node (see Wasserman and Faust 1994:188-192 for specifics).

Table 6.8 shows the betweenness centrality scores for the network containing all sites, as well as for sites divided by time period. In all three networks, there are a small number of sites (highlighted) with betweenness centrality scores nearly double that of all other sites within their own network. This suggests that these sites were key nodes for mediating connections among settlements within the sample considered. The highest scoring sites are all located in the West Zuni and Carrizo Wash sub-regions near the center of the study area and along the edges of the two over-arching groups defined above. However, not all sites in these sub-regions have high betweenness centrality scores. Of particular note, the two sites with the highest overall centrality scores, for both the full network and for the Pueblo III period network, are Post-Chacoan great house communities with oversized, unroofed great kivas. This suggests that the these settlements may have been the locations of somewhat more diverse interactions than other sites within the regional networks, perhaps in part through periodic public gatherings focused on public architectural spaces.

Table 6.8. Betweenness centrality scores for all sites and for sites divided by time period.

Sites	Sub-region	All Sites	PIII	PIV
Atsinna	EMV	0		0
Cienega	EMV	16.07		2.57
Los Gigantes	EMV	2.52	0.50	
Mirabal	EMV	16.07		2.57
Pueblo de los Muertos	EMV	0.57		0.40
Scribe S	EMV	30.71	15.87	
Tinaja	EMV	32.13	17.28	
Heshotauthla	PB	31.21		1.50
Spier 81 Cluster	PB	1.14	0.50	
Yellowhouse	PB	4.35		0
Hinkson	WZ	284.66	68.28	
Jaralosa	WZ	12.52	12.94	
Ojo Bonito	WZ	82.01		14.40
Spier 170	WZ	16.07		2.57
Garcia Ranch	CW	117.41	33.61	
Platt Ranch	CW	5.59	0.92	
Horse Camp Mill	MM	18.10		0
Hubble Corner	MM	23.90	6.12	
Techado Springs	MM	0.00		0
Tri-R Pueblo	MM	23.90	6.12	
UG481	MM	34.05	10.94	
UG494	MM	0	0	
Baca Pueblo	ULC	0		0
Casa Malpais	ULC	17.65		0
Coyote Creek	ULC	6.57	2.31	
Hooper Ranch	ULC	2.25		0
Rudd Creek Ruin	ULC	18.10	4.89	
Vernon Area	VA	25.71	10.94	
Apache Creek	MH	2.25	0.80	
Foote Canyon	MH	0.50		0
WS Ranch	MH	0		0

Note: EMV- El Morro Valley, PB - Pescado Basin, WZ - West Zuni, CW - Carrizo Wash, MM - Mariana Mesa, ULC - Upper Little Colorado, VA - Vernon Area, MH - Mogollon Highlands

Comparison with Traditional Typological Analysis

The method of technological analysis used in this study provides an interpretable measure of ceramic technological similarity that can be used to make socially meaningful interpretations of the archaeological record at a regional scale. In order to further evaluate the method and results presented above, it is important to consider how the current approach differs from the kinds of typological analyses typically applied to ceramic assemblages in the Cibola region. In this section, I briefly discuss the relationships between these different approaches.

First, it is important to clarify the distinction between the ceramic technological clusters defined above and traditional ceramic types. Types are normally used to identify discrete sets of objects that share some analytically important characteristic such as design or corrugation style. Although there has long been a great deal of debate over exactly what typological categories may mean in terms of human behavior or identity (e.g., Ford 1954; Spaulding 1953), most archaeologists accept that types have a great deal of analytical utility (see Adams and Adams 2007). Combinations of variables similar to those measured and coded in this study often form the basis for ceramic typologies (e.g., Gifford and Smith 1978; Rinaldo and Bluhm 1956). Thus, some may argue that the methods used here simply quantify these variables and define clusters that are essentially analogous to types.

While it is true that the approach used here shares several characteristics with quantitative methods for creating and evaluating typologies (e.g., Dunnell 1986; Gilboa et al. 2004; Spaulding 1953), the ultimate goal is somewhat different. This analysis is not designed to create a set of reproducible categories, but instead is designed to partition variability among all vessels included in this study based on their relative similarities. It is the proportional representation of categories, rather than the categories themselves, that are of interest. The content of each technological cluster may vary considerably depending on the sample of vessels considered, but the relationships among sites are robust.

A single ceramic technological cluster may include vessels that have a number of attributes in common but that also differ in other respects. For example, one cluster may include vessels that have the same interior surface treatment, indentation type, and coil width but vary substantially in terms of surface elaborations or the width of indentations. In traditional typological analyses, this may be seen as a failure of the method. In the approach used here, this instead suggests that vessels within such a ceramic technological cluster may have shared certain production steps, but not others. This kind of information is lost in traditional typological analyses where the ultimate goal is the creation of reproducible groups. Importantly, the method used here also allows for the independent evaluation of the influence of specific attributes on overall patterns of similarity.

In order to illustrate this point, it is useful to consider the relationships among the settlements described above across subsets of the measured and coded variables used in this analysis. Figure 6.16 shows network graphs among settlements based only on A) the continuous variables measured in this study and B) on the nominal, presence/absence, and ordinal variables.[10] In general, these two network graphs show the same basic relationships among settlements and sub-regions described above, but there are important differences. Specifically, ceramic assemblages from sites in the Carrizo Wash area (in particular Garcia Ranch) are more similar to assemblages from settlements in the southern sub-

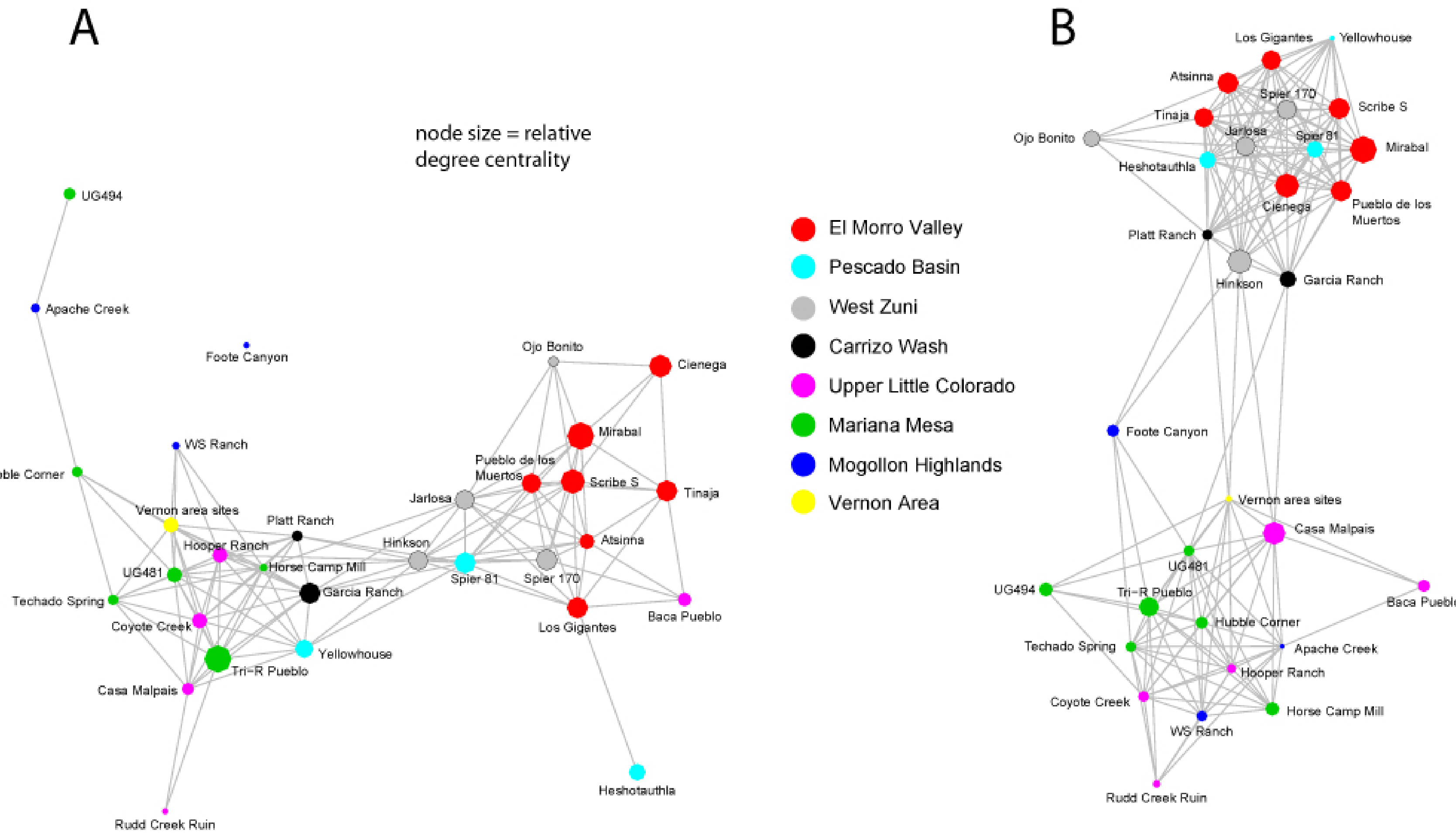


Figure 6.16. Network graph for all settlements included in this study based on A) continuous variables only and B) presence/absence, nominal, and ordinal variables only

regions in terms of the continuous variables, but more similar to assemblages from sites in the northern sub-regions in terms of the non-continuous variables. Further, Baca Pueblo shows the strongest relationships with settlements in the northern sub-regions in terms of the continuous variables and no particularly strong relationships at all for the non-continuous variables. This suggests that attributes of ceramic vessels produced and consumed at these settlements may be somewhat technologically transitional between the typical range of vessels produced to the north and south. In other words, vessels produced in these areas incorporated diverse production practices that were most common to the north and to the south. Interestingly, these sites are physically located along the edges of the two groups of settlements defined above.[11]

The patterns documented here are not simply a function of assemblages containing varying proportions of brown and gray ware ceramics or different frequencies of particular types or vessel forms. Figure 6.17 shows that the same basic pattern documented in the original network graph based on all samples and all variables holds even when considering A) only vessels falling within the dominant ware category for each site (i.e., vessels that were likely locally produced), and B) only vessels which would be placed within a single traditional type category and vessel form (indented corrugated jars). Importantly, the strength of association between each of the networks graphs shown in Figures 6.16 and 6.17 and the original network graph based on all variables is significantly greater than would be expected by chance.[12] Overall, this suggests that the patterned relationships among sub-regions and settlements documented in this chapter are

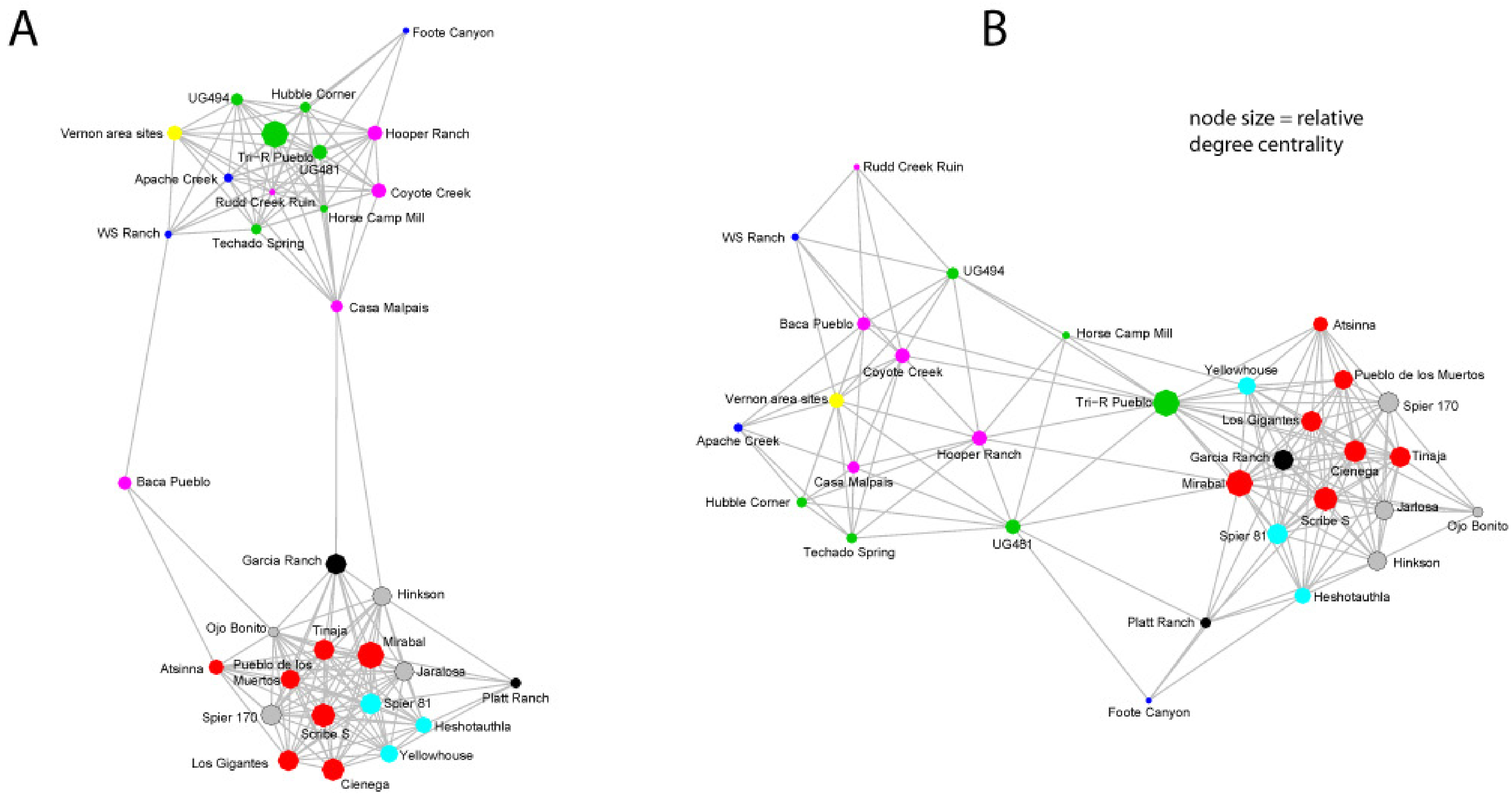


Figure 6.17. Network graph for all settlements included in this study based on A) only the dominant ware from each settlement and B) only samples classified as indented corrugated jars

extremely robust. Such nuanced patterns of ceramic technological similarity would not be apparent through traditional typological analyses alone.

Finally, it is instructive to compare the ceramic technological clusters defined above with traditional ware assignments. Figure 6.18 displays the frequencies of each of the 10 ceramic clusters based on all variables for sherds/vessels classified as Cibola Gray Ware and Mogollon Brown Ware respectively. The proportions of ceramic technological clusters differ dramatically between brown and gray ware in the region wide sample, indicating that these two traditionally defined wares were relatively distinct in terms of the range of techniques used to produce them and suggest that they were largely produced by potters operating within two distinct technological frameworks. This interpretation is in line with several previous comparisons conducted within the Cibola region (Crown 1981; Elkins 2007; Nauman 2007; Wichlacz 2009).

Although Mogollon Brown Ware and Cibola Gray Ware vessels are generally similar in construction, there are a few technological distinctions that are likely key factors determining the differences between the wares noted above. Specifically, Mogollon Brown Ware vessels occur in bowl form far more frequently than Cibola Gray Ware vessels which are almost always jars. Furthermore, Mogollon Brown Ware bowls often have smudged interiors (a lustrous black finish produced during the firing process) whereas this surface treatment is exceedingly rare in Cibola Gray Ware. As several researchers have previously suggested, these differences in vessel inventories and surface treatments may indicate underlying distinctions in food preparation and serving

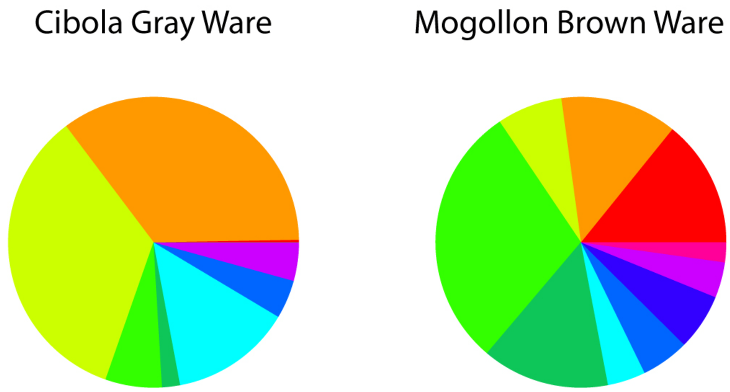


Figure 6.18. Proportions of the 10 ceramic technological clusters for Cibola Gray Ware and Mogollon Brown Ware vessels

between the areas dominated by Mogollon Brown Ware and Cibola Gray Ware respectively. Such differences perhaps suggest that the producers of these different wares belonged to distinct social groups (Clark et al. 2006; Crown 2000; Elkins 2007; Nauman 2007).

Despite the differences between gray and brown wares, almost all of the technological clusters defined in the regional study conducted here are present in some quantity for both Mogollon Brown Ware and Cibola Gray Ware. This suggests that there was also a degree of overlap in the technological attributes of both wares. The analyses above suggest that this overlap was particularly prevalent along the transition zone between areas dominated by Cibola Gray Ware and Mogollon Brown Ware (i.e., West Zuni Region and Carrizo Wash), even when only the dominant ware at each settlement is considered. This important subtlety is lost when comparisons are conducted only at the level of wares or when individual variables are treated independently. Overall, this suggests that the methods designed for this study provide a better proxy for the relationships among potters at a regional scale than considerations of traditional typological data alone.

Summary and Conclusions

In this chapter, I have described and implemented a quantitative method for evaluating ceramic technological similarity at a regional scale. As the discussion above highlights, this method provides a substantial amount of information which would be lost when relying solely on traditional typological analyses. In this final section, I briefly review the primary results described above and place these results within the broader context of this study.

The analyses above suggest that one of the major factors influencing the degree of ceramic technological similarity among settlements across the study area is the spatial distance between them. The inhabitants of the Cibola region were most frequently interacting with their closest neighbors and these interactions likely included learning and teaching pottery production. It is possible to divide the core portion of the study area into northern and southern groups of sub-regions within which most interactions took place (Figure 6.8). The Mariana Mesa area does not fit this pattern, however. Settlements in the Mariana Mesa area exhibit strong similarities with relatively distant settlements to the west and south despite evidence for other forms of interaction with the spatially closer sub-regions along the Zuni River Valley. This deviation from the general spatial pattern, along with other lines of evidence discussed in subsequent chapters, suggests that the inhabitants of the Mariana Mesa region included migrants with a diversity of origins, likely including the western or southern portions of the Cibola region and more distant areas as well.

The patterns of ceramic technological similarity documented here remained relatively consistent across the social transformation occurring towards the end of the thirteenth century. The same two groups of sub-regions can be defined both before and after this transformation and the negative relationship between spatial distance and ceramic similarity is equally strong in both the Pueblo III and Pueblo IV periods, even for comparisons among sites dating to different periods. This suggests that relational connections among the inhabitants of different portions of the Cibola region were remarkably consistent through time despite the reorganization of settlement occurring across the Pueblo III to Pueblo IV transition. The consistency in patterns of technological similarity across the transition considered here suggests that this social transformation was organized largely along the lines of individuals and social groups that were already frequently interacting before the transformation.

Examinations of ceramic technological similarity in relation to specific settlements reveal that a few settlements along the edges of the overarching northern and southern groups of sub-regions defined above may have had ceramic assemblages that were somewhat transitional between the dominant patterns within the core of each group. Such fine-grained patterns of technological differentiation would not be accessible using traditional typological methods alone. Furthermore, the transitional nature of assemblages found in the area along the central portion of the study area provides a very different picture of interaction at a regional scale than considerations based on the distributions of Mogollon Brown Ware and Cibola Gray Ware alone.

Although I do not argue that a network tie between two settlements represents a particular kind of social relationship, the consistency in the connections among sites despite which variables are included and even when considering only a single traditional type can be used to argue that the relationships documented across the study area as a whole are extremely robust. In general, in both the Pueblo III and Pueblo IV period, two clusters of settlements characterized by substantially overlapping internal ties and a smaller number of cross-cutting ties can be identified. The two groups defined above may have become somewhat more distinct through time as areas along the periphery of each group were depopulated.

Finally, it is important to note that the two overarching groups of settlements and sub-regions defined above roughly conform to areas that are traditionally placed within the northern Anasazi and the southern Mogollon archaeological culture areas. The fact that the groupings defined here, which are based on a detailed ceramic technological characterization, do coincide with the traditional boundaries between these archaeological constructs suggests that the culture areas defined so long ago likely do have some basis in patterns of social interaction at regional scales. However, the analyses presented here suggest that the boundaries of these archaeologically defined regions were somewhat more diffuse than has previously been suggested based on the distribution of distinct ceramic wares alone. Rather than being characterized by interactions between two "cultures," this study suggests that social relations across the Cibola region were more likely negotiated on a relatively local scale.

Chapter 6 Notes

[1] Variables were defined based on the observed variation in corrugated ceramics noted during a pilot study focused on a large sample of ceramic whole vessels and sherds from the El Morro Valley and the Upper Little Colorado sub-regions. The coding system was further refined through experimental reproductions of corrugated pottery directed at identifying the specific techniques that may have produced a particular attribute in a finished vessel. Observations of corrugated pottery production by John Olsen at the 2009 Leupp Kiln Conference were particularly helpful in refining the coding scheme used here.

[2] In order to choose the sample contexts, provenience data on all available contexts for each site were first compiled. Sample contexts were then chosen at random using a random selection database function. Sherds from each selected context were then measured until either all viable samples were measured or until approximately 100 samples were coded. This random sample was then supplemented by coding all available whole or partial vessels.

[3] The first three axes were selected because the total percentage of variance explained by each remaining dimension of the PCoA is typically smaller than 5%.

[4] For the purposes of this analysis, the K-medoids analysis was based on the Partitioning Around Medoids (PAM) algorithm described by Kaufman and Rosseeuw (1990). The major difference between K-means and K-medoids is that the medoids must be an actual data point within a cluster rather than a random point. Beyond this, strictly speaking, K-medoids cluster analysis forms clusters by minimizing average dissimilarities and not the sum of squared error in dissimilarities (SSE). It is possible to assess different cluster solutions using plots comparing average dissimilarity between the actual and randomized data sets rather than using SSE. This procedure is extremely computationally intensive, however, often taking several hours for a small number of random runs. Experiments comparing relative reduction in SSE and average dissimilarity for different cluster solutions suggest that the results are highly correlated for both actual and randomized datasets (Pearson's $r > 0.95$). Other methods of cluster validation not described here such as assessment of silhouettes provide comparable results. Due to these factors, as well as the wider familiarity with SSE methods in archaeology, the SSE procedure was presented here.

[5] The clustering level chosen here was selected after numerous trials as a compromise between consistency and interpretability. The general patterns of similarity across the region discussed in this chapter are not, however, severely impacted by the cluster level selected.

[6] When only comparisons involving settlements in the Mariana Mesa area are considered, there is actually a weak positive correlation between spatial distance and ceramic technological similarity (Pearson's r=0.53).

[7] The Fruchterman-Reingold force directed algorithm was selected for this analysis.

[8] Roosevelt Red Ware at Baca Pueblo is primarily limited to floor contexts was likely only present during the latest occupation of the site (see Duff 1999:5.32). As many of the measured sherds also came from floor contexts, the sample may be heavily weighted towards the late occupation.

[9] The apparent isolation of sites in the Mogollon Highlands may be, in part, a product of chronological resolution. Although both Foote Canyon Pueblo and WS Ranch were both occupied into the Pueblo IV period (ca. A.D. 1275-1325), the occupation of these settlements likely spanned the late Pueblo III period as well.

[10] As with all of the other network graphs displayed in this chapter, a tie is defined as a BR value greater than one standard deviation above the mean BR value in the 1,000 randomized matrices.

[11] The sample from Yellowhouse also shows quite a bit of variation between the metric and non-metric variable graphs. The currently available sample from Yellowhouse is quite small, however, so little confidence can be placed on any potential differences.

[12] To further evaluate the similarities among these network graphs, I conducted a comparison using the quadratic assignment procedure (QAP; Krackhardt 1987). QAP is a method of graph comparison which calculates the probability that the degree of association between two graphs is spurious. This first step in this procedure is to calculate some measure of association between two graphs. In this case, the product moment correlation was used (see Krackhardt 1987:172-175). All of these various network graphs shown in Figures 6.16 and 6.17 are positively correlated with the original network graph based on all variables and all samples (Figure 6.13), but the strength of association varies considerably (correlations coefficients between original graph and: 6.16a=0.64, 6.16b=0.40, 6.17a=0.77, and 6.17b=0.46). The next step is to determine the strength of correlation between graphs that might expected by chance given graph density and the total number of nodes. In order to do this, the symmetric matrix of ties for the original network graph was compared to 1,000 randomized matrices based on each one of the other graphs (created by permuting row and column headings) and correlation coefficients were calculated for every random run. The total number of random runs which produced correlations greater than or equal an actual correlation can be used to calculate the probability that a given association could occur by chance. In the comparisons between the original network graph and all of the graphs in Figures 6.16 and 6.17, no random comparisons produced correlation coefficients greater than or equal to any observed value. Thus, all associations are highly statistically significant (p<0.01).

Chapter 7:

DOMESTIC ARCHITECTURAL SPACES AND RELATIONAL CONNECTIONS

Similarities in domestic architectural spaces are frequently cited as particularly good indicators of interaction or common historical origins among the individuals or larger groups that produced those structures (e.g., Burmeister 2000:541-542; Clark 2001; Hegmon et al. 1998; Hillier and Hanson 1984; Riggs 2005). Such built spaces provide the physical contexts in which many daily social activities are conducted. The form and use of domestic architecture tends to be highly conservative, even in contexts where multiple distinct social groups are present (Clark 2001; Jordan and Kaups 1987; Rapoport 1990). From this, I argue that the degree of similarity in domestic structures and features can be used as a proxy for the frequency of interaction and historical connections among the inhabitants of the study area at various scales.

In this chapter, I characterize several aspects of the organization of domestic space and architectural features at excavated settlements across the study area. The analyses presented here are meant to serve as a complement the more detailed ceramic technological study presented in Chapter 6. I argue that robust patterns of similarity in terms of the form, size, and placement of domestic architectural features, which relate to the technological learning frameworks of those who produced them, reveal insights into the nature and direction of relational connections among individuals and groups across the Cibola region. As I illustrate below, the patterns of relational connections suggested by both the ceramic technological data and domestic architectural data gathered for this study largely coincide. This supports my initial expectations, described in Chapter 2, as these are likely both technologies learned through face-to-face interpersonal interactions.

Architectural Data

The architectural data used in this study were gathered from published sources and original field notes from 35excavated sites dating between ca. A.D. 1150 and 1325 within the core portion of the study area (Table 7.1). These data include details such as room dimensions, wall and floor construction styles, hearth form/placement, and mealing feature form and size for over 700 above ground pueblo rooms. For the purposes of this chapter, subterranean structures were not included in this sample nor were large, potentially public architectural spaces (see Chapter 9). For each site, data were recorded for as many variables as was possible for all excavated or thoroughly documented rooms dating to the period considered here. Features were coded independently for each floor surface within a room when multiple floors were present. These detailed architectural data were supplemented with additional information from a smaller number of sites in the expanded study area. Only a limited range of variables that could be easily obtained from site plan maps or descriptions were recorded for sites in the expanded study area. The raw data gathered for this analysis are provided in Appendix E.

Table 7.1. Sites included in the architectural analyses.

Sub-region	Site Name	Site Number	# Recorded Rooms	References
Core Area				
El Morro Valley	Atsinna	LA 99	15	Watson et al. 1980; Woodbury/CARP
El Morro Valley	Pueblo de los Muertos	LA 1585	17	Watson et al. 1980; CARP
El Morro Valley	Tinaja	LA 427	4	Watson et al. 1980; CARP
El Morro Valley	Cienega	LA 425	3	Watson et al. 1980; CARP
El Morro Valley	Mirabal	LA 426	7	Watson et al. 1980; CARP
El Morro Valley	Scribe S	LA 59321-59331	24	Watson et al. 1980; CARP
El Morro Valley	Los Gigantes	LA 56159	9	Schachner 2007; EMVPP
El Morro Valley	LA 132353	LA 132353	9	Howell 2004
El Morro Valley	Pettit	LA 1571	57	Linthicum 1980
Pescado Basin/Zuni	Heshotauthla	LA 2114	4	Kintigh et al. 2004; HARP
Pescado Basin/Zuni	NM 12:K3:108	NM 12:K3:108	6	Varien 2000
Pescado Basin/Zuni	NA 11527	NA 11527	10	Zier 1977
Pescado Basin/Zuni	NA 11530	NA 11530	25	Zier 1977
West Zuni	Hinkson Ranh	LA 11439	3	Eckert 1995; OBAP
Carrizo Wash	Platt Ranch	AZ Q:7:26 (ASM)	12	Westfall 1981
Carrizo Wash	Platt Ranch	AZ Q:7:27 (ASM)	6	Westfall 1981
Upper Little Colorado	Rim Valley	AZ Q:15:73 (ASM)	9	Martin et al. 1962; CFM
Upper Little Colorado	Hooper Ranch	AZ Q:15:6 (ASM)	21	Martin et al. 1961; CFM
Upper Little Colorado	Coyote Creek Pueblo	AZ Q:16:3 (ASM)	35	DeGarmo 1975
Upper Little Colorado	Rudd Creek Ruin	AZ Q:16:63 (ASM)	12	Clark 2006; RCAP
Mariana Mesa	Sandstone Hill	NA 11233	19	Bartlett 1974
Mariana Mesa	Horse Camp Mill	LA 10983	22	McGimsey 1980
Mariana Mesa	UG481	UG481	32	McGimsey 1980
Mariana Mesa	UG494	UG494	12	McGimsey 1980
Mariana Mesa	Fisher Site	LA 12133	18	Bice 2004; AAS
Mariana Mesa	Techado Spring	LA 2148, LA 6010	245	Smith et al. 2009
Mariana Mesa	Tri-R Pueblo	n/a	8	Jimmy Smith, personal communication
Vernon Area	Chilcott Ranch I	n/a	6	Martin et al. 1962; CFM
Vernon Area	Mineral Creek	n/a	5	Martin et al. 1961; CFM
Mogollon Highlands	Apache Creek	LA 2949	9	Martin et al. 1957; Peckham et al. 1956; CFM
Mogollon Highlands	Higgins Flat	LA 8682	13	Martin et al. 1956; CFM
Mogollon Highlands	Foote Canyon Pueblo	LA 4425	11	Rinaldo 1959; CFM
Mogollon Highlands	WS Ranch	LA 3099	13	Tomka 1988; Robinson 1992; UT
Mogollon Highlands	Hough 70	LA 3279	11	Zamora and Oakes 1999
Mogollon Highlands	DZ Site	LA 70185	2	Zamora 1999
Sub-total			***714***	
Expanded Study Area				
Silver Creek	Pottery Hill	AZ P:12:12 (ASM)	4	Mills et al. 1999
Silver Creek	Bryant Ranch	AZ P:11:133 (ASU)	4	Mills et al. 1999
Silver Creek	Bailey Ruin	AZ P:11:1 (ASM)	7	Mills et al. 1999
Hay Hollow Valley	Joint Site	Longacre 151	33	Hansen and Schiffer 1975
Hay Hollow Valley	Broken K	Longacre 156	90	Hill 1968, 1970; Martin et al. 1967
Hay Hollow Valley	Carter Ranch	Longacre 155	23	Longacre 1970; Martin et al. 1964
Arizona Mountains	Grasshopper Pueblo	AZ P:14:1 (ASM)	103	Riggs 2001
Arizona Mountains	Turkey Creek Pueblo	AZ W:9:123 (ASM)	280	Lowell 1986
Hardscrablle Wash	Hardscrabble Ruin	NA 14650	17	Stebbins et al. 1986
Cebolleta Mesa	Los Pilares, Calabash	LA 1331	12	Forester 1962-1965; Dittert 1959; Ruppé 1990
Cebolleta Mesa	LP 2:25-V	LP 2:25-V	8	Dittert 1959; Ruppé 1990
Cebolleta Mesa	LP 2:13-B	LP 2:13-B	7	Dittert 1959; Ruppé 1990
Mount Taylor area	LA 2639	LA 2639	9	Wendorf 1956
Mount Taylor area	LA 2640	LA 2640	15	Wendorf 1956
Manuelito Canyon	NM 12:U2:108A	NM 12:U2:108A	8	Anyon et al. 1983
Petrified Forest	Puerco Ruin	AZ Q:1:22 (ASM)	29	Burton 1990; Jennings 1961
Sub-total			***649***	
TOTAL			***1363***	

Note: CARP = Cibola Archaeological Research Project, EMVPP = El Morro Valley Prehistory Project, HARP = Heshotauthla Archaeological Research Project, OBAP = Ojo Bonito Archaeology Project, CFM = Chicago Field Museum, RCAP = Rudd Creek Archaeological Project, AAS = Albuquerque Archaeological Society, UT = University of Texas, TCAS = Tarrant County Archaeological Society

The remainder of this chapter is divided into four sections. First, I characterize the distribution of room sizes for sites across the study area in order to explore potential variation in household size as well as the scale of organization and planning involved in the construction of settlements across the study area. Following this, I consider the construction and placement of intramural domestic features; specifically hearths and mealing bins. Similarities in the styles and placement of these features are interpreted as one measure of the degree of social interaction and relational connections among the inhabitants of the region. Next, I consider the distribution of relatively rare wall construction styles which may suggest patterns of population movement across the region. Finally, the results of these brief architectural analyses are summarized and compared with the patterns of interaction and relational connections suggested by the ceramic technological analyses described in the previous chapter.

Room Size

Room size is a variable that is both commonly recorded on sites across the greater Southwest, and has been used in research on numerous topics including population and household size, room function, social organization, post-marital residence patterns, and the organization of construction task groups (Cameron 1999; see also Baldwin 1987; Crown and Kohler 1994; Ferguson 1996; Hill 1970; James 1994, 1997). Patterns of room sizes across the Cibola region, described below, suggest that there are broad differences among settlements across different portions of the study area. These differences may relate to particular culturally specific building practices or, alternatively, may suggest differences in the pace and scale of construction among settlements in different portions of the Cibola region.

Although there are key differences in some of the specific details and materials used, pueblo rooms are reasonably consistent in terms of basic form and construction across much of the Colorado Plateau and the mountainous areas along the Mogollon Rim after A.D. 1100. Rooms are almost exclusively rectangular with masonry or adobe walls that bear at least some of the weight of their roofs. Pueblo roofs are usually constructed of large wooden beams (*vigas*) spanning the shorter dimension of the room with smaller wooden elements, thatching and earth used to fill in the remaining gaps. Rooms are usually part of larger units consisting of multiple adjacent rooms that share walls (for extended discussions see Riggs 2001:35-111; Mindeleff 1891:137-219). Some settlements in the Cibola region have multiple stories with upper rooms generally conforming to the plan of ground floor rooms.

The size of rooms may be constrained, to a certain degree, by the specific materials or methods used in construction including the availability of different varieties of large trees suitable for use as primary roof beams or posts (Ciolek-Torrello 1985:46-47), the specific methods used for constructing interior roof supports (James 1997:435-438), or by the load-bearing capacity of materials available for wall construction (Cameron 1999:203-208). In general, however, the range of materials and construction methods commonly employed across the Cibola region study area does not differ dramatically from place to place.

Due to the basic similarities in construction materials and methods across much of the Puebloan Southwest, differences in the sizes of rooms have more frequently been attributed to social factors than technical ones. For example, James (1994) noted that room sizes are typically somewhat smaller at Puebloan settlements north of the Mogollon Rim than at settlements to the south. This broad pattern appears to be consistent throughout the prehispanic period. Based on comparisons with ethnographic data on room size from a number of historic populations across the Southwest, James (1994) argues that these differences may relate to differences in post-marital residence patterns and descent rules. Specifically, he argues that larger rooms typical of areas south of the Mogollon Rim may have been constructed and owned by males, representing a patrilineal descent pattern, whereas smaller rooms above the Rim may have been constructed and owned by women in matrilineal societies. James attributes differences in room size to differing agricultural processing and storage practices which he associates with each descent pattern.

In another study, Cameron (1999) points out that the organization and size of construction task groups may have also played a major role in the distribution of room sizes. Specifically, some pueblo settlements are constructed or expanded by simply adding rooms either singly or in small groups along existing rooms. Such additions would likely have been built by relatively small social units such as a nuclear or extended family. This method of construction tends to lead to what are known as “agglomerative” settlement layouts where rooms of various sizes are massed together with no apparent overall settlement plan. In other settlements, large numbers of rooms are constructed simultaneously using what is known as the "ladder type" construction method (see Cordell 1998:27). Ladder construction entails laying out two or more long linear walls which are then subdivided into individual rooms by creating walls along the short axis of the rooms. As Cameron (1999:207-208) notes, this method of construction tends to produce settlements with long, linear blocks of rooms that are usually reasonably consistent in size because one dimension is the same for all rooms. The size of the units that are often simultaneously built using ladder construction suggests some degree of coordinated construction labor perhaps beyond one or a few households (see also Mills 1998:66-71).

As these brief examples illustrate, there are a number of potentially competing explanations for the distribution of room sizes in pueblo settlements across the Southwest. At the same time, the basic similarities in methods and materials employed for above ground pueblo rooms across the Cibola region suggest that differences in room size may be indicative of differences in social practices relating to construction or settlement more broadly. In the section below, I briefly describe the primary patterns of room size across the study area by sub-region and some of the potential explanations for these patterns.

In order to explore variation in room size across the greater Cibola region, I compiled available information on room dimensions for a large number of excavated sites across the core study area. These room dimensions were obtained only for fully excavated or exposed rooms from published sources, original notes, and scaled plan maps where available. Figure 7.1 displays mean room sizes by the

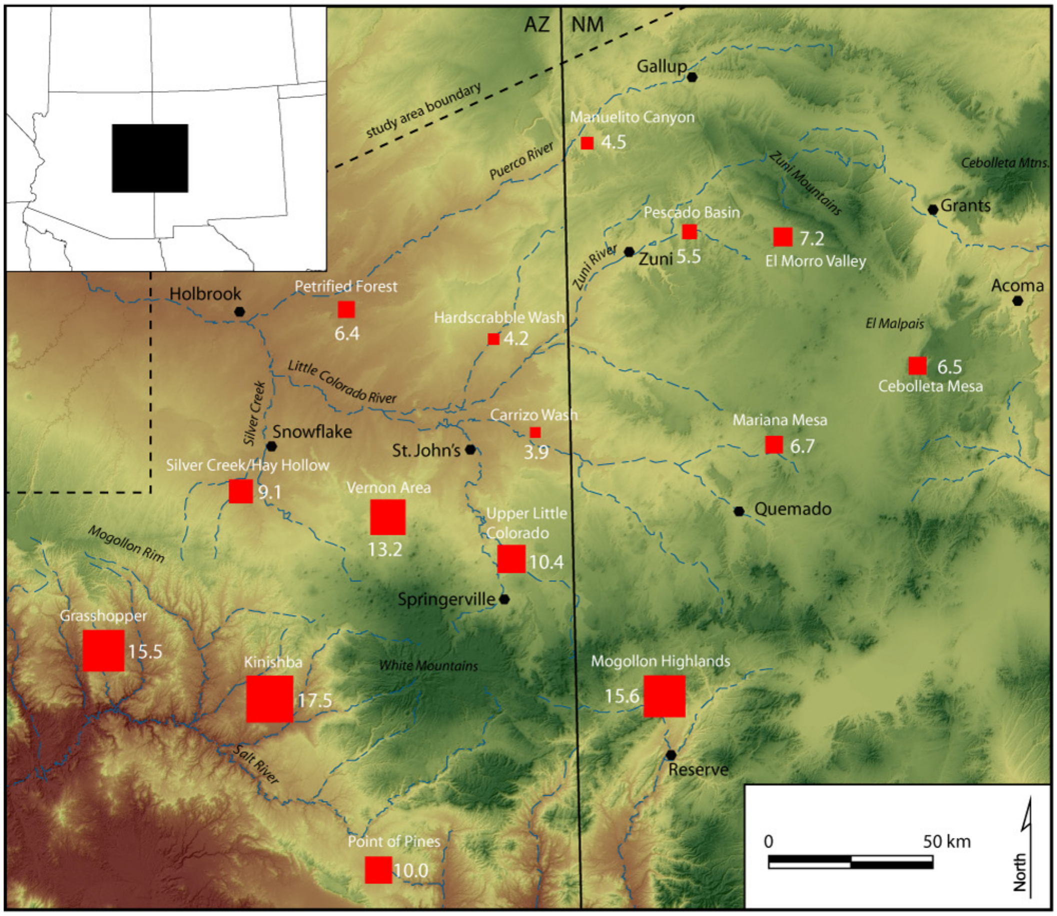


Figure 7.1. Mean room sizes (m^2) across the study area (the linear dimension of each square is proportional to the mean room size for the area).

sub-regions defined in Chapter 4 as well as for a few additional areas in the expanded study area where data were available. As this map illustrates, there is a general trend towards increasing room size from north to south. Not surprisingly, this is the same general trend documented by James (1994) using data gathered from across the Southwest as a whole. This regional scale pattern may suggest broad differences in household size or the specific construction methods used across the study area.

Since rooms can sometimes vary considerably in size within a single site it is also important to examine the distribution of room sizes. Figure 7.2 shows histograms of room size for each of the core sub-regions included in this study as well as for several portions of the expanded study area where data were available. The West Zuni region is excluded because very few rooms have been excavated in this area. As these histograms illustrate, room sizes in the northern Cibola region, including El Morro Valley, Pescado Basin, Carrizo Wash, and Mariana Mesa sub-regions within the core study area as well as the Cebolleta Mesa, Mount Taylor, Hardscrabble Wash, and Petrified Forest areas, are strongly unimodal with the vast majority of rooms less than 10 m^2 in area. Room sizes at settlements to the south, including sites in the Upper Little Colorado, Vernon Area, and Mogollon Highlands sub-regions in the core study area as well as the Silver Creek, the Hay Hollow Valley, and the Arizona Mountains areas, are somewhat more diverse with two or perhaps three modal sizes. Modes in the distribution of pueblo room sizes have frequently been interpreted as categories of rooms with different intended functions (e.g., \Hill 1970:37-47). Typically, the smallest rooms are assumed to have been used for storage, larger rooms for habitation, and the largest rooms for ceremonial purposes (see discussion in Cameron 1999:209-210). There are some data supporting this interpretation in the Cibola region as featureless rooms with other evidence for use as storage areas do tend to be smaller than rooms with intramural features. At the same time, however, the frequency of remodeling and repurposing of rooms muddles the relationship

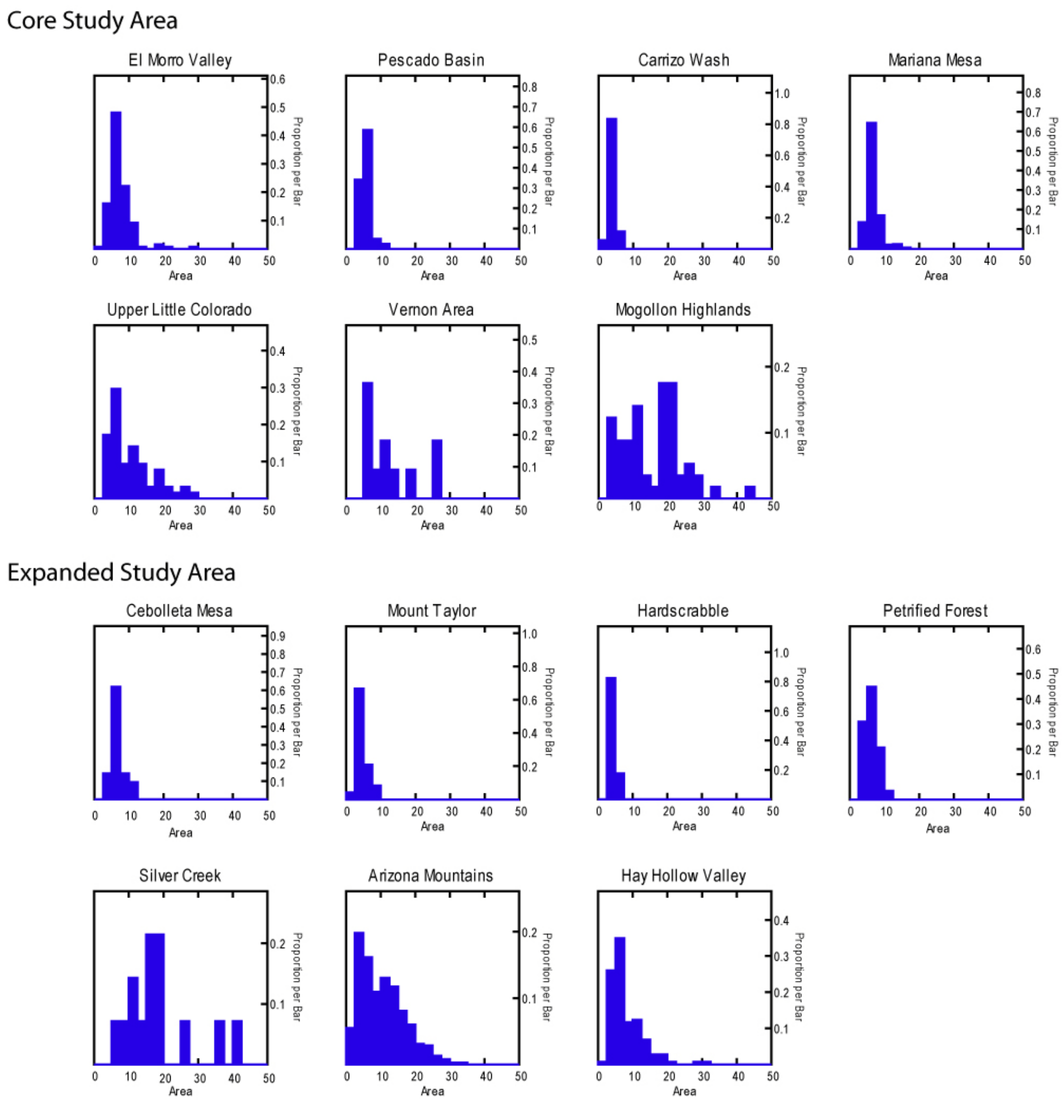


Figure 7.2. Histograms of room size (m^2) for major sub-regions and nearby areas.

between room size and function (Lowell 1991:36-38; Riggs 2001:176-178). At the very least, the differences between the sub-regions characterized by a single modal room size and the sub-regions with more diverse room sizes suggest that the inhabitants of various portions of the Cibola region were constructing dwellings using somewhat different methods or criteria for organizing domestic space. Interestingly, excluding the Mariana Mesa area, these two groups of sub-regions within the core portion of the study area defined based on room size distributions conform to the overarching groups defined in the previous chapter based on similarities in the methods used to produce utilitarian ceramic vessels.

As Cameron (1999:230) points out, however, it is also necessary to consider the prevalence of ladder type construction when interpreting room size distributions because ladder construction tends to produce rooms of similar sizes. The data necessary to directly quantify the frequency of ladder versus agglomerative construction across the entire Cibola region are not readily available because ladder construction has entered the literature relatively recently. A general examination of the plans of sites included in this study as well as other published site plans (e.g., Fowler et al. 1987; Kintigh 1985a; Morgan 1994) suggests, however, that ladder construction was much more prevalent in the sub-regions characterized by unimodal distribution of room sizes (El Morro Valley, Pescado Basin, Carrizo Wash, Mariana Mesa, Cebolleta Mesa) than in the other areas considered here.[1] Figure 7.3 illustrates representative plans of several of the largest sites from across the Cibola region. Note that sites from the northern sub-regions tend to be characterized by long, linear blocks of rooms whereas sites in the southern sub-regions tend to be much less regular in plan.

Cameron (1999:226-230; see also Mills 1998) goes on to argue that ladder type construction is an efficient means of building a large number of rooms simultaneously. The prevalence of ladder construction may provide evidence for the scale of coordinated effort that characterized the construction of dwellings

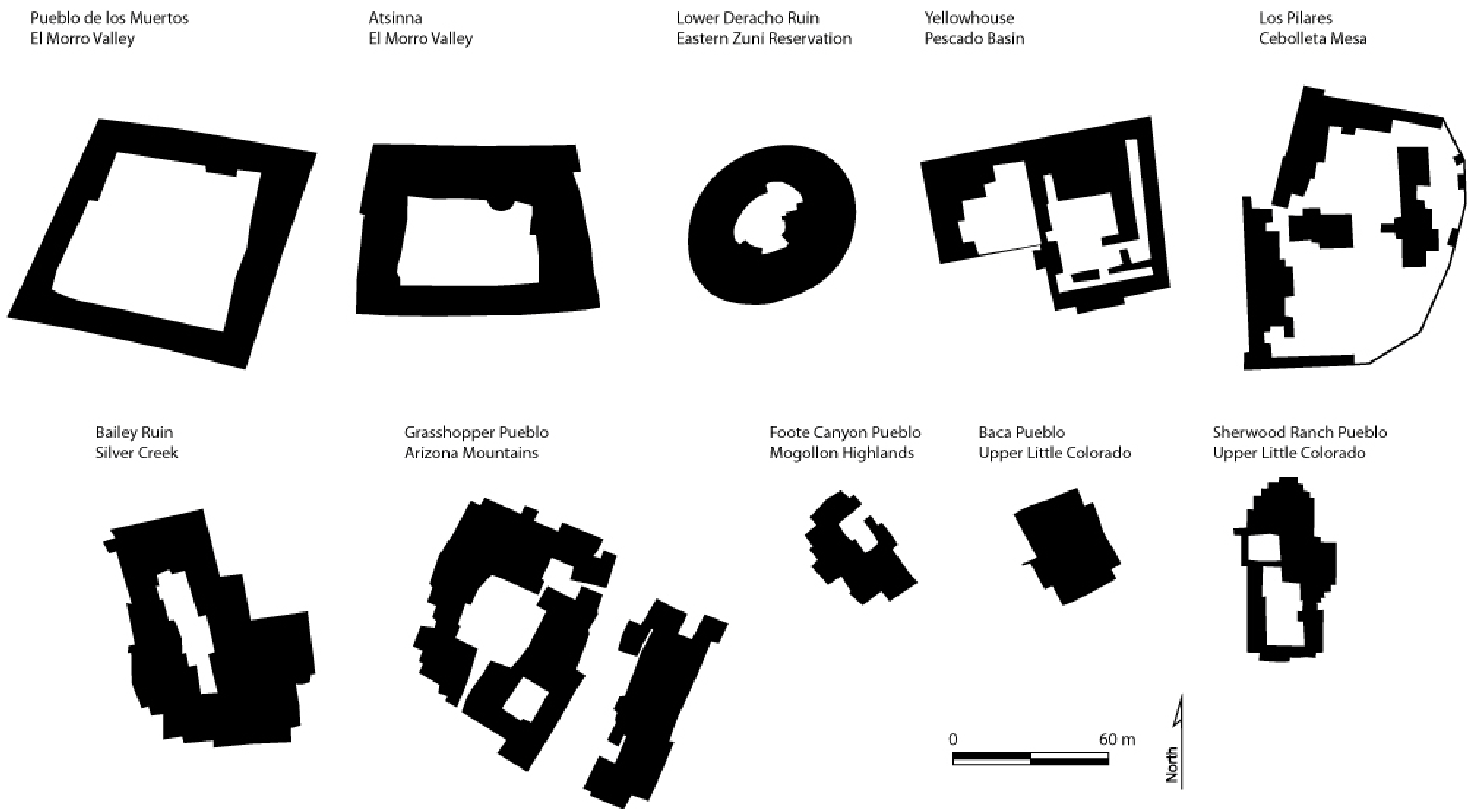


Figure 7.3. Examples of large settlements from the northern (top row) and southern (bottom row) Cibola region.

across the Cibola region. Thus, although differences in room size distributions may have some basis in specific construction practices among different social groups, the patterns noted here are also likely partly functions of the size of the groups inhabiting these areas. In line with Cameron's (1999) expectations, the sub-regions characterized by a prevalence of ladder construction, indicating a high degree of labor coordination, were also the portions of the Cibola region with the greatest population densities during the interval considered here (see Peeples and Schachner 2008; Wilcox et al. 2007:Figures 12.6-12.8). Modular, ladder constructions may have provided an efficient means for the large populations in these areas to accommodate increasing aggregation.

As the brief comments above suggest, the distribution of room sizes across the Cibola region varies substantially from place to place. Some of this variation may relate to the frequency of interactions among social groups with different notions of room construction techniques or domestic spatial organization. Alternatively, the rapid increases in population characterizing the northern sub-regions of the Cibola region during the period considered here may have prompted groups of individuals to coordinate construction efforts among larger social groups, resulting in a higher frequency of pueblos with ladder type construction and by extension, unimodal room size distributions. It is difficult to determine to what degree each of these processes may have been responsible for the differences in room construction across the Cibola region.

Intramural Domestic Architectural Features

Across the greater Cibola region, a wide variety of intramural architectural features have been recorded including formal hearths, mealing bins, ovens, storage bins/pits, post supports, stepped entryways, and pottery drying features. Although many such features are common across much of the Southwest, similarities and differences in the specific form and placement of these features within rooms provide an indication of patterns of shared technological learning frameworks across the study area. From this, I argue that similarities in the style and configuration of intramural domestic architectural features can be used as one proxy for strong relational connections among individuals and larger social groups across the Cibola region. For the purposes of this chapter, I focus primarily on hearths and mealing bins as these are the only features that have been consistently recorded with enough detail and enough frequency to allow for comparison at a regional scale. Because the total sample of excavated rooms at most settlements is relatively small, comparisons are limited to the sub-regional scale and not divided by time period.

Excavated hearths and mealing bins from settlements across the Cibola region take a wide variety of forms, sometimes even within a single settlement. These different forms relate variously to differences in the intended function of features (Kidder 1932:67-68; Lowell 1999), the size or composition of the social group using them (Ciolek-Torrello and Reid 1974; James 1994:250-252; Ortman 1998), or differences in cuisine (Crown 2000:241-249). In the context of this study, I interpret similarities in the form or placement of heating, cooking, and mealing features, which may be influenced by any or all of the factors listed above, as broadly indicative of similarities in daily activities revolving around food preparation. Practices relating to foodways are particularly useful avenues through which to explore relationships among social groups because cuisine tends to be conservative, learned through direct face-to-face interaction, and closely related to group membership (Clark 2001:12-22). Thus, in this study, similarities in attributes of hearths and mealing bins are interpreted as evidence for the nature of relational connections among individuals and social groups across the study area.

Hearth Form and Placement

Interior domestic hearths found in the Cibola region heated interior spaces, provided light, and were used for food preparation. Several different forms of hearths have been recorded at settlements across the study area, and available paleoethnobotanical as well as ethnohistoric data suggest that different forms of these features may have been used for somewhat different purposes including various styles of wet or dry cooking (e.g., Cushing 1920; Lowell 1999). In addition, there is considerable variation in the placement of hearth features within rooms at settlements across the study area. The location of interior hearths would have structured the interactions among members of the households occupying those spaces to some degree. Thus, similarities in the design and placement of hearths may provide an indication of underlying similarities in the organization of domestic activities.

In order to characterize variation in hearth form, a series of categories of common feature types were defined based on a general assessment of available descriptions, feature plan illustrations, and photographs (Table 7.2; see also Hegmon et al. 1998). In some cases, these categories could be parsed more finely at specific settlements, but the groups used here were designed to allow for consistent application across all sites included in this study. The analyses presented below include only formal hearths and exclude informal burned floor areas as such features have not been consistently recorded during excavations across the Cibola region. In addition to placing excavated hearths into these broad form categories, the locations of hearths within rooms were recorded in three broad categories: along a wall, in a room corner, or in the room interior.[2] The West Zuni sub-region is excluded from the analyses presented below because data were available for only a single excavated hearth from this area. Due to the relatively small sample sizes available for most regions, sites were not divided by time period. Additional analyses not described in detail here suggest, however, that patterns of hearth design and placement were highly consistent in each sub-region with data from multiple time periods.

Figure 7.4 displays the proportions of each of the hearth types defined above for all sub-regions included in this study area. By far, the most common is a formal rectangular hearth lined with upright slabs. This type of feature accounts for a majority of excavated features in all sub-regions except for the Vernon area, but the Vernon area sample is small so little confidence can be placed in any interpretations based on this difference. Rectangular, slab-lined hearths have been

Table 7.2. Categories of hearth form.

Hearth Style		Description
A	Rectangular slab-lined	Rectangular pit excavated into the floor surface with stone slab sides that extend well above the floor. Many examples also have slab-lined bottoms.
B	Circular/irregular slab-lined	Circular or irregular pit excavated into floor surface with stone slab sides that extend well above the floor. Many examples also have slab-lined bottoms.
C	Clay lined pit with stone rim	Pit of any shape excavated in the floor and lined with a thick layer of clay. The exterior rim of the pit may be lined by horizontal slabs or other small stones.
D	Clay lined pit, no rim	Pit of any shape excavated into the floor and lined with a thick layer of clay.
E	Pit with raised adobe coping	Pit of any shape excavated into the floor with a raised adobe coping that extends well above the floor surface.

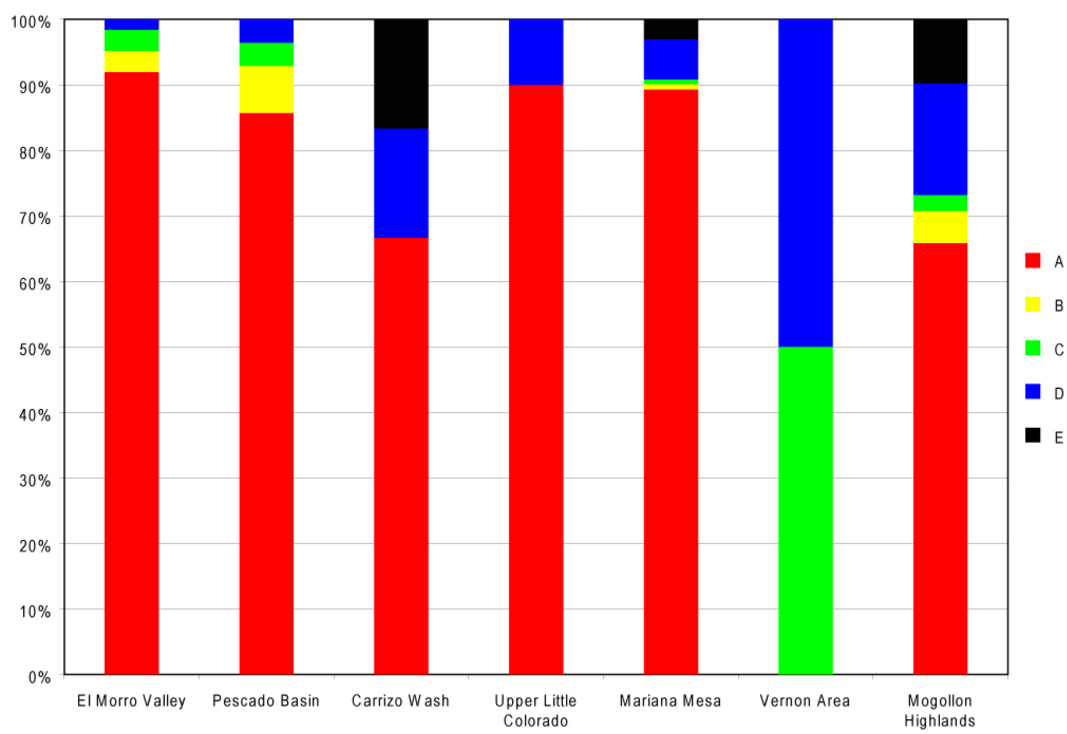


Figure 7.4. Percentages of each hearth type by sub-region (letters correspond to Table 7.2).

interpreted as cooking features that are particularly well suited to pot boiling (Lowell 1999:460-462). Thus, the widespread distribution of this particular kind of feature during the period in question may suggest broad similarities in methods food preparation and the degree of agricultural reliance across much of the region.

The proportions of other hearth types across the study area are generally similar with the Mogollon Highlands and Carrizo Wash areas representing possible exceptions. In the available sample from both of these sub-regions, clay lined hearths and hearths with adobe copings are more common than in other sub-regions. The size and contents of these clay and adobe features suggest that they were also used primarily for food preparation (see descriptions in Martin et al. 1952, 1956; Rinaldo 1959; Westfall 1981). The differences in form may indicate different cultural notions of proper hearth construction methods or differences in the intended use. Overall, however, the overwhelming dominance of rectangular, slab-lined hearths across the entire Cibola region suggests that the primary feature most commonly used for daily cooking did not differ dramatically across the study area. This pattern is also consistent with published information from the expanded study area (see plan maps in Burton 1990; Dittert 1959; Hill 1970; Lowell 1991; Mills 1999; Riggs 2001; Ruppé 1990).

Patterns of hearth placement show substantially more variation than hearth form. Figure 7.5 shows the frequency of hearths found in each of the three general location categories for the core study area as well as for several portions of the expanded study area. As this map illustrates, in most portions of the study area north and east of Carrizo Wash, hearths are typically placed along room walls or

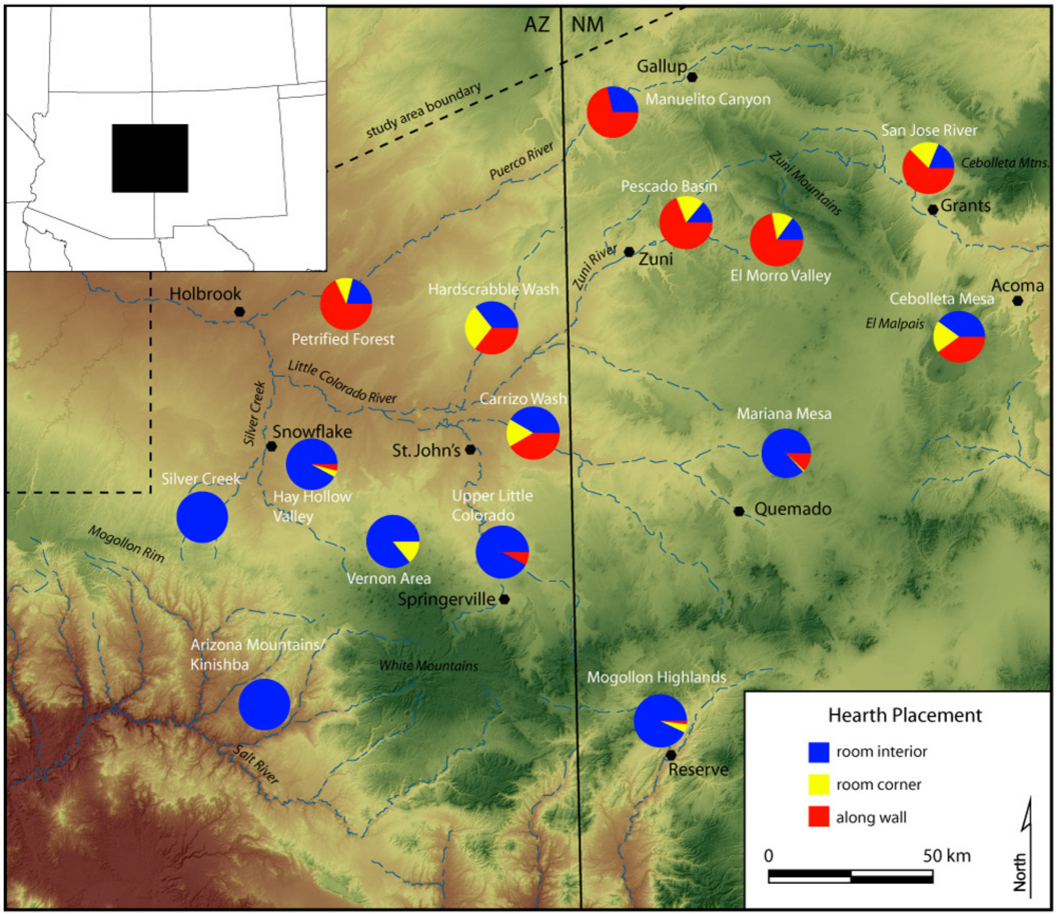


Figure 7.5. Map showing percentages of hearth placement categories across the region.

in room corners. In many cases, one or more walls of a hearth are actually formed by the walls of the room itself. Conversely, in the southern and western portions of the study area hearths are typically located away from walls and in the interiors of rooms, usually near the room center. The Mariana Mesa sub-region in the eastern Cibola region is also dominated by hearths constructed in room interiors in contrast to other nearby areas. Importantly, there is somewhat more diversity in hearth placement in areas along the edges of the two general groups including the Carrizo Wash, Hardscrabble Wash, and Cebolleta Mesa areas, perhaps suggesting that individuals in these areas variously ascribed to methods of features construction dominant to the north and to the south respectively.[3]

Differences in the placement of hearths within rooms likely would have structured interactions among the members of households occupying these rooms to some degree. Cooking over wood fires using clay pots can be a time consuming endeavor (e.g., Cushing 1920:289-316). In the northern portions of the study area, where hearths are typically found against walls or in corners, the members of the household responsible for preparing food may have spent long periods of time focused on maintaining fires, potentially isolated from other activities occurring within the same room or adjacent habitation rooms. In the southern and western portions of the study area where hearths are usually centrally located in large rooms, individuals may have more easily engaged with others while performing daily cooking activities. Although it is virtually impossible to determine how space was allocated as tasks were being performed, such differences in the locations of features may indicate underlying differences in the potential for socialization revolving around the common daily activity of cooking.

An additional consideration with regard to the pattern of hearth placement is the relationship between feature placement and room size. It could be argued that hearths are more likely to be found along walls or in corners in smaller rooms with less interior space. As Figure 7.6 shows, when considering the study area as a whole, it is indeed the case that rooms with hearths along walls or in corners do tend to be somewhat smaller than rooms with interior hearths. A general assessment of the data included here divided by sub-region suggests,

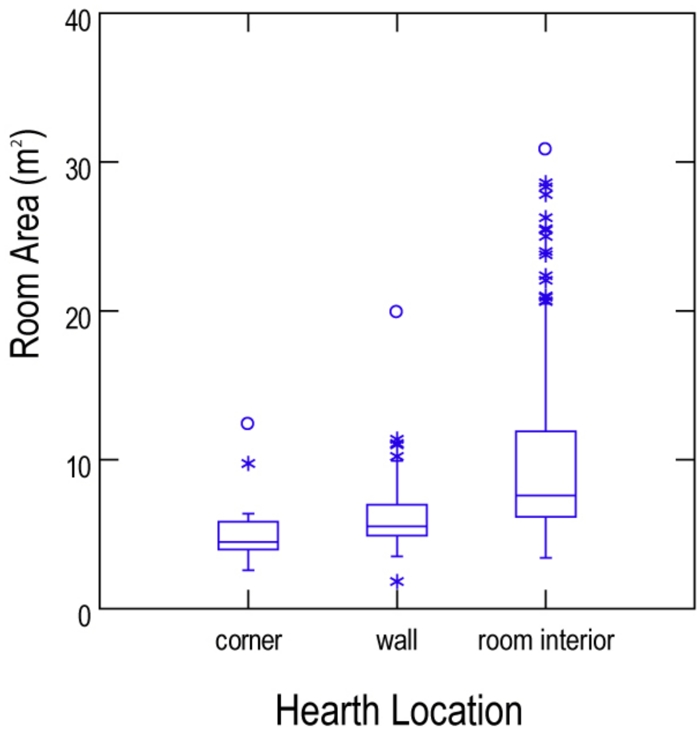


Figure 7.6. Boxplots of room area for each hearth location category.

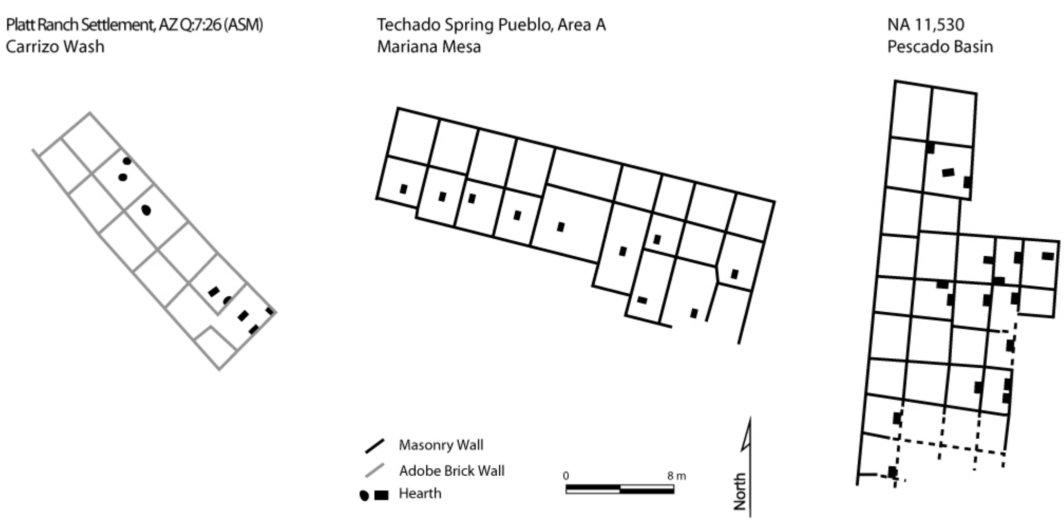


Figure 7.7. Examples of structures with similar room sizes but different patterns of hearth placement.

however, that there is no consistent patterned relationship between room size and feature placement when each sub-region is considered separately. For example, 93% of excavated hearths from the Mariana Mesa region are located in room interiors whereas only 14% of hearths from the El Morro Valley and Pescado Basin are in room interiors. All of these sub-regions have similar mean room sizes and similar, unimodal distributions of room sizes. Figure 7.7 illustrates this point further. The three site plans shown in this figure are all characterized by rooms of similar sizes, but quite different patterns of hearth placement. This suggests that the regional patterns of hearth placement documented above are more likely related to specific technological practices or cultural notions of the use of space than any physical constraints on feature placement.

Grinding Facility Form and Size

Across the prehistoric American Southwest, the primary method for processing corn for consumption was grinding kernels into flour using a mano and metate. During the interval considered in this study, grinding facilities most often consisted of slab metates set into some form of permanent mealing facility, often with an associated flour receptacle. Such permanent grinding facilities are particularly well suited to efficiently grinding corn for long periods of time (Adams 1993:334; see also Crown 2000:243-249). Historically, Pueblo women spent as much as three to five hours per day grinding corn in similar permanent facilities (Cushing 1920:289-316). Osteological and other evidence suggest that women were engaged in a similar level and intensity of corn grinding in the prehistoric past (see discussion in Spielmann 1995:96). The time commitment involved preparing corn meal emphasizes the importance of such features in the food system and the daily activities of women in general.

Following the analysis of hearth form described above, several categories of grinding facilities were defined based on available illustrations, photographs, and notes (see Table 7.3). These categories include only formal facilities such as stone or adobe lined bins and flour receptacles embedded in floor surfaces. Rooms with loose metates that are not part of any formal grinding facility and rooms with no identified metates were grouped into a single category. This coding scheme may have the effect of over estimating the proportion of non-grinding rooms. In general, however, loose metates without formal bins or flour receptacles are rare across the Cibola region during the period considered here, so most rooms with no formal grinding facilities were likely spaces where grinding probably did not take place on a regular basis.

Figure 7.8 shows the proportions of common mealing bin forms, including rooms with no formal grinding facilities. The West Zuni and Vernon sub-regions have been omitted because only a single grinding facility has been formally documented in each of these areas. Across the core portion of the study area, although most rooms have no formal grinding facilities, rooms that do are dominated by upright slab-lined bins. The Mogollon Highlands sub-region is unique, however, in that it is the only area within the larger study area where ceramic bowls set into the floor as flour receptacles have been documented. This particular type of mealing feature is also found in earlier and contemporaneous sites in other areas to the south including the Mimbres Valley, along the Upper

Table 7.3. Categories of grinding facility form.

	Grinding Facility Style	Description
A	No permanent grinding facility	Fully excavated and documented rooms with no formal grinding facilities or only loose metates present.
B	Slab-lined bin	Grinding facility consisting of one or more slab metates with an upright slab-lined bin area.
C	Bin with adobe coping	Grinding facility consisting of one or more slab metates with adobe coping dividers.
D	Bowl embedded in floor	Grinding facility consisting of one ore more bowls embedded in the floor surface to be used as flour receptacles.
E	Slab-lined bin and bowl embedded in floor	Grinding facility consisting of one or more slab metates with an upright slab lined bin area and associated bowls embedded in the floor for use as flour receptacles.

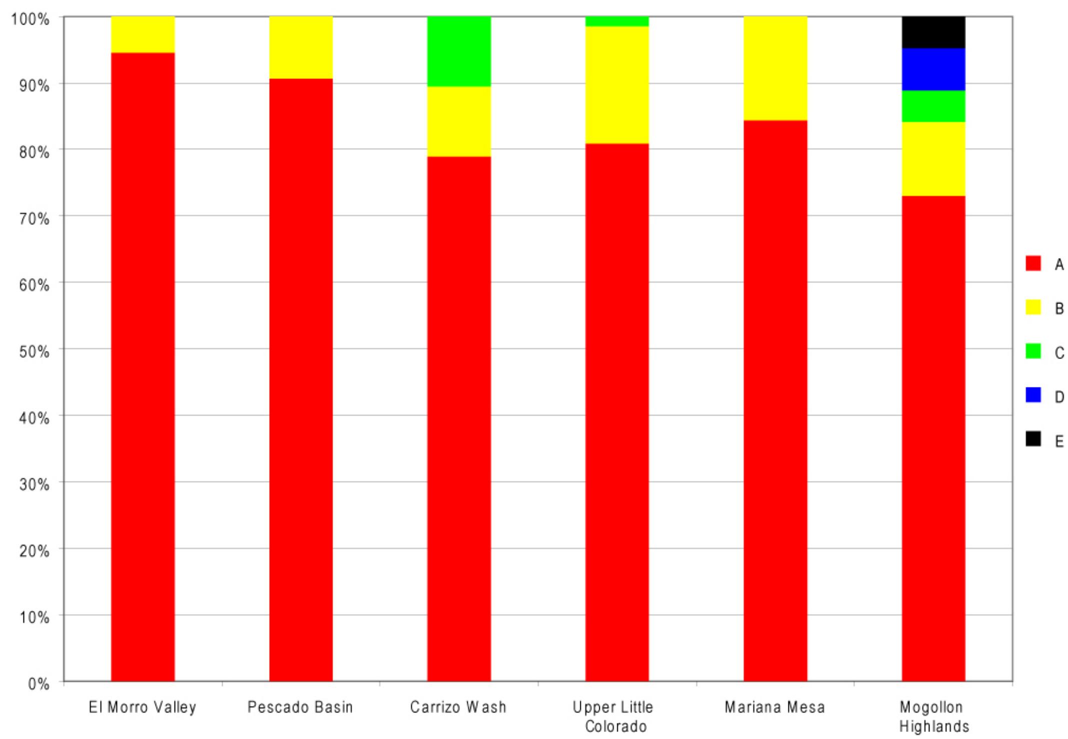


Figure 7.8. Percentages of each grinding facility category (including rooms with no bins) by sub-region (letters correspond to Table 7.3).

Gila River near Cliff, New Mexico, and along the eastern slopes of the Black Range (e.g., Hegmon et al. 1998).

In addition, as Figure 7.8 also illustrates, formal mealing bins are found in a somewhat smaller proportion of rooms in settlements in the El Morro Valley and Pescado Basin sub-regions than in areas to the south (see also James 1994:255-260). It could be argued that the lower frequency of mealing bins in the excavated sample from the El Morro Valley and Pescado Basin areas may be due, in part, to the greater frequency of upper story rooms in these areas. Among the historic western Pueblos, grinding did sometimes take place in upper story habitation rooms where bins would be less likely to preserve (Adams 1993:Figure 1; see also Brew 1937:Figure 2; Mindeleff 1891:Plate LXXIX). At this point, however, there is little direct evidence for the presence of formal grinding facilities either on roofs or in upper story rooms (see also James 1994:253-254) so differences in the frequency of recorded features likely instead indicate a distinction in the use of space for grinding activities across the study area.[4]

Another attribute of grinding facilities, which may indicate similarities and differences in the organization of daily food preparation activities across the study area, is their size in terms of the number of bins within a single context. Mealing features often occur in groups of two to as many as eight within a single interior architectural space. Early historic accounts of such bin sets have often attributed each separate metate to a different stage of the grinding process with surfaces graded from coarse to fine indicating early to late stage grinding (Baxter 1882:83-

84; Kidder 1932:67-68; Mindeleff 1891:208-214). Although this functional interpretation may have merit in certain contexts, other researchers have argued the size of grinding facilities may instead relate to the size of the domestic unit involved in corn grinding (Adams 1993:41-42; James 1994:250-253; Ortman 1998).

Figure 7.9 shows the proportions of grinding facilities of various sizes across the study area. As this plot illustrates, in the El Morro Valley and Pescado Basin sub-regions all recorded grinding facilities consist of three or fewer mealing bins. To the south in the Carrizo Wash, Mogollon Highlands, Mariana Mesa, and Upper Little Colorado areas, grinding facilities containing four or more mealing bins are also common. This suggests that daily grinding activities preformed by the inhabitants of settlements in the southern portions of the study area may have more frequently involved somewhat larger groups of women working together simultaneously. The higher number of bins per architectural unit to the south may also suggest differences in household size across the study area (a possibility also suggested by patterns of room size), or differences in the organization of women's labor. Some of the largest grinding facilities in the Mariana Mesa area contain as many as eight bins, perhaps suggesting specialization in food preparation by some women within these communities (see similar suggestion by Crown 2000:247-248 regarding Chaco Canyon).

Across the greater Southwest as a whole, Ortman (1998) documented a trend in the size of grinding facilities through time. Specifically, he argues that the

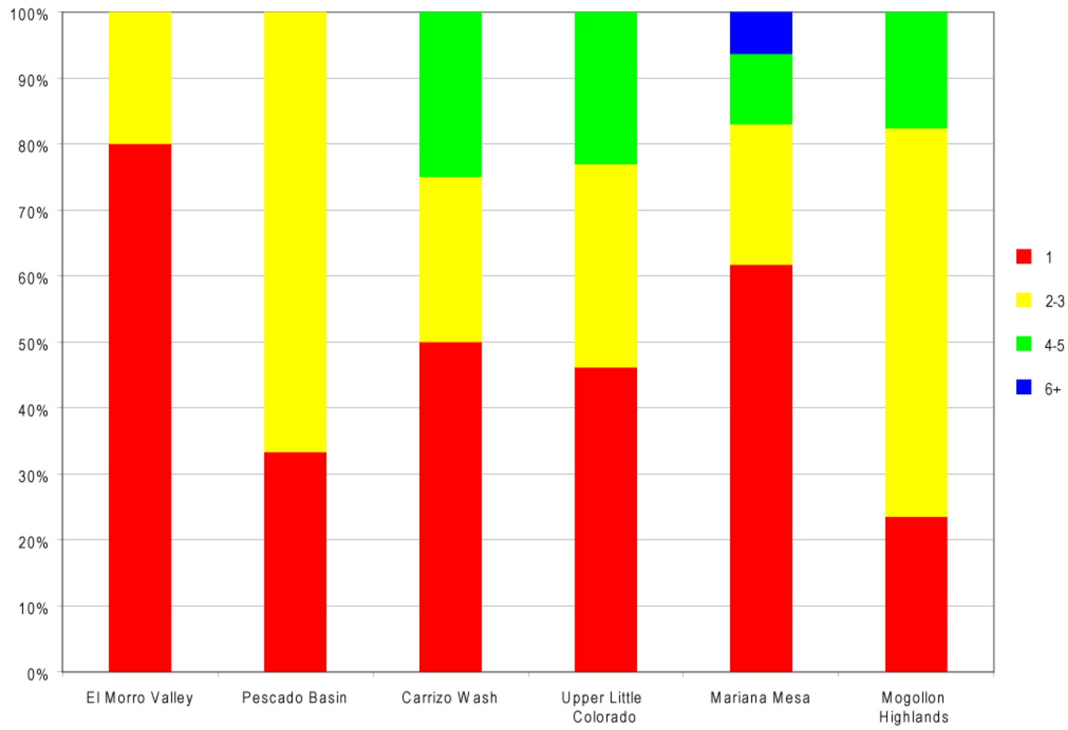


Figure 7.9. Percentages of grinding facilities of varying sizes by sub-region.

average number of bins per context decreased in most areas across the Pueblo III to Pueblo IV transition. Ortman suggests that this change may reflect the decreasing importance of extended family residential units in the context of large, Pueblo IV villages. However, Ortman notes (1998:173) that this macro-regional pattern does not play out particularly well in the central portion of the Cibola region around Zuni and Mariana Mesa, a finding which the additional data collected for this study support. In the southern and western portions of the study area including the Upper Little Colorado, the Mogollon Highlands, Silver Creek, and the Arizona Mountains area, however, a pronounced decrease in grinding facility size through time does occur (Ortman 1998:Table 9.2). This may suggest differences in the organization of residential units across the Pueblo III to Pueblo IV transition between different portions of the Cibola region.

Wall Construction Methods

The vast majority of pueblo rooms in the Cibola region were constructed using some form of masonry. The style of masonry varied from roughly shaped cobbles set in substantial amounts of mortar to well-shaped banded wall rocks with prepared interior wall faces. Some of the variation in wall construction from place to place is likely due to the availability of materials appropriate for cobble, slab, or shaped masonry construction while some differences may also represent culturally specific technological building practices. However, the use of adobe, which is possible virtually anywhere clay and water are available, cannot easily be explained as simply a function of material availability. The distribution of this relatively rare construction method may provide insights into patterns of interaction and population movement across the study area.

Two basic methods of adobe construction have been documented in the Cibola region; coursed adobe construction and adobe brick construction. Coursed adobe walls are constructed by building up a thick mud in layers, allowing each layer to dry before applying the next (Cameron 1999:204; Stubbs and Stallings 1953:25-26). Coursed adobe construction is known from many portions of the greater Southwest but is particularly prevalent in the Hohokam region of Arizona, in the northern Rio Grande, and in the Mimbres region after the mid 12th century (Cameron 1998). Prehispanic adobe bricks in the Southwest were produced from a clay matrix similar in consistency to that used for pottery. These bricks were either hand formed or formed in a mold and then air dried rather than fired. Adobe brick construction has a somewhat more limited distribution than coursed adobe walls and has been documented only in areas above the Mogollon Rim, primarily in northeastern Arizona and along the Little Colorado River Valley; including portions of the Cibola region (see Gann 1996). Both adobe bricks and coursed adobe walls appear to be most common in contexts dating after about A.D. 1150-1200 in and around the Cibola region although there are earlier examples in some areas (see Cameron 1998).

Within the core portion of the study area, there are only two settlements with direct evidence for adobe brick construction. These are the Platt Ranch settlement in the Carrizo Wash area (Westfall 1981:Figure 46) and the Horse Camp Mill site in the Mariana Mesa area (McGimsey 1980:45-46). Adobe brick construction is also known from a few sites to the west in the expanded study area including Fourmile Ruin in the Silver Creek area (Van Keuren 2006:5), at least two of the late Pueblo IV period villages of the Petrified Forest area (Stone Axe Pueblo and Wallace Tank Pueblo; see Schachner 2010), as well as just outside of the study area in the Homol'ovi pueblos near Winslow, Arizona (Gann 1995). Walls constructed of coursed adobe have been documented at the Techado Spring site in the Mariana Mesa area (Smith et al. 2009:17-18), at several sites the southern Cebolleta Mesa area (Dittert 1959:234-235; Ruppé 1990), as well as in the Homol'ovi area west of the study area.[5] At almost all of the sites where coursed adobe or adobe brick architecture is present, other portions of the same structures are constructed from stone masonry. This co-association of adobe and masonry suggests that material availability was not the primary motive for adobe construction and, instead, that these various forms of adobe construction were likely culturally specific building practices.

Across the Cibola region and slightly beyond, sites with evidence for coursed adobe or adobe brick construction primarily fall along an west to east line running roughly from Winslow, Arizona along the Little Colorado and Carrizo Wash to Mariana Mesa and into the southern Cebolleta Mesa area (Figure 7.10). The appearance of adobe brick and coursed adobe architecture in the 13th century in the Carrizo Wash and Mariana Mesa sub-regions may suggest interaction or historical ties between settlements in these areas and the more western portions of the Cibola region. In Chapter 6 I argued, based on ceramic technological similarities, that the Mariana Mesa sub-region in particular may have been inhabited by a diverse group of migrants, including many people from the southern and western portions of the study area. The diversity of methods used for wall construction in the Mariana Mesa area provides additional evidence for this scenario (see McGimsey 1980; Smith et al. 2009). Importantly, distinct wall construction styles are spatially contiguous at several well documented large settlements in the Mariana Mesa area (Figure 7.11; see also McGimsey 1980; Smith et al. 2009), suggesting that segments of settlements with multiple construction styles may represent the residences of small groups of households with diverse origins (Smith et al. 2009:35-73). The diversity of architectural styles, including both coursed adobe and adobe brick architecture in the Mariana

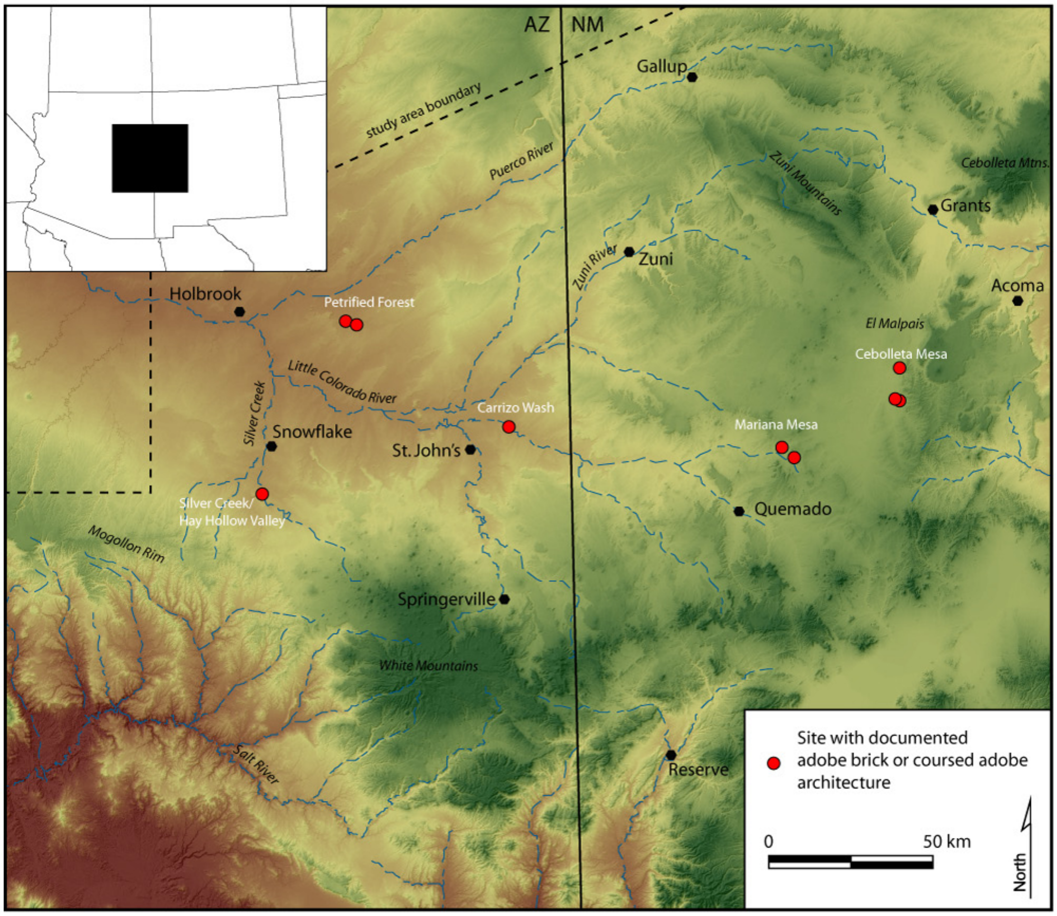


Figure 7.10. Map showing known locations of adobe brick or coursed adobe architecture in the Cibola region during the Pueblo III and Pueblo IV periods.

Mesa area provides some additional evidence for the hypothesized connections from west to east and patterns of migration across the Cibola region.

Summary and Conclusions

The sections above provide a general overview of several aspects of domestic architectural construction that suggest patterns of frequent interaction and historical connections, and by extension relational connections, among the inhabitants of different portions of the study area. Some of the patterned variation noted here is difficult to interpret due to problems of equifinality. For example,

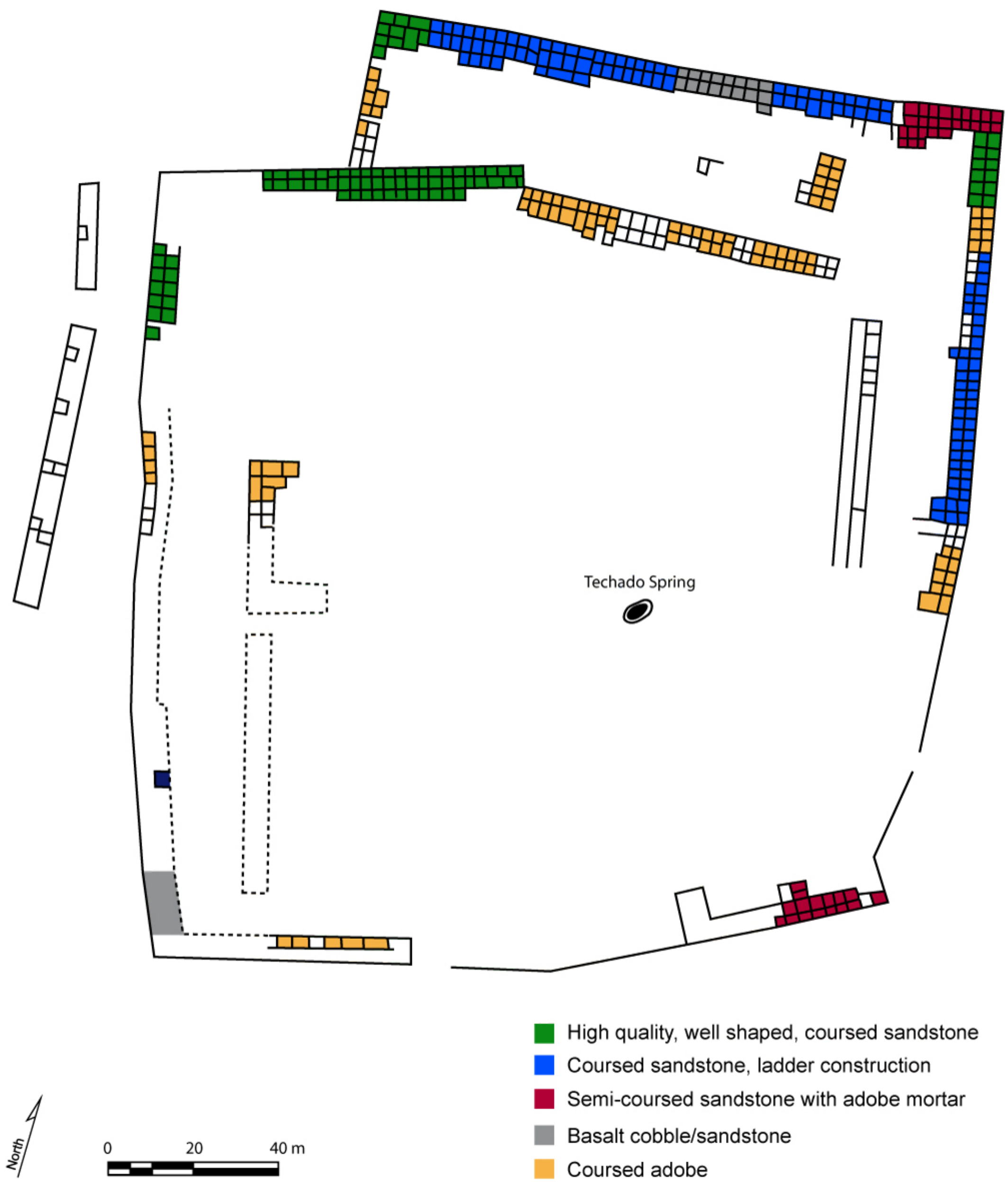


Figure 7.11. Map of Techado Spring Pueblo in the Mariana Mesa sub-region showing the distributions of different styles of construction (courtesy of Jimmy Smith).

the mean and distribution of room sizes across the study area may variously be due to differences in household size, particular technological practices related to domestic construction, or other factors such as the size or organization of construction task groups. Other variables, such as the form, size, and placement of domestic architectural features, are more easily interpreted as products of specific technological decisions among functional equivalents. In this final section, I briefly summarize some of the results discussed above and then place these results within the context of the analysis of ceramic technological similarity presented in the previous chapter.

Although hearth forms are generally similar across most of the study area, patterns of hearth placement differ dramatically from place to place. In the northern portions of the study area hearths along walls and in corners are most common, whereas in the southern portions of the study area, including the Mariana Mesa sub-region, hearths are usually in room interiors (usually centrally located). This pattern is not simply a product of room size and may represent a fundamental difference in notions of domestic spatial organization among the inhabitants of different portions of the study area. The consistent differences between these two large areas suggest that the inhabitants of these zones maintained the strongest relational connections with others within the same zone. Importantly, sites in areas along the edges of the two broad zones are somewhat more diverse in terms of the design and placement of intramural domestic features, perhaps suggesting that the boundaries between the two strong networks of relational connections were relatively permeable.

Similarly, although the forms of grinding facilities across the study area are fairly similar among all sub-regions (excepting the Mogollon Highlands) there are slight differences in the frequency and size of these features which may provide some evidence for the directionality of interaction across the region.

Specifically, bins are somewhat less frequent in the El Morro Valley and Pescado Basin sub-regions than in the areas to the south for which data are available (Upper Little Colorado, Carrizo Wash, Mariana Mesa, and the Mogollon Highlands). Furthermore, in the El Morro Valley and Pescado Basin, documented grinding facilities are limited to groups of three or fewer bins whereas in areas to the south, grinding facilities including four or more bins are also common. These differences in the frequency and size of grinding facilities suggest that the northern and southern portions of the study area may have also been characterized by broad differences in the organization of women's labor. This is suggestive of differences in social organization among the inhabitants of these different portions of the Cibola region.

Wall construction methods vary considerably across the Cibola region as a whole, but for the most part, it is difficult to separate variation due to material availability from variation due to specific technological practices. The distribution of adobe construction, however, may provide one indication of a specific technological practice that suggests interaction or historical connections among populations across the study area. Coursed adobe and adobe brick construction are rare, but have primarily been documented along a west-east line running from the Homol'ovi area to the Mariana Mesa and the southern Cebolleta Mesa areas. The patterned distribution of adobe architecture across the study area provides evidence for strong connections among the inhabitants of settlements in these areas, possibly established through migration from west to east across the Cibola region.

Overall, the patterns of domestic architectural feature forms, frequency, and placement across the Cibola region for areas with available data suggest that the core study area can essentially be divided into two groups of sub-regions: 1) the El Morro Valley and Pescado Basin to the north and 2) the Upper Little Colorado, Mariana Mesa, Vernon Area, and Mogollon Highlands to the south. The Carrizo Wash area appears to be somewhat transitional in that individual sites contain attributes that typically dominate areas to the north and to the south in roughly equal proportions. The groups of sub-regions defined here based on architectural data coincide well with the groups of sub-regions defined in the previous chapter based on ceramic technological similarities (see Figure 6.7). Indeed, in terms of both the ceramic technological data and domestic architectural data, the Carrizo Wash sub-region is somewhat transitional between dominant patterns to the north and to the south. The similarities in the patterns of ceramic production and domestic architectural construction suggest that both of these domestic crafts were likely taught and learned through similar vectors of strong relational connections.

Chapter 7 Notes

[1] This pattern may change through time, however. Mills (1998) notes that prior to about A.D. 1325, settlements in the Silver Creek area are characterized by agglomerative construction whereas during the later 14th century, ladder construction is more common. In the primary portion of the study area considered here, the distinction between areas dominated by ladder type construction and areas dominated by sites with agglomerative layouts appears to have been in place throughout the period considered in this study.

[2] Hearths were categorized as "along a wall" if either one side of the hearth was formed by the wall of the room itself or, if the hearth was less than approximately 20 cm from the wall. Hearths defined as being in a "room corner" when two sides of the hearth were either formed by the wall of the room or less than 20 cm from two walls. Hearths were defined as "room interior" when they did not fit into the categories described above. The vast majority of “room interior” hearths were roughly centrally located.

[3] Patterns of hearth placement change dramatically across the Protohistoric transition in the Zuni region (ca. A.D. 1450) with the vast majority of hearths at Hawikku located in room centers. Interestingly, the Protohistoric transition at Zuni has often been associated, based on several different lines of evidence, with the arrival of migrants from many of the areas to the south (Mills 2007b; Peeples 2010; Schachner 2006) where central hearth placement was the dominant pattern.

[4] It is also possible that lower frequency of grinding facilities in the El Morro Valley and Pescado Basin areas may be due to a greater frequency of extramural grinding areas. Although such features are known from the Homol'ovi area (Ortman 1998:179), there is currently little evidence for permanent outdoor grinding facilities in the Cibola region.

[5] A bit further afield, coursed adobe construction appears to have also been common at sites dominated by Socorro Black-on-white just east of the Acoma/Cebolleta area (Wozniak and Marshall 1991:6.40-6.42; Wendorf 1956).

Chapter 8:

CERAMIC DESIGN AND CATEGORICAL IDENITITIES

There is a voluminous literature in archaeology focused on stylistic variation in material culture as well as the relationships between different kinds of style and social identities (e.g., Bowser 2000; Conkey and Hastorf 1990; Hegmon 1992, 1998, 2000; Sackett 1977; Wiessner 1983; Wobst 1977). This body of research suggests that, although the specific factors that drive stylistic similarities and differences in a particular social setting are quite diverse, there are also certain regularities that to cross-cut a wide variety of contexts (Hegmon 1998:277). For example, a large body of ethnoarchaeological literature suggests that highly visible objects or designs found in public settings are often used to actively express social identities (e.g., Bowser 2000; Carr 1995; Hodder 1982; Mills 2007a, 2007b; Wobst 1977). Furthermore, design styles that span multiple media (e.g., ceramics, rock art, murals, clothing, etc.) are also often symbolically charged (see DeBoer 1991 on pervasive styles). Such broad regularities suggest that, through a careful contextualization of production and use, it may be possible to identify certain kinds of objects or designs which were actively manipulated as a means to express social distinctions in a given context.

As discussed in Chapter 2, categorical identification refers to the process through which people identify with larger groups based on perceived similarities with social roles or categories to which one can belong. As categorical distinctions are not necessarily built out of direct and frequent interactions among people, such identities must be symbolized in order to facilitate recognition among members and non-members of categorical social groups. The process of symbolization often involves the kinds of active expressions of identities through material culture described above. From this, I argue that patterns of similarity and difference in highly visible objects and designs, when appropriately contextualized, can be used as one indication of patterns of shared categorical identities at various social and spatial scales.

This chapter presents a series of related ceramic stylistic analyses directed at documenting the strongest patterns of shared categorical expression and identification across the Cibola region during the Pueblo III to Pueblo IV transition. Through the discussion below, I argue that patterns of similarity in ceramic design, in particular for large polychrome serving bowls used and exchanged in the context of public gatherings (see Chapter 5), provide evidence for public expressions of categorical identities among the inhabitants of various portions of the study area. Importantly, the analyses below suggest that the geographic and demographic scales at which categorical identities were expressed changed dramatically across the Pueblo III to Pueblo IV transition. This change in the scale of shared categorical expressions suggests that the social scale or distinctiveness of categorical groups likely also changed across the late thirteenth century social transformation. Importantly, different portions of the Cibola region were marked by different trajectories of change through time.

Painted Ceramics in the Cibola Region

A wide variety of painted ceramics types were produced across the greater Cibola region during the period considered in this study. In this section, I provide an overview of several of the wares commonly found in the core study area and describe a few broader temporal trends in painted ceramics across the Cibola Region as background for the subsequent analyses. Additional details and wares not common in the core study area are relegated to the cited resources provided in Table 8.1. As the descriptions below illustrate, painted ceramics produced and used in the Cibola region became both more visually distinctive and regionally diverse across the Pueblo III to Pueblo IV transition.

Cibola White Ware

Cibola White Ware was produced in the greater Cibola region beginning by about A.D. 550 and continuing at least until 1325 (see Goetze and Mills 1993; Hays-Gilpin and van Hartesveldt 1998; Mills and Herr 1999).These vessels were produced using light-firing clays tempered with sherd fragments or a combination of sherd and sand. Designs were painted in black mineral paint primarily on the interiors of bowls and the exteriors of jars. Design styles were quite variable from place to place (see Cibola White Ware Conference 1958) but, during the period considered in this study, most often included combinations of solid and hatched design elements (see Carlson 1970; Figure 8.1). As discussed further in Chapters 4 and 5, Cibola White Ware was produced across most of the greater Cibola region, probably excluding a few areas south of the Mogollon Rim (Wilson 1994, 2007; Wilson and Sevrets 1999). In general, Cibola White Ware declines in frequency throughout the Pueblo III and Pueblo IV period as it is gradually replaced by the closely related red ware and polychrome types described below.

Table 8.1. Date ranges and references for Pueblo III and Pueblo IV period wares/types in the greater Cibola region.

Ware/Series	Type	Date Range (A.D.)	Reference
Cibola White Ware			
	Reserve Black-on-white	1100-1200	Hays-Gilpin and van Hartesveldt 1998
	Snowflake Black-on-white	1100-1275	Hays-Gilpin and van Hartesveldt 1998
	Tularosa Black-on-white	1175-1300	Hays-Gilpin and van Hartesveldt 1998
	Pinedale Black-on-white	1275-1325	Hays-Gilpin and van Hartesveldt 1998
Early White Mountain Red Ware			
	Wingate Black-on-red	1050-1200	Hays-Gilpin and van Hartesveldt 1998; Carlson 1970
	Wingate Polychrome	1100-1200	Hays-Gilpin and van Hartesveldt 1998; Carlson 1970
	St. Johns Black-on-red	1200-1300	Hays-Gilpin and van Hartesveldt 1998; Carlson 1970
	St. Johns Polychrome	1200-1300	Hays-Gilpin and van Hartesveldt 1998; Carlson 1970
	Springerville Polychrome	1250-1300	Hays-Gilpin and van Hartesveldt 1998; Carlson 1970
	Techado Polychrome	1250-1300	Smith et al. 2009
Late White Mountain Red Ware			
	Pinedale Black-on-red	1280-1330	Mills and Herr 1999; Carlson 1970
	Pinedale Polychrome	1290-1330	Mills and Herr 1999; Carlson 1970
	Cedar Creek Polychrome	1300-1350	Mills and Herr 1999; Carlson 1970
	Fourmile Polychrome	1330-1390	Mills and Herr 1999; Carlson 1970
	Show Low Polychrome	1330-1390	Mills and Herr 1999; Carlson 1970
Zuni Glaze Ware			
	Heshotauthla Black-on-red	1275-1450+	Eckert 2006; Smith et al. 1966
	Heshotauthla Polychrome	1275-1450+	Eckert 2006; Smith et al. 1966
	Kwakina Polychrome	1280-1450+	Eckert 2006; Smith et al. 1966
	Pinnawa Glaze-on-white	1350-1450+	Eckert 2006; Smith et al. 1966
	Pinnawa Red-on-white	1350-1450+	Eckert 2006; Smith et al. 1966
	Kechipawan Polychrome	1370-1450+	Eckert 2006; Smith et al. 1966
Roosevelt Red Ware			
	Pinto Black-on-red	1280-1330	Neuzil and Lyons 2005; Crown 1994
	Pinto Polychrome	1280-1330	Neuzil and Lyons 2005; Crown 1994
	Gila Polychrome	1300-1450	Neuzil and Lyons 2005; Crown 1994
	Tonto Polychrome	1300-1450	Neuzil and Lyons 2005; Crown 1994
	Cliff Polychrome	1350-1450	Neuzil and Lyons 2005
Jeddito Yellow Ware			
	Awatovi Black-on-yellow	1300-1375	Neuzil and Lyons 2005
	Jeddito Black-on-yellow	1350-1700	Neuzil and Lyons 2005
Puerco Valley Red Ware			
	Showlow Black-on-red	1030-1280	Mills and Herr 1999
Mogollon Brown Ware			
	Tularosa White-on-red	1200-1350	Rinaldo and Bluhm 1956
	McDonald Painted Corrugated	1150-1280	Mills and Herr 1999
	Cibicue Painted Corrugated	1300-1350	Mills and Herr 1999
Additional Rare Wares/Series			
Winslow Orange Ware	multiple	1260-1350	Hays-Gilpin et al. 1996; Lyons et al. 2001
Kintiel-Klagetoh types	multiple	1250/1275-1300+	Hays-Gilpin and van Hartesveldt 1998; Fowler et al. 1987
Maverick Mountain Series	multiple	1275-1450	Neuzil and Lyons 2005

Figure 8.1. Examples of Cibola White Ware jars (Tularosa Black-on-white). Photograph on left courtesy of Jimmy Smith. Photograph on right by Garret Trask.

Early White Mountain Red Ware

Early White Mountain Red Ware, as this designation is used here, refers to a group of related red-slipped ceramic types produced in many portions of the Cibola region prior to the Pueblo III to Pueblo IV transition (ca. A.D. 1000-1275). Like Cibola White Ware, these vessels were produced from light-firing clays and tempered with crushed sherd or sherd and sand (see Hays-Gilpin and van Hartesveldt 1998). The surfaces of these vessels were slipped with a thick and well-polished layer of red to orange clay and painted with black or black and white mineral paint (Carlson 1970). The most common early White Mountain Red Ware type during the Pueblo III period, St. Johns Polychrome, occurs primarily in bowl form with black designs painted on the interior and bold geometric designs painted in white on the exterior (Figure 8.2). The painted design styles on early White Mountain Red Ware vessels overlap with those on Cibola White Ware, so much so that these distinct wares are usually seen as simply two colors within the same basic design tradition (Carlson 1970). The production of early White

Figure 8.2. Early White Mountain Red Ware bowl (St. Johns Polychrome). Photograph courtesy of the Archaeological Research Institute at Arizona State University.

Mountain Red Ware, however, was considerably more restricted than that of Cibola White Ware and probably limited to areas along the Zuni River, the El Morro Valley, the Mariana Mesa area, the Upper Little Colorado, and perhaps additional areas along the Puerco of the West and Cebolleta Mesa (Chapter 5).

During the latter half of the thirteenth century, early White Mountain Red Ware vessels (as well as some Cibola White Ware vessels) were sometimes painted using lead glaze paints. The earliest glaze paints were probably unintentional products of increased firing temperature and various minerals included in paint recipes. After about A.D. 1275, however, distinct recipes for glaze paints, indicating the intentional manipulation of fluxes, were established (Fenn et al. 2006; Huntley 2006, 2008:44-59). Importantly, different glaze recipes emerged in different portions of the greater Cibola region, perhaps suggesting a divergence in the technology of early White Mountain Red Ware after about A.D. 1275. During the Pueblo IV period, White Mountain Red Ware ceramics can be split into two distinct series or wares referred to as Zuni Glaze Ware and late

White Mountain Red Ware (see Carlson 1970), both of which are described below.

Zuni Glaze Ware

Zuni Glaze Ware, sometimes called the Zuni series of White Mountain Red Ware, refers to a set of painted types produced across the Zuni area, the El Morro Valley and portions of the Upper Little Colorado area, and possibly other areas including the Petrified Forest, which developed out of the early White Mountain Red Wares described above (ca. A.D. 1275-1450+; see Chapter 5). These vessels were essentially identical in paste recipe to the earlier White Mountain Red Ware types, but differed substantially in other aspects of design and technology (see Figure 8.3). During the early Pueblo IV period (ca. A.D. 1275-1325), Zuni Glaze Ware vessels were typically red-slipped with designs painted in a blackish or greenish glaze paint on the interior of bowls and the exteriors of jars. One particular type within the Zuni Glaze Ware series, Kwakina Polychrome, consists of bowls that were red-slipped on the exterior and white-slipped on the interior. Much like the earlier St. Johns Polychrome bowls described above, the exteriors of Zuni Glaze Ware bowls were often painted with geometric designs in white or white and black, but the line work was typically much finer and the exterior designs smaller. Painted design styles used on Zuni Glaze Ware vessels overlapped somewhat with early White Mountain Red Ware and Cibola White Ware, but Eckert (2006) notes that Zuni Glaze Ware vessels

Figure 8.3. Zuni Glaze Ware bowl (Heshotauthla Polychrome). Photograph courtesy of the BYU Museum of Peoples and Cultures.

were also often painted in a distinct geometric style which she calls Heshotauthla style. By the late Pueblo IV period (ca. A.D. 1325-1400) new varieties of Zuni Glaze Ware, slipped in white with blackish, greenish, or even purplish glaze paint, sometimes with an additional red matte paint, were added to the repertoire, but early Zuni Glaze Ware types continued to be produced at least into the fifteenth century (see Smith et al. 1966).

Late White Mountain Red Ware

The second ceramic tradition that emerged out of early White Mountain Red Ware across the Pueblo III to Pueblo IV transition is sometimes referred to as the White Mountain Series of White Mountain Red Ware, or simply as late White Mountain Red Ware. These vessels were similar in paste preparation and surface treatment to early White Mountain Red Ware vessels, but like the Zuni Glaze Wares, included many new elements and designs painted in black glaze paint. During the early Pueblo IV period (ca. A.D. 1275-1325), vessels defined as Pinedale Black-on-red and Pinedale Polychrome were painted with dense, black

Figure 8.4. Late White Mountain Red Ware bowl (Pinedale Polychrome). Photograph courtesy of the BYU Museum of Peoples and Cultures.

glaze paint most often in what is known as Pinedale style (Carlson 1970), usually with black or polychrome designs painted on the exteriors of bowls (Figure 8.4). Unlike early White Mountain Red Ware and Zuni Glaze Ware vessels, the designs painted on the exteriors of Pinedale bowls were complex geometric unit designs or sometimes birds, snakes, or other life forms. During the late Pueblo IV period (A.D. 1325-1400) the Pinedale types were largely replaced by new glaze painted types including Cedar Creek Polychrome and Fourmile Polychrome. These later types were characterized by increasingly elaborate, often asymmetrical designs on the interior of bowls and simple banded designs on the exteriors (Carlson 1970).

Available evidence (see Duff 2002; Triadan 1997; Zedeño 1994) suggests that late White Mountain Red Ware was produced primarily in the Silver Creek area along the Mogollon Rim, but was also produced in somewhat smaller quantities in the Upper Little Colorado area, and possibly near Mariana Mesa and the Petrified Forest. Local varieties (or perhaps imitations; see Van Keuren 2001) of late White Mountain Red Ware types were also produced in a few communities below the Mogollon Rim in the Arizona Mountains area after A.D. 1325 (Triadan 1997; Triadan et al. 2002). Interestingly, most of the areas where late White Mountain Red Ware was produced were outside of the likely production area for early White Mountain Red Ware.

Roosevelt Red Ware

Roosevelt Red Ware, sometimes called Salado Polychrome, refers to a set of related bi-chrome and polychrome types produced across a large swath of the central and southern Southwest beginning during the late thirteenth century and extending into the fifteenth century (ca. A.D. 1280-1450+; Crown 1994; Neuzil and Lyons 2005:20-34). The earliest Roosevelt Red Ware was likely produced in the Mogollon Rim area along Silver Creek and the Arizona Mountains. Roosevelt Red Ware vessels are visually and technologically quite distinct from the contemporaneous polychrome types described above. Roosevelt Red Ware was typically produced with a brown paste with sand temper. Painted surfaces are characterized by combinations of red and white slipped areas painted in black matte paint incorporating a variety of complex geometric designs and life forms (Figure 8.5; Neuzil and Lyons 2005:20-34). Available evidence suggests that Roosevelt Red Ware was produced in small quantities in the northern and central portions of the Upper Little Colorado area by the late Pueblo IV period (ca. A.D. 1325-1400; see Duff 2002; Chapter 5) but is generally absent from most portions of the core study area until the establishment of the Protohistoric Zuni towns around the beginning of the fifteenth century (Smith et al. 1966). Prior to A.D.

Figure 8.5. Roosevelt Red Ware bowl (Tonto Polychrome). Photograph courtesy of the BYU Museum of Peoples and Cultures.

1325, the production of Roosevelt Red Ware within the confines of the greater Cibola region was likely limited to settlements in the Silver Creek area, the Arizona Mountains, and perhaps the Petrified Forest. Some researchers associate the emergence and spread of Roosevelt Red Ware with migrants from the Kayenta-Tusayan region, thus the distribution of this ware may suggest potential destinations of northern immigrants within the greater Cibola region (see Crown 1994; Lyons 2003).

Jeddito Yellow Ware

Jeddito Yellow Ware, or Hopi Yellow Ware, refers to a set a visually distinct painted ceramics produced exclusively on the Hopi Mesas in northern Arizona (ca. A.D. 1300-1700), but widely exchanged across much of the Southwest (Colton and Hargrave 1937:146-156). This ware is easily recognized due to its yellow paste and surfaces, which are most often painted with blackish or brownish matte paint along with red matte paint in some later varieties (Figure

Figure 8.6. Jeddito Yellow Ware bowl (Jeddito Black-on-Yellow). Photograph courtesy of the BYU Museum of Peoples and Cultures.

8.6). Jeddito Yellow Ware is rare across most of the Cibola Region but does show up in substantial quantities in the Petrified Forest area (Burton 1990) and at least one settlement in the northern Upper Little Colorado area (Table Rock Pueblo; see Martin and Rinaldo 1960), perhaps suggesting particularly strong exchange relationships with the Hopi area for the inhabitants of at least some villages (see Duff 2002). Jeddito Yellow Ware has not been documented at settlements in the core study area prior to the late Pueblo IV period (ca. A.D. 1325-1400), and is absent from the Zuni area prior to the Protohistoric period (ca. 1400-1540).

Puerco Valley Red Ware

Although it is very rare within the core study area, Puerco Valley Red Ware deserves some discussion here. This ware was produced in a wide area along the western edge of the greater Cibola region as I define it for this study between about A.D. 1030 and 1280 (see Hays-Gilpin and van Hartesveldt 1998:140-141). Puerco Valley Red Ware is typically tempered with sherd and sand in a dark brown paste and slipped with a thin, washy red clay. Designs are painted in black organic paint in a variety of styles, similar to the range of designs found on early White Mountain Red Ware vessels. This ware is generally similar to several early White Mountain Red Ware types except that it has a much thinner slip, organic paint, and typically lacks the painted exterior designs common on early White Mountain Red Ware polychrome types.

Painted Mogollon Brown Ware Types

In the southern portions of the study area along either side of the Mogollon Rim, a few distinct varieties of painted Mogollon Brown Ware vessels were produced during the period considered here. These vessels incorporated bold designs on the exteriors of bowls in a format similar to those characteristic of the White Mountain Red Ware and Zuni Glaze Ware vessels described above. One of these types produced in the Mogollon Highlands area, Tularosa White-on-red (originally called Reserve White-on-red), occurs only in bowl form and is characterized by highly polished, red-slipped surfaces, usually with a smudged interior. These bowls have a recurved or flaring lip with three to four exposed and indented corrugated coils just below the rim (Nesbit 1938:139; Rinaldo and Bluhm 1956:173,177,179). White painted designs on the exterior consist of banded geometric forms similar to those on St. Johns Polychrome (Figure 8.7). Tularosa White-on-red is essentially a slipped and painted variety of the much more common Tularosa Fillet Rim bowl. The production dates for Tularosa White-on-red have been a subject of some debate. Early descriptions of the type suggested that it was produced primarily between A.D. 1100 and 1200, suggesting

Figure 8.7. Examples of Tularosa White-on-red bowls. Photographs used with permission of the Chicago Field Museum.

that it may have preceded St. Johns Polychrome (see Rinaldo and Bluhm 1956:152-155). Although absolute dates are few and far between, this range is certainly too early. In the ceramic data collected for this study, Tularosa White-on-red was present only at sites with St. Johns Polychrome, and appeared in greater frequencies at sites with other later types such as Springerville Polychrome, late White Mountain Red Ware and Zuni Glaze Ware. This suggests that the production of Tularosa White-on-red spans the period from about A.D. 1200 to 1350 (see also Neuzil and Lyons 2005:53), and that it likely increased in prevalence through time to dominate the painted assemblages at the few sites in the Mogollon Highlands with substantial fourteenth century occupations such as Foote Canyon Pueblo (Rinaldo 1959) and Hough 70 (Zamora and Oakes 1999).

In the Arizona Mountains and Silver Creek areas to the west, another painted Mogollon Brown Ware type, designated as McDonald Painted Corrugated, was produced. This type occurs primarily in bowl form and is characterized by a corrugated or indented corrugated exterior surface, often with a smudged interior. Bold designs were painted in white on the exterior of these

Figure 8.8. McDonald Painted Corrugated bowl. Photograph courtesy of the BYU Museum of Peoples and Cultures.

vessels in banded geometric forms similar to those on St. Johns Polychrome (Figure 8.8; Martin et al. 1967; Mills and Herr 1999:259-260). The production dates associated with this type span the period from about A.D. 1150 to 1280 (Mills and Herr 1999) or perhaps somewhat later (Wood 1987:167). Between about A.D. 1300 and 1350, related varieties of painted corrugated brown wares known as Cibicue Painted Corrugated and Cibicue Polychrome were also produced (Haury 1934:131-134). The Cibicue types are rare in the core study area and are usually recovered as small bowls associated with mortuary contexts at Pueblo IV sites in the Arizona Mountains (Hagenbuckle 2001).

Major Trends in Painted Pottery through Time

The brief descriptions of common wares and types across the greater Cibola region provided above reveal a few over-arching trends relevant to considerations of changing patterns of categorical identities through time. First, the relative proportions of the widely produced Cibola White Ware vessels decreased through time as these vessels were largely replaced by red ware and polychrome types. Indeed, the relative frequency of white ware in the Cibola region was recognized as a temporal indicator by some of the earliest archaeologists to work in the region (e.g., Spier 1917). In addition, the period considered here was also marked by an associated change in the frequency of different vessel forms. Specifically, bowls increase in prevalence throughout the prehistoric occupation of the Cibola region, and by the Pueblo III period, often made up 80% or more of painted ceramic assemblages. Most of these bowls had bold designs on their exteriors, suggesting that potters were increasingly concerned with the visual communication potential of the vessels they produced (see discussion below). Finally, as I demonstrate in more detail below, the descriptions above also suggest that there was a marked diversification of ceramics across the greater Cibola region as a whole associated with the Pueblo III to Pueblo IV transition. During the Pueblo IV period, there were both more wares, and those wares were more visually distinct.

Painted Ceramics, Visual Communication, and Categorical Expression

As I argue above, aspects of the decorative styles associated with painted ceramic vessels in the Cibola region may provide an indication of the scales at which potters and those who obtained pots chose to signal similarity and difference in the contexts of public gatherings where these vessels were used and exchanged. In order to link the production and use of painted vessels to the expression of categorical identities more directly, it is important to first demonstrate that these vessels were made with a concern for their visual communication potential. In this section, building on analyses previously presented by Mills (2007a), I demonstrate that the size and boldness of painted designs on the exteriors of polychrome bowls in the Cibola region changed through time in relation to changes in the size and configuration of public spaces. From this, I argue that patterns of similarity in these polychrome bowls can be used as one indication of shared categorical identities among the inhabitants of different portion of the Cibola region.

For a number of reasons, painted serving bowls produced and circulated across the Cibola region during the Pueblo III and Pueblo IV periods are particularly good candidates for objects that were used to actively express social distinctions among large groups of people (see Mills 2007b). First, painted bowls in the greater Cibola region, at least by the twelfth century, were most often produced with a red slip on both the interior and exterior surfaces, in contrast to the unslipped or white slipped surfaces that were most common on other vessel forms. Red-slipped vessels in the northern Southwest are often larger, more widely circulated than other painted vessels and also frequently associated with evidence for feasting and public food consumption at least as early as the ninth century A.D. (see Blinman 1989; Hegmon et al. 1995; Mills 2007a, 2007b; Potter 2000). In addition, red-slipped bowls in the greater Cibola region during the twelfth and thirteenth centuries were among the first bowls produced in the northern Southwest with designs painted on their exteriors as well as the interior surface (see also Carlson 1970; Mills 1999; Robinson 2005). Mills (2007a) notes that the increased focus on exterior designs would have meant that, even when full of food, the designs on these bowls would have been highly visible in public settings. The increased prevalence of exterior designs during the twelfth century and later was also associated with a period of aggregation across much of the greater Cibola region (see Kintigh 1996; Chapter 3), perhaps suggesting that this change in the use of different design fields was associated with a transition in the social context or scale of food consumption.[1]

As the structure of settlement changed across the Pueblo III to Pueblo IV transition, so too did the nature of the designs painted on the exteriors of serving bowls. Mills (2007a) has previously shown that the sizes and boldness of exterior designs of several ceramic types produced or used in the Silver Creek area varied in relation to changes in the size and structure of public spaces through time. Specifically, during the Pueblo III period, most settlements across the greater Cibola region consisted of closely spaced clusters of roomblocks characterized by a high ratio of open space to total roofed area (Mills 2007a; Potter 1998). At this time, exterior designs on bowls were typically quite large and designs were almost always banded around the entire circumference of the bowl, making them highly visible from a distance and from almost any angle. During the early Pueblo IV period, as nucleated settlements became increasingly common, the ratio of open space to total roofed area decreased markedly as enclosed plazas became the norm (Mills 2007a; Potter 1998; see also Chapter 9). This decrease in the ratio of open to roofed space and the enclosed nature of public spaces together suggest that the average distance between participants in public gatherings decreased. As Mills (2007a) notes, this change was associated with a decrease in the size of designs painted on the exterior of vessels as well as an increase in the frequency of unit designs that could only be viewed from certain angles.[2] From this, Mills argues that the large polychrome serving bowls produced across the greater Cibola region during the period considered in this study were likely made with a fundamental concern for visual communication.

For the purposes of this study, I collected additional data on the size of vessels and exterior designs in order to determine whether the association between the size of open spaces and the size of designs identified by Mills (2007a) for wares found in the Silver Creek area also characterizes vessels produced across the Cibola region as a whole. Following methods described in detail by Mills (2007a:221-232), I measured the height of exterior designs as well as total vessel height for a number of whole or partial bowls recovered from sites across the Cibola region. I focused on wares and types not included in Mills' original study; early Zuni Glaze Wares (Heshotauthla Polychrome and Kwakina Polychrome), Tularosa White-on-red, and McDonald Painted Corrugated.

As Figure 8.9 illustrates, with the addition of these new wares and types, the pattern of decreasing design height across the Pueblo III to Pueblo IV transition is still quite pronounced. Importantly, this pattern holds when design heights are calculated as a percentage of total vessel height, demonstrating that this pattern is not the result of changes in vessel size (see Figure 8.10). All together, the data presented here suggest that the red ware and polychrome serving bowls produced across the greater Cibola region during the Pueblo III and Pueblo IV periods were likely produced with a fundamental concern for their visual communication potential. Thus, I argue that comparisons of the frequencies of different wares as well as the designs on these vessels can be used to explore

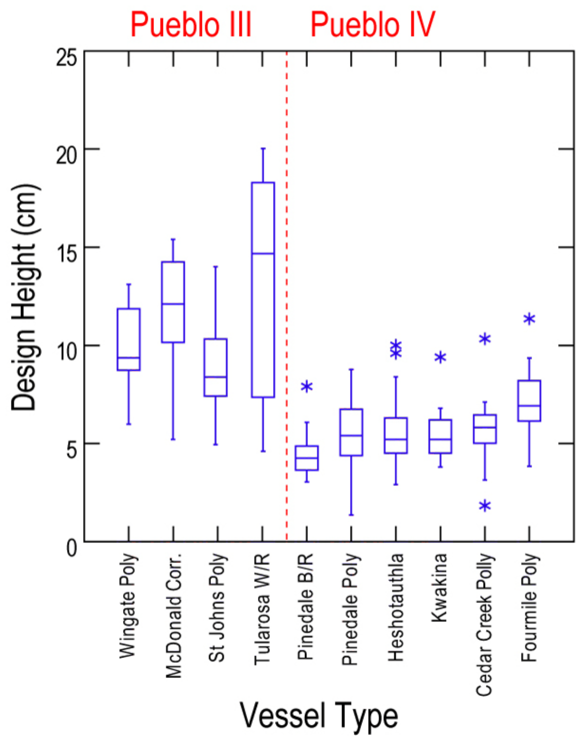


Figure 8.9. Design height in centimeters by type. Types are arranged in chronological order of earliest production dates from left to right.

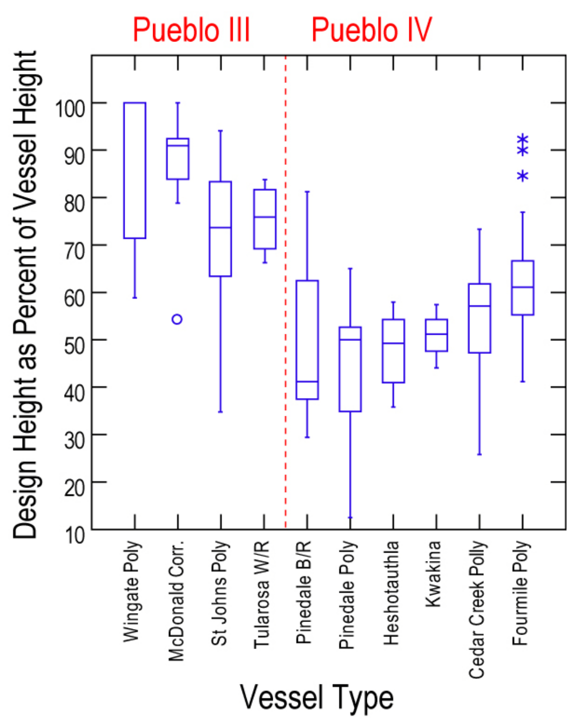


Figure 8.10. Design height as percentage of vessel height by type. Types are arranged in chronological order of earliest production dates from left to right.

patterns of shared expressions of categorical identities across the study area through time.

Ceramic Ware Distributions and Changing Scales of Categorical Expression

Following the patterns documented in the previous section, I argue that the relative proportions of different painted ceramic wares (in particular polychrome ceramics) may reveal strong patterns of shared categorical identities across the study area through time. In this section, I present and describe the procedures used to produce maps showing the relative proportions of the most common polychrome ceramic wares during the Pueblo III and Pueblo IV periods respectively. These maps demonstrate that there was a dramatic diversification of ceramics across the Pueblo III to Pueblo IV transition as well as a major transition in the scale at which wares were shared among the inhabitants of different portions of the region. These changes suggest a transition in the nature and scale of categorical expressions across the late thirteenth century social transformation.

In the analysis presented here, I focus exclusively on the painted red, orange, yellow, and polychrome wares (referred to simply as polychromes from here on out) produced and exchanged across the greater Cibola region. I do not include Cibola White Ware both because it was widely produced across almost the entire region, and because it became less common over time. Furthermore, unlike the white ware, polychromes are overwhelming bowls (>80% of vessels in many cases), usually with designs painted on their exteriors. Thus, the relative proportions of different polychrome wares, consisting primarily of bowls that were likely produced with a concern for visual communication, are considered a good proxy for patterns of active expressions of categorical commonality at a regional scale.

The ceramic ware proportions presented below were compiled for each time period by segregating types that primarily date to the Pueblo III period or the Pueblo IV period. For example, early Pueblo IV sites often have relatively high proportions of early White Mountain Red Ware (St. Johns Polychrome and Springerville Polychrome) along with later Zuni Glaze Ware types. If early White Mountain Red Ware types were included in the Pueblo IV period map, there would be substantial differences among Pueblo IV sites that are largely a product of time (i.e., sites initially constructed in the 1270s vs. the 1290s). Thus, types dating primarily to the Pueblo III period were not included in the ceramic counts for the Pueblo IV period and vise versa. This procedure has the effect of essentially discounting the relatively high diversity of ceramics across the Pueblo III to Pueblo IV transition, but makes these maps more useful for demonstrating major differences between the two periods without a substantial temporal bias.

Pueblo III Period

Figure 8.11 shows the ware proportions for the Pueblo III period. As this map illustrates, most of the Cibola region was characterized by a single polychrome ware (early White Mountain Red Ware). Beyond this, many areas where other wares are present are still dominated by early White Mountain Red Ware. The exceptions to this broad pattern are found primarily along the southern and western edges of the study area. In the Mogollon Highlands, several sites have substantial amounts of Tularosa White-on-red associated with early White

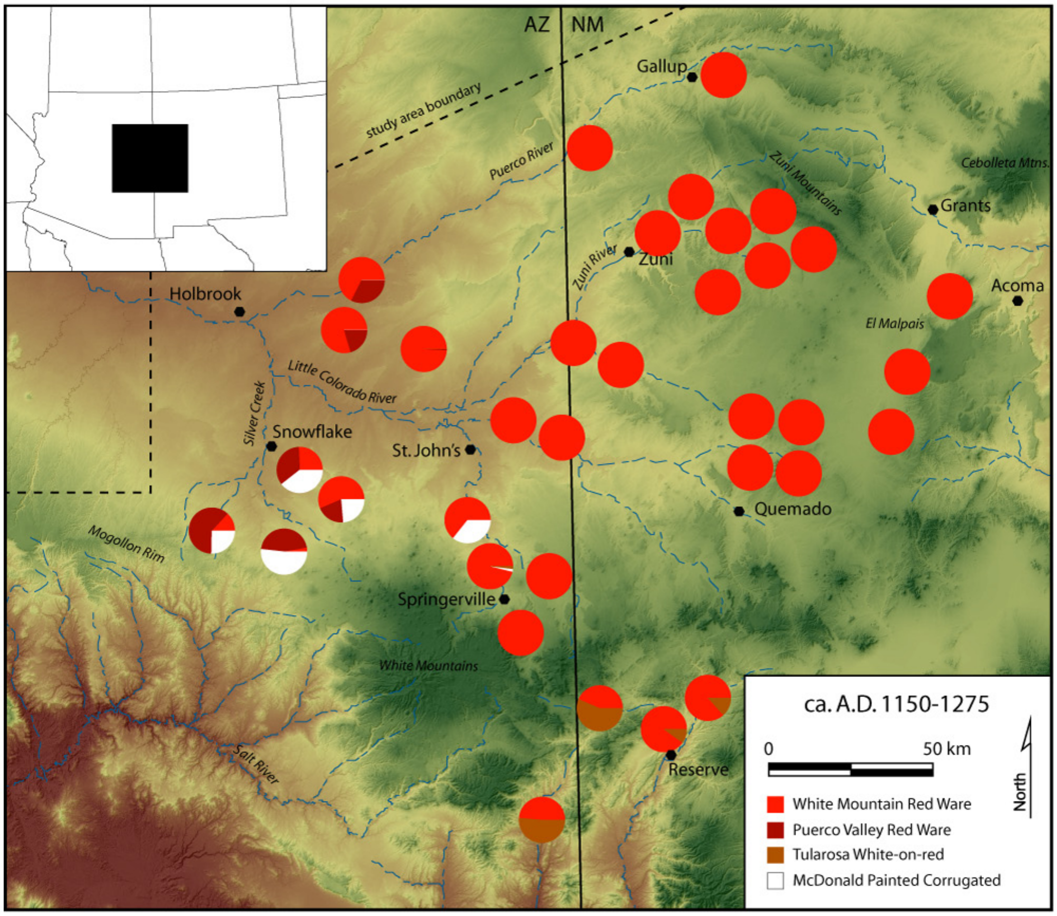


Figure 8.11. Distribution of polychrome wares for the Pueblo III period.

Mountain Red Ware types. As described briefly above, Tularosa White-on-red is locally produced in the Mogollon Mountains (whereas White Mountain Red Ware is not) and is quite similar in design style to the imported types (see next section). To the west along the Arizona Mountains and the Silver Creek area, painted assemblages also include substantial amounts of Puerco Valley Red Ware as well as McDonald Painted Corrugated, both of which were likely locally produced. Like the early White Mountain Red Ware types, McDonald Painted Corrugated is characterized by bold, banded, geometric designs in white on the exteriors of bowls.

In general, the map presented here illustrates that polychrome ware distributions during the Pueblo III period were quite homogenous. Almost the entire region was dominated by a single ware, and other wares show striking similarities in their application of white designs to the exteriors of bowls. This suggests that the inhabitants of much of the greater Cibola region shared some common notion of categorical identity that was expressed in the context of public gatherings through the use of these similar polychrome ceramics. The application of bold white designs on the exterior of bowls used in public settings was likely a design convention that was similarly understood across the region as a whole. At the same time, the inhabitants of some areas along the edges of the Cibola region chose to produce their own visually distinct versions of vessels within this widespread design convention, perhaps suggesting the maintenance of social distinctions between the eastern and western Cibola regions at this time (see also Mills 2007b).

Pueblo IV Period

Figure 8.12 shows the proportion of polychrome wares for the Pueblo IV period. At a glance, this map illustrates that patterns of shared ceramic wares differed markedly between the Pueblo III and Pueblo IV periods. Many more distinct wares were produced during the Pueblo IV period, and as described earlier, the visual differences among these wares were considerably greater than during the Pueblo III period. Some areas that have traditionally been considered discrete settlement clusters are characterized by considerable ceramic ware diversity (e.g., Upper Little Colorado, Silver Creek, Arizona Mountains), whereas

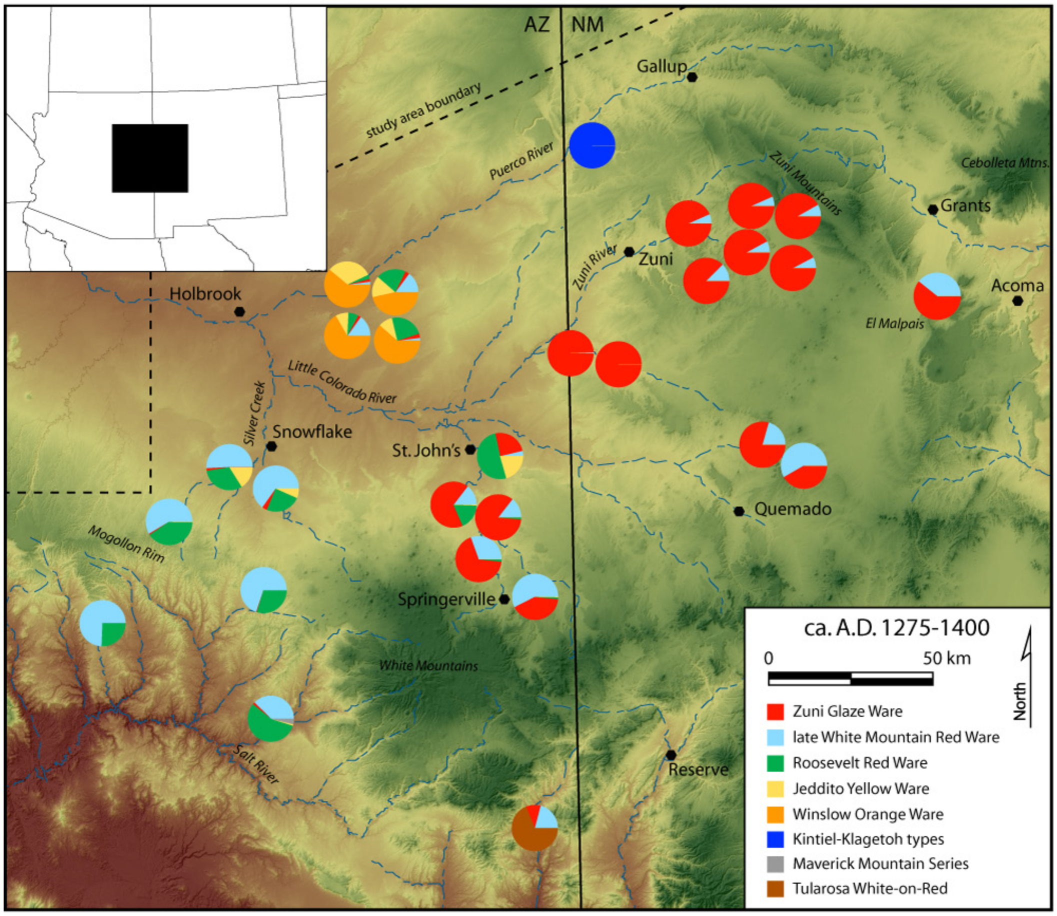


Figure 8.12. Distribution of polychrome wares for the Pueblo IV period.

the central Zuni area including the Pescado Basin, the El Morro Valley, and the West Zuni sub-regions, is quite homogenous. This important point was first discussed in detail by Duff (2000, 2002), who argued that differences in ceramic diversity may have been driven, in large part, by demographic differences among settlement clusters across the Western Pueblo world. Duff drew on sociological theory focused on group size and interaction (e.g., Blau 1977) and argued that small populations tend to both allow and facilitate diverse interactions or expressions of identity whereas larger social groups are typically more internally focused, often with restrictions on inter-group interactions and pressures to conform. As Duff (2000, 2002:80-84) demonstrates, the diversity of ceramic wares produced and obtained by the inhabitants of various portions of the Western Pueblo world is largely inversely related to the size of populations in those areas (see also Nelson et al. 2011). The relationship between population size and diversity is not necessarily simply a structural property of groups, however, as many areas with lower population densities were destinations for migrants across the Pueblo III to Pueblo IV transition (see Chapter 3). Thus, differences in the diversity of ceramic wares may suggest differences both in the diversity of categorical social identities expressed in the context of public gatherings as well as differences in the trajectories of population movement through time.

There is a strong east to west dichotomy in the distribution of ceramic wares across the study area. As noted above, sites in the Zuni area are dominated almost exclusively by Zuni Glaze Ware with smaller amounts of late White Mountain Red Ware (Pinedale Black-on-red and Polychrome). The Mariana Mesa and Cebolleta Mesa areas are characterized by the same two wares, but the total proportions of each ware varies considerably more, perhaps suggesting greater diversity in the expression of categorical identities in those areas. To the west along the Upper Little Colorado, there is much greater diversity. Sites in the central and northern portion of this sub-region have substantial amounts of Roosevelt Red Ware and Jeddito Yellow Ware (probably not until about A.D. 1325, however) in addition to Zuni Glaze Ware and late White Mountain Red Ware. With the exception of Jeddito Yellow Ware, all of these other wares were, at least in part, locally produced (see Chapter 5; Duff 2002). This suggests that the

Upper Little Colorado sub-region was essentially the edge of the primary distribution of Zuni Glaze Ware as well as for Roosevelt Red Ware and Jeddito Yellow Ware. Notably, Zuni Glaze Ware is most common in the areas where early White Mountain Red Ware was produced during the Pueblo III period.

Sites in the southern and western portion of the greater Cibola region along Silver Creek and the Arizona Mountains are dominated almost exclusively by Roosevelt Red Ware and late White Mountain Red Ware. This suggests that these areas were largely involved in a sphere of ceramic production and exchange distinct from the communities in the Zuni area. The dramatic differences in ware distributions further support the argument that there was a categorical distinction or social boundary between sites in the mountainous western Cibola region and the Zuni area to the east. The little data available from the Mogollon Highlands area suggest that locally produced Tularosa White-on-red ceramics dominated early Pueblo IV period painted assemblages, perhaps suggesting an increasing local focus for the fourteenth century inhabitants of this area. Along the Puerco of the West, the Petrified Forest area is dominated by varieties of Winslow Orange Ware pottery that were likely locally produced (Schachner et al. 2011) along with smaller amounts of all other common wares. Finally, the Kintiel and Manuelito Canyon areas are dominated almost exclusively by locally produced orange and yellow ware types that likely developed out of earlier White Mountain Red Ware (Fowler et al. 1987; Hays-Gilpin and van Hartesveldt 1998).

Overall, the data presented here illustrate that the Pueblo III to Pueblo IV transition saw a massive diversification of ceramic wares across the Cibola region, and an increasing localization of ceramic distinctions. This localization suggests that the spatial scale at which shared categorical identities were expressed through ceramics was dramatically reduced across the late thirteenth century. Most portions of the study area saw an increase in diversity at a local level across the Pueblo III to Pueblo IV transition. However, evidence for expressions of categorical identities through ceramics in the Zuni area suggests that this portion of the study area remained both homogenous and relatively discrete. It appears that by the early Pueblo IV period, the Zuni area resembled traditional anthropological notions of a well-bounded and discrete region characterized by a high degree of homogeneity suggesting active efforts towards maintaining conformity (see Duff 2002).

Design Style and Shared Categorical Identities

In order to further explore the similarities and differences among painted vessels produced across the Cibola region, I compiled a large database of whole and partial vessel images both by photographing museum collections and by compiling other available published and unpublished photographs (Table 8.2). Using this large image database, I conducted two related analyses focused specifically on the designs painted on the exteriors of serving bowls. The first analysis consists of a quantitative comparison of common elements and design treatments found on Pueblo III period bowls recovered from sites throughout the core study area. The second analysis consists of a comparison of the nature and frequency of repeated design configurations found on the exteriors of early Pueblo IV period Zuni Glaze Ware and late White Mountain Red Ware bowls. As

Table 8.2. Whole and partial vessel photographs used in this study.

Site/Area	Sub-region	Early WMRW	Tularosa W/R	Late WMRW	Zuni GW	Location/Image Source
Atsinna	EMV			2	8	ASU, ELMO
AZ W:10:50 (ASM)	AM			13	2	ASM
Casa Malpais	ULC			3	1	CMAP
Cienega	EMV	3			3	ASU
Cosper Cliff Dwelling	MH		1			CFM
Coyote Creek	ULC	9		2		MNA
Foote Canyon	MH	6	10	3		CFM
Fourmile Ruin	SC			16		SMTH
Grasshopper Pueblo	AM			27		GH
Greenwood Pueblo	ULC	2		1	1	Kintigh
Greer, AZ	ULC	1				Carlson 1970
Halona:wa	ZUNI				12	PMAA
Heshotauthla	PB				4	PMAA
Higgins Flat	MH	2	3			CFM
Hooper Ranch	ULC	3		2		CFM
Horse Camp Mill	MM	14		1		PMAA
Kinishba	AM			4	1	ASM
Los Gigantes	EMV	2				ASU
Mirabal	EMV	9			2	ASU
Nutria Road Sites	PB	4				Zier 1976
Ojo Bonito	WZ				2	CFM
Ojo Caliente, NM	WZ				3	CFM
Pinedale Ruin	SC			3		SMTH
P. de los Muertos	EMV			2	26	ASU
Rattlesnake Point	ULC				2	ASU
Rudd Creek Pueblo	ULC				2	ASU
Scribe S Pueblo	EMV	22				ASU
Springerville, AZ	ULC	2				Carlson 1970
St. Johns 11:1	ULC	7				Carlson 1970
St. Johns 12:1	ULC	1				Carlson 1970
St. Johns 16:15	ULC	1				Carlson 1970
St. Johns 16:5	ULC	2				Carlson 1970
St. Johns 4:1	WZ	14				Carlson 1970
St. Johns 6:1	ULC	1				Carlson 1970
St. Johns 7:2	CW	7				Carlson 1970
Techado Spring	MM	19		8	3	TCAS
Tinaja	EMV	1				ASU
UG481	MM	2				PMAA
Other/Unprov'd	N/A	28		113	7	multiple
TOTAL (N=455)		***162***	***14***	***200***	***79***	

Note: EMV=El Morro Valley, PB = Pescado Basin, ZUNI=Zuni Pueblo, WZ=West Zuni, CW=Carrizo Wash, ULC=Upper Little Colorado, MM=Mariana Mesa, MH=Mogollon Highlands, SC=Silver Creek, AM=Arizona Mountains.

will become apparent in the discussion below, Pueblo III and Pueblo IV period types were analyzed separately because they differed so greatly that they confounded efforts to place them within a single analytical scheme.

Design Element Analysis

As described in the previous section, during the Pueblo III period, ceramic ware distributions were quite homogenous across the study area. The purpose of the element analysis presented here is to further characterize patterns of shared categorical expression by determining to what degree specific designs or design applications may have varied on vessels of the same ware recovered from different portions of the Cibola region. The majority of previous stylistic analyses in the study area have focused on jars or the interior painted designs on bowls (e.g., Carlson 1970; Kintigh 1985b; LeBlanc 1975; but see Kelley 2006). In this study, I follow recent work by Moore (2006, 2011) to conduct a hierarchical analysis of the simple exterior design elements found on early White Mountain Red Ware bowls as well as a limited comparison with Tularosa White-on-red bowls. This hierarchical approach is used to independently explore similarities and differences in primary design elements, secondary appended elements, as well as specific design treatments such as fills and line interactions (see also Friedrich 1970; Hegmon 1995; Plog 1980). The variables recorded in this analysis are summarized in Table 8.3. My expectation is that, if the producers of early White Mountain Red Ware vessels across different portions of the Cibola region shared common concepts of categorical identity, there should be a high degree of similarity in the decorative elements and design treatments considered here.

Table 8.3. Variables recorded for design element analysis (see Appendix D).

Variable	Description
Site	Site where vessel was recovered (where available)
Ware	Ware designation (e.g., White Mountain Red Ware, Mogollon Brown Ware)
Type	Type designation (e.g., St. Johns Polychrome, Springerville Polychrome, etc.)
Design Style (interior)	Traditional named design style category (e.g., Wingate, Tularosa, Pinedale, etc.)
Exterior Color	Combination of colors used on exterior of vessel (e.g., white on red, etc.)
Interior Color	Combination of colors used on interior of vessel (e.g., black on red, etc.)
Primary Element	Code for smallest, self-contained repeating unit in design
Primary Element Fill	Type of element fill for closed shapes (e.g., solid, hollow, etc.)
Element Interaction	How do primary elements interact? (e.g., attached, running, interlocked, etc.)
Secondary Element	Code for elements within/appended to primary design elements
Design Placement	Exterior design placement (e.g., banded design or isolated unit design)
Bounding Lines	Presence/absence of bounding lines around design

Note: Analyses below based on shaded variables only

The first step in this analysis was to identify primary design elements that commonly occurred on the exteriors of bowls across the entire sample. In order to do this, images were sorted into major design categories independently by the author and a research assistant, Garret Trask. Our initial groupings overlapped considerably and suggested that nine common design elements accounted for the vast majority of exterior painted designs within the image corpus (~90%; see Figure 8.13). Each of these nine elements occurred more than six times across all recorded vessels. Eight of the nine common primary elements also coincided with those identified by Moore (2006) in her more detailed study of early White Mountain Red Ware vessels from the Pettit site in the El Morro Valley, further verifying our identifications.

After primary elements were identified, each vessel photo was coded for as many variables in Table 8.3 as was possible. Primary elements were coded as

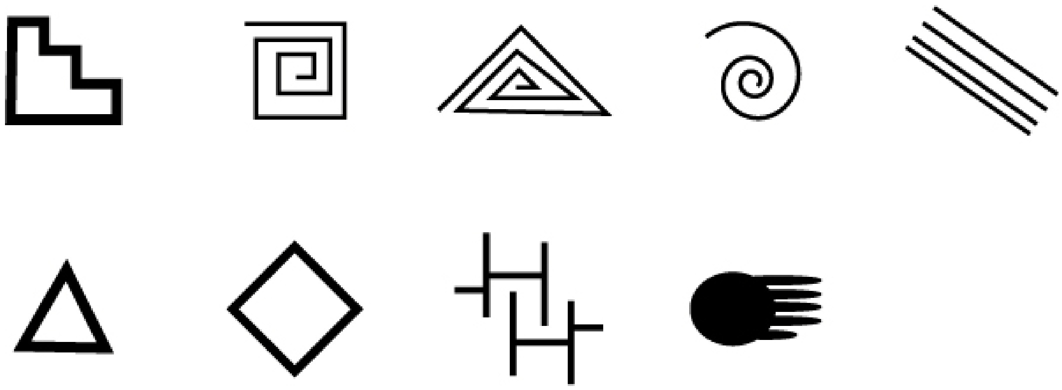


Figure 8.13. Examples of the 9 most common primary design elements.

one the nine major categories described above or as "other" and described in the notes. Next, the specific details of primary elements were further characterized by coding the type of fill used for closed polygons and by noting the type of interaction between design elements. In a few cases, where primary design elements were elaborated with additional features either appended to the primary designs or placed within them, these features were coded as secondary elements. Finally, designs were characterized by documenting whether they occurred as an isolated unit or in a continuous band around each vessel, and by noting the presence or absence of bounding lines around the painted design. Appendix D provides additional details used to determine values for each of these variables.

In order to determine whether there were significant differences among the early White Mountain Red Ware vessels recovered from different portions of the study area, I first conducted a series of X^2 tests for each of the variables described above. However, because sample sizes for some sub-regions were small, it was necessary to combine samples from adjacent areas. In the analyses below, vessels from the Carrizo Wash and West Zuni area were considered together, as were vessels from the El Morro Valley and Pescado Basin. These groupings are warranted because of the similarities in the proportions of different production sources in these sets of sub-regions (see Chapter 5). In addition, because many of the tables were relatively sparse (many cells <5), probabilities associated with the X^2 tests were simulated rather than calculated based on the X^2 distribution. Specifically, each table was randomized 1,000,000 times and the X^2 statistic was calculated for each random table. Probabilities were estimated as the proportion of randomized X^2 values greater than or equal to the actual X^2 statistic.

As Table 8.4 illustrates, there are no statistically significant differences (α=0.10) by region of recovery for the coded early White Mountain Red Ware bowls in terms of primary design elements, primary element fills, primary element interactions, or design placement, indicating that the designs painted on vessels produced and circulated across different portions of the study area were broadly similar. Put another way, the lack of statistically significant differences for these variables suggests that early White Mountain Red Ware vessels recovered across the Cibola region were painted by people drawing on the same basic repertoire of elements, perhaps suggesting that they were expressing similar categorical identities. There were, however, significant differences by region in terms of the secondary elements as well as the presence or absence of bounding lines. These differences suggest that the elaboration of designs and aspects of execution did differ somewhat across the study area.

Table 8.4. X^2 tables and associated probabilities for each of the five measured variables. Statistically significant probabilities are highlighted.

Primary Element	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Circular scroll	3	3	1	0	1
Hand	1	2	2	1	1
Interlocking brackets	0	1	1	2	1
Lines	2	3	2	0	0
Diamond/rectangle	1	0	7	1	0
Rectangular scroll	12	6	12	12	0
Step/terrace	13	4	12	5	5
Triangle/zig-zag	8	4	7	4	1
Triangular scroll	5	0	2	2	1
X^2= 40.0994	**p = 0.1518**				

Element Fill	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Solid	2	2	1	2	1
Hatched	1	0	0	0	0
Hollow	18	8	17	10	6
Corbelled	3	0	2	1	0
Line outlined	1	0	0	1	0
Complex	0	0	3	0	0
X^2 = 16.2253	**p = 0.7301**				

Element Interaction	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Isolated	6	6	13	6	4
Running	1	3	4	5	2
Interlocking	14	7	14	13	1
Nested	9	3	5	2	1
Attached	7	3	2	1	0
X^2 = 20.9792	**p = 0.1874**				

Secondary Element	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Step/terrace	12	4	7	8	1
Dots	0	0	1	1	0
Hook	0	0	0	4	2
Linking line	0	2	2	1	0
Linking corbel	4	0	1	4	0
X^2 = 27.3277	**p = 0.03840**				

Design Placement	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Band	34	19	25	23	6
Unit	2	2	8	5	2
X^2 = 6.0034	**p = 0.1961**				

Bounding Lines	**EMV/PB**	**CW/WZ**	**MM**	**ULC**	**MH**
Absent	16	11	16	22	5
Present	20	8	17	5	2
X^2 = 10.5109	**p = 0.03198**				
TOTAL	**42**	**21**	**34**	**28**	**8**

Although the region-wide X^2 tests described above are useful for identifying variables for which there are potentially important differences across the region as a whole, they do not reveal which specific areas may have differed. In order to address this issue further, I conducted a series of pairwise X^2 tests among all of the sub-regions using the same Monte Carlo simulation procedure described above (see Table 8.5).[3] As the probability values reported in Table 8.5 illustrate, once again there are no statistically significant differences between any pairs of sub-regions in terms of primary elements or primary element fills. There are, however, several statistically significant differences in terms of element interactions, secondary elements, and bounding lines.

Pairwise comparisons for element interactions and secondary elements show several significant differences between the El Morro Valley/Pescado Basin area and other areas to the south. These differences suggest that, although individuals were applying a similar suite of primary design elements, the specific ways in which those elements were being used may have been locally distinct. These results may be heavily impacted by sample size, however, as the tables for element interactions and secondary elements are particularly sparse. It is interesting to note that the frequency of secondary elements also differs somewhat among sub-regions. Specifically, approximately 65% of vessels from the Upper Little Colorado have elaborated secondary elements whereas less than 38% of vessels from any other sub-region do.

For comparisons of the frequency of design bounding lines, the Upper Little Colorado sub-region is significantly different than all other areas except the

Table 8.5. X^2 probabilities for pairwise comparisons between sub-regions for each of the five measured variables. Statistically significant probabilities are highlighted.

Primary Element

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.3063			
MM	0.4568	0.2274		
ULC	0.2424	0.2379	0.5497	
MH	0.2269	0.2334	0.2434	0.1201

Element Fill

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.7071			
MM	0.4338	0.2584		
ULC	1.0000	1.0000	0.4133	
MH	0.8920	1.0000	0.5932	1.0000

Element Interaction

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.3828			
MM	0.0680	0.8311		
ULC	0.0330	0.6057	0.6777	
MH	0.0249	0.5672	0.5862	0.4338

Secondary Element

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.0535			
MM	0.1029	1.0000		
ULC	0.1049	0.2189	0.3588	
MH	0.0175	0.1629	0.0970	0.5692

Design Placement

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.6202			
MM	0.0384	0.3053		
ULC	0.2109	0.6847	0.7361	
MH	0.1624	0.5482	1.0000	1.0000

Bounding Lines

	EMV/PB	CW/WZ	MM	ULC
CW/WZ	0.4073			
MM	0.8246	0.5572		
ULC	0.0005	0.1044	0.0135	
MH	0.2469	0.6607	0.4038	0.6197

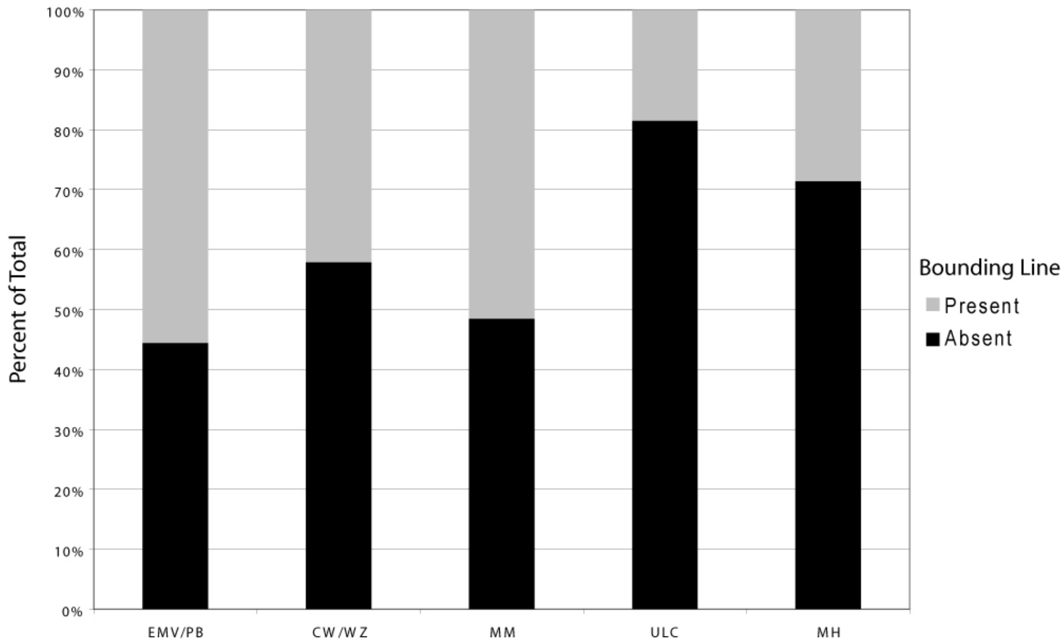


Figure 8.14. Barplot showing the relative percentage of designs with and without bounding lines by region of recovery.

Mogollon Highlands. As Figure 8.14 illustrates, vessels recovered from most portions of the study area were roughly evenly split between designs with banding lines and those without. Both the Upper Little Colorado and Mogollon Highlands areas are instead dominated by designs without bounding lines. Detailed examinations of several available whole vessels suggest that, when they were present, bounding lines were usually the first thing painted on the vessel exterior, setting up the layout of the design field. Such early steps in the design process are often among the most conservative aspects of design structure and heavily influenced by the learning framework of the producer (see Van Keuren 1999, 2001). Differences in the frequency of bounding lines may suggest differences in the learning frameworks of potters across the Cibola region rather than strong categorical distinctions. Interestingly, as the NAA study presented in Chapter 5 illustrates, the Upper Little Colorado area was largely separate from the sphere of ceramic circulation characterizing much of the Cibola region during the Pueblo III period, perhaps suggesting that direct interaction with potters to the east was somewhat limited. Thus, although potters across the Cibola region apparently drew on a common suite of decorative elements suggesting some level of shared categorical identity, differences in the details of execution like those discussed above suggest that the learning frameworks of potters were somewhat more local in nature.

Finally, in order to determine if similar designs were used by the producers of other common wares during the Pueblo III period, I conducted an additional X^2 test comparing the primary elements considered above for early White Mountain Red Ware bowls made across much of the Cibola region and Tularosa White-on-red bowls produced in the Mogollon Highlands. As Table 8.6 shows, the primary elements are not significantly different between these two wares. This result is, perhaps somewhat suspect, however, because of the small sample size and the number of elements that do not occur in Tularosa White-on-red. At the same time, the three most common primary elements across all early White Mountain Red Ware vessels are the only three elements recorded on the small sample of Tularosa White-on-red considered here. Overall, this suggests that, although Tularosa White-on-red and early White Mountain Red Ware bowls were distinct in terms of technology, color, and form, the individuals painting these vessels likely drew on a similar suite of design elements. Altogether, the analyses presented above suggest that, during the Pueblo III period, ceramic

Table 8.6. X^2 table and associated probability for comparison of primary design elements betwen early White Mountain Red Ware (WMRW) and Tularosa White-on-Red (TWoR).

Bounding Lines	WMRW	TWoR
Circular scroll	10	0
Hand/paw	8	0
Interlocking brackets	6	0
Simple lines	8	0
Rectangle/diamond	9	0
Rectangular scroll	52	9
Step/terrace	45	6
Triangle/zig-zag	28	1
Triangular scroll	12	0
$X^2 = 9.8933$	$p = 0.2369$	

wares were relatively homogenous across the study area, as were the exterior designs painted on those vessels, even when considering different wares. This further suggests a broad level of categorical identity shared among widely dispersed populations across the Cibola region during the Pueblo III period.

Identifying Repeating Design Configurations

As described above, there was a major change in the ceramic designs that individuals chose to paint on vessels in the Cibola region across the Pueblo III to Pueblo IV transition. The simple geometric exterior designs of early White Mountain Red Ware bowls and similar types were replaced by complex unit designs on late White Mountain Red Ware vessels and, although geometric figures were still common, designs on Zuni Glaze Ware bowls were considerably more discrete and complex. After numerous attempts to code exterior designs on these Pueblo IV period ceramics within the same design element analysis described above, I concluded that the differences were too great to produce meaningful results. Thus, I conducted a separate analysis focused instead on identifying the frequency with which repeated design configurations appeared on these Pueblo IV bowls in order to characterize similarities and differences across the study area. The analysis presented below reveals that the scale at which common design configurations were shared varied considerably between Zuni Glaze Ware and late White Mountain Red Ware bowls. These differences suggest that the scales at which strong categorical identities were shared and expressed likely also differed between areas dominated by each of these wares.

The analysis presented in this section, previously presented by Trask and Peeples (2011), is modeled after a similar study conducted by LeBlanc and Henderson (2009) focused on characterizing exterior designs on Jeddito Yellow Ware vessels. In their study, LeBlanc and Henderson note that certain iconic designs painted on the exteriors of Jeddito bowls appear on multiple vessels, perhaps suggesting that these designs were used to signal aspects of social identity to those who viewed them. Through a detailed analysis of the specific attributes of these exterior designs and details of their execution, the authors convincingly argue that the complex repeated designs in Jeddito Yellow Ware may have been used as signatures marking the work of specific artists or groups of artists. They also identified some groups of designs that were generally similar, but which varied substantially in detail and in quality of execution. LeBlanc and Henderson (2009:36) define these groups of vessels as "loose sets" and suggest that such similarities may indicate attempts by artists to signal membership in somewhat broader social groups. They (2009:21-23) also note the similarities between exterior designs on Jeddito vessels and those produced in the Cibola region and suggest that a consideration of repeated design configurations may produce similar results.

In this study, the heuristics for identifying and verifying repeating design sets described by LeBlanc and Henderson (2009:25-33; see Figure 8.15) were employed to analyze a sample of Zuni Glaze Ware (Heshotauthla and Kwakina Polychrome) and late White Mountain Red Ware (Pinedale Black-on-red and Polychrome) bowls. The creation of design sets through this analysis was an iterative process. All provenience information was stripped from the whole vessel photographs and they were sorted independently by me as well as by a research assistant, Garret Trask. We first attempted to identify vessels that shared designs representing the level of similarity in details noted in the Jeddito Yellow Ware study. We also placed groups of vessels in what we called "design families" when designs were generally similar, but differed substantially in detail and execution. These design families are similar to the "loose sets" described above but allow for somewhat more variation. We then compared groups created by both analysts. We considered the strongest design groupings to be those identified by both analysts independently. Remaining unassigned vessels were then reevaluated in relation to the groups created by both analysts until relatively discrete groupings had been established.

The analyses described above did not reveal many "tight sets" of exterior designs that as discrete or with so little variation in detail as those identified by LeBlanc and Henderson (2009). The sample considered in this analysis was considerably smaller than that used by LeBlanc and Henderson, so it is certainly

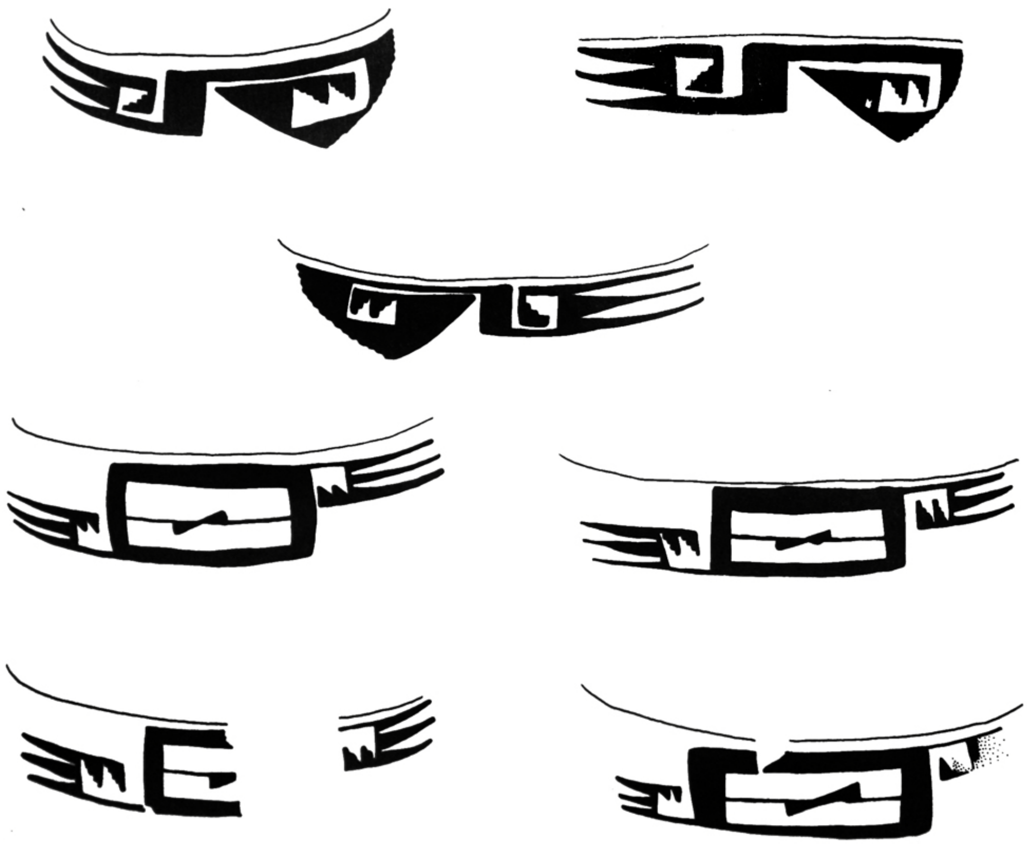


Figure 8.15. Example of two tight design sets defined by LeBlanc and Henderson in their study of Jeddito Yellow Ware bowls (redrawn from LeBlanc and Henderson 2009:Figure 4.1).

possible that tight sets of designs would be present in a larger image corpus. It is very likely, however, that strong design sets are much less common in the Cibola region as nearly half of the Jeddito Yellow Ware bowls could be placed in a design set (LeBlanc and Henderson 2009:32). We were able to identify several design families (see Figures 8.16 and 8.17). These design families likely do not represent the work of a single artist group, and instead suggest common adherence to broadly shared conventions of design, perhaps further suggesting efforts at signaling shared categorical identities.

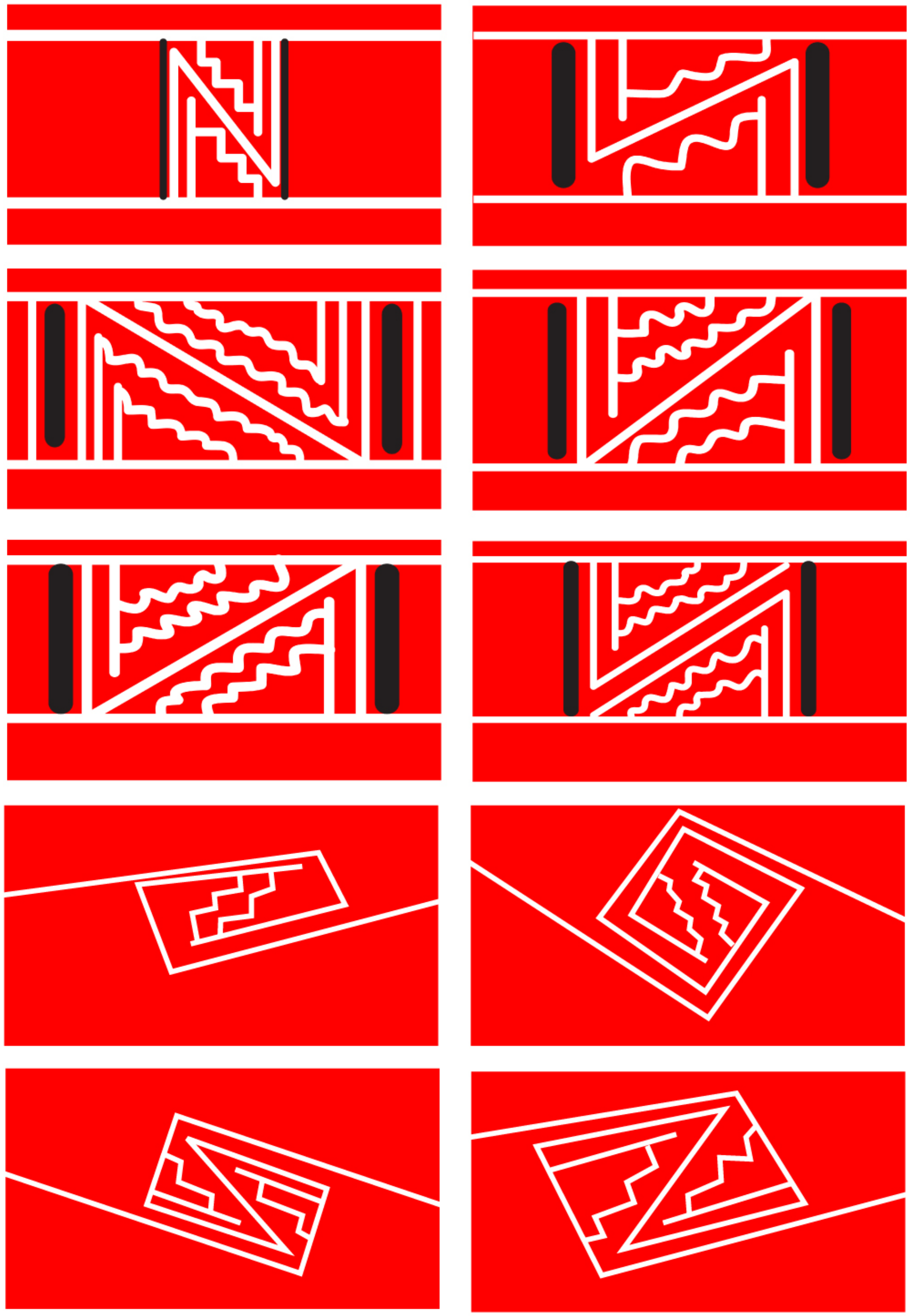


Figure 8.16. Examples of design families found on Zuni Glaze Ware bowls. The top six images represent the most common design family and the bottom four represent the second most common.

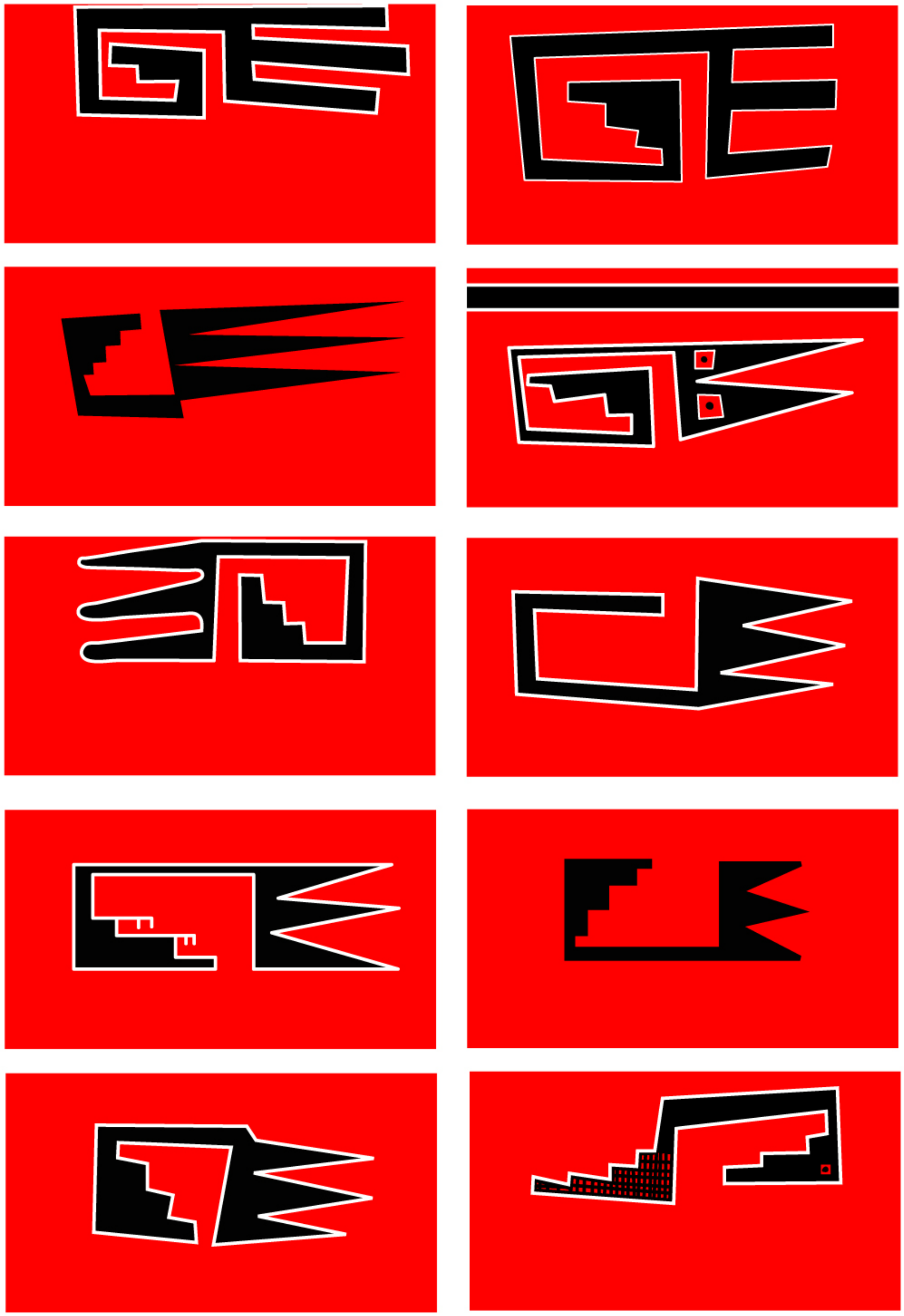


Figure 8.17. Examples of the most common design family found on late White Mountain Red Ware bowls.

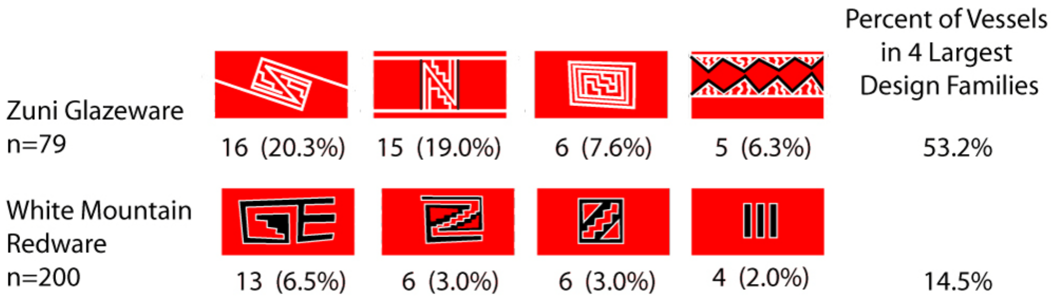


Figure 8.18. Frequencies of the four most common design families by ware.

Importantly, the scale at which common design families were shared varies widely. The four most common design families observed in the Zuni Glaze Ware sample account for over half of the image corpus, whereas the four most common families in late White Mountain Red Ware only account for only about 14% of all bowls considered (Figure 8.18). Furthermore, the majority of designs on the exteriors of late White Mountain Red Ware vessels were unique (68.5%) and could not be placed into any design family (Figure 8.19). These distinctions suggest differences in the scales at which designs were shared and, perhaps, differences in the scales at which categorical identities were expressed (or the strength of categorical identities in general) in areas where these different wares were produced and used.

The homogeneity of both traditionally defined ceramic wares and the designs painted on those wares in the Zuni area suggests that the inhabitants of this densely populated area engaged in active efforts at producing and maintaining conformity in the context of public displays involving these large serving vessels. Interestingly, one of the most common design families recorded on Zuni Glaze

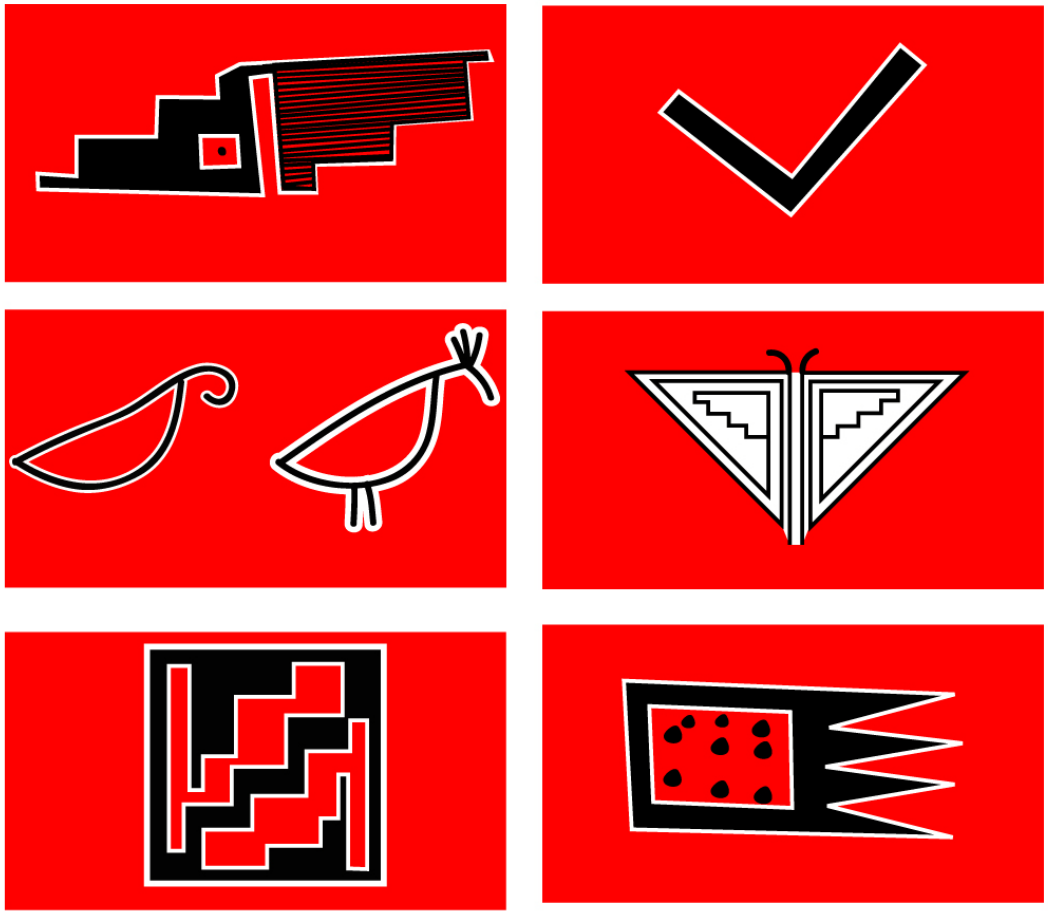


Figure 8.19. Examples of the range of variability in exterior designs on late White Mountain Red Ware bowls.

Ware vessels also appears in a wall mural documented at Atsinna pueblo in the El Morro Valley (Figure 8.20). Thus, these highly repetitive designs were used in multiple media, and may fit the definition of "pervasive styles" described by DeBoer (1991). Conformity in the realm of designs found on vessels which were used in public events may have helped to promote cooperation among the formerly distinct groups who came together to build the large towns in the Zuni area across the Pueblo III to Pueblo IV transition (sensu Kohler et al. 2004). In contrast, the diversity of designs on late White Mountain Redware vessels may

Figure 8.20. Mural on the east wall of room 4 at Atsinna in the El Morro Valley showing a common design found on Zuni Glaze Ware bowls. Photograph used with permission of El Morro National Monument, National Park Service.

reflect the diverse origins of the small social groups that gradually consolidated to form the large villages in the western portion of the Cibola region.

Spielmann (2004) has previously noted an even broader division, characterizing the Southwest as a whole, between Pueblo IV village clusters characterized by considerable diversity (emergent clusters) and those marked by homogeneity in material culture (integrated clusters). Spielmann argues that the inhabitants of emergent village clusters often chose to signal certain aspects of social coherence, but also maintained and expressed distinctions likely tied to their diverse histories and past affiliations. This pattern fits well with the ware distribution and stylistic information from the western and southern Cibola region described here. Within integrated clusters, like the Zuni area, the historical processes leading up to aggregation and nucleation often had a longer history locally (see also Huntley and Kintigh 2004). Material differences are often muted within integrated settlement clusters perhaps suggesting a more coherent sense of shared (categorical) identity at the level of the settlement cluster.

Summary and Conclusions

The analyses presented above illustrate through several lines of evidence that patterns of similarity in painted ceramic vessels in the Cibola region can be used to characterize patterns of shared categorical identity and distinctions at a regional scale. The size and boldness of designs painted on the exteriors of bowls varied in relation to the size and configuration of public spaces through time (see also Mills 2007a). This suggests that polychrome bowls across the Cibola region were produced with a concern for their visual communication potential. This can further be used to argue that these polychrome vessels were likely vehicles for the active expression of categorical identities in the context of public gatherings where they were used and exchanged.

In general, during the Pueblo III period, painted ceramics ware distributions were relatively homogenous across the Cibola region as a whole. In the few areas along the southern and western edges of the study area where ware frequencies varied somewhat, locally produced wares incorporated design configurations similar to those found on vessels produced in the central Cibola region including bold geometric white lined designs painted on a red slipped surface. Furthermore, the specific design elements painted on the exteriors of bowl recovered from settlements located across the study area were also quite homogenous, though differing in some details of execution. Together, the data presented above suggest that, during the Pueblo III period, highly visible conventions of design used on painted ceramics were broadly shared across most of the Cibola region. This suggests that the inhabitants of the entire region likely also shared some level of categorical identity that was regularly and publicly expressed through painted ceramics. Importantly, the broad similarities and shared categorical expressions noted above spanned multiple distinct wares and even areas characterized by distinct spheres of ceramic circulation.

Patterns of similarity in ceramic designs changed quite dramatically across the Pueblo III to Pueblo IV transition. There was a massive diversification of ceramic wares in the last years of the thirteenth century along with an increasing localization of specific wares. Local diversity increased quite markedly in many portions of the Cibola region. At the same time, within the Zuni area including the West Zuni, Pescado Basin, and El Morro Valley sub-regions, a strong pattern of homogeneity in ceramic wares persisted. This homogeneity was even been more pronounced than in earlier periods as the designs painted on the exteriors of Zuni Glaze Ware bowls were extremely repetitive and even appeared on multiple media. The data presented above suggest that the spatial scale (and presumably social scale) at which shared categorical identities were expressed declined across the Pueblo III to Pueblo IV transition. Within the Zuni area, expressions of categorical identity were increasingly homogenous, suggesting a strengthening or consolidation of categorical identities across the late thirteenth century social transformation. In the areas to the west and south, categorical expressions were considerably more diverse, suggesting weaker categorical connections overall, likely reflecting the diverse histories and past affiliations of the inhabitants of those areas.

Chapter 8 Notes

[1] Interestingly, there is even evidence in some portions of the Cibola region that settlements with certain architectural features (kivas and great kivas) had higher relative frequencies of polychrome bowls, perhaps suggesting that public food consumption and serving occurred more often in association with certain architectural features.

[2] Mills (2007a) also notes that, during the late Pueblo IV period (ca. A.D. 1325-1400), as the average size of plaza spaces increased, the height of designs and the frequency of banded designs once again increased. Such a transition was not noted in the Zuni area, however, the average size of plaza spaces did not differ substantially between the early and late Pueblo IV periods (see Chapter 9).

[3] For these pairwise X^2 tests, rows with marginal values of 0 were removed.

Chapter 9:

PUBLIC ARCHITECTURAL SPACES AND SHARED CATEGORICAL IDENTITIES

Public architecture is defined here as highly visible built spaces with evidence for use by large numbers of individuals simultaneously. Public structures provide formal spaces for individuals to interact with those outside of their own kin or residential groups. Cross-culturally, the largest forms of public architecture are often associated with public ritual or other specialized community level activities (Adler 1989; Adler and Wilshusen 1990; Hegmon 1989:7-9; Rapoport 1982:29-30). As gathering places or focal points, public spaces are contexts where social norms and ideologies can continually be reinforced or contested. Such structures often become powerful symbols of interaction and interdependence among segments of a society (Hegmon 1989; Lipe and Hegmon 1989; Low 1996; Varien 1999:22-23). Thus, public architecture can be conceptualized as both a venue for interaction at a large social scale as well as a symbol of the shared traditions that are enacted in those spaces.

In the analyses presented below, shared forms of public architecture are interpreted as common contexts for public rituals. I argue that communities with similar public structures were likely engaged in similar, perhaps overlapping, spheres of public ceremonialism (see also Adams 1991; Herr 2001:30-31; Stein and Lekson 1992). Furthermore, the scale of these spaces in the Cibola region suggests that public architectural features may have provided formal contexts for the active expression of identities in gatherings above the scale of co-residing units (e.g., Kintigh et al. 1996; Mills 2007a; Peeples 2006; Potter 2000). In the context of such gatherings, public buildings may have served as important "mnemonics" for shared membership in social groups and social expectations among participants with diverse origins (Hegmon 1989:7; see also Kus 1982:54). In this vein, patterns of shared public architectural features can be interpreted as one indication of shared categorical identities among the inhabitants of communities across the Cibola region.

Forms of Public Architecture in the Cibola Region

There are a variety of common architectural features in the Cibola region which fit the broad definition of public structures provided above, often with multiple types constructed at single settlements. Unfortunately, not all forms of public architectural spaces can be easily characterized without extensive excavation or documentation. The approach I take in this chapter is to concentrate primarily on the dimensions of variation in public structures that can be compared based largely on surface remains. Specifically, I focus on three types of features found across the Cibola region ca. A.D. 1000-1400: great kivas, great houses, and plazas. Following this, I provide a brief discussion of the limited evidence available for other potentially public or ceremonial architectural features. The period considered in this chapter begins more than a century earlier and extends later in time than the interval considered in the bulk of this dissertation. This is because many of the strongest patterns in the distribution of public architectural spaces were in place at least by the eleventh century and continued to structure regional patterns throughout the prehispanic period.

Great Kivas

Although the label "great kiva" has been applied to a wide variety of structures at different times in places across the Southwest (see Anyon and LeBlanc 1980; Haury 1985; Herr 1994; Martin et al. 1964:55-58; Roberts 1929:73-81; Vivian and Reiter 1960), the term is usually reserved for large subterranean or semi-subterranean structures, often with a specific set of internal features, which are inferred to have served a communal ritual purpose. The earliest structures traditionally accepted as great kivas date to about A.D. 300 (Bluhm 1957:25-27; Haury and Sayles 1985; Martin et al. 1957:200-203; Roberts 1929; Vivian 1990; Wheat 1955). These early great kivas resemble contemporaneous residential pithouses, but they are larger and have formal features not typically found in habitation structures. Great kivas increase in formality and frequency through time, peaking between about A.D. 900 and 1200 (Herr 1994). The specific forms of great kivas vary at a regional scale in ways that are often identifiable based on surface remains alone.

Great kivas on the Colorado Plateau are typically circular in plan. The earliest examples are little more than oversized pithouses with earthen walls and relatively little internal embellishment. Beginning in the tenth century and escalating dramatically by the mid eleventh century, a number of highly elaborate masonry great kivas were constructed in Chaco Canyon in the central San Juan Basin (Van Dyke 2007:94-95). These structures range from 12 to about 22 meters in diameter and have intramural features including massive roof support posts, formal hearth complexes, benches lining the walls, antechambers, and floor vaults which may have been used as foot drums (Lekson 2007:20-21; Van Dyke 2007; Vivian and Reiter 1960). Chacoan style masonry great kivas were also constructed across many portions of the Cibola region at this time (Figure 9.1; Roberts 1932). Not all of these outlying circular great kivas share all of the formal features of the Chacoan great kivas, but Herr (2001:30-33) argues that after the fluorescence of great kiva construction in Chaco Canyon, circular great kivas of varying degrees of formality were likely symbolically associated with Chacoan developments (see also Fowler et al. 1987:72-74; Haury 1985:386-388).

In the Cibola region there is another class of feature typically known as oversized, unroofed great kivas. These structures range from 25 to 35 meters in diameter and consist of an outer wall, a lower bench or inner wall, usually without any permanent internal features (Figure 9.2; Fowler et al. 1987; Kintigh et al. 1996; McGimsey 1980; Schachner and Kintigh 2005; Schachner 2007). Large unroofed great kivas are often associated with thirteenth century Post-Chacoan great house complexes or other Post-Chacoan era communities, but one somewhat smaller earlier example has been documented at the Cox Ranch site near the Zuni Salt Lake (ca. A.D. 1050-1130; Duff 2005).[1] Unroofed great kivas are also found near some of the earliest and largest nucleated pueblos in the Zuni and El Morro Valley areas, but were likely no longer constructed after the mid thirteenth century (Duff and Schachner 2007; Schachner 2007:236-237). Oversized great kivas have been interpreted as late manifestations of Chacoan style great kiva architecture in the Cibola region (Fowler et al. 1987:86-87). Interestingly,

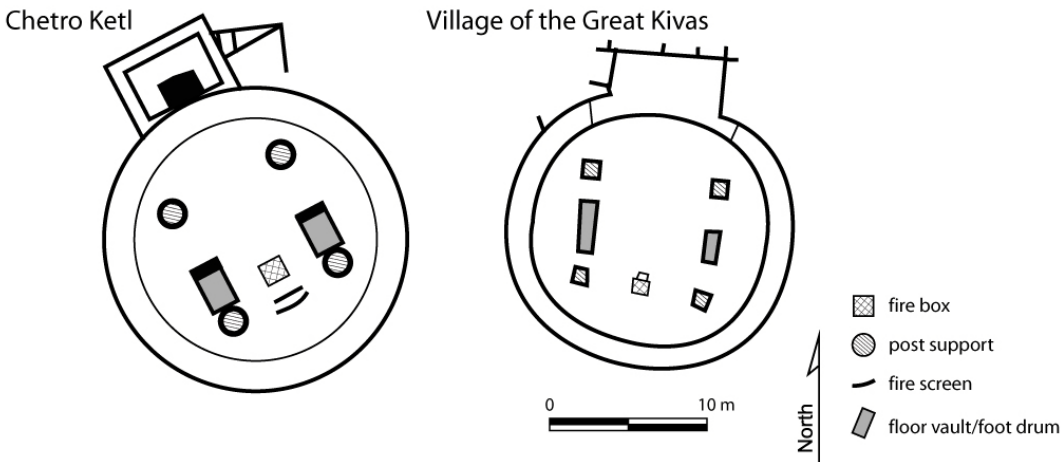


Figure 9.1. Examples of Chacoan era circular great kivas from the Chaco Canyon region (left) and the Cibola region (right).

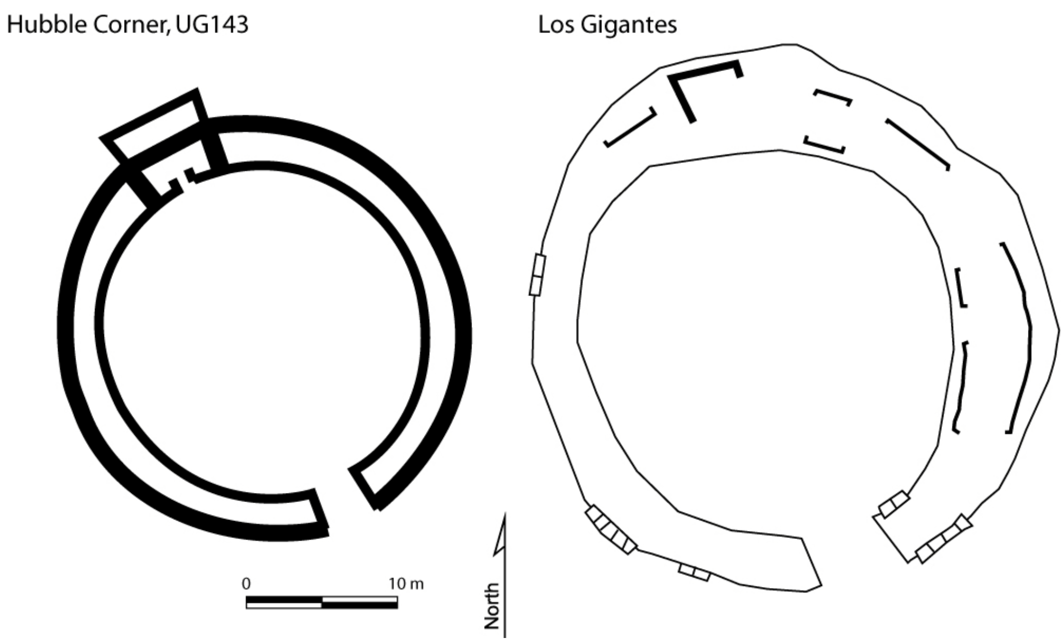


Figure 9.2. Examples of unroofed, oversized great kivas from the Mariana Mesa (left) and El Morro Valley (right) sub-regions.

however, as these structures are unroofed, they may have been designed to be more inclusive than earlier roofed Chacoan era structures. Kintigh and others (1996; Kintigh 1994) argue that the increased size and openness of these structures suggest that the scale of participation in communal ritual may have expanded somewhat during the Pueblo III period.

In contrast to the circular Chacoan style great kivas found across a large portion of the Colorado Plateau, in the mountainous areas to the south, great kivas were usually square or rectangular in form during the period considered here (Bluhm 1957; Hough 1907; Martin et al. 1956; Olson 1960; Rinaldo 1962; Zamora and Oakes 1999).[2] They typically consist of large semi-subterranean masonry or earthen walled structures with a ramp entryway facing east or southeast, a small informal fire pit, post roof supports, floor grooves which may have been similar to Chacoan floor vaults, and masonry lined benches in many later examples (Figure 9.3). These rectangular structures have many features in common with large Three Circle phase (post A.D. 900) masonry lined pithouses of the Mogollon Highlands and the Mimbres areas (Anyon and LeBlanc 1980; Bluhm 1957:25-27; Danson 1957:81-82).

During the tenth through twelfth centuries, rectangular great kivas were typically separate structures located near large pueblos or clusters of small settlements (Bluhm 1957; Olson 1960). In later centuries, rectangular great kivas were sometimes attached to masonry pueblos (e.g., Danson and Malde 1950; DeGarmo 1975; Martin et al. 1962), and some of the latest examples consist of plaza spaces converted into roofed great kivas (e.g., Riggs 2001:107-111). These plaza features are perhaps the latest great kivas constructed in the greater Cibola region (ca. A.D. 1325) and may have continued to be used throughout the

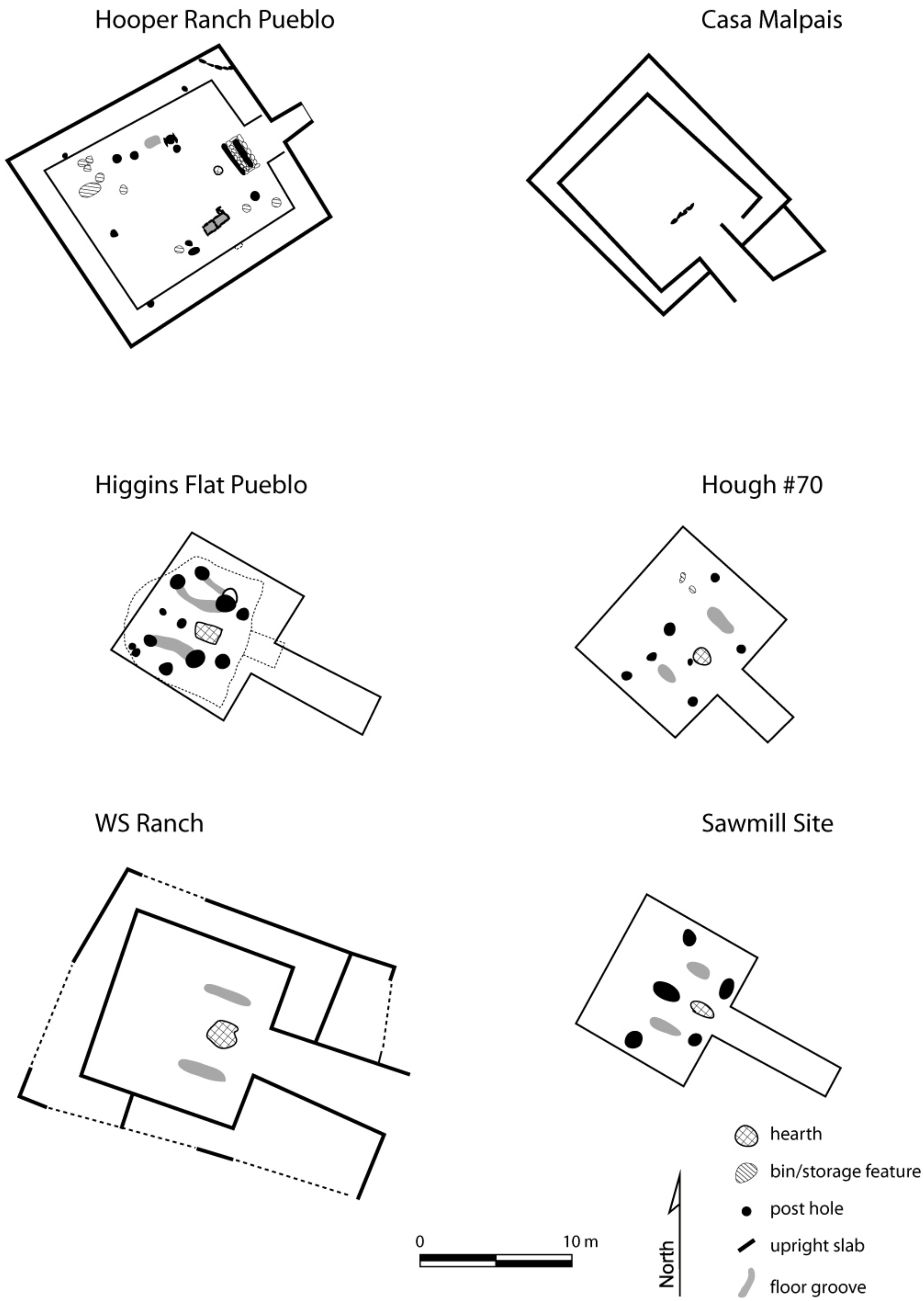


Figure 9.3. Examples of rectangular great kivas from the Upper Little Colorado (top row) and Mogollon Highlands (bottom two rows).

fourteenth century (Riggs 2005:338-340). Although there are obvious formal similarities between circular Chacoan great kivas and rectangular great kivas (i.e., benches, overall size, floor grooves/foot drums, etc.), due to the long-term persistence of their shape, entryway orientation, and distinctive floor features, many researchers see rectangular great kivas as distinct architectural developments related to a different ceremonial tradition (see discussions in Gregory and Wilcox 2007; Haury 1985:47-52; Oakes 1999; Olson 1960; Riggs 2005; Rinaldo 1962).

The long-term maintenance of distinct traditions of great kiva form and construction described above suggests that these circular and rectangular structures were used in different kinds of public ritual activities (Gregory and Wilcox 2007; Herr 2001; Whittlesey 2010). Thus, the distribution of circular and rectangular great kivas across the Cibola region may provide one indication of patterns of shared ritual expression, or categorical identities, at a broad social scale. As the distributions of various forms of great kivas across the region are closely tied to the distribution of great house architecture, these features will be discussed together in a subsequent section.

Great Houses

Great houses are unusually prominent and massively constructed pueblos showing strong similarities to the large structures built in Chaco Canyon between the late A.D. 800s and the early 1100s. Great houses are characterized by the presence of any or all of a set of distinctive architectural features including; core and veneer masonry walls, blocked in kivas, oversized rooms, multi-story

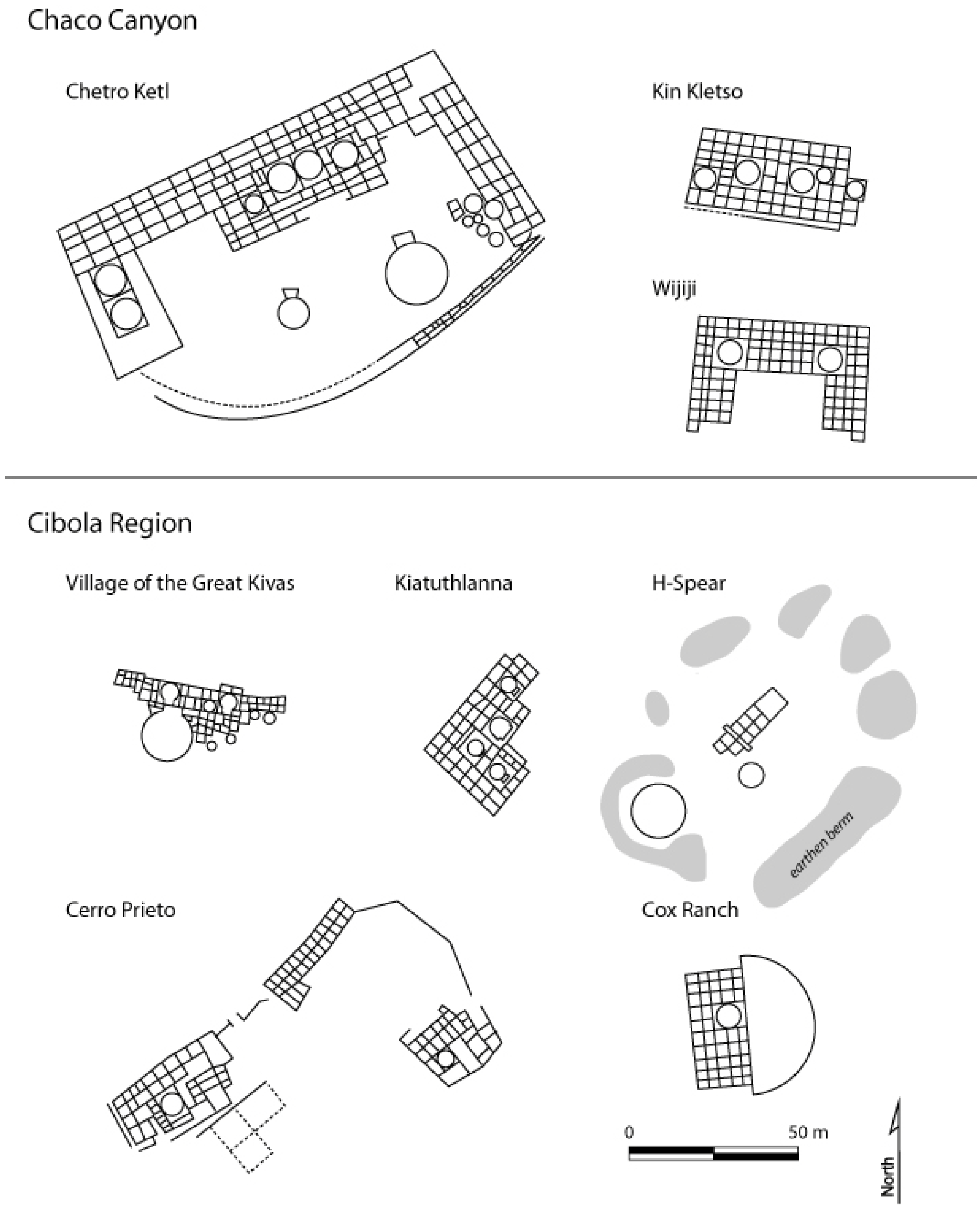


Figure 9.4. Examples of Chacoan era great houses from Chaco Canyon (top) and the Cibola region (bottom).

construction/massive single story construction, or distinctive architectural layouts (Figure 9.4; Fowler and Stein 1992; Kantner and Kintigh 2006:155; Lekson 1991:31-36; Lekson et al. 2006; Van Dyke 1998). Many great houses are part of larger architectural complexes associated with features such as great kivas (see discussion above), large earthen berms, and roads. Researchers disagree regarding how many and which architectural features are essential for characterizing a structure as a great house (c.f., Fowler et al. 1987:78-80; Fowler and Stein 1992; Gilpin 2003; Kintigh 2003; Marshall et al. 1979), but at a minimum, great houses are recognized as relatively large and elaborate masonry structures when compared to contemporaneous residential buildings (Lekson 1991:31-36).

Until the 1980s, definitions of the great house were usually restricted to buildings constructed during the Pueblo II period (ca. A.D. 900-1150), coinciding with the interval of great house construction in Chaco Canyon itself. More recently, however, a number of researchers have documented the continuation of many elements of great house architecture in the Cibola region at least into the late thirteenth century (ca. A.D. 1150-1275), well after the major declines in populations within Chaco Canyon and much of the central San Juan Basin (Figure 9.5; Fowler et al. 1987; Kintigh 1994; Kintigh et al. 1996; Schachner and Kintigh 2005). Great house complexes built during the Post-Chacoan era continued to reference Chacoan architecture (massive construction, blocked in kivas, earthen berms, etc.) but also added new elements to the architectural repertoire including the oversized, unroofed great kivas described above (Kintigh et al. 1996). Several Post-Chacoan great houses may also have been symbolically linked to earlier Chacoan era structures by landscape modifications including roads connecting non-contemporaneous structures, which some have termed "time bridges" (Fowler

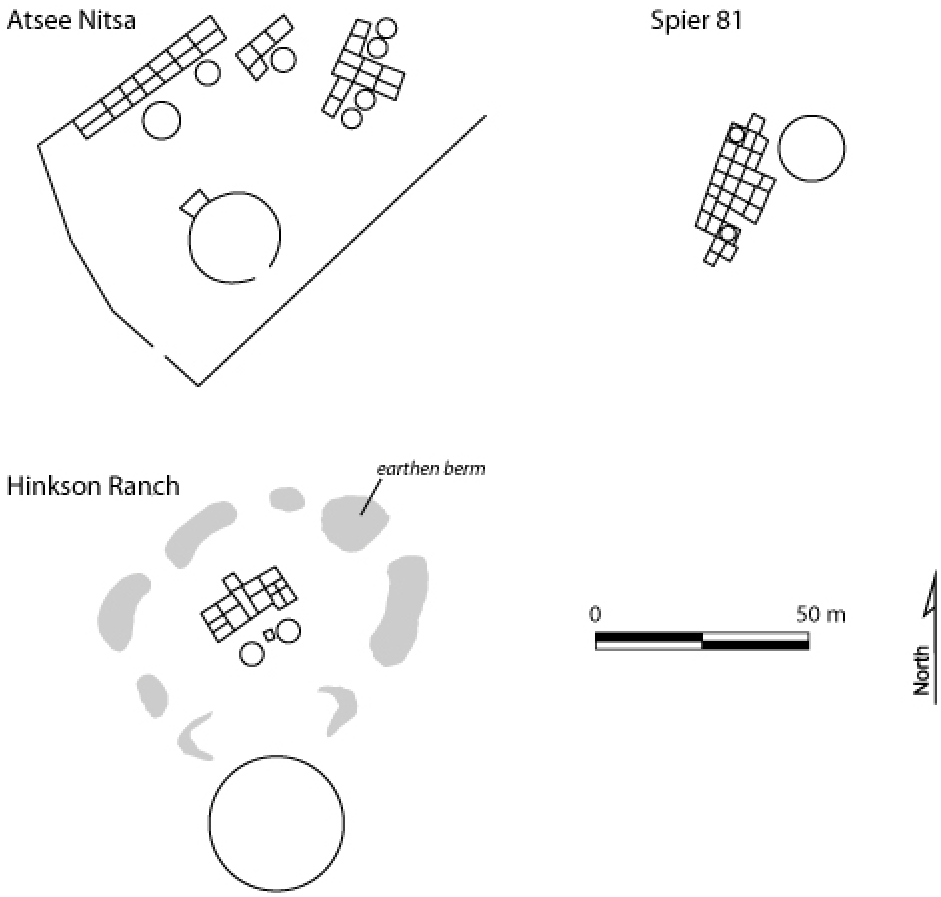


Figure 9.5. Examples of Post-Chacoan era great houses from the Cibola region.

and Stein 1992:116-118; see also Fowler et al. 1987; Stein and Fowler 1996). The continued use of Chacoan architectural symbolism after the decline of Chaco as a regional center emphasizes the local importance of great house architectural complexes in the Cibola region (Cameron and Duff 2008).

Although a few Post-Chacoan great houses persisted in some fashion into the early fourteenth century (as suggested by ceramic types present on the surface [Gilpin and Hasbargen 2004:1095-1105]), this specific form of architecture was no longer the focus of settlements intensively occupied after about A.D. 1275 (Duff and Schachner 2007). Across most of the Cibola region at this time, aggregated site clusters and great house sites were replaced by large nucleated pueblos (Duff 2002; Kintigh 1985; Kintigh et al. 2004). Some of these nucleated pueblos retained certain features of Chacoan architecture (Fowler et al. 1987:93-101), but the transition to nucleated settlement represented a fundamental shift in the organization of communities and architectural space across the region as a whole and an apparent decline in the importance of Chaco Canyon as an architectural referent (Duff and Schachner 2007; Kintigh et al. 2004).

Few Chacoan or Post-Chacoan great houses in the Cibola region have been extensively excavated or documented (but see Burton 1993; Fowler et al. 1987; Kintigh et al. 1996; Mahoney et al. 1995; McGimsey 1980; Roberts 1932, 1939; Schachner and Kintigh 2005; Warburton and Graves 1992). Due to their size and formal construction, however, great houses can often be identified based on surface remains alone. As discussed above, the long history of great house construction in the Cibola region suggests that these structures were powerful architectural symbols which provided contexts for communal activities in the region for nearly three centuries. I interpret the presence of great house architecture as indicative of participation in some form of shared ritual practice among the inhabitants of great house communities across the Cibola region. The distribution of great houses and great kivas are discussed together in the following section.

The Distribution of Great Kivas and Great Houses

In order to explore the distribution of the most common public architectural features found across the Cibola region, I have compiled available locational and chronological information on all relatively well documented great kivas and great houses throughout the study area.[3] These data were used to create a series of maps to show changes in the distribution of public architectural features through time in three temporal intervals; ca. A.D. 1000-1150, A.D. 1150-1275, and A.D. 1275-1400. These maps reveal regional scale patterns in the distribution of the most common public structures, which I argue indicate strong patterns of shared categorical identity across the study area.

As Figure 9.6 shows, during the late Pueblo II period (ca. A.D. 1000-1150), Chacoan great houses and circular great kivas were common in the northern and eastern portions of the study area including the Zuni area, the Carrizo Wash and Mariana Mesa areas as well as near Cebolleta Mesa, the Puerco Valley, and the Red Mesa Valley along the edges of the Cibola region. Although both circular and rectangular great kivas have been documented in the western portion of the study area between the Silver Creek and the Vernon, there are no great houses in those areas. This pattern will be explored further below. Rectangular great kivas dating to this interval have also been documented in the Mogollon Highlands and along the edges of the Arizona Mountains.[4] Although the specific locations and architectural details are not known, Danson (1957:61-62) noted rectangular great kivas as well as possible circular great kivas in the upper reaches of the Little Colorado River near the White Mountains (see also Duff 2002:69-71).

Interestingly, there is also at least one possible great house and an associated circular great kiva in the Mogollon Highlands along Apache Creek

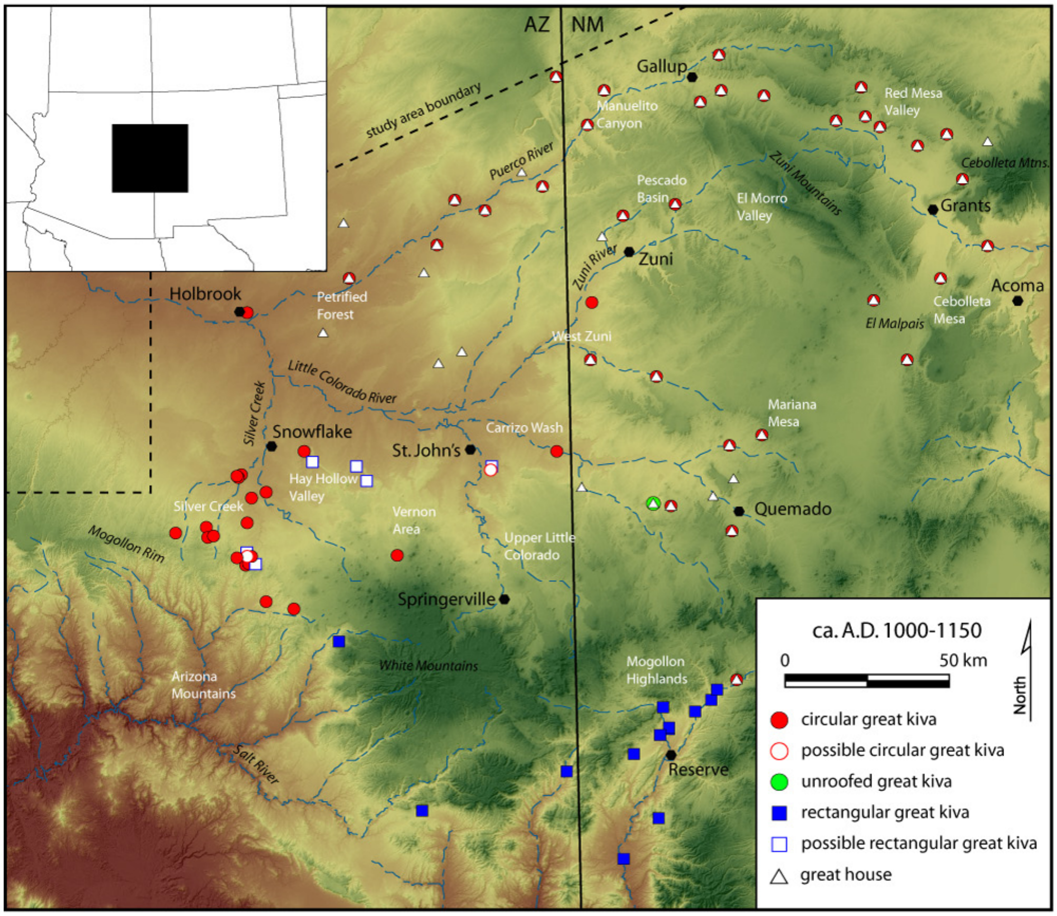


Figure 9.6. Map showing the locations of great houses and great kivas of various forms during the late Pueblo II period.

near the town of Aragon, New Mexico. This site was first recorded by Hough in 1905 as No. 111 and is also sometimes known as the Aragon site (Hough 1907). The Aragon site is a relatively poorly known C-shaped pueblo of about 70 rooms with massive coursed stone walls, multiple stories, and a large circular depression which may represent a great kiva (Hough 1907; Schroeder and Wendorf 1954; ARMS notes). Unfortunately, this site was largely destroyed by highway construction in the 1950s and completely bulldozed in the 1980s. Hough (1907:Plate VIII) published two photographs of the walls and possible great kiva depression at Aragon which are certainly suggestive of Chacoan architecture. Although only limited information is available for the Aragon site, it potentially represents the southernmost Chacoan era great house in the region (see also Lekson 1999:42-44).[5] Overall, however, despite intriguing possible exceptions such as the Aragon site, the available data suggest that the distributions of great houses with circular great kivas and other communities with rectangular great kivas were fairly distinct during the late Pueblo II period.

The distribution great houses during the Pueblo III period (ca. A.D. 1150-1275) was generally similar to that documented for the previous interval, except that Post-Chacoan great houses were fewer in number and more heavily concentrated in the central portion of the region near Zuni and the El Morro Valley (Figure 9.7). Notably, the Red Mesa Valley in the northeastern portion of the study area was largely depopulated by the Post-Chacoan era. A few great houses and circular great kivas first established during the Chacoan era persisted into the early thirteenth century, but absolute dates are currently unavailable. There are also a few probable examples of roofed great kivas associated with Post-Chacoan great houses or other Pueblo III communities in the Zuni and Cebolleta Mesa areas (e.g., Spier 81 [Kintigh et al. 2004]; Casa Mosca [Wozniak and Marshall 1991]; LZ1306 [Schachner 2007:236]), but most newly built circular great kivas during this interval were extremely large and almost certainly unroofed. There are also at least three oversized unroofed great kivas associated with some of the earliest nucleated pueblos in the El Morro Valley and along the

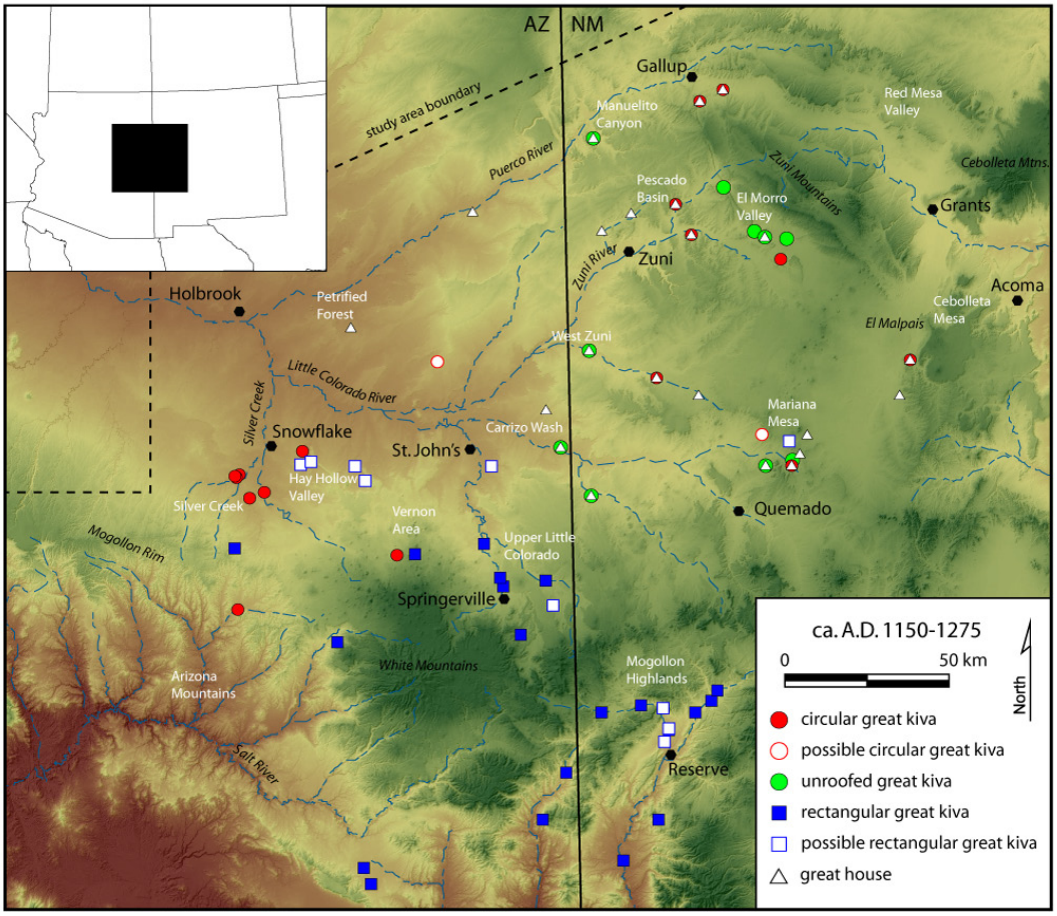


Figure 9.7. Map showing the locations of great houses and great kivas of various forms during the Pueblo III period.

Upper Nutria River, but it is likely that these features were no longer in use after A.D. 1275 (see Schachner 2007:236-237, 245; Duff and Schachner 2007).[6]

The distribution of rectangular great kivas during the Pueblo III period is also similar to that for the late Pueblo II period, but the frequency of great kivas in the Upper Little Colorado area, especially in the south near Springerville, increased dramatically during the thirteenth century. In addition, one possible rectangular great kiva was been excavated by an amateur archaeologist in the Mariana Mesa region from a site likely dating between about A.D. 1150-1250

(LA 10982; ARMS field notes). Although little information is currently available on this feature, the possibility of a rectangular great kiva is intriguing as many other lines of evidence suggest that the Mariana Mesa area was a destination for migrant populations, perhaps including individuals from areas to the south and west where rectangular great kivas were common.

The distribution of public architectural spaces across the Cibola region changed dramatically after about A.D. 1275 (Figure 9.8). Although absolute dates are not available in most cases, existing data suggest that the vast majority of great kivas and likely all great houses in the Cibola region were no longer occupied or intensively used by or around A.D. 1275. There are, however, several exceptions to this general pattern in the southern and western portions of the region. The rectangular great kivas at Hooper Ranch Pueblo (Martin et al. 1962) and Casa Malpais (Duff 1999:Appendix A) in the Upper Little Colorado area were built during the thirteenth century, but there is evidence for their continued use into the mid fourteenth century. Some thirteenth century rectangular great kivas in the Mogollon Highlands area including the structures at Foote Canyon Pueblo (Rinaldo 1959), Hough's site 70 (Zamora and Oakes 1999), WS Ranch (Tomka 1988) as well as possible rectangular great kivas at Shumway Ruin (Van Keuran 2006) and Tundastusa (Hough 1903:290) in the Silver Creek area may have continued to be used into the fourteenth century. In the Arizona Mountains, rectangular great kivas were newly constructed at Grasshopper Pueblo, Kinishba, and substantially remodeled at Point of Pines Pueblo (AZ W:10:50 [ASM]) during the fourteenth century (ca. A.D. 1325; Riggs 2005:338-340).[7] These

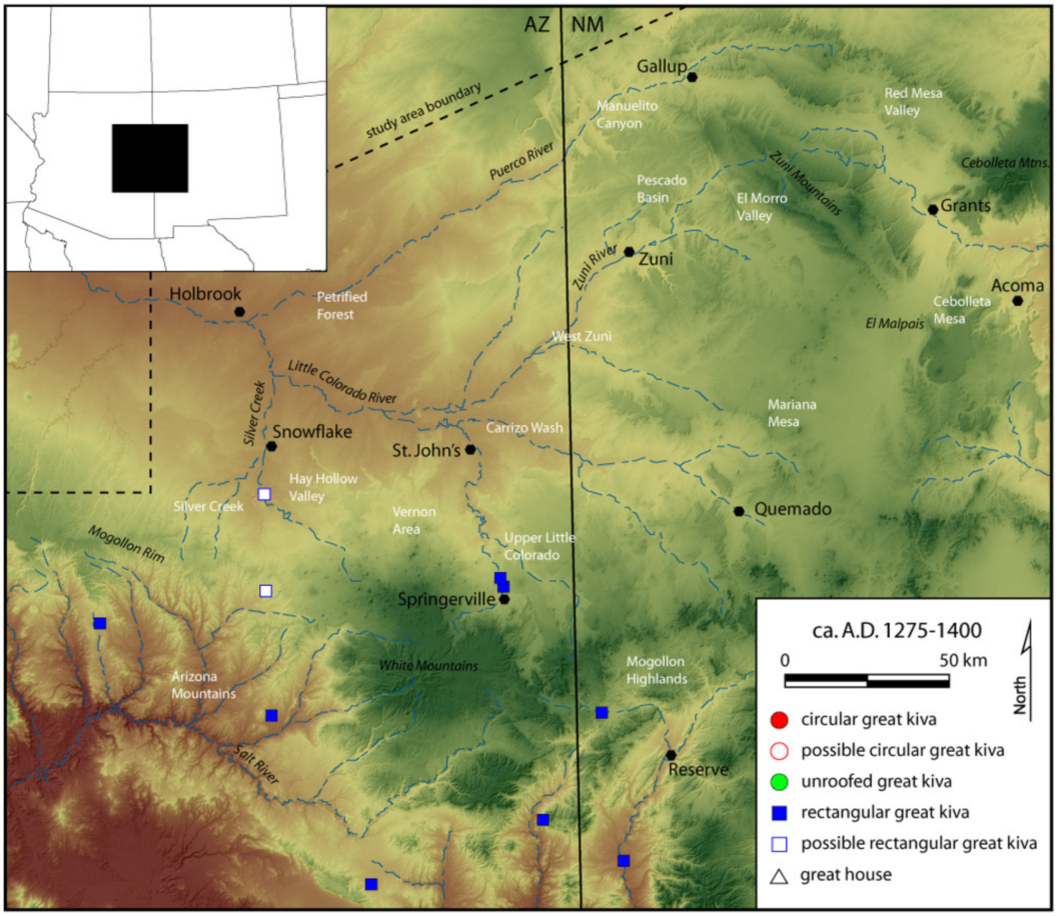


Figure 9.8. Map showing the locations of rectangular great kivas during the Pueblo IV period.

fourteenth century structures consist of plazas converted into roofed areas with orientations and floor features similar to earlier great kivas. Interestingly, the available data suggest a divergence between the northeastern and southwestern portions of the study area as rectangular great kivas were constructed well after circular great kivas fell out of use across the region as a whole.

One strong pattern which is apparent across all of the maps presented here is that great houses are exclusively associated with circular great kivas, both roofed and unroofed. Further, there are relatively few areas where the distributions of rectangular and circular great kivas overlap. The consistent dichotomy between areas characterized by great houses with circular great kivas and areas characterized by aggregated or clustered settlements with rectangular great kivas illustrates the long-term maintenance of regional differences in public architectural spaces across the study area. This further supports the idea that these different forms of public architecture likely related to distinct spheres of public ceremonialism and distinct contexts for categorical expression (see also Riggs 2005; Whittlesey 2010). However, there are a few areas where this consistent regional pattern appears to break down to some degree.

The distribution of great kivas and great houses in the western portion of the study area, especially in the Silver Creek area, is particularly interesting in light of the general patterns described above. This western area has the highest density of circular great kivas in the study area between about A.D. 1000-1150, but relatively low population levels throughout the eleventh through the thirteenth centuries. At the same time, there are no great houses in this portion of the study area. This same general pattern of circular great kivas without great houses holds for nearby areas including the Forestdale Valley, the Hay Hollow Valley, the Vernon area, as well as the Chevelon Creek and Hopi Buttes areas just west of the current study area (see Burton 1993; Haury 1985:Appendix A; Herr 2001; Rinaldo 1964:55-58; Solometo 2004). Although excavated circular great kivas in these areas are similar to Chacoan style great kivas in many ways, there are also notable differences. Specifically, these western circular great kivas are often shallow, possibly only partially roofed, the orientations are often different from that of most Chacoan great kivas, and internal features are not consistently present

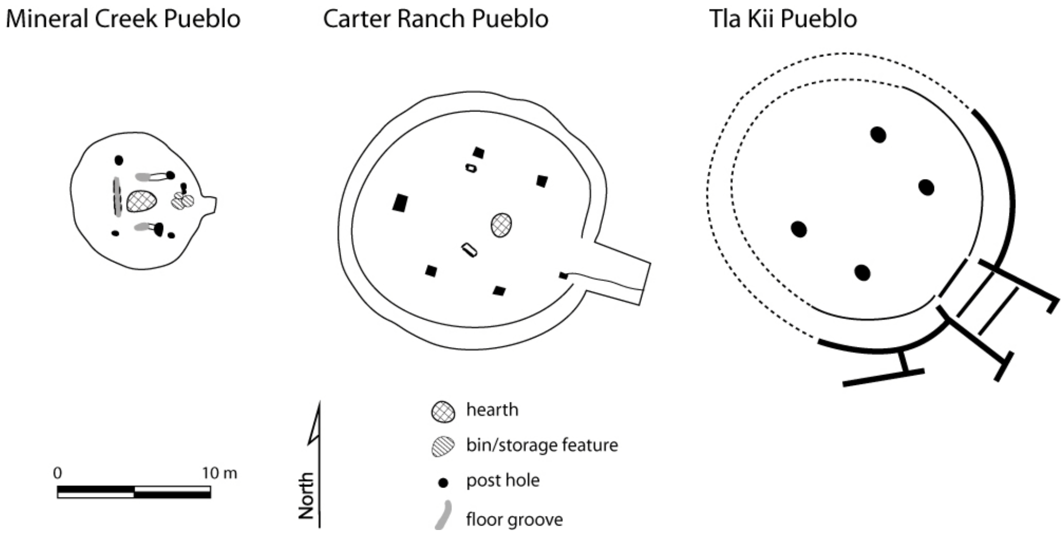


Figure 9.9. Examples of circular great kivas from the Vernon area (left), the Hay Hollow Valley (center), and the Forestdale Valley (right).

or as highly formalized. (Figure 9.9; Burton 1993; Herr 2001:42-59; Haury 1985:415-422; Martin et al. 1961; Rinaldo 1959).

Herr (2001) argues that circular great kivas along this western edge of the study area fell along a frontier zone, beyond Chaco and between other major population centers. Circular great kivas in the Silver Creek drainage and surrounding areas my have been constructed, in part, by migrant populations from the southern edge of the Chacoan world, including the Puerco Valley to the north (see Gregory and Wilcox 2007:140 for an alternate perspective). In this resource-rich but labor poor western frontier, architectural symbols associated with Chacoan developments may have provided a means to integrate dispersed migrant and local households across the landscape, and a context for the coordination of social and economic activities (Herr 2001:91-94). Because population levels were low, however, the labor may not have been available to construct more formal great kivas or massive great houses.

The same general areas described above (Silver Creek, the Hay Hollow Valley, the Forestdale Valley, and the Vernon area) are essentially the only areas in the Cibola region where circular and rectangular great kivas overlap substantially in distribution. Unfortunately, little is known about the specific form and date ranges of the early rectangular great kivas in this zone as most examples are known exclusively through surface information. Because only general descriptions are usually available, it is often difficult to distinguish between the ramp entry rectangular great kivas described above and smaller, rectangular platform kivas which are also found in this area (these features are described in detail below). Further, it is possible that some of the overlap is due, in part, to the lack of chronological resolution. Almost all of the circular great kivas present in this western zone during the Pueblo III period were likely initially constructed during the eleventh or early twelfth centuries, but continued to be used through the end of the twelfth century and perhaps somewhat later (e.g., Lightfoot 1981; Martin et al. 1964). Where good chronological data are available, rectangular great kivas appear to be most common in this area in the thirteenth century (Herr 2001:24-25). The apparent architectural variability within this western zone may be a product of the diverse populations inhabiting this frontier or changing external relationships through time. Additional site recording and excavations in this area could potentially provide the data necessary to evaluate these possibilities.

Plazas

For the purposes of this study, plazas are defined as open areas enclosed within the boundaries of other architectural features. In contemporary Puebloan communities, plazas are important spaces for both routine daily activities as well as periodic ceremonial gatherings (Adams 1991:81-86; Bunzel 1932:896-897; Dozier 1958; Parsons 1939:309; Triadan 2006). Several researchers have suggested that changes in the specific forms and sizes of the plazas through time may indicate changes in the kinds of ritual or the scale of activities occurring within those spaces (Adams 1991; Chamberlin 2008:121-158; Mills 2007; Potter 1998). Thus, I argue that patterns of shared ritual practices and categorical identities can be explored through an examination of patterns of similarities and differences in plaza spaces across the Cibola region.

Several of the largest sites in the Cibola region have been mapped in ways that allow for the consideration of overall site plans and the nature of plaza spaces, but most have not been so thoroughly documented. Thus, the approach I take in this section is to describe general trends in the use of plaza spaces across the Cibola region through time rather than attempting to map the distributions of specific forms. This discussion necessarily reduces much of the variability present in plaza architecture across the region as a whole, but some broad scale patterns are still identifiable.

Although enclosed plazas are known from a few eleventh and twelfth century great houses across the Cibola region and elsewhere (Fowler et al. 1987:80-81; see plan maps in Fowler et al. 1987; Marshall et al. 1979; Van Dyke

1998; Warburton and Graves 1992), formal plaza spaces are relatively rare across the Cibola region until the thirteenth century.[8] Schachner (2007:238, Figure 7.6) recently documented several partially enclosed plazas in the El Morro Valley dating from about A.D. 1225-1275. These plaza pueblos consist of L or C-shaped masonry structures partially encircling large open spaces, some of which have evidence for being cleared down to bedrock. Similar partially enclosed L or C-shaped plaza pueblos have also been mapped along the Zuni River Valley to the west (Kintigh 1985:Figure 4.39) in the Cebolleta Mesa area to the east (Roney 1996) as well as in Mariana Mesa district to the south (ARMS Notes; see Figure 9.10). Some of these partially enclosed plazas are located near mesa edges which may have served to further bound portions of the open space, while other settlements have low walls encircling the open area. The specific nature of the open spaces at these sites and how they might have been used is not currently well understood, but these partially enclosed open spaces bounded by planned constructions may have been predecessors to the fully enclosed plazas which characterized late thirteenth century sites in these same areas. At sites dating to about the same period in the southern portion of the study area including the Upper Little Colorado, the Mogollon Highlands, as well as the Silver Creek and Arizona Mountains areas, open areas partially surrounded by loose clusters of room blocks have sometimes also been called plazas (Danson1957:82-83), but these spaces do not appear to have been as formally bounded as those at contemporaneous settlements on the Colorado Plateau.[9]

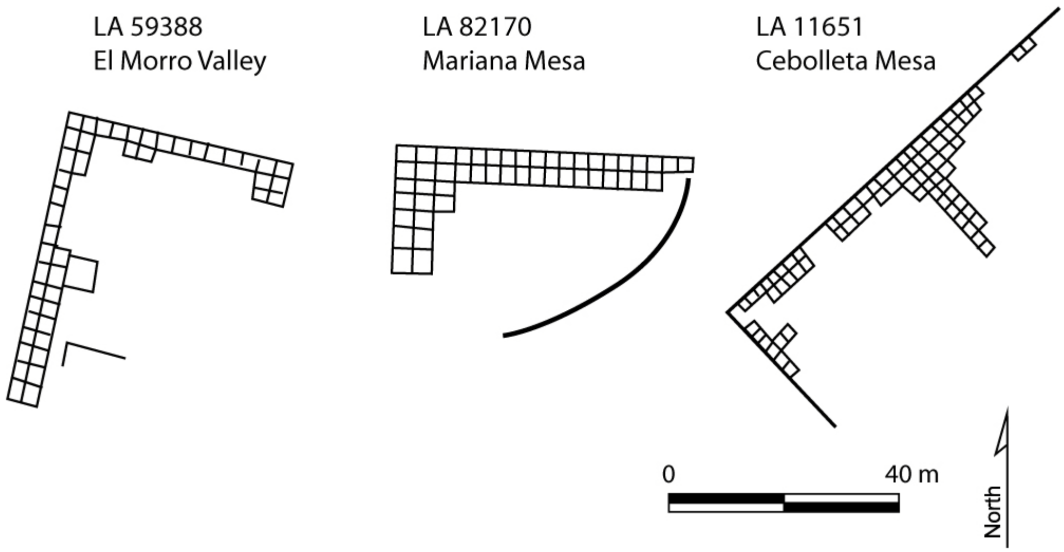


Figure 9.10. Examples of late Pueblo III period partially enclosed plaza pueblos.

The mid to late thirteenth century also saw the construction of the first true plaza-oriented communities in the Cibola region. Plaza-oriented communities consist of large, nucleated pueblos constructed around one or more well defined open areas. Unlike many Post-Chacoan era communities with numerous dispersed small room blocks, nucleated communities were entirely encompassed within one or a few closely spaced structures. By about A.D. 1275, these plaza-oriented nucleated communities became the dominant pattern across the El Morro Valley and Zuni area and by A.D. 1300, across most of the Cibola region and the Colorado Plateau in general (Adams 1991; Adams and Duff 2004).[10] The specific form of plaza-oriented communities varied, however, from place to place across the study area perhaps suggesting differences in the use of space or in the scale and organization of construction.

In most of the areas where Chacoan architectural complexes are known, including the Puerco Valley, areas along the Zuni River, the El Morro Valley, as well as in the Mariana Mesa and Cebolleta Mesa areas, thirteenth and early fourteenth century plaza-oriented pueblos consist of massive, planned constructions, many with of distinctive rectangular and circular layouts (Figure 9.11; see discussion below). These nucleated pueblos were some of the largest prehistoric constructions anywhere in the Southwest at this time, some with more than 1,400 rooms.

Available ceramic data suggest that the earliest nucleated pueblos in this area were likely constructed around A.D. 1225 or 1250 (Kintigh 1985; Schachner 2007:160-171). Some of the first nucleated structures may not have been truly plaza-oriented, as interior spaces may have been almost entirely filled with single story rooms and possibly smaller plazas or courtyards (Duff and Schachner 2007:193-194; Schachner 2007:245). By A.D. 1275 or shortly thereafter, however, virtually the entire population of this northern portion of the study area was residing in one of these nucleated towns, and most were constructed around one or more large, formal plazas (Kintigh 1985; Watson et al. 1980). Although there is certainly variation across the study area, these plaza-oriented pueblos are similar in that they were apparently planned, rapidly constructed, and consisted of long linear room blocks built by ladder construction around large open plazas.

Variation in the shapes of nucleated pueblos in the El Morro Valley and along the Zuni River may highlight somewhat smaller scale social distinctions among the inhabitants of different communities in this area. As mentioned above,

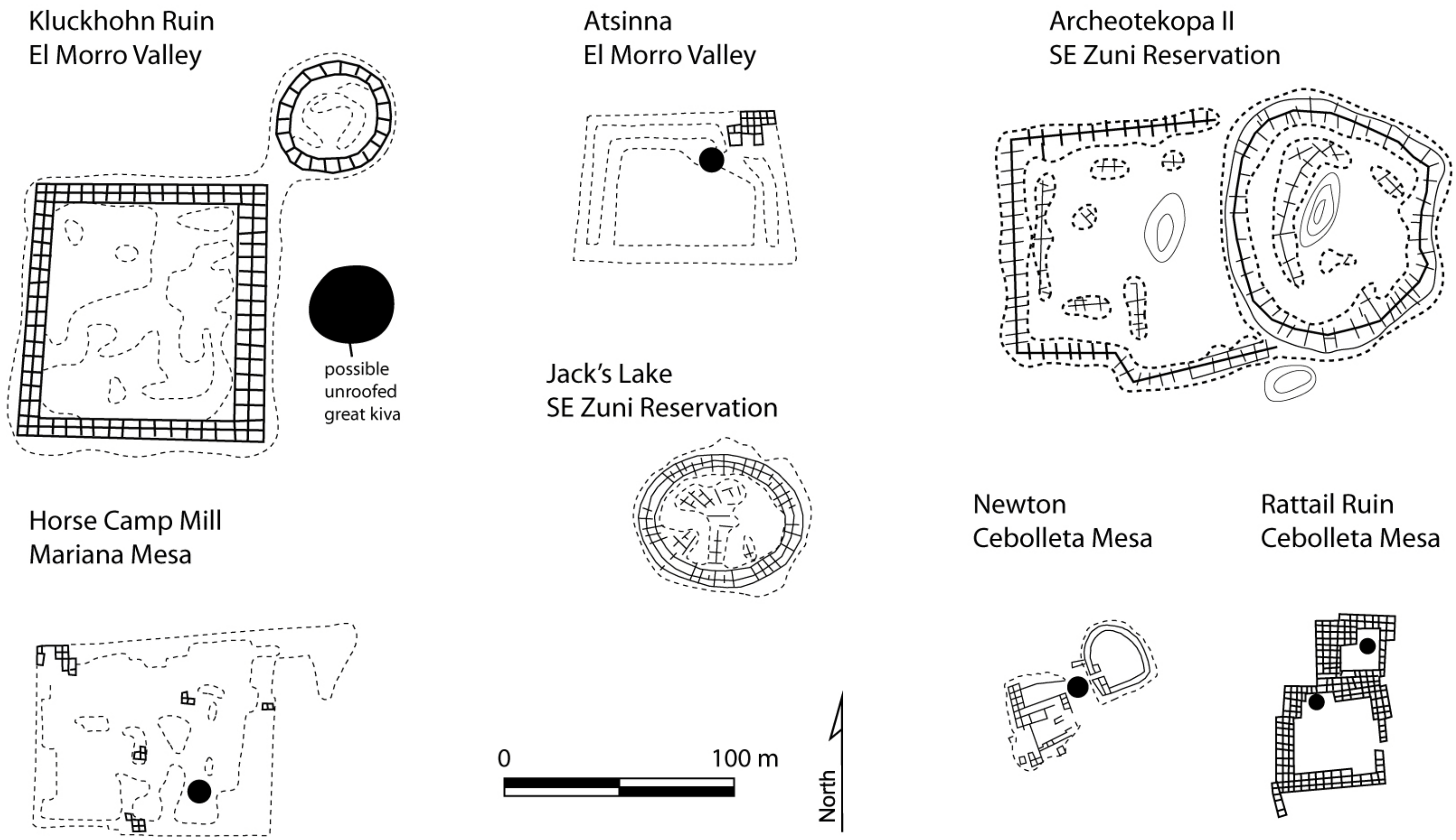


Figure 9.11. Examples of Pueblo IV period plaza pueblos in the northern and eastern Cibola region.

nucleated towns in these areas are typically either circular, rectangular, or composites combining both shapes. There are several interesting distinctions between circular and rectangular towns including differences in the frequencies of ritual fauna (Potter 1997:223-226) and differences in the frequencies of certain Zuni Glaze Ware types (Huntley and Kintigh 2004:70-71). It is possible that these subtle differences indicate variation in religious practice or perhaps categorical identities among the inhabitants of different communities in the Zuni area. Potter (1997, 2000) argues that the duality of community forms suggests that circular and rectangular pueblos may have played complementary roles in regional spheres of religious practices. Interestingly, two of the earliest nucleated towns in the Zuni area (Kluckhohn and Archeotekopa II) combined circular and rectangular structures suggesting that such distinctions may have originally emerged from intra-community relationships (Potter 1997:224).

Plaza-oriented pueblos are also known in the southern portions of the study area including the Silver Creek area, along the Arizona Mountains, in the Upper Little Colorado, and perhaps in the Mogollon Highlands. Although there are a few exceptions, plaza-oriented pueblos in this southern Cibola region tend to date primarily to the latter half of the thirteenth century (Kaldahl et al. 2004; Lowell 1991; Reid 1989). Further, where good data are available, most Pueblo IV period plaza-oriented pueblos in the southern Cibola region appear to have grown. accretionally rather than being planned and rapidly constructed around a plaza (Duff and Lekson 2006:330; Lowell 2001; Mills 1998:67; Riggs 2001:106-107). Due to this accretional construction, plaza-oriented pueblos in the southern Cibola

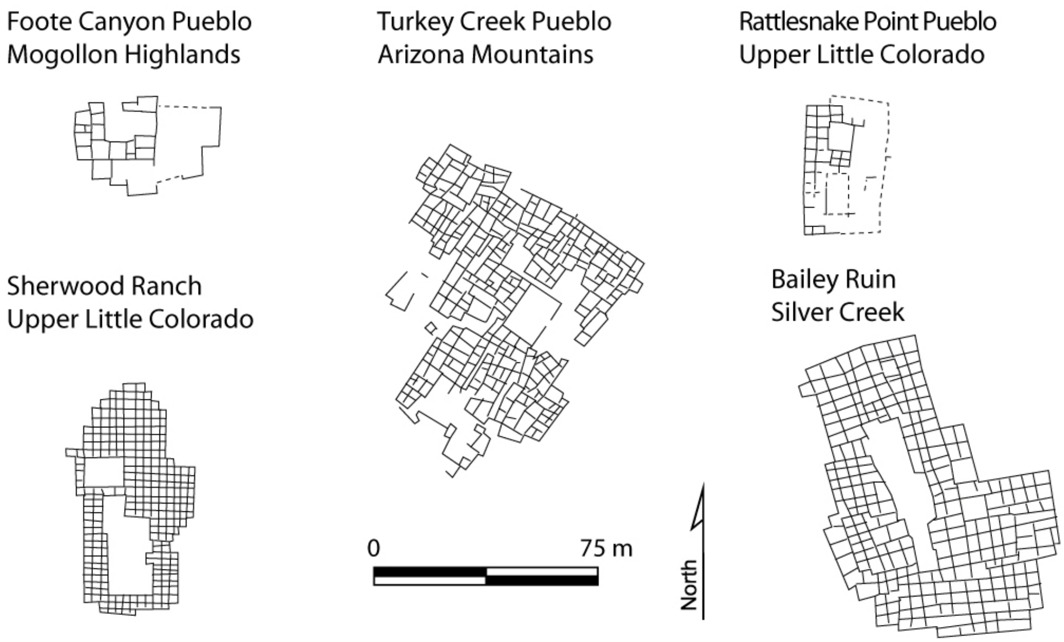


Figure 9.12. Examples of Pueblo IV period plaza pueblos from the southern and western Cibola region.

region tend to have agglomerative layouts consisting of massed clusters of rooms with no overall settlement plan (Figure 9.12). In the Mogollon Highlands, as I have defined the area for the purposes of this study, no unambiguous examples of fully enclosed plazas have been documented (Lekson 1996:170-171). At Foote Canyon Pueblo on the Blue River, there is a large area enclosed by a series of rooms which has been called a plaza, but this area was apparently roofed (Rinaldo 1962:181), and perhaps more similar to the converted plaza-great kivas in the Arizona Mountains. Although Hough (1907) mapped plazas and courtyards at several sites along the San Francisco and Blue River Valleys, subsequent investigations have not been able to definitively identify these features (see Zamora and Oakes 1999). Overall, what can be said is that, in the southern Cibola region, enclosed plazas were most frequently products of the accretional growth of large villages rather than planned constructions and that plazas were far less formal at settlements in the Mogollon Highlands.

To further illustrate differences in the organization of plaza spaces across the greater Cibola region, Figure 9.13 displays a dot plot of the ratio of total enclosed plaza space against the total number of rooms for several well documented sites. As this plot illustrates, there are multiple modes in the ratio of plaza space to room count. Interestingly, there is some regional structure to this measure across the study area. Sites in the Upper Little Colorado, Mogollon Highlands, and the Arizona Mountains all have relatively small plaza space to room count ratios. Sites in the El Morro Valley, Pescado Basin/Zuni, Mariana Mesa, and Cebolleta Mesa areas typically have considerably higher plaza space to room ratios, though a few sites in the El Morro Valley and Pescado Basin also fall within the lowest mode. These regional differences suggest potential differences in the organization and use of public space across the study area. For example, it may be that public spaces at sites with large plazas in relation to their residential populations were gathering places for social groups including members of multiple residential communities.

As the discussion above highlights, the nucleated, plaza-oriented settlement layout characterized virtually the entire Cibola region, as well as much of the northern Southwest, after about A.D. 1275-1300. This suggests broad similarities in public ritual practices across the entire Cibola region. Indeed, Adams (1991) argues that the rapid spread of plazas and plaza-oriented pueblos across the Southwest was likely associated with the spread of the Katsina religion

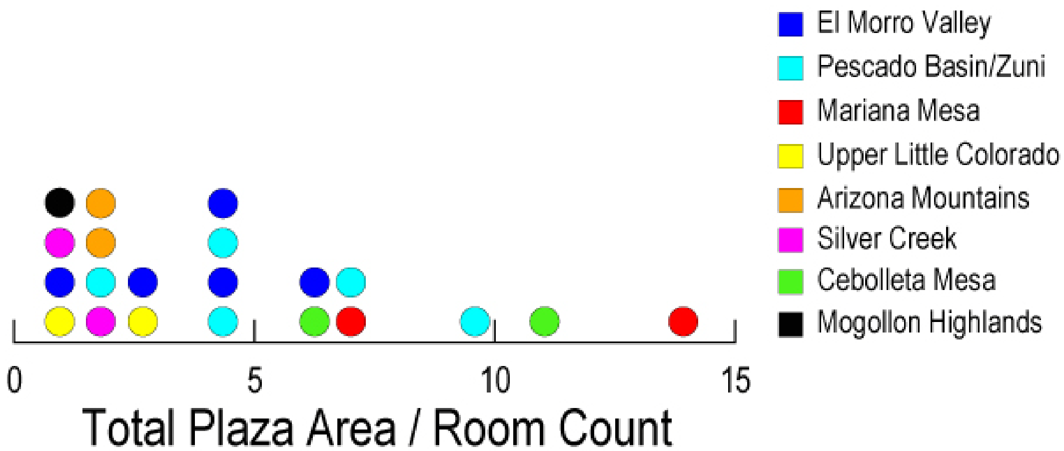


Figure 9.13. Dot plot showing ratio of total plaza area (m^2) to room count for plaza-oriented sites across the greater Cibola region.

at this time. At the same time, there are apparently differences in how nucleated communities and plaza spaces were constructed across the study area. In the northern and eastern portions of the study area, plazas appear to have been quite large planned constructions whereas in the south, plazas appear to have typically been smaller and developed somewhat more slowly as villages grew. Overall, this suggests that the scale at which construction was organized may have been greater in the northeastern portions of the study area than in the southern portions. It is interesting that the massive *planned* nucleated pueblos are found primarily in areas where earlier Chacoan complexes are known. This pattern perhaps suggests that labor coordination for construction was, in part, a legacy of Chacoan influence in the region (see also Fowler et al. 1987; Stein and Fowler 1992). Additionally, the differences in plaza form and village form between the northern and eastern portions of the study area and areas to the south and west may suggest differences in the activities occurring in those spaces, and perhaps the emergence of a categorical distinction between these broad areas during the Pueblo IV period.

Other Architectural Features

In addition to the large public spaces described above, there are other smaller architectural features found at many settlements in the Cibola region that may have also served a public or ceremonial purpose. In particular, oversized kivas and rectangular room block kivas may also have been used as ceremonial spaces. Although these structures may be too small to have enclosed events including all or even most members of a community, specific aspects of these features suggest that the activities conducted within them differed from the activities conducted in common domestic spaces (see Lipe 2002:220-221 on public structures as exclusive spaces). In this section, I briefly describe the limited evidence available for these smaller, potentially ceremonial spaces.

During the period considered in this study, typical kivas in the Cibola region consisted of circular, D-shaped, or rectangular subterranean or semi-subterranean structures, usually 3-4 meters across, with masonry lined benches, vent complexes, and sometimes floor vaults, sipapus, or other specialized floor features (see plan maps in Dittert 1959; Martin et al. 1964; McGimsey 1980; Roberts 1939; Ruppé 1990; Varien 2000; Zier 1976; see also Smith 1972:127; Smiley 1952:11-12).[11] Although there is some indication that small subterranean kivas were somewhat less common in the Cibola region than in much of the rest of the northern Southwest (Kintigh et al. 2004:445), where excavation data are available, small kivas appear to be present at most sites on the Colorado Plateau and somewhat less frequently at sites in the Upper Little Colorado and below the Mogollon Rim after about A.D. 1150. Kivas are sometimes associated with evidence for certain specialized activities such as weaving (see Varien 1990:65), but these features are not typically interpreted as public or ceremonial spaces in the Cibola region (c.f. Kintigh et al. 2004:445).[12] In some portions of the study area, however, there appears to have been a class of structures intermediate in size between typical small kivas described above and the much larger great kivas. It is possible that these feature were also intermediate in terms of their ceremonial importance (as has been suggested for Pueblo I period pit structures in the Dolores area; see Wilshusen 1989; Schachner 2001). For the purposes of this chapter, I refer to these intermediate structures as oversized kivas.

Oversized kivas ranging from about 8-10 meters in diameter have been documented at several settlements across the Cibola region, and large depressions which may represent similar features have been recorded at many others. In the few contexts where these structures have been excavated enough to determine their form, oversized kivas appear to be D-shaped in plan, sometimes with subterranean walls and sometimes incorporated into room block architecture (Figure 9.14). Probable examples of oversized kivas have been partially excavated associated with Post-Chacoan great houses in the Mariana Mesa area (Smith 2010, personal communication) and the El Morro Valley (Schachner and Kintigh 2005). In addition to this, depressions which may represent similar oversized kivas have been recorded at the Post-Chacoan great house of Atsee Nitsa along

Figure 9.14. Excavated oversized kiva at Atsinna Pueblo within El Morro National Monument.

the Puerco Valley (Fowler et al. 1987:87) as well as contemporaneous non-great house sites in the El Morro Valley (CS195, Pettit; Schachner 2007:235).

Similar oversized kivas have also been recorded in association with nucleated sites dating to the Pueblo IV period including the excavated structures at Atsinna (Woodbury 1954) and Mirabal (Watson et al. 1980:Figure 6) in the El Morro Valley, possibly at Techado Spring (Smith et al. 2010:Figure 12) and Horse Camp Mill (McGimsey 1980:Figure 40) in the Mariana Mesa area, at Big House along the Rio Puerco (Fowler et al. 1987:96), as well as at Los Pilares (Ruppé 1990:Figure 14) in the Cebolleta Mesa area. Some of these features have sometime been referred to as great kivas in the literature (Danson 1957:Table 16; Smith et al. 2010:25; Watson et al. 1980:211-212), but they are smaller than typical Chacoan or Post-Chacoan era great kivas and lack many of the formal features found in great kivas. Little can currently be said about the regional distribution of oversized kivas, but these features appear to be associated primarily with Post-Chacoan era communities and Pueblo IV period nucleated towns in the northern Cibola region along the Zuni and Puerco Rivers as well as in the Mariana Mesa and Cebolleta Mesa districts (i.e., areas characterized by substantial Chacoan influence).

Rectangular room block kivas (or platform kivas) are relatively large rooms incorporated into room blocks, often with flagstone lined floors, elaborate masonry walls, wall niches, formal hearths, ventilator complexes, and sometimes benches or raised platforms along one or more walls in the latest examples (Figure 9.15; Adams 1991:103-110). Unlike rectangular great kivas, these rooms typically lack floor grooves and ramped entries. In the Cibola region, rectangular room block kivas are similar in many ways to the well documented fourteenth century and later rectangular kivas of the Hopi Mesas (Smith 1972). Some have argued that rectangular room block kivas combine features of northern (Anasazi) small kivas from the Colorado Plateau and the rectangular great kivas of areas south of the Mogollon Rim, while others see the origins of the rectangular kivas in earlier subterranean structures from northern Arizona (c.f., Adams 1991:103-110; Gumerman and Skinner 1968; Lyons 2001:Chapter 9). Wherever these features originated, they become common across the Cibola region as well as many other areas around the mid to late thirteenth century (ca. A.D. 1275), in particular at nucleated pueblos built around open plazas (Adams 1991:Figure 5.8).

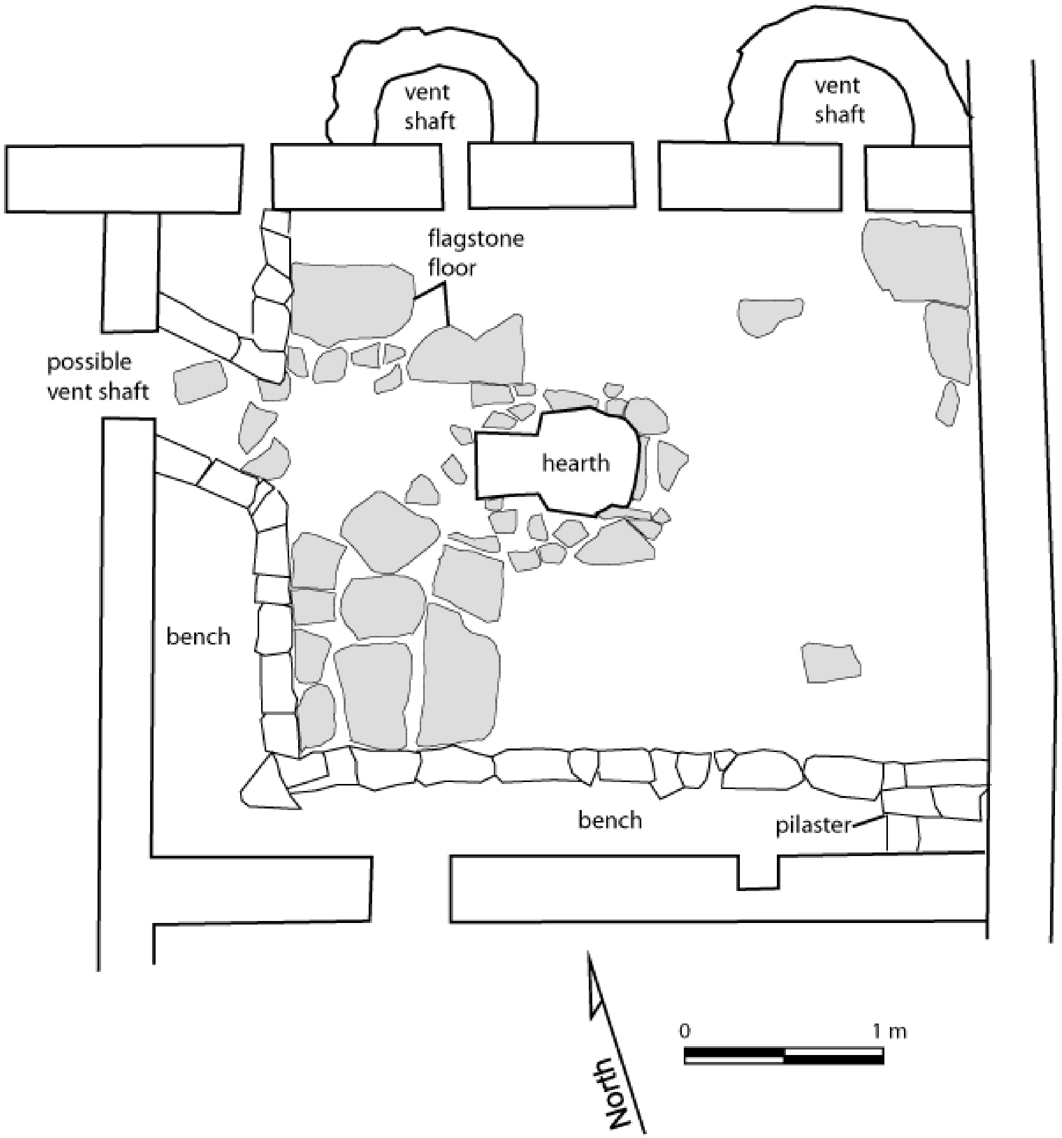


Figure 9.15. Rectangular roomblock kiva from Pueblo de los Muertos in the El Morro Valley.

Adams argues that, like enclosed plazas, rectangular room block kivas are associated with the spread of the Katsina religion across much of the Southwest at this time. Indeed, rectangular room block kivas are essentially the only structures where murals depicting Katsinas have been documented (Adams 1991:84).

Rectangular room block kivas fitting the description above have been documented in contexts dating to about A.D. 1275 or later in almost every portion of the Cibola region study area where excavation data are available. Although rectangular room block kivas with raised platforms are known from Point of Pines (Adams 1991:109), they are not known from any other extensively excavated sites along the Arizona Mountains (see Adams 1991:108-109; Lyons 1999:Appendix BB). In the Mogollon Highlands, although there are some rooms that show similarities to rectangular room block kivas (Martin et al. 1956:44-46), there are no unambiguous examples.[13] In general, available data suggest that rectangular room block kivas were present across most of the Cibola region, in particular after A.D. 1325, but primarily limited to areas above the Mogollon Rim.

Adams (1991) argues that the relatively rapid and widespread appearance of rectangular room block kivas across much of the Cibola region and beyond may suggest some degree of shared ritual practice among the inhabitants of much of the northern Southwest in the late thirteenth and early fourteenth centuries. At the same time, the apparent lack of rectangular room block kivas in the Mogollon Highlands and throughout most of the Arizona Mountains, as well as the continued use and construction of rectangular great kivas in these areas, could be used to argue for broad scale differences in ceremonial practice and distinctions in the common contexts of categorical expressions in areas above and below the Mogollon Rim by the Pueblo IV period (see also Whittlesey 2010).

Summary and Conclusions

The discussion above illustrates that the Cibola region was marked by numerous distinct forms of public architecture throughout the period considered here. Some features like enclosed plazas and rectangular room block kivas had extremely broad distributions encompassing most of the Cibola region and beyond, although the specific forms, and perhaps uses, may have differed from place to place. Such widespread features suggest some level of similarity in ceremonial practice, and perhaps categorical identity, across most of the Cibola region at least during the Pueblo IV period (e.g., Adams 1991). Other features such as great houses and circular or rectangular great kivas appear to have had limited distributions, suggesting distinct patterns of categorical expression among the inhabitants of somewhat smaller areas through time.

In general, based on the patterns documented above, the Cibola region can be roughly divided into two broad geographic areas characterized by similar public architectural features through time. First, the northern portions of the study area including the entire Zuni River Valley, the El Morro Valley, the Mariana Mesa area, the Puerco Valley, and the Cebolleta Mesa area are characterized by great houses, circular great kivas, and by the late thirteenth century, planned nucleated plaza pueblos, many of distinctive shapes. The southern portions of the region including the Upper Little Colorado area, the Arizona Mountains, and the Mogollon Highlands are characterized by a lack of great houses, rectangular great kivas, and across most of this area, agglomerative settlements focused around one or more less formal plazas after the mid to late thirteenth century. The western portions of the study area from the Vernon area to Silver Creek are marked by circular great kivas without great houses, rectangular great kivas perhaps later in time, and agglomerative plaza-oriented pueblos by the late thirteenth century. The diversity of features along this western frontier may suggest the presence of populations with diverse origins or changing patterns of regional interaction through time.

The consistent and relatively distinct distributions of the suites of public architectural features described above suggest that there were likely substantial differences in the common contexts for ceremonial activity across different portions of the Cibola region that were maintained for centuries. Different portions of the study area also appear to have been marked by somewhat different trajectories of change in public spaces through time. Across the northern Cibola region as it is defined in this chapter, great kivas generally increase in size from the late Pueblo II to the Pueblo III period. The latest examples lack roofs, perhaps suggesting that these structures were becoming more inclusive spaces through time. By about A.D. 1275 circular great kivas in the northern Cibola region appear to have declined dramatically or fallen out of use all together and were replaced by massive enclosed plazas. In the southern portion of the Cibola region, rectangular great kivas were never fully replaced by enclosed plazas during the period considered here, and indeed, rectangular great kivas were newly constructed within plaza spaces as late as the first quarter of the fourteenth century. There was a great deal of diversity in the forms of public spaces found at many settlements in the western and southern portions of the region during the Pueblo IV period (Mills 1998). Similar patterns of change through time have been documented in the Mogollon Highlands areas, but fully enclosed plazas were apparently absent, or never as formal as in other portions of the southern Cibola region. These differences in the trajectories of change in public features through time further suggest that these different portions of the Cibola region may have been involved in distinct and largely separate spheres of public ceremonialism, further suggesting the maintenance of distinct categorical identities. Intriguingly, the distribution of Chacoan architecture during the eleventh century presages most of the patterns of similarity in architectural features across the subsequent 400 years.

Chapter 9 Notes

[1] There are great kivas dating to the eleventh and early twelfth century in the Hopi Buttes and Petrified Forest areas which may have also been unroofed and similar in form to the later unroofed great kivas, but these structures are more similar to Chacoan style great kivas in size (Burton 1993:97-100).

[2] Prior to about A.D. 900, most great kivas in the mountains and to the south were typically circular or bean shaped in form (Anyon and LeBlanc 1980; Haury 1985), though they were also distinct in several features from Chacoan style great kivas on the Colorado Plateau to the north. Haury (1985) documented a long sequence of circular great kiva construction in the Forestdale Valley which extended into the period considered in this study. Herr (2001) argues, however, that although they share many similarities with earlier southern great kivas, post-A.D. 1000 circular great kivas in the Forestdale Valley as well as in the Silver Creek area were likely related to and referencing Chacoan developments.

[3] For the purposes of this study, I limit the distribution of great houses to those with relatively uncontroversial great house status. There are a number of other structures, especially in areas within the Mogollon Highlands, which have been put forth as possible great houses (Fowler et al. 1987:213-214; Lekson 1991:Figure 3.10; Lekson 1999). These potential great house sites generally have fewer features in common with Chacoan constructions than great houses further north, but they do meet the criterion of being large in relation to other contemporaneous habitations. Potential examples of great houses in these areas need to be documented in more detail in order to assess their historical or social connections with rest of the Chacoan/Post-Chacoan world.

[4] The specific date range of many great kivas in the Mogollon Highlands area is unknown, as most of these sites have not been intensively investigated. Where no additional information was available, great kivas were assumed to span the entire estimated occupation of the sites where they were located.

[5] Schroder and Wendorf (1954) note that at least one other site in the vicinity of Aragon displayed what they refer to as an "Anasazi village plan" meaning a Prudden unit consisting of a room block with multiple kiva depressions in front.

[6] Ceramic seriation of collections from nucleated pueblos associated with unroofed great kivas suggest that these sites primarily date to the mid to late thirteenth century (Huntley 2004; Kintigh 1985; Schachner 2007). One unroofed great kiva (CS189) in the El Morro Valley may be an exception to this general pattern. This isolated structure is located between two large nucleated pueblos (Cienega and Mirabal). Although both of these nucleated sites have thirteenth century occupations, they also both continued to be occupied into the fourteenth century. It is possible that the unroofed great kiva continued to be used into the fourteenth century as well. However, the small ceramic collection available from the area in and around the great kiva itself contains no glaze painted ceramics, suggesting a pre A.D. 1275 date.

[7] The thirteenth century pueblo of Turkey Creek in the Point of Pines area included a plaza space which was converted into a great kiva during the thirteenth century (Lowell 1991). In addition to this, the roofed plaza area excavated at Foote Canyon Pueblo along the Blue River may have been a similar structure, although internal floor features other than post holes were not documented (Rinaldo 1959:181).

[8] The earliest formal plazas in the Cibola region are associated with eleventh century Chacoan great houses. These spaces typically consist of bounded areas, lined by room blocks or an

enclosing wall, often also containing other internal features such as subterranean kivas, hearths, and low masonry walls. Many examples are slightly elevated above the ground surface outside of the plaza. In general, enclosed formal plaza areas of this kind are relatively rare in the Cibola region but have been documented at a few Chacoan and Post-Chacoan great houses throughout their entire regional distribution. Several great house plazas include elaborate masonry features which have been interpreted as offering boxes, perhaps hinting at the ceremonial activities occurring within these spaces (Fowler et al. 1987:80-81; Marshall et al. 1979:202).

[9] Broken K Pueblo in the Hay Hollow Valley may also represent an early example of a partially enclosed plaza pueblo (Hill 1970) although this settlement may have grown into this form rather than being initially planned and constructed around a plaza. There are also possible formal plazas in the Mogollon Highlands area that have been recorded by Hough, but little information is available on these spaces.

[10] Adams (1991:101-103, 125) argues that enclosed plazas north of the Mogollon Rim may have had their origins in the coursed adobe pueblos south of the Gila River down into the Casas Grandes area. Interestingly, however, the site plans examined for this study suggest that partially and fully enclosed plaza spaces were already common in the northern Cibola along the Zuni and Puerco Rivers by the mid thirteenth century and perhaps somewhat earlier. The massive perimeter walls of many thirteenth century and later nucleated plaza-oriented pueblos may have developed out of earlier Chacoan architectural forms rather than the southern plaza pueblos (Fowler et al. 1987:97).

[11] See Lyons (2001:Chapter 9) for a discussion of the timing of the arrival and spread of kivas of various forms in the southern Cibola region.

[12] Lekson (1989) argues that these small, subterranean features were probably used for habitation and were not much like the historic Puebloan kivas from which the name is derived.

[13] In addition to the well dated rectangular and platform kivas documented by Lyons (2001:Chapter 9), other examples have been documented at large sites in the El Morro Valley including Pueblo de los Muertos and Atsinna (CARP notes), in the Manuelito Canyon area at Naat'a'anii Bikin (Fowler et al. 1987:97), in the Mariana Mesa area at Horse Camp Mill (McGimsey et al. 1980; Field notes) and Techado Spring pueblo (Smith et al. 2010), possibly in the Cebolleta Mesa area at the site of Los Pilares (Forrester 1965), as well as at the Protohistoric and Historic Zuni villages of Hawikuh (Smith et al. 1966) and Kechiba:wa (Cambridge field notes).

Chapter 10:

IDENTITY AND SOCIAL TRANSFORMATION IN THE PREHISPANIC CIBOLA WORLD

This chapter draws together the various lines of evidence presented throughout this study to paint a synthetic picture of the changing patterns of social identification at regional scales in the greater Cibola region across the Pueblo III to Pueblo IV transition. At the beginning of this study, I set out a series of general principles and expectations based on a body of contemporary sociological theory focused on social movements and the process of social transformation. In this final chapter, I revisit these topics to explore the complex relationships between identity and transformation in the Cibola region. I conclude by discussing the contributions of this study and the prospects of the theoretical model used here for exploring the relationship between identity and transformation in general.

Tracking Relations and Categories in the Cibola Region

One of the primary arguments that I made at the beginning of this study is that the processes involved in social identification can be profitably characterized in terms of the nature of relational connections and patterns of shared categorical identities among groups of people at various scales. In contrast to assumptions pervasive in many traditional archaeological explorations of social identity, relations and categories (i.e., tight-knit networks of interaction and formally recognized social groups) are not necessarily coterminous. I argue that a more explicit recognition of this basic point may provide new insights into the processes involved in social identification in archaeological contexts and new ways to think about how social identities change through time. In this section, I demonstrate the utility of this theoretical perspective through a brief summary of the major results presented in previous chapters.

Evidence for Relational Connections

Relational identification refers to the processes through which individuals identify themselves and others with larger collectives based on their positions within networks of interpersonal interaction. In this study, I used three primary lines of material evidence to explore the strength and directionality of relational connections across the Cibola region through time; 1) ceramic compositional characterizations focused on identifying patterns of ceramic circulation, 2) technological characterizations of utilitarian pottery production focused on identifying similarities in production methods, and 3) technological characterizations of domestic architectural spaces and features focused on characterizing common household building practices. Remarkably, the strongest patterns of similarity across each of these lines of material evidence overlap considerably, suggesting that the material patterns identified in each analysis relate to similar vectors of frequent interaction and strong relational connections among individuals.

In Chapters 4 and 5, I presented an analysis of a large ceramic compositional database in order to explore patterns of ceramic circulation across the greater Cibola region through time. As this analysis demonstrates, ceramics were frequently transported across the Cibola region, but different wares were characterized by different intensities and geographic scales of movement.

Utilitarian vessels were circulated infrequently and primarily among settlements in adjacent areas, whereas decorated vessels were often moved over vast distances. Based on ethnoarchaeological studies of traditional ceramic producing communities, I argue that utilitarian vessels are most likely to be circulated among frequently interacting individuals within tight-knit relational networks, such as among kin-groups or marriage partners. Decorated vessels, on the other hand, are more frequently used and exchanged in contexts of public gatherings as a means for solidifying somewhat more distant relational connections (i.e., less frequently activated) among participants. Thus, the compositional data provide evidence for different kinds of relational connections at different geographic and social scales.

Although most utilitarian vessels were discarded in the general areas where they were produced, they were also sometimes transported across the Cibola region, primarily within two over-arching spheres roughly conforming to the northern (El Morro Valley, Pescado Basin, West Zuni, Carrizo Wash, and Cebolleta Mesa) and southern (Upper Little Colorado, Mariana Mesa, and the Mogollon Highlands) portions of the core study area (Figure 10.1). These northern and southern spheres of ceramic circulation were quite consistent across the Pueblo III to Pueblo IV transition despite the depopulation of several areas and massive population movements into others. These two broad zones were not entirely discrete, however, as settlements along the edges of each area were characterized by some evidence for interaction in both directions. Overall, this suggests that the relational networks through which utilitarian vessels circulated

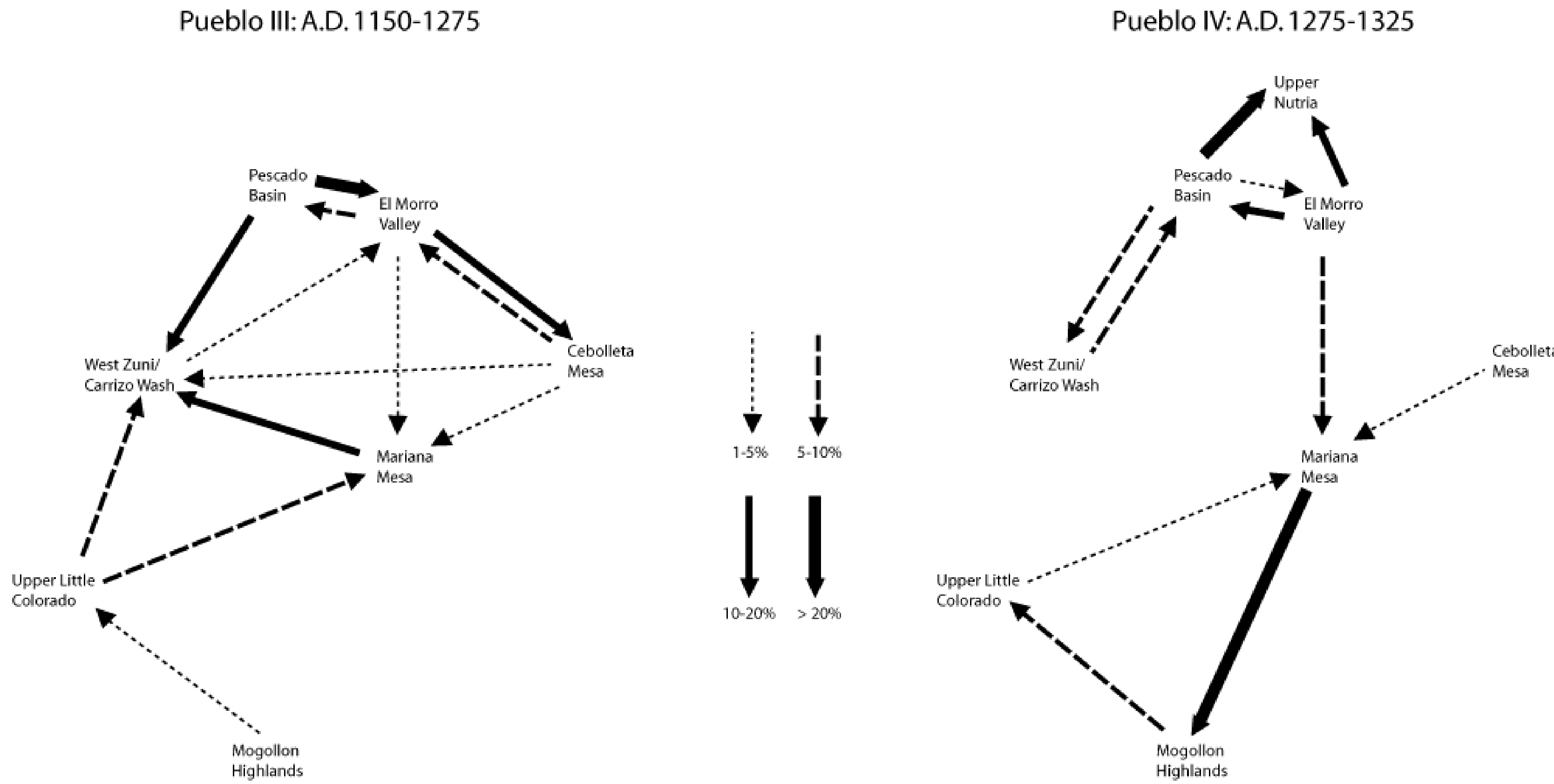


Figure 10.1. Simplified schematic diagram showing the primary vectors of utilitarian ceramic circulation during the Pueblo III and Pueblo IV periods.

were relatively local in nature and somewhat permeable, but that there was also a strong tendency for the segmentation of regional networks of exchange that increased through time.

The circulation of decorated vessels was considerably more frequent and geographically expansive than that of utilitarian vessels (Figure 10.2). During the Pueblo III period, most of the Cibola region was involved in a widespread sphere of ceramic circulation that appears to have centered on the Pescado Basin in the Zuni area. Communities spread far and wide across the region were linked through the exchange of decorated ceramics, probably occurring in the context of periodic public gatherings. This suggests that the inhabitants of much of the Cibola region shared broad social ties based on their common participation in such gatherings. Interestingly, the Upper Little Colorado area appears to have been isolated from this widespread sphere of ceramic circulation, perhaps suggesting the emergence of a social boundary or some kind of hindrance to certain kinds of interaction between the eastern and western portions of the Cibola region by the Pueblo III period.

After the Pueblo III to Pueblo IV transition, the circulation of decorated vessels was increasing localized and limited within the central Zuni area (Pescado Basin, El Morro Valley, and Box S in particular), while long distance exchange was more common among settlements to the west, at least by the late Pueblo IV period. This transition in the dominant patterns of exchange was also associated with the increased local production of polychrome vessels in the western Cibola region. These data suggest that the inhabitants of the eastern and western portions

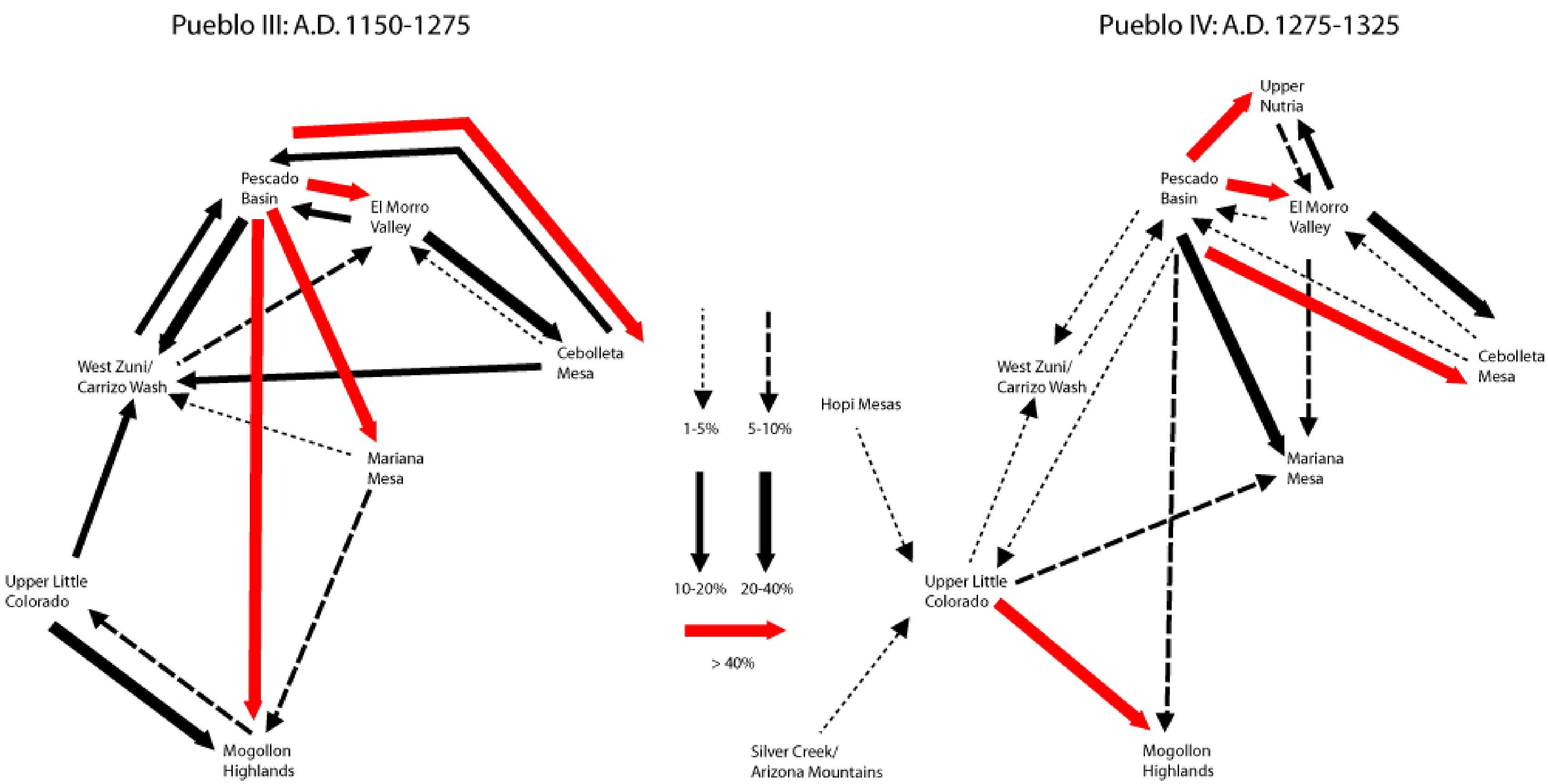


Figure 10.2. Simplified schematic diagram showing the primary vectors of decorated ceramic circulation during the Pueblo III and Pueblo IV periods.

of the study area were increasingly involved in distinct spheres of decorated ceramic exchange and public ceremonialism likely indicating an increasing consolidation of distinct social identities across the late thirteenth century social transformation.

Throughout this study, I argue that examinations of patterns of similarity in aspects of technology that were learned in the context of frequent and direct interaction can provide a good proxy for patterns of strong relational connections and historical ties among individuals and larger groups across the study area. In Chapter 6, I presented a detailed technological analysis focused on the production of utilitarian ceramic vessels using formal methods for social network analysis. The basic premise of this analysis is that patterns of similarity in the methods used to produce these household goods provide indications of the strongest patterns of frequent interaction and social learning, and by extension, strong relational connections among the inhabitants of the study area. One of the major results of this chapter was that the patterns of similarity in the methods used to produce utilitarian vessels were closely related to the spatial distance between settlements. This spatial relationship was pronounced during both the Pueblo III and Pueblo IV periods and, importantly, also in comparisons between periods. The consistency in this spatial pattern through time suggests that the Pueblo III to Pueblo IV transition was largely organized among groups of people that were already interacting on a regular basis prior to the late thirteenth century social transformation. The few exceptions to this general pattern, primarily involving settlements in the Mariana Mesa area, provide evidence for patterns of long-distance population movement across the Cibola region through time.

Based on the ceramic technological data, it is possible to divide the study area into two zones which were characterized by strongly overlapping internal social ties, with relatively few external ties. Interestingly, these tight-knit networks of settlements once again largely conform to the northern (El Morro Valley, Pescado Basin, West Zuni, and Carrizo Wash) and southern (Upper Little Colorado, Vernon Area, Mariana Mesa, and Mogollon Highlands) portions of the study area through time (Figure 10.3). As was the case with the circulation of utilitarian vessels, settlements along the edges of these two overarching groups (particularly during the Pueblo III period) showed some similarities to settlements in both the northern and southern portions of the study area. A few settlements along the edges of these two groups may have even produced pottery that was technologically transitional between the dominant technologies characterizing areas to the north and south. Overall, this suggests that the patterns of interaction through which pottery production was learned were likely local in nature, characterized to some degree by a north vs. south dichotomy, but that any boundaries to interaction were likely quite permeable.

Finally, in Chapter 7 I characterized the technology of domestic architectural construction across the Cibola region as a complement to the more detailed technological analysis of utilitarian pottery described above. As the architectural sample was defined by the extent of existing excavation data, the level at which comparisons could be made was somewhat coarser than with other

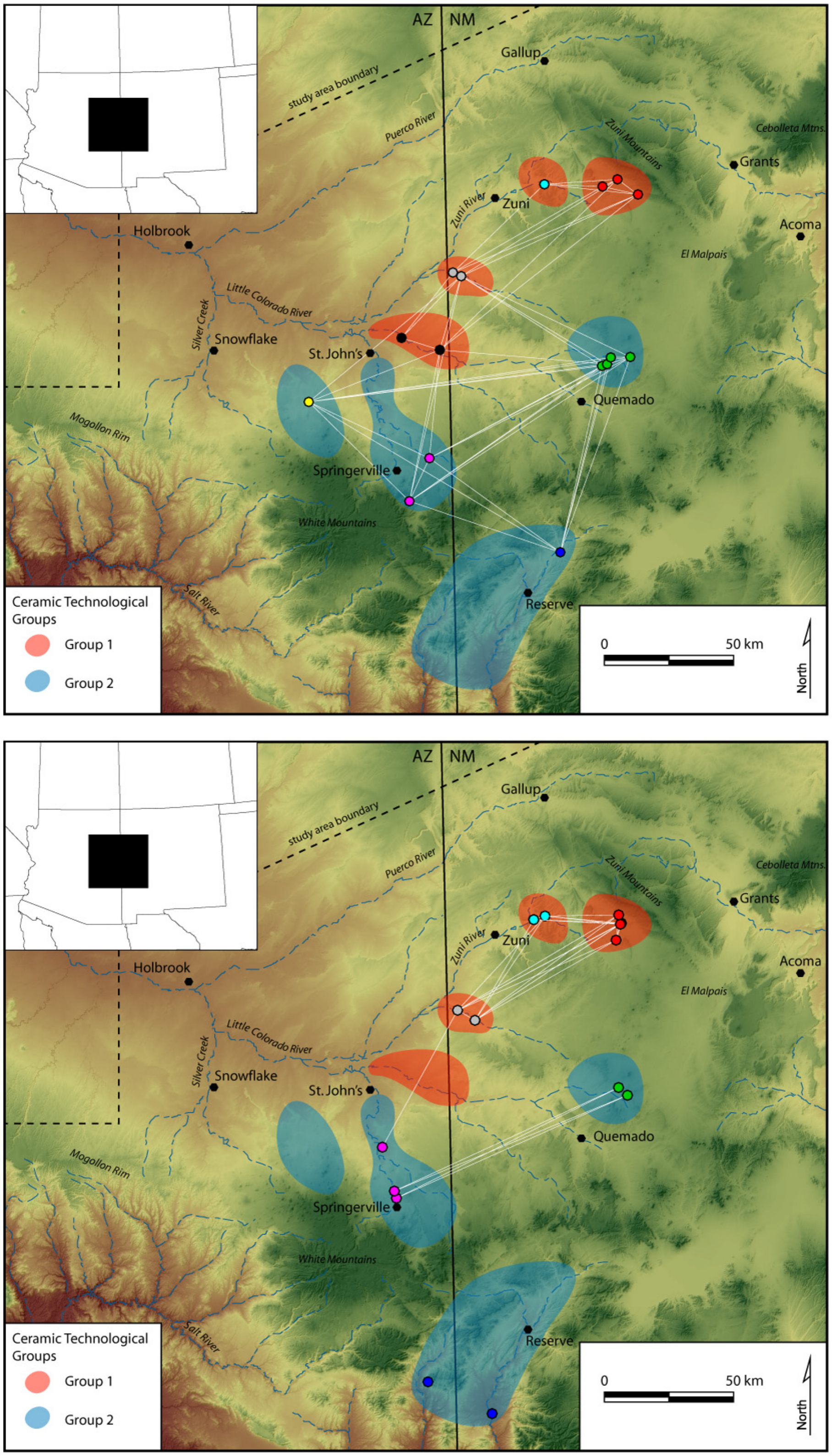


Figure 10.3. Social networks defined based on patterns of ceramic technological similarity for the Pueblo III (top) and Pueblo IV (bottom) periods.

analyses. However, the available evidence suggests similar patterns of technological similarity to those described above based on characterizations of utilitarian pottery. Specifically, patterns of domestic feature style (hearths and mealing bins) as well as their size and placement within rooms once again suggest a division of the study area into a northern (El Morro Valley, Pescado Basin, West Zuni, Carrizo Wash as well as nearby areas including the Hardscrabble Wash, Cebolleta Mesa, Mount Taylor, Manuelito Canyon, and the Petrified Forest) and southern (Upper Little Colorado, Mariana Mesa, Mogollon Highlands, as well as areas in Silver Creek, Hay Hollow Valley, and the Arizona Mountains) zone characterized by consistently overlapping patterns of feature styles and arrangements (for example see Figure 10.4). Although the nature of the sample did not allow for quantitative comparisons of change through time, the strongest patterns of similarity persist across the Pueblo III to Pueblo IV transition where data from both periods are available.

The multiple lines of evidence used to track the strength, scale, and direction of relational connections across the Cibola region through time provide complementary results. Specifically, evidence for the strongest relational connections across the region suggests that the most frequent vectors of interaction were largely local in nature, and furthermore, that there was a strong tendency towards segmentation of regional relational networks between the northern and southern portions of the study area. The strongest patterns of relational social ties were consistent across the Pueblo III to Pueblo IV social

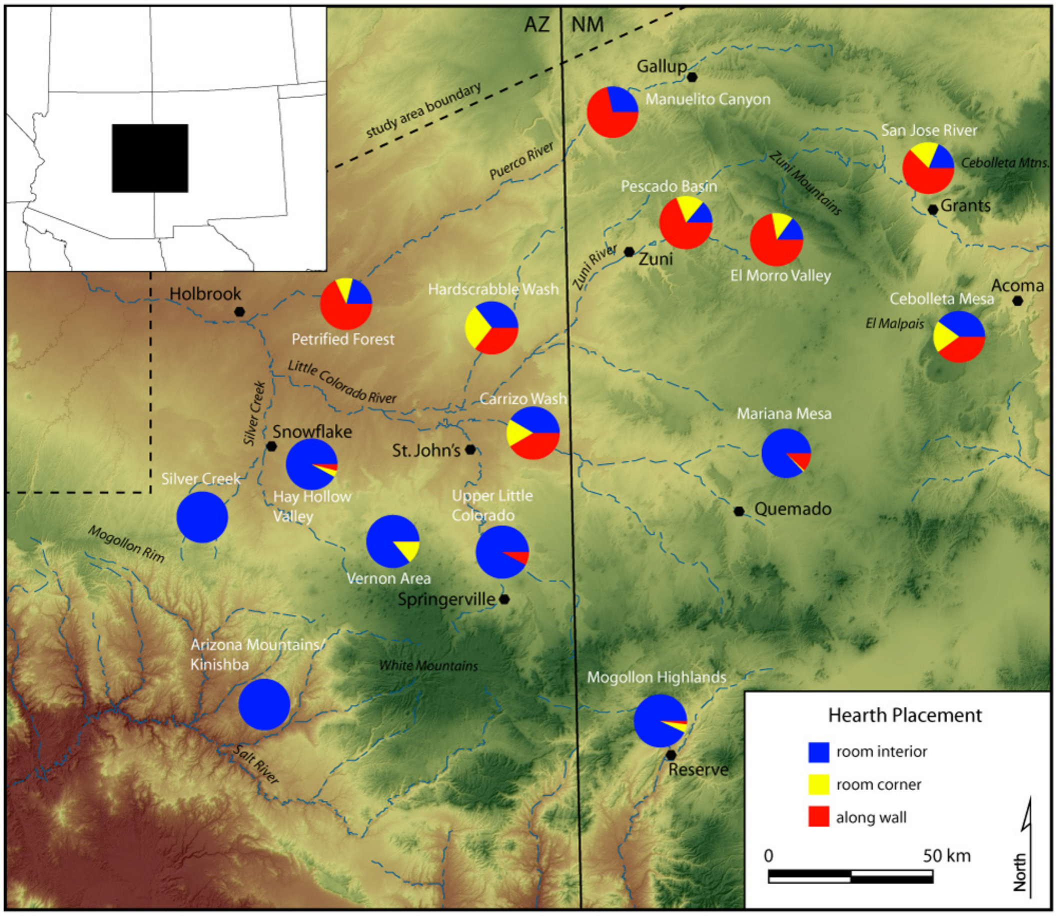


Figure 10.4. Map of the Cibola region showing patterns of hearth placement.

transformation despite the fundamental reorganization of settlement structure and location across this transition. Interestingly, the northern and southern portions of the study area, which are characterized by increasingly distinct relational networks of interaction through time, essentially conform to areas traditionally placed within the Anasazi and Mogollon archaeological culture areas respectively; a topic discussed in more detail below.

Beyond the strong patterns of tight-knit relational connections outlined above, the circulation of decorated ceramic vessels provides evidence for social ties that were considerably broader. These data suggest that, at least during the

Pueblo III period, the inhabitants of much of the Cibola region were likely connected through common participation in periodic public gatherings, during which decorated ceramic vessels were exchanged. Across the Pueblo III to Pueblo IV transition, exchanges of decorated pottery became increasingly localized, bifurcating the eastern and western portions of the Cibola region. This pattern suggests that these different portions of the region may have diverged into distinct spheres of public ceremonialism over the course of the period considered here. As I discuss in more detail below, the divergence in long-distance patterns of exchange suggests not only changing patterns of weak relational connections, but also perhaps a consolidation of distinct categorical social boundaries across the Pueblo III to Pueblo IV transition.

Evidence for Shared Categorical Identities

Categorical identification refers to the process through which individuals identify themselves and others as members of larger collectives based on similarities in socially defined roles or groups to which one can belong. In contrast to relational identification, categorical identification occurs through an active and conscious process of boundary marking and symbolization rather than through frequent interaction and/or historical connections alone. In this study, I relied on two primary lines of evidence for documenting patterns of shared categorical identities across the study area through time; evidence for the active expression of identities through 1) highly visible designs painted on polychrome ceramics and 2) shared forms of public architectural spaces across the region. Patterns of similarity along both of these lines of evidence overlap to a considerable degree, but importantly, these patterns also differ in several respects from the strongest patterns of relational connections outlined above.

Categorical identities must be symbolized in order to facilitate recognition among members and non-members of a social group. This process of symbolization often includes the kinds of active expressions of identity through material culture that archaeologists refer to as "emblemic" style (see Wiessner 1985). Thus, patterns of similarity in highly visible and public aspects of style can provide indications of shared categorical expressions and identities at a regional scale. In Chapter 8, I characterized patterns of stylistic similarity and difference in the designs found on the exteriors of large, polychrome serving bowls across the Cibola region. Based on contextual data relating changes in design size and boldness through time to the organization of public space, I argue that these vessels were produced with a fundamental concern for visual communication and thus, are good candidates for active an intentional signals of categorical social identities (see also Mills 2007a).

During the Pueblo III period, although there was considerable variation in the surface treatments characterizing vessels across the study area, the inhabitants of much of the greater Cibola region produced or obtained vessels characterized by similar simple, geometric, and circumferential designs painted in bold white lines on a red or reddish-brown surface. Beyond this, the most commonly used design elements were similar for vessels recovered across the study area, even between areas characterized by relatively little direct exchange (Figure 10.5). This suggests that vessels produced and used across the Cibola region at this time were

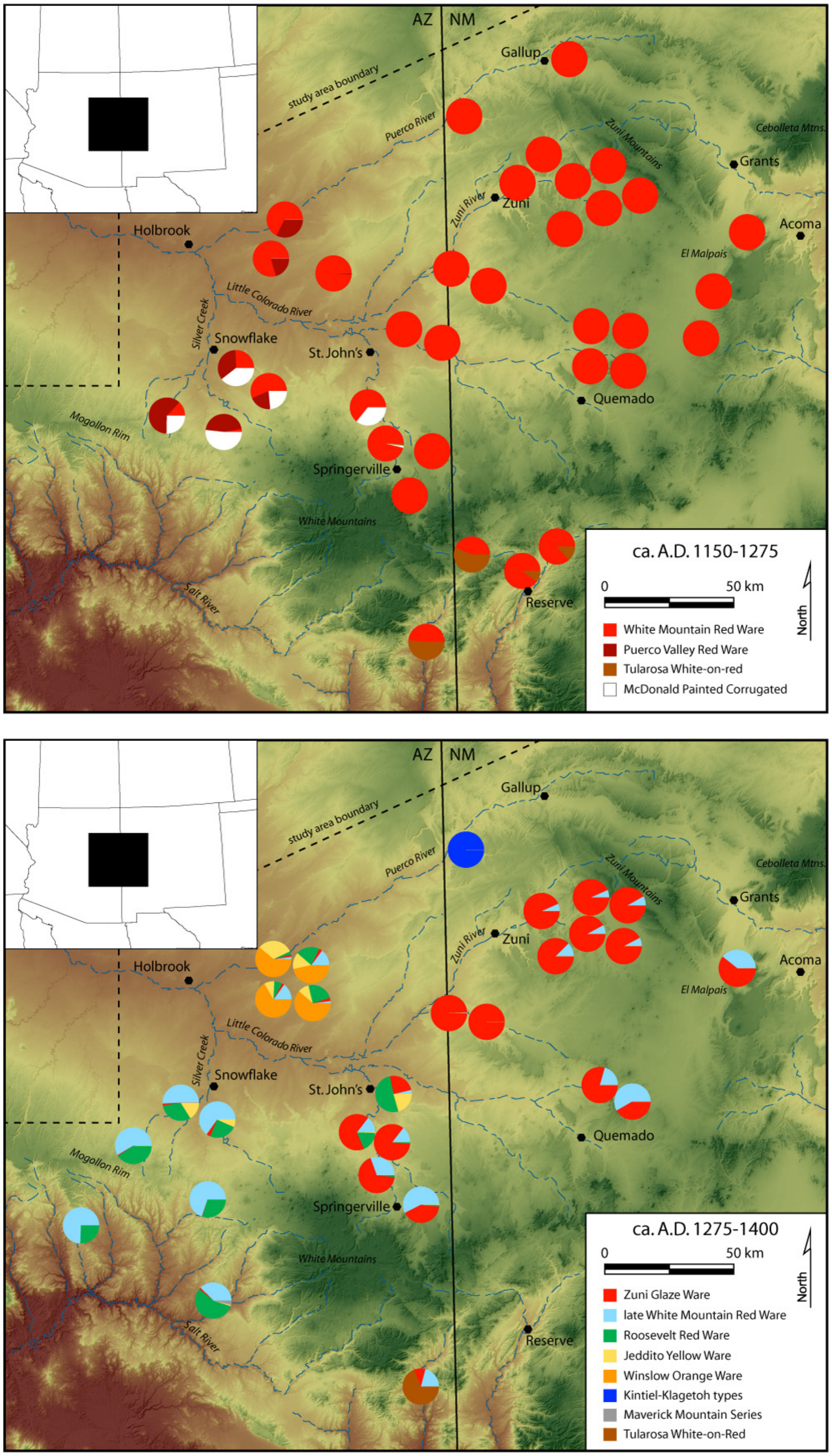


Figure 10.5. Distribution of polychrome wares for the Pueblo III period (top) and the Pueblo IV period (bottom).

made by individuals employing similar design conventions, perhaps some degree of shared categorical identity across the region as a whole.

Across the Pueblo III to Pueblo IV transition, however, patterns of stylistic similarity in bowl exterior designs broke down (Figure 10.5). The Zuni area to the east and the western and southern (Upper Little Colorado, Mariana Mesa, Mogollon Highlands, Silver Creek, and the Arizona Mountains) portions of the region diverged and began to produce vessels that differed in terms of design color and the structure of exterior designs. In the most populous areas near the Zuni River Valley after about A.D. 1275, potters began to produce vessels that archaeologists have designated as Zuni Glaze Wares. These Zuni Glaze Ware vessels were characterized by exterior designs that were simple, geometric, and circumferential much like earlier polychrome pottery across the region. However, specific designs were repeated with a much greater frequency, and even on other media such as wall murals. This repetition and homogeneity suggests active efforts towards maintaining conformity by potters in the Zuni area. To the west at about the same time (A.D. 1275), potters began producing vessels that archaeologists have designated as late White Mountain Red Ware (Pinedale Polychrome) types. On the exteriors of these late White Mountain Red Ware bowls, the simple geometric designs of earlier polychrome bowls were largely replaced by intricate unit designs, often consisting of animals or other recognizable forms. The broad differences between vessels produced in the eastern and western portions of the Cibola region suggest the emergence of a categorical social boundary between these areas across the Pueblo III to Pueblo

IV transition. Interestingly, settlements in between the primary production areas of these two distinct ceramic traditions including the Upper Little Colorado region, the Mogollon Highlands, and the Mariana Mesa area, were characterized by a mixture of both Zuni Glaze Ware and late White Mountain Red Ware vessels, both locally produced and imported (along with other wares after A.D. 1325). This may suggest that these areas were inhabited by diverse populations, or that the inhabitants of these areas were making active efforts to signal membership in multiple categorical social groups.

As expressions of categorical identity often take place in public settings, patterns of similarity in public spaces may provide indications of shared categorical identities at a regional scale. In Chapter 9 I explored patterns of similarity in the distribution and form of public architectural spaces across the Cibola region through time. There are a number of distinct varieties of public architectural features found across the study area, often with multiple features constructed at single communities. Although there is a great deal of change through time in the specific forms of public structures, many of the strongest patterns of similarity and difference across the region are relatively consistent across the late thirteenth century social transformation (see Figure 10.6). In general, the eastern portions of the study area (El Morro Valley, Pescado Basin, West Zuni, Carrizo Wash, Cebolleta Mesa, Puerco Valley, and Mariana Mesa) were characterized by great houses, circular great kivas, and after the Pueblo III to Pueblo IV transition, nucleated pueblos, many of distinctive shapes. The southern

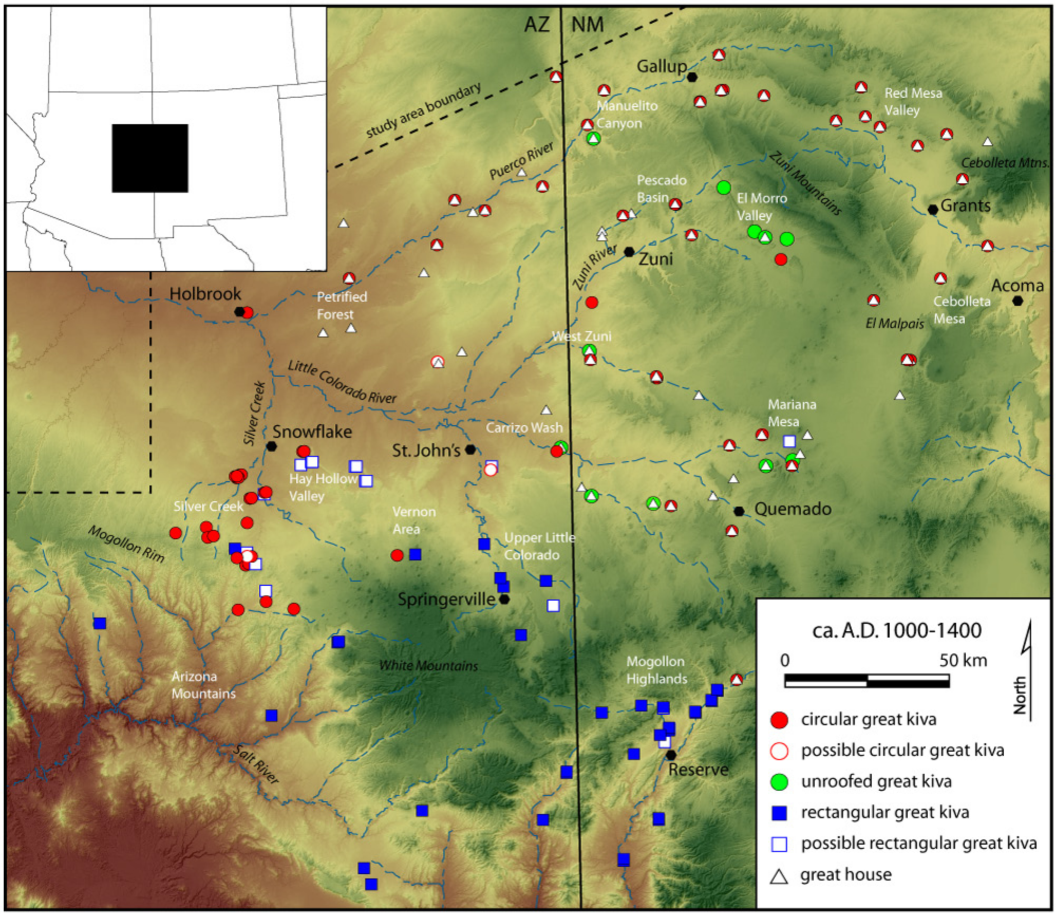


Figure 10.6. Map showing the distribution of great houses and great kivas of various forms ca. A.D. 1000-1400.

portions of the study area (Upper Little Colorado, Mogollon Highlands, and the Arizona Mountains) were characterized by a lack of great houses, rectangular great kivas, and agglomerative villages constructed around one or more plazas after the Pueblo III to Pueblo IV transition. A few areas along the western portions of the study area from the Vernon area to Silver Creek were marked by circular great kivas without great houses during the eleventh and early twelfth centuries, rectangular great kivas perhaps later in time, and agglomerative plaza-oriented pueblos by the Pueblo IV period. The diversity of features along this western frontier of the Cibola region suggests the presence of populations with diverse historical origins (Herr 2001). The consistent patterns of similarity in suites of public architectural spaces documented in this study suggest that the eastern and western portions of the study area may have been characterized by distinct forms and contexts for ceremonial activities that were maintained for centuries. Certain widespread features were shared across the entire region both before and after the thirteenth century social transformation (e.g., plazas, great kivas), but the specific forms of these features and trajectories of change across the period considered here differed considerably from place to place.

Overall, the material evidence for patterns of shared categorical expressions across the Cibola region documented in this study suggest that there was an increasing regional divergence and localization of categorical expressions across the Pueblo III to Pueblo IV transition. This further suggests that the social scale at which categorical groups were defined changed during the late thirteenth century. Within the Zuni area, including all of the lands along the Zuni River valley and the El Morro Valley, the Pueblo III to Pueblo IV transition was marked by an increasing homogenization of ceramic design and the creation of new forms of public architecture and communities that differed from those found across the rest of the study area. In areas to the south and west, evidence for categorical expressions in terms of ceramics and public features instead became somewhat more diverse through time. These differences may relate to patterns of regional population movement across the Cibola region. Specifically, in the southern and western Cibola region, there is evidence for the arrival of migrants from outside of the region across the Pueblo III to Pueblo IV transition, whereas population movement in the Zuni area was likely local in nature. Importantly, although changes in the expression of categorical identities through different lines of material evidence do overlap to a considerable degree, these patterns do not map on to the strongest patterns of relational connections described above.

Connecting Relations and Categories

The lack of a consistent fit between the strongest patterns of relational connections and categorical expressions in the greater Cibola region outlined above is intriguing, but not entirely surprising in light of the theoretical perspective considered in this study. As discussed in Chapter 2, although shared relations and categorical identities often overlap to a degree in many social settings, they can and do sometimes also vary independently (see Stokke and Tjomsland 1996; Tilly 1978). In many archaeological studies, mismatches between material evidence for relational connections (i.e., interaction) and categorical identities (i.e., active expressions of similarity/difference) have often been seen as hindrances to identifying social groups using archaeological data (e.g., Jones 1997:122-127; MacEachern 1998; Saetersdal 1999). The theoretical model used in this study suggests instead that such mismatches may also indicate particular social configurations that would have influenced the potential for and trajectory of coordinated social action and social transformation among large groups of people.

The Mariana Mesa area represents a particularly good example of an area marked by a mismatch of relational social ties and expressions of categorical identity. Specifically, the inhabitants of this area appear to have had strong relational social ties suggesting frequent interaction and/or common historical origins with communities in the southern and western Cibola region, including areas below the Mogollon Rim. As I suggest in several of the previous chapters, such relational connections were likely forged in part through long term patterns of immigration into the Mariana Mesa region from the western and southern Cibola region or perhaps even further afield. At the same time, the residents of this area produced and obtained decorated vessels similar to those made by the inhabitants of the northern Cibola region and constructed massive great houses, circular great kivas, and walled villages very similar to those in the Zuni area. Overall, the varying lines of material evidence combined in this study suggest that the inhabitants of the Mariana Mesa area made active efforts towards signaling a shared categorical identity with populations in the Zuni area in particular, despite their strong relational and historical connections with populations primarily to the west and south of the Colorado Plateau.

The mismatch between strong patterned relations and categorical expressions in the Mariana Mesa area during the Pueblo III and early Pueblo IV periods (ca. A.D. 1150-1325) considered in this study has an even deeper history than the period considered in this study. In a series of recent analyses, Andrew Duff and several of his students (Clark 2010; Duff 2005; Duff and Nauman 2010; Duff et al. 2008; Elkins 2007; Nauman 2007; Wichlacz 2009) have documented a similar pattern of decorated ceramics and public architectural traditions associated with Chacoan settlements to the north along with utilitarian pottery assemblages dominated by a southern technological tradition at several eleventh century great house and non-great house communities along the southern edge of the Colorado Plateau west of Mariana Mesa. Duff and colleagues argue that these communities, sitting along the traditional boundary between the Anasazi and Mogollon archaeological culture areas, were likely constructed and occupied by a diverse, possibly multi-ethnic population, primarily comprised of people with social ties and origins south of the Plateau.[1]

As the previous chapters have demonstrated, there was certainly some degree of interaction between the inhabitants of the Mariana Mesa area and the northern Cibola region near Zuni and the El Morro Valley. Small numbers of utilitarian vessels produced in the Zuni area did find their way to settlements in the Mariana Mesa region during the period considered here, suggesting that a segment of the population of this area had close social ties to communities along the Zuni River and the El Morro Valley. Perhaps more importantly, the inhabitants of the Mariana Mesa area also obtained substantial numbers of decorated vessels (in particular polychrome bowls) produced in the Zuni area to the north. Indeed, during the Pueblo III period, St. Johns Polychrome bowls produced in the Pescado Basin were more common than locally produced St. Johns Polychrome vessels at the sampled Mariana Mesa settlements. The movement of large numbers of decorated vessels suggests that communities in the Mariana Mesa area may have been hosting or participating in periodic public gatherings, likely including people from the Zuni area to the north, where these decorated vessels were exchanged. The common participation in such gatherings suggests weak relational ties between Mariana Mesa and the inhabitants of areas to the north. However, the movement of vessels from the Zuni area to the Mariana Mesa settlements was not reciprocal. This suggests that the Mariana Mesa settlements were likely somewhat peripheral to the sphere of exchange and public ceremonialism that characterized settlements along the Zuni River and the El Morro Valley during the period considered in this study. Interestingly, this also suggests that categorical expressions of similarity may have been mediated through relatively ephemeral and infrequent interactions.

The question that arises from the discussion above is: why did people in the Mariana Mesa region choose to express shared categorical identities (through the construction of great houses, great kivas, and painted ceramics) with populations in the northern Cibola region despite their strong social ties, historical connections, and frequent interactions with areas to the south of the Colorado Plateau? At a very basic level, the construction of Chacoan-inspired architectural complexes suggests an awareness of developments in Chaco Canyon and the political and social power of Chaco itself. It is possible that the leaders of local communities in the Mariana Mesa region used Chacoan-inspired architectural symbolism to exploit the political and social resources associated with Chaco (and later Post-Chacoan developments) to their own advantages (see Cameron and Duff 2008; Duff 2005). The construction of similar public architectural features, representing common contexts for public ceremonialism, suggests some degree of participation or ideological buy-in to widely held cosmological principals associated with Chaco and later developments (e.g., Fowler et al. 1987; Fowler and Stein 1992; Lekson 2006; Stein and Lekson 1992). Importantly, as the evidence presented in this study suggests, such an ideological buy-in does not necessarily indicate a high degree of direct and frequent interaction.

I am, of course, not the first to point out that strong patterns of interaction and active expressions of identity are not necessarily isomorphic. For example Jones (1997:122-127; see also Eckert 2008:2-3) notes that the extent to which a shared enculturative milieu does or does not overlap with the boundaries of ethnic groups, and how such groups are symbolized through material culture, can vary considerably. From this, Jones suggests that certain contexts may be more or less amenable for considerations of social identity, specifically ethnicity, through archaeological remains. In other words, where *habitus* and ethnicity lack homology, it may be difficult to identify discrete social groups through material culture without some other line of independent evidence. While it is true that we must be careful not to assume that all social differences will be expressed through material culture, and conversely, that not all material culture differences indicate strong social distinctions, through careful contextualization it is often possible to identify the most robust social boundaries (categorical distinctions) and patterns of interaction (relational connections). From this, I argue that mismatches between strong evidence for frequent interaction and active expressions of social identities do not simply influence our ability to identify discrete social groups in the past, but rather may also suggest particular configurations of social relationships that would have influenced the organization of cooperation and collective actions among populations at large social and spatial scales.

Identity and Social Transformation in the Cibola World

The complex interrelationships between relational connections and patterns of shared categorical identities described above play a foundational role in the creation of contexts where collective activities are likely to occur. Furthermore, the relationships between these modes of identity also influence potential long-term success of such sustained collective actions. Specifically, collective actions that are truly transformative are most frequent among groups of individuals characterized by strong relational connections as well as a high degree of categorical homogeneity. Such groups represent what White (2008a) has termed a *catnet*. Importantly, many widespread social transformations involve the creation of a social setting resembling a *catnet* out of some other combination of relations and categories.

Building on this perspective, I argue that the patterns of frequent interaction representing strong relational connections, prior to a period of transformation (i.e., prior to the Pueblo III to Pueblo IV transition) should provide an indication of the lines along which increasingly dense relational networks and new categorical identities are most likely form or solidify across that transformation. Put another way, if the Pueblo III to Pueblo IV transition follows the typical trajectory of social transformation processes documented in many contemporary and recent historical settings (see Diani 2003; McAdam et al. 2001; McAdam 2003; Tilly 1978), we should expect a trajectory of change through time marked by an increasing consolidation of groups sharing strong relational connections, followed by the creation of new and more distinct categorical identities. In this section, I demonstrate that such a pattern of change through time is well supported for the Cibola region.

Although it is difficult to identify the specific actions and events involved in the process of social transformation through archaeological remains alone, it may be possible to demonstrate general similarities in the trajectories of change through time between archaeological cases and other well studied contemporary contexts. Such similarities further suggest underlying structural correspondence in the mechanisms involved in widespread social change among vastly different social settings. This general comparison is not meant to provide a causal explanation for social transformation, but instead a mechanical one. As McAdam and others (2001:11) put it, such mechanisms represent "a delimited class of events that alter relations among specified elements in identical or closely similar ways over a variety of situations" (see also Tilly 2001:24-26). If the social transformation in the Cibola region is mechanically similar to transformations in contemporary and recent historic contexts (i.e., state level and commercial societies), it would suggest that the traditional scope of comparative research focused on social transformation has been far too narrow. Demonstrating that such mechanical similarities exist is particularly important as scholars studying the interrelationships between identity and social change in contemporary and recent historical settings often assume that pre-modern and non-state societies operated primarily in terms of relations, and therefore, were typically not subject to the dynamics of social transformation described in this study (e.g., Calhoun 1997:42-48).

As summarized in the previous section, the various lines of material evidence for the strongest patterns of relational connections across the Cibola region considered in this study were remarkably consistent across the Pueblo III to Pueblo IV transition. At one level, this suggests that the establishment of nucleated settlements was largely organized among groups of individuals who were already interacting on a regular basis prior to the late thirteenth century transformation (see also Huntley and Kintigh 2004; Kintigh et al. 2004; Kintigh 2007). At the same time, there were also important changes in the nature and scale of relational networks across this transition which may have influenced the organization and scale of coordinated social change at this time. For example, the theoretical framework used in this study suggests that the relative density of sub-groups within a network (the proportion of total possible social ties that are active) can be used as a measure of the potential for collective action at a particular scale (see Kim and Bearman 1997; Siegel 2008; Tilly 1978; White 2008a). Specifically, as the density of a particular sub-group within a larger network increases relative to overall network density, the importance of that sub-group as a center of collective mobilization is also likely to increase (see Nexon 2009:52-61).

In order to further characterize the relationship between the density of relational networks and the potential for collective mobilization, I return to the social network graphs produced in Chapter 6 (see Figure 10.7). As Figure 10.7 illustrates, during both the Pueblo III and Pueblo IV periods there is a strong tendency towards segmentation into two sub-groups of settlements characterizing

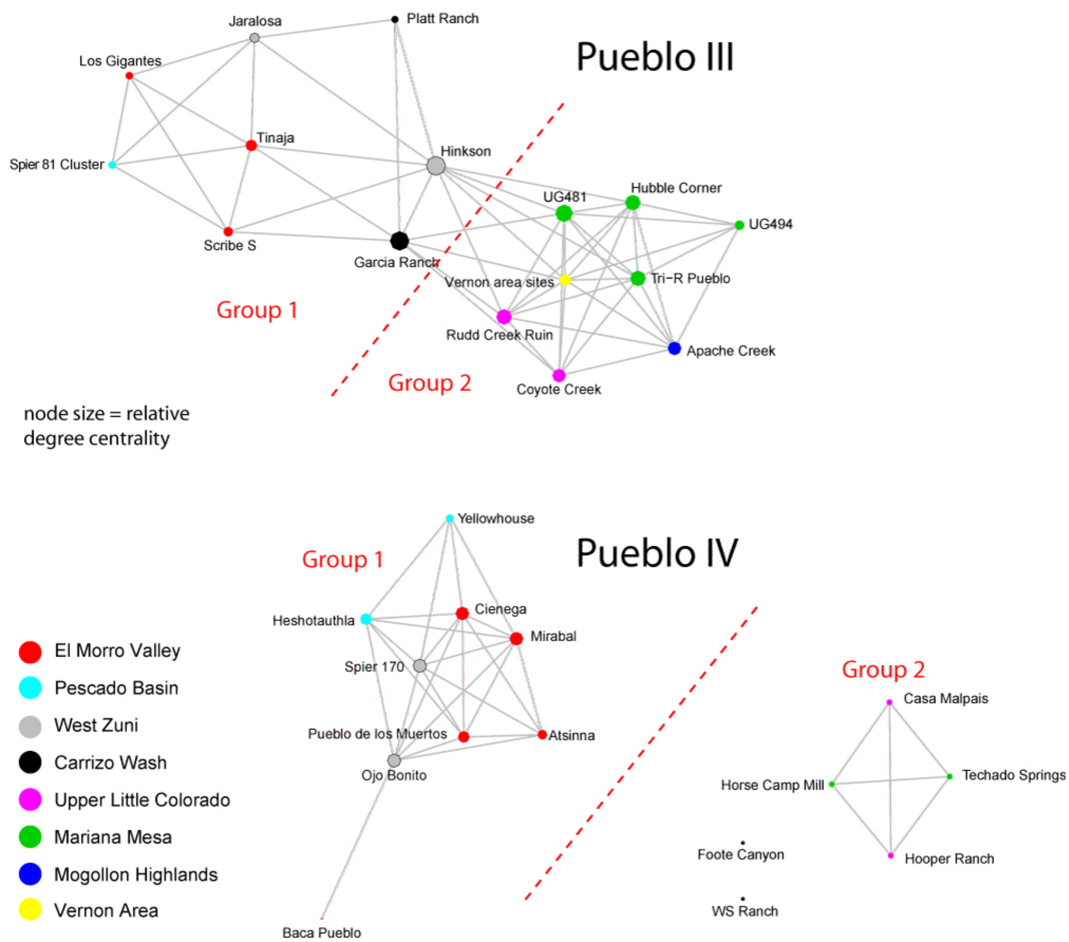


Figure 10.7. Network graphs based on similarities in ceramic technological data (see Chapter 6).

the northern and southern portions of the study area respectively. Network density is calculated as the proportion of all possible pair-wise connections among nodes in a network graph that are active in a given context. Not surprisingly given the pattern of increasing segmentation of the network graphs across the Pueblo III to Pueblo IV transition, overall network density decreases through time (Table 10.1). Network density can also be calculated independently among sites in the sub-groups defined above. As Table 10.1 shows, during both the Pueblo III and Pueblo IV periods, network density by sub-group is considerably greater than

Table 10.1. Network density by time period and sub-group.

	Network Density		
	Overall	Group 1	Group 2
Pueblo III	0.44	0.64	0.93
Pueblo IV	0.30	0.70	0.40
PIV excluding Baca and Mogollon Highlands	0.33	0.86	1.00

overall network density. Following the expectations outlined above, this suggests that these somewhat smaller areas within the larger Cibola region are more likely scales of collective mobilization and social transformation than the region as a whole.

The northern and southern sub-groups of sites defined in Chapter 6 and described above may also be characterized by somewhat different trajectories of change in network density through time. Specifically, the absolute density as well as the relative difference from overall density among sites in the northern portion of the Cibola region (Group 1) increases across the Pueblo III to Pueblo IV transition, while the density of settlements in the southern group (Group 2) decreases. This suggests that settlements in the northern Cibola region may have been consolidated into increasingly dense relational networks of frequent interaction, further increasing the relative potential for the organization of collective mobilization, across the Pueblo III to Pueblo IV transition.

As an examination of the network graphs shown in Figure 10.7 reveals, however, during the Pueblo IV period, there are outliers within both groups characterized by a single network tie or none at all (Baca for Group 1 and the Mogollon Highlands sites for Group 2). In both cases, these outliers are spatially distant from other sites in each group. When these outliers are removed, there is a dramatic increase in density between the Pueblo III and Pueblo IV periods for both Group 1 and Group 2. This increase in density also represents a reduction in the spatial extent of both groups. Although these results are based on a limited sample of sites in the Cibola region, the pattern of segmentation and increasingly dense sub-groups is quite pronounced, and can be recognized through multiple lines of material evidence.

Importantly, the Pueblo III to Pueblo IV transition did not only entail a consolidation of regional networks of interaction. This transition also saw the creation of new and more discrete categorical identities. During the last years of the thirteenth century, the Cibola region was marked by an increasing localization of distinctions in highly visible expressions of categorical identity including polychrome ceramics and public architectural spaces. As I argue above, the public nature of these new categorical expressions suggests that people were making active and unprecedented efforts towards marking social similarities, boundaries, and shared identities during the Pueblo IV period. Within the Zuni area there was a widespread homogenization of such public categorical expressions which perhaps further suggests active efforts towards maintaining social conformity. Conversely, along the edges of the Cibola region, the Pueblo III to Pueblo IV transition was marked by a pattern of increasing diversity in categorical expressions through time, in particular in terms of painted ceramics. These different portions of the Cibola region were characterized by different scales of population movement in the late thirteenth century. Specifically, the western and southern portions of the Cibola region likely saw the arrival of migrants from northeastern Arizona or other areas during the late thirteenth century whereas population movement into the Zuni area was likely more local in nature.

As the brief discussion above illustrates, the Pueblo III to Pueblo IV transition in the Cibola region was marked by a consolidation of relational networks of interaction followed by the creation and spread of new and more distinct categorical identities. The scale at which new categorical expressions of identity were shared differed across the region, perhaps largely as a result of the differing population histories of specific areas. However, across the Pueblo III to Pueblo IV transition, the Zuni area in particular increasingly resembled the idealized description of a *catnet* described above as a social context marked by strongly overlapping relational connections and shared and homogenous categorical identities. The trajectory of change through time documented here suggests that the late thirteenth century social transformation in the Cibola region was characterized by processes that might be expected based on characterizations of contemporary instances of collective mobilization and social transformation described in Chapter 2. As such similarities in the nature and trajectory of social change suggest broader similarities in the mechanisms involved, this further suggests that the historical ubiquity of social transformation processes, which have traditionally been seen as limited to state level societies, needs to be reevaluated.

In many ways, the picture of increasingly homogenous relations and categories in the Zuni area described above is quite similar to the model of regional scale interaction in the Pueblo IV period previously presented by Duff (2002). Relying primarily on data relating to the production and exchange of ceramics, Duff (2002:187-192) argues that the broader Western Pueblo region (a somewhat larger unit than the greater Cibola region considered in this study) is marked by a dichotomy between high density population areas characterized by material homogeneity (Zuni and Hopi) and low density population areas characterized by greater material diversity. Duff argues that the differences in the degree of material homogeneity among various portions of the Western Pueblo world are tied to the structural constraints of different demographic configurations. Specifically, Duff argues that smaller populations likely would have allowed for and even facilitated diverse expressions of identity whereas such expressions are more likely to have been suppressed in higher density population areas. From this, Duff further argues that explorations of social identity in archaeology should be conducted through a consideration of social interactions in relation to demographic conditions "without regard to outward expression of identity in material culture itself" (2002:187). While I do not disagree that there is a reasonably strong negative relationship between population density and material diversity (see also Nelson et al. 2011), the results presented in this study suggest that this relationship is not strictly structurally determined. Instead, I argue that changing patterns of interactions (relations) and active expressions of identity (categories) through material culture can and do vary independently and further, that the relationship between these different dimensions and expressions of identity can create contexts ripe for social change.

Contributions of this Study

This study has resulted in a number of specific and general methodological and theoretical contributions. In this final section, I briefly review several of these contributions and provide an assessment of the potential advantages of the theoretical framework employed in this study for considerations of the relationship between identity and social change in general. I conclude with a few brief comments regarding how this study relates to broader archaeological goals, including efforts towards assessing cultural affiliation using material culture.

At the most basic level, this dissertation has resulted in the creation and compilation of a large amount of data including; a regional settlement and architectural database, detailed technological characterizations of ceramics and domestic architectural features, stylistic information and photographs of a large sample of painted ceramic vessels, and a large chemical compositional database including a varieties of wares and types from settlements across the Cibola region. The raw data and interpretations produced through this study are available online through the Digital Archaeological Record (tDAR) and other sources (see Appendix E). Thus, this study not only makes large amounts of data available, but also provides an accessible template for the development of similar projects in other regions.

The primary methodological contributions of this study stem from the ceramic technological analyses presented in Chapter 6. This chapter describes and applies a new method of technological characterization that can be used to create a scale of relative technological similarity based on individually measured attributes including multiple classes of data. This approach has several advantages over methods used in the past which have typically focused on comparing individual variables independently. In addition to this, Chapter 6 also presents a method for assessing the results of such technological characterizations using social network graphs. Importantly, this general method of analysis could be applied to comparisons or classifications of other archaeological materials.

From a theoretical standpoint, the research presented here provides a new perspective for understanding archaeologically observed social transformations by relating the mechanisms involved in the process of social change to the nature and scale of social identities. This perspective relies on a set of concepts and expectations derived from relational sociology and political science which have not been previously applied to archaeological analyses. Thus, this research has resulted in the use of well-developed body of theory new to archaeology, including the development of methods for operationalizing it, and new insights into how to address regional-scale social processes through archaeological data. Beyond this, the theoretical framework employed in this study has traditionally only been applied to (and argued to only be relevant for) contemporary and recent historical settings, in particular focused on state level, commercial, and democratic societies. By applying this framework to the Cibola region, this dissertation also provides a case study for comparing the relationships between social transformation and collective identity across a broader array of historical and political contexts. Furthermore, this research provides theoretical tools for exploring scales of social organization that have often been overlooked or taken for granted in the past.

Finally, this study is fundamentally concerned with issues of identity and how we can study it through material culture. This is a topic of broad theoretical relevance to archaeology in general, but in North America, also one with concrete ramifications. Considerations of identity have taken on a new importance over the last twenty years due in large part to the passage of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 U.S.C. 3001). Among other provisions, NAGPRA mandates a process through which certain cultural items (human remains, funerary objects, sacred objects, and objects of cultural patrimony) held by museums and federal agencies may be repatriated to lineal descendants or Native American tribes deemed culturally affiliated with those objects. Cultural affiliation is defined as "a relationship of shared group identity which can be reasonably traced historically or prehistorically between a present day Indian tribe or Native Hawaiian organization and an identifiable earlier group" (25 U.S.C. 3001). Relationships of cultural affiliation are assessed based on a preponderance of evidence, including archaeological information.

NAGPRA has often been interpreted as requiring the identification of a bounded social group (a cultural entity) in the past and tracking its connections with a modern tribal organization (a political entity). Seen in this way, cultural affiliation is often assessed in terms of archaeological cultures, reified as bounded social groups (see Todd 2005). This approach has been criticized by many as homogenizing both the archaeological record and contemporary Native American groups (e.g., Bernardini 2005; Dongoske et al. 1997).

How then, does the multi-dimensional model of social identity used in this study relate to concepts of cultural affiliation as they are applied in NAGPRA and traditional cultural taxonomies in general? As noted in several of the previous chapters, patterns of relational and categorical connections do, at different times and places, *sometimes* show a strong correspondence with archaeological cultures as they have been traditionally defined (i.e., archaeological constructs such as Anasazi and Mogollon). For example, the strongest patterns of technological similarity in terms of utilitarian pottery production and domestic architecture are strongly bifurcated along the traditional boundary between areas traditionally defined as Anasazi and Mogollon territory respectively. This suggests, not surprisingly, that the archaeological cultural designations defined so long ago by the first generation of cultural historians in the Southwest likely do capture certain aspects of interaction (relations) and active expressions of identity (categories) among people at regional scales. At the same time, the analyses presented in this study suggest that such rigid taxonomies also mask a considerable amount of variation and, perhaps most importantly, are not particularly amenable to considerations of change through time. Furthermore, traditional cultural taxonomic classifications are based on the assumption that patterns of interaction and identity must overlap; an assumption explicitly rejected in this study. Indeed, I would argue that many cultural historical debates in archaeology (e.g., the Mogollon controversy; see Reid and Whittlesey 2010) boil down to differences between scholars emphasizing either relational connections or categorical distinctions independently, without considering the interplay between them.

The approach to social identity advocated in this study not only allows patterned relations and categorical distinctions to vary independently but actually focuses on the relationship between these dimensions of identity. Although assessments of cultural affiliation based on such complex notions of identity as multiple and fluid are considerably more difficult than assessments that emphasize traditional cultural taxonomies or geography, such efforts have been successful in the recent past (see Beisaw 2010). Perhaps most importantly, the multi-dimensional model of social identity used in this study is more in line with many traditional tribal notions of culture and identity in that it does not force Native American groups to approach affiliation through a strictly limited range of social and political organizational forms.

Chapter 10 Notes

1 Even earlier in time (ca. A.D. 600-900), a number of sites along the southern edge of the Colorado Plateau have been recorded that include ceramics associated with both the Anasazi (e.g., Lino Gray, Kana'a Gray, Cibola White Ware, etc.) and Mogollon (Alma Brown Ware, Forestdale Brown Ware, Mogollon Red-on-brown, etc.) areas in varying proportions (Danson 1957:71). Wasley (1959) argues that, at the Cerro Colorado site near Quemado, both Anasazi and Mogollon ceramic wares were locally produced.

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APPENDIX A

ADDITIONAL STATISTICAL DOCUMENTATION FOR NAA COMPOSITIONAL GROUP ASSIGNMENTS

This appendix provides detailed descriptions of all NAA compositional groups defined for this study as well as the specific criteria used to attribute them to a particular geographic production zone. I limit the discussions below to the final group configurations, including both core and non-core members. Table A.1 lists all of the major compositional groups (including sub-groups) and provisional groups defined using the methods described in Chapter 4 as well as two groups previously defined by Triadan (1997; Triadan et al. 2002) from the Silver Creek area. Following these group descriptions, I provide a few additional details regarding the procedures used to assign samples as non-core members of core compositional groups. The statistical documentation associated with compositional group and sub-group evaluations are provided in Tables A.2-A.13 at the end of this appendix.

Major Compositional Groups and Sub-Groups

A total of 13 major compositional groups (groups large enough to be evaluated using log-transformed element concentrations) were defined within the primary compositional dataset considered here. Several of the major compositional groups could be divided into somewhat smaller sub-groups, which are also described under each of the sub-headings below. I refer to each group using the aliases in shown Table A.1.

EMV-1

EMV-1 represents a well defined group of ceramics, including both decorated vessels (St. John’s Polychrome, Cibola White Ware, and Zuni Glaze Ware) and Cibola Gray Ware vessels. Approximately 98% of samples within this

Table A.1. Compositional groups used in this study.

Group Alias	Sub-group	Group #	Probable Production Zone	# of Samples
EMV-1		1	El Morro Valley (east)	120
EMV-2		2	El Morro Valley (west)	210
EMV		1/2	El Morro Valley	31
PLATEAU	PB	3	Pescado Basin	312
	CEB	4	Cebolleta Mesa	47
	P_EMV	5	El Morro Valley	9
	PLATEAU	3/4/5	Pescado Basin/El Morro/Cebolleta Mesa	52
MM-1	MM-1a	6	Mariana Mesa	36
	MM-1b	7		25
MM-2		8	Mariana Mesa	76
WEST-1		9	West Zuni/Carrizo Wash	55
WEST-2		10	West Zuni/Carrizo Wash	50
AZ/NM		11	West Zuni & Central ULC	169
ULC-2	ULC-2a	12	Northern ULC	48
	ULC-2b	13	Central ULC	14
ULC-3a		14	Central ULC	65
ULC-3b		15	Southern ULC	90
ULC-4	ULC-4ab	16	Central/Southern ULC	94
	ULC-4c	17	Central ULC	6
SOUTH	S-ULC	18	Southern ULC	29
	S-BR	19	Below Mogollon Rim	38
box-s		20	Box S area	16
emv-3		21	El Morro Valley	13
lpv		22	Pescado Basin	9
zuni-2		23	Pescado Basin	17
ulc-3		24	Southern ULC	19
WMRW-1		25	Silver Creek	5
WMRW-3		26	Silver Creek	23

group were recovered from sites in the El Morro Valley. This strongly suggests that the vessels within this group were locally produced in this area. Further, 67% of samples within this group were recovered from settlements in the eastern El Morro Valley along the slope of the Zuni Mountains (Tinaja, Pueblo de los Muertos, and Scribe S), perhaps suggesting production at this more specific geographic scale. The eastern portion of the El Morro Valley is characterized by several major outcrops of the clay bearing Chinle formation sandstones and thus, it is likely that light-firing Chinle derived clays were used to produce these vessels. This group is well distinguished from other compositional groups attributed to the El Morro Valley on principal components plots as well as on biplots of elements like cesium, tantalum, thorium, and rare earth elements (Figure A.1).

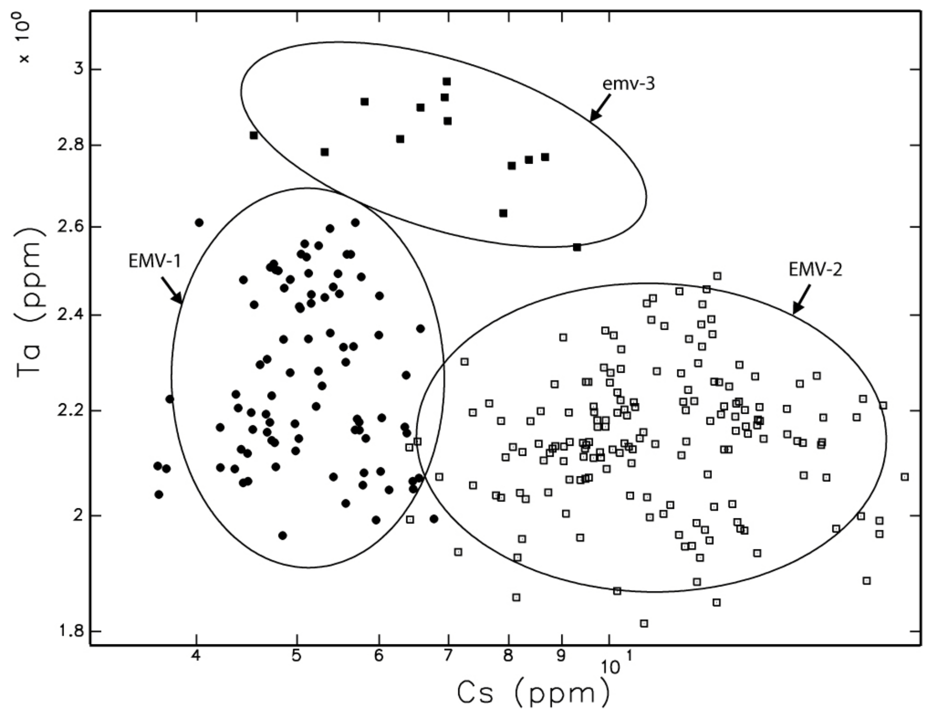

Figure A.1. Plot of El Morro Valley compositional groups based on the logged concentrations of Cesium (Cs) and Tantalum (Ta).

EMV-2

EMV-2 represents another group of decorated (early White Mountain Red Ware, Cibola White Ware, and Zuni Glaze Ware) and Cibola Gray Ware sherds. This compositional group is similar to the EMV-1 group but has lower concentrations of rare earth elements and higher concentrations of alkali metals like cesium and rubidium (see Figure A.1). Approximately 91% of samples within this group were recovered from the El Morro Valley suggesting local production in this area. Vessels in the EMV-2 group are found at every sampled settlement in the El Morro Valley, but are somewhat more frequently recovered from sites in the western portion of the Valley. The western El Morro Valley is characterized by several major outcrops of Dakota sandstone and it is likely that Dakota formation clays were used to produce vessels within this group. In addition to this, EMV-2 includes one unfired painted ceramic vessel and one unfired ball of tempered clay recovered from the Pettit site within Togeye Canyon in the western El Morro Valley, further suggesting production in this area.

EMV

A small number of sherds included in this analysis had high probabilities of membership in only EMV-1 and EMV-2 but could not be confidently placed in either group using the strictest criteria for core group membership. Since both the EMV-1 and EMV-2 compositional groups are strongly associated with production in the El Morro Valley, these interstitial samples are placed in a separate group labeled simply EMV. This group is treated as an intermediate category and is not statistically assessed as a separate group. The transitional nature of samples within this small group could be due either to the gradational mixing of clay and tempering materials across the El Morro Valley or the mixing of materials through the inclusion of non-local sherd temper in ceramic pastes. Many initial members of this intermediate group were later attributed to one of the two El Morro Valley compositional groups through non-core analysis.

PLATEAU

The PLATEAU group is the largest compositional core group defined in this study with a total of 420 members consisting primarily of decorated ceramics (ca. 84% of total) but also containing a number of Cibola Gray Ware sherds. This group is compositionally similar to several other major groups defined for this study including EMV-2, MM-1, and WEST-1 but is distinguishable based on Mahalanobis distances calculated on log-transformed element concentrations as well as on several element and PCA biplots. Because the PLATEAU compositional group is similar to several other major groups, somewhat stricter criteria were used to define core membership to avoid spurious assignments and the unwarranted expansion of the group by the inclusion of outliers (e.g., Neff et al. 2006). Specifically, samples were defined as core members of this group only when they had greater than a 5% probability of membership in the PLATEAU group coupled with at least five times greater probability of membership in PLATEAU than in any other group. Further, samples were excluded from the core group if they had probabilities of membership in any other group exceeding 5%. Most samples with marginal probabilities of membership in the PLATEAU group were defined as non-core members during subsequent analyses.

Examinations of element and PCA biplots of the PLATEAU compositional group suggest that this core group is relatively diverse with several potential sub-divisions. In order to evaluate sub-group structure within the PLATEAU core group, I conducted a series of exploratory cluster analyses including hierarchical cluster analysis of element concentrations and *K*-means cluster analysis of standardized principal component scores (see also Glowacki 2006). Several of these exploratory procedures produced similar divisions within the data set suggesting that the PLATEAU core group can be divided into three sub-groups; PB, CEB, and P-EMV (Figure A.2). The two sub-groups large enough to be evaluated based on log-transformed element concentrations (PB and CEB) are distinct in terms of group membership probabilities calculated based on Mahalanobis distances (Table A.6). Further, all three sub-groups are well distinguished based on probabilities of group membership calculated on canonical discriminant functions (Figure A.3). Importantly, these three sub-groups also differ dramatically in terms of the wares represented and the region of recovery for samples within them providing additional support for the division of the core group.

After sub-groups were defined among the core members of the PLATEAU group, non-core members were projected against the sub-groups using log-transformed element concentrations. Non-core members were placed into sub-groups when probabilities of membership exceeded the thresholds set for membership used in the core group analysis. After this procedure, a number of non-core samples could still not be placed into one of the three sub-groups using the strictest criteria for membership. These additional samples were projected against the sub-groups using a PCA scores and discriminant functions. Additional non-core samples were considered members of sub-groups if they merited inclusion based on *both* PCA scores and discriminant functions. The insistence on the agreement of both PCA and discriminant function assessments of membership

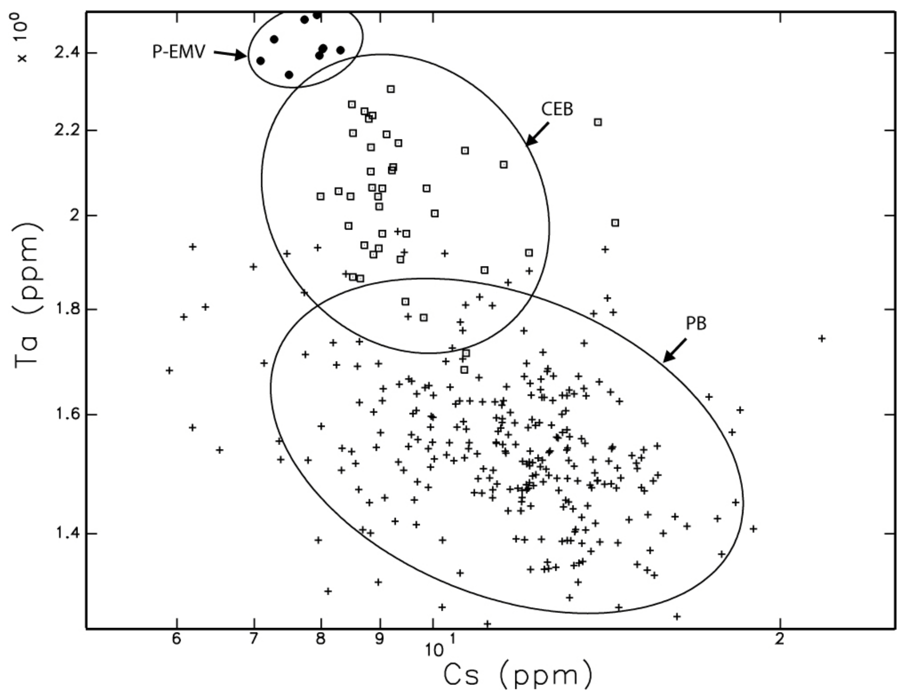

Figure A.2. Plot of PLATEAU sub-groups based on the logged concentrations of Cesium (Cs) and Tantalum (Ta).

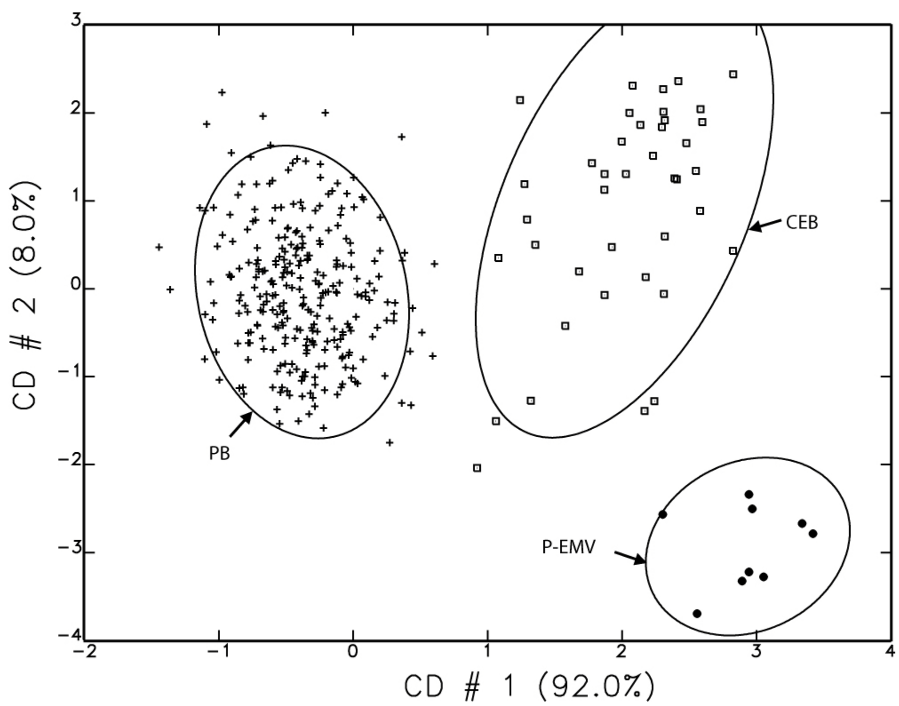

Figure A.3. CDA Plot of PLATEAU sub-groups.

provides a conservative assessment of sub-group membership but potentially helps to avoid compounding uncertainty by including samples with marginal probabilities of membership in more than one sub-group. After all of these procedures were completed, 52 samples (or approximately 12% of the PLATEAU group) could still not be placed into any of the three sub-groups (see Tables A.7 and A.8). Samples which could not be placed into a specific sub-group are considered to have likely been produced in one of the three areas to which the sub-groups are attributed. These samples are simply designated as PLATEAU in tables and figures presented in Chapter 5.

The largest of the three sub-groups defined above is the PB group, consisting primarily of decorated ceramics and a smaller amount of Cibola Gray Ware. Samples within this large sub-group are relatively common at sites along the Zuni River Valley from Carrizo Wash to the El Morro Valley as well as in the Mariana Mesa, and Cebolleta Mesa areas along the edges of the Cibola region. Although this compositional group is common in many portions of the northern Cibola region, several contextual lines of evidence suggest that vessels within this group were produced in the Pescado Basin area and possibly nearby areas with similar geology. First, the Pescado Basin is the only sub-region within the primary portion of the study area that is dominated by samples within the PB group during both the Pueblo III and Pueblo IV periods. Further, when considering utilitarian ceramics only, members of the PB group account for approximately 67% of the sherds recovered from the Pescado Basin area, which is far greater than the percentage of PB in the utilitarian ceramic assemblage from any other well sampled sub-region across the study area.

The central Pescado Basin area is characterized by large outcrops of clay bearing Gallup and Crevasse Canyon sandstones while the margins of the valley are marked by outcrops of Dakota sandstones. Due to the compositional differences between the PB group and the EMV-2 group, which is associated with the Dakota formation, it is likely that either the Gallup or Crevasse Canyon formations provided the materials used to produce vessels in the PB compositional group. It is possible that sherds within the PB group were produced in other areas by potters using similar materials, perhaps including the El Morro Valley or Mariana Mesa areas where this group is also very common (see also Duff 2002:132). However, the consistent dominance of the PB group in both the decorated and plainware assemblages from the Pescado Basin through time, the major geological differences between the Pescado Basin and other nearby areas, as well as the compositional differences between PB and core groups associated with other sub-regions suggest that production within the Pescado Basin is most likely (see also Schachner 2007:119-123; Schachner et al. 2011). Similar geological resources would have also been available in densely occupied areas to the southeast of the Pescado Basin, but no sites in that area have been sampled so production in that area cannot be directly assessed. In Chapter 5, I argue that the widespread distribution of painted vessels from this group across much of the study area may be related to community level specialization in decorated ceramic production.

The next major sub-group within the PLATEAU core compositional group is designated as CEB. This group consists almost exclusively of Cibola Gray Ware and Cibola White Ware (Tularosa Black-on-white) vessels with a few St. John's Polychrome sherds. Members of this sub-group make up a small percentage of samples from a number of areas across the northern Cibola region along the Zuni River as well as in the Mariana Mesa region. This group is most common, however, in the Cebolleta Mesa area as well as in the Cañada Alamosa area outside of the primary study area. Greater than 92% of samples within this group come from sites occupied only during the Pueblo III period. The consistency in the wares represented as well as the occupation span of sites where samples have been recovered supports the designation of this sub-group within the larger PLATEAU core group. Importantly, the CEB group is rare at sites in the Pescado Basin area further suggesting a strong distinction between the PB and CEB sub-groups. The PB and CEB sub-groups are also relatively well separated on PCA plots (Figure A.4).

Although the ascription of the CEB sub-group to a specific locus of production is somewhat tentative due to the limited number of samples available and the range of wares that have been characterized across different portions of the study area, a few lines of contextual evidence point to the Cebolleta Mesa area as the likely production zone. First, the CEB group accounts for approximately 89% of the small utilitarian ceramic sample from the sites in the Cebolleta Mesa area included in this study, and less than 6% of the utilitarian sample for any other area across the primary study area. Utilitarian vessel sherds within the CEB group

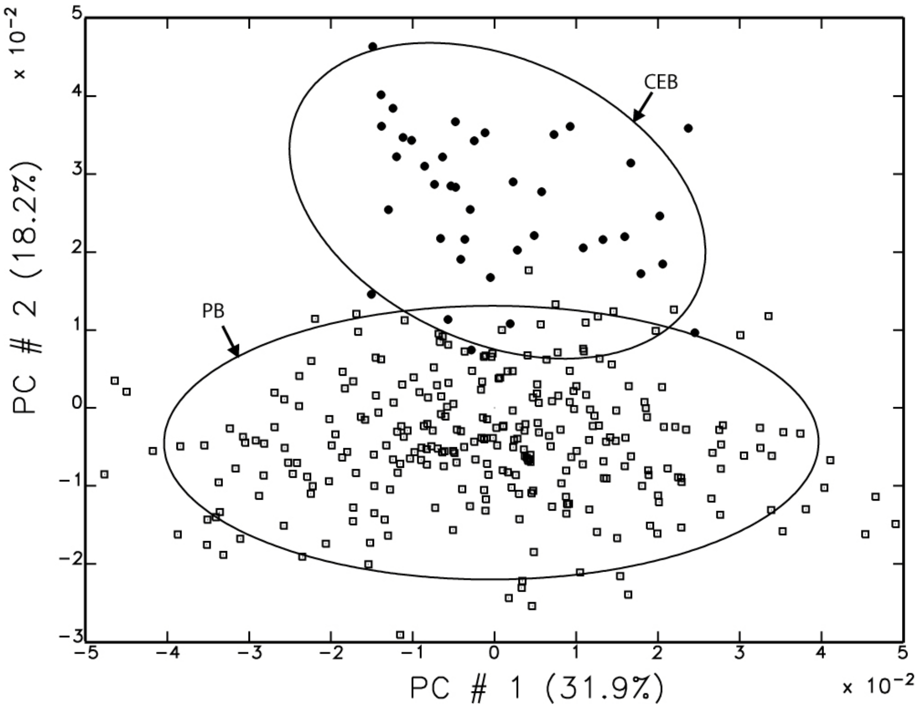

Figure A.4. PCA plot of PB and CEB sub-groups.

recovered from areas outside of the Cebolleta Mesa area are most common in the adjacent El Morro Valley and Mariana Mesa sub-regions. In terms of decorated ceramics, the CEB group is rare across the primary study area, but found in small amounts at several sites in along the Zuni River and in the El Morro Valley. No decorated sherds from the Cebolleta Mesa area are attributed to the CEB group. However, the decorated sherds falling within the CEB group are almost exclusively Cibola White Ware, and no samples of Cibola White Ware have yet been characterized from sites in the Cebolleta Mesa area. The lack of any White Mountain Red Ware samples within the CEB group is in line with previous temper and refiring studies which suggest that, although Cibola White Ware was likely locally produced in the Cebolleta Mesa area, most if not all White

Mountain Red Ware vessels may have been imported during the Pueblo III period (Eleya et al. 1994:63-65, Table 5).

The only area for which data are currently available with more than trace amounts of decorated ceramics in the CEB group is the Cañada Alamosa region south of the current study area. These samples were originally submitted by Karl Laumbach as part of the Cañada Alamosa Project and were included in this study because many wares likely produced in the Cibola region were recovered from sites in this area (Ferguson 2008). Sherds within the CEB group account for over 25% of all decorated wares included in the Cañada Alamosa sites and nearly half (48%) of the Cibola White Ware samples that could be placed in a compositional group. Interestingly, there are a few other lines of evidence suggesting possible connections between the Cebolleta Mesa and the Cañada Alamosa areas such as the relatively frequent occurrence in both areas of ceramic types and wares that are rare across most of the Cibola region (e.g., Socorro Black-on-white, Carbon painted White Ware, and associated Brown Ware types [e.g., Eleya et al. 1994:Chapter 5; Laumbach 1999; Wozniak and Marshall 1991:6.34-6.42]). Based on the limited available contextual evidence described above, I tentatively attribute the CEB group to production in the Cebolleta Mesa area.

Many members of the CEB sub-group described above were previously defined as part of Schachner's (2007) Zuni North or ZN group which he attributed to production in the Manuelito Canyon area along the Puerco River Valley because this group comprised over half of the small sample from the Manuelito Canyon sites. The original ZN group also dominated the plainware assemblage of sites in the Cebolleta Mesa region. Schachner (2007:124-125) noted that, although the ZN group could be reasonably distinguished based on log-transformed element concentrations, it was not distinct on element or PCA biplots. Further, he suggests that the assignment of some corrugated sherds to this group was questionable. With the addition of Cibola White Ware samples to the compositional database in this study, the CEB group defined here (comprising a substantial portion of Schachner's ZN group) is somewhat smaller, but also more coherent. Almost all samples from the Manuelito Canyon sites no longer have high probabilities of membership when projected against the PLATEAU core group or the smaller CEB sub-group.

Although some samples from the Manuelito Canyon area are somewhat compositionally similar to samples within the PB and CEB groups, they generally have low probabilities of membership in all compositional core groups. In the current analysis, over half of the characterized samples from the Manuelito Canyon sites remain unassigned (17 of 30). Further, there is a tendency towards separation in terms of both PCA and element biplots between samples within the newly formed CEB group and the additional unassigned Manuelito Canyon samples from Schachner's (2007) original ZN group (Figures A.5). Although the unassigned samples from the Manuelito Canyon area, which consist primarily of utilitarian sherds, could potentially be defined as a provisional group, they remain unassigned because there is still a great deal of compositional variability within the small number of samples available. Future compositional studies of ceramics

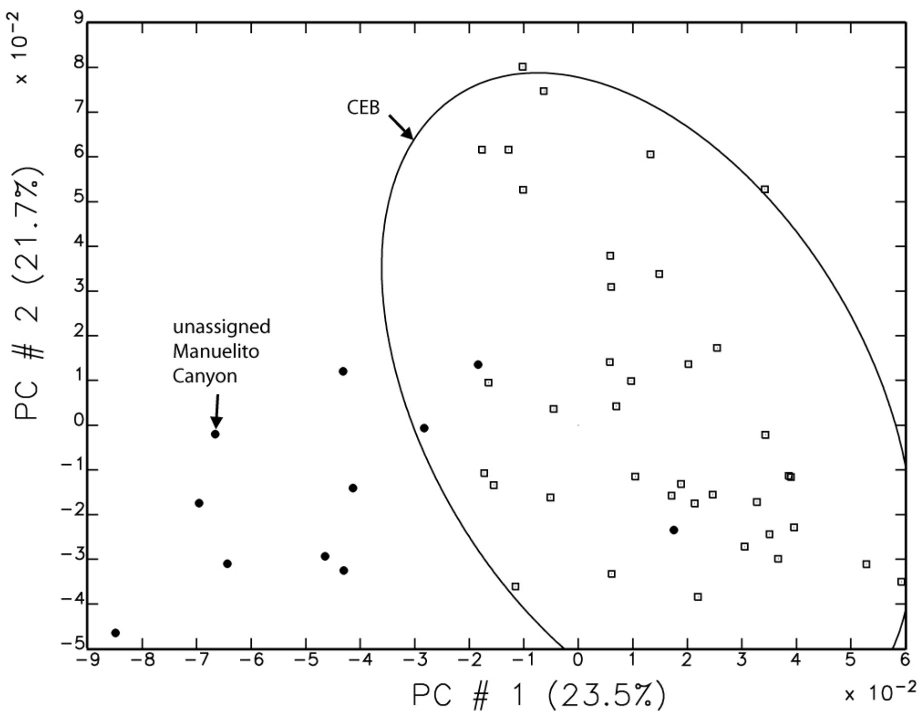

Figure A.5. PCA plot of the CEB sub-group with unassigned samples from the Manuelito Canyon area.

from both the Cebolleta Mesa and Manuelito Canyon areas may be able to clarify this issue further.

The final sub-group within the PLATEAU core compositional group is designated as P-EMV. This group represents a small number of decorated sherds (primarily St. John's Polychrome) which are compositionally similar to members of the CEB group but distinguishable based on discriminant functions and element biplots including tantalum and related transition metals. These samples were all potential outliers to the original PLATEAU core group and, indeed, almost all members were previously attributed to the EMV-2 (EVD) group produced in the El Morro Valley by Schachner (2007). Due to the consistency in types represented within this group, the strong compositional similarities to the

EMV-2 group, and the higher relative frequency of samples recovered from the El Morro Valley compared to other areas, the small P-EMV sub-group is tentatively ascribed to the El Morro Valley.

One final comment regarding the sub-groups defined within the PLATEAU group is necessary. Specifically, two of the sub-groups defined above (PB and CEB) are large enough to be evaluated based on log-transformed element concentrations in relation to the remaining 12 core compositional groups. Probabilities of group membership calculated based on Mahalanobis distances for PB, CEB, and all other compositional core groups produced only 2 misclassifications across all samples (~0.1%), though the inclusion of the CEB group does increase equivocal probabilities for a small number of samples beyond the threshold defined for core group analysis. In addition to this, no unassigned samples have exclusively high probabilities of membership in the CEB group despite its small size. Overall, this suggests that the sub-division of the PLATEAU group defined above is appropriate and does not change the structure of the other core groups defined in this study.

MM-1

The MM-1 group consists primarily of decorated ceramics (early White Mountain Red Ware and Cibola White Ware) recovered almost exclusively from the Mariana Mesa sub-region. This group is compositionally similar to the PB group but has lower concentrations of elements like thorium and higher concentrations of uranium (Figure A.6). The MM-1 group is also distinct based on

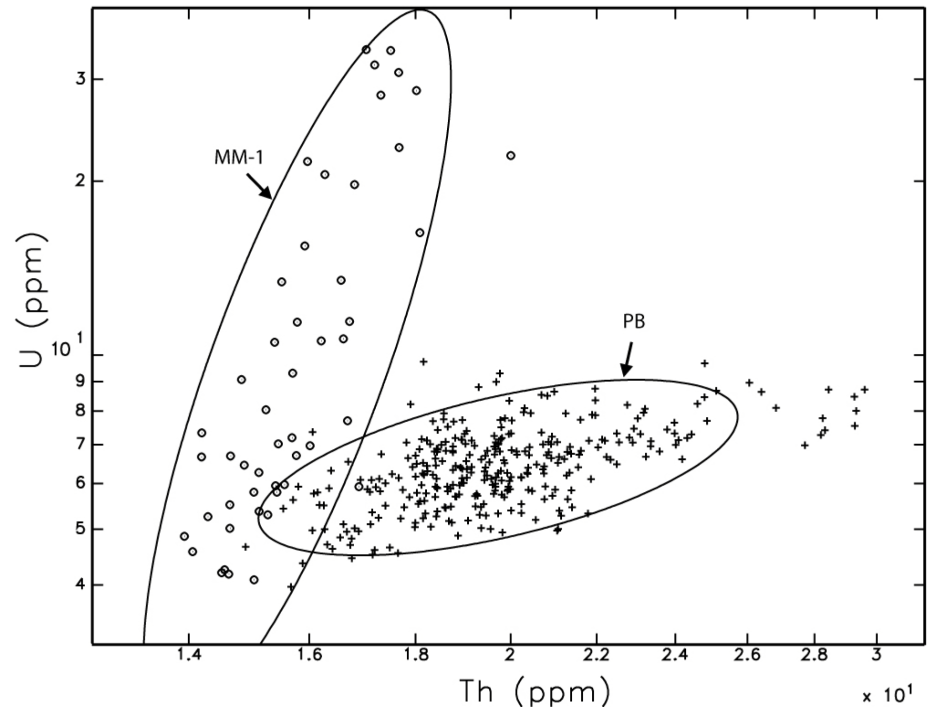

Figure A.6. Plot of the MM-1 and PB groups based on the logged concentrations of Thorium (Th) and Uranium (U).

Mahalanobis distance probabilities calculated on log-transformed element concentrations. The likely clay bearing strata in the Mariana Mesa area which may have been used to produce these vessels include both the Cretaceous Moreno Hill-Atarque Sandstone formation as well as the tertiary Baca formation. Both of these clay bearing formations are variable in composition, but often elevated in uranium, which is consistent with the composition of ceramics in this group (see Arkell 1984). Interestingly, this group includes one sherd classified as Cibola Gray Ware, perhaps suggesting that some gray ware recovered in this area was locally produced. In addition to this, MM-1 also includes one painted but unfired Cibola White Ware (Pinedale Black-on-White) vessel recovered from the

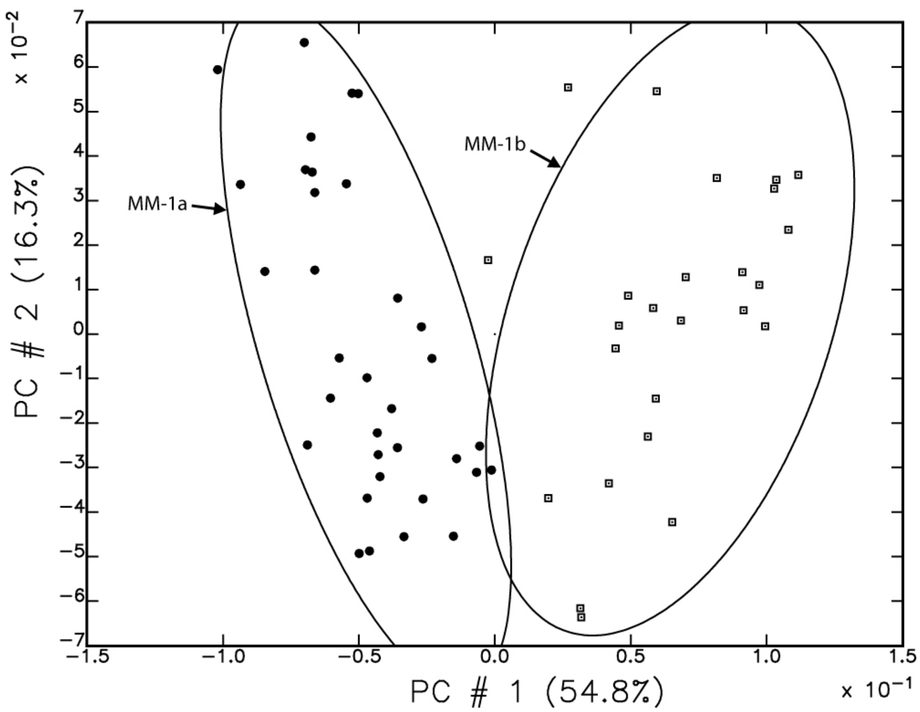

Figure A.7. PCA plot of the MM-1a and MM-1b sub-groups.

Techado Spring site, further suggesting that this group represents local production in the Mariana Mesa area.

The MM-1 group can be sub-divided into two smaller sub-groups by Mahalanobis distances calculated based on PCA scores; MM-1a and MM-1b. These sub-groups are clearly separated based on PCA biplots (Figure A.7) as well as on element biplots including uranium, chromium, and hafnium. Although there is some overlap, MM-1a includes primarily White Mountain Red Ware vessels (St. John's Polychrome) and MM-1b is dominated by Cibola White Ware vessels (Tularosa and Pinedale Black-on-White). The tendency for division by ware suggests that different wares may have been produced using slightly different materials or paste preparation techniques.

MM-2

MM-2 consists entirely of Brown Ware ceramics recovered almost exclusively from the Mariana Mesa region. This group is compositionally similar to several other brown ware groups but is distinguishable through Mahalanobis probabilities calculated based on log-transformed element concentrations, PCA scores, as well as several biplots including elements like thorium, cesium, and rubidium (Figure A.8). Ceramics in this group, like other brown ware groups in the regional sample, are relatively elevated in iron and were likely produced using iron-rich, volcanic derived alluvial clays which are widely available in the vicinity of the Mariana Mesa sub-region.

WEST-1

This group consists primarily of decorated ceramics recovered from the West Zuni and Carrizo Wash sub-regions. This group overlaps substantially with Schachner's (2007:126) provisional Zuni-1 group, which he tentatively ascribed to the El Morro Valley. Indeed, this group is compositionally similar to the EMV-2 group described above, but can be distinguished based on Mahalanobis probabilities and on element biplots including elements like chromium, rubidium, hafnium, and thorium (Figure A.9). The compositional similarities between WEST-1 and the EMV-2 group may suggest that similar materials were used to produce vessels in these groups, perhaps including outcrops of Cretaceous sandstone that would have been readily available to the inhabitants of the West Zuni and Carrizo Wash areas. It is also possible that this group represents vessels produced in multiple areas, but the consistency in types represented (see

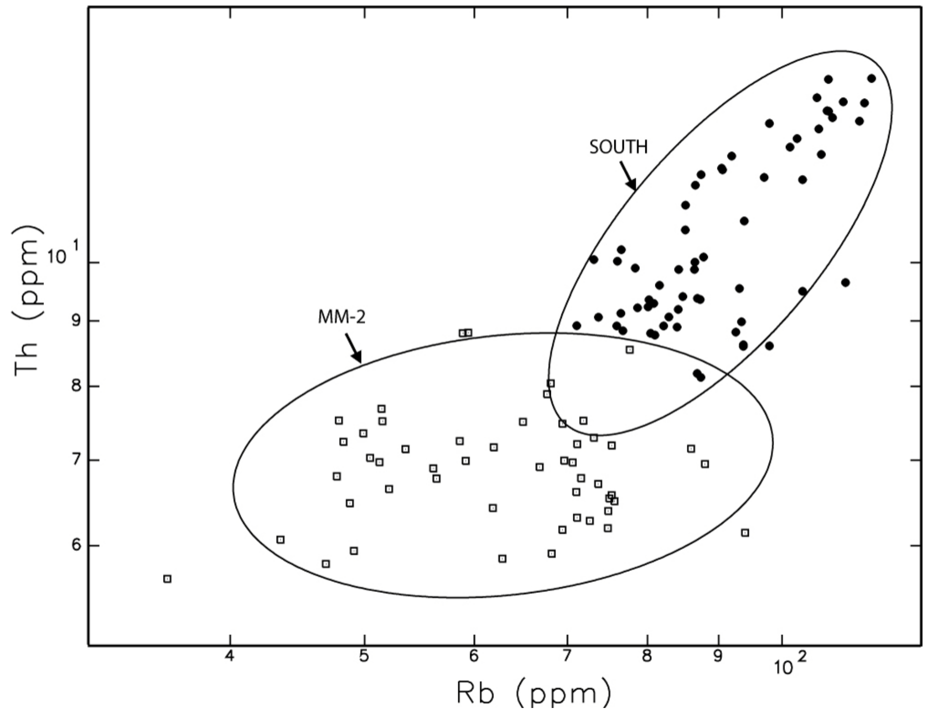

Figure A.8. Plot of the MM-2 and SOUTH groups based on logged concentrations of Rubidium (Rb) and Thorium (Th).

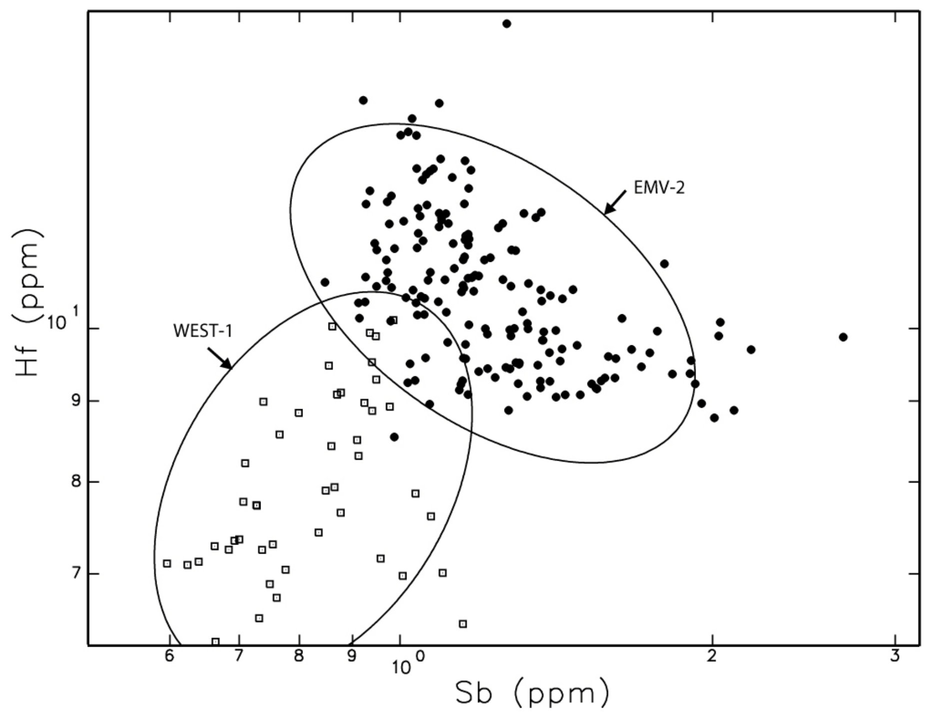

Figure A.9. Plot of the WEST-1 and EMV-2 groups based on the logged concentrations of Antimony (Sb) and Hafnium (Hf).

discussion below) and the high percentage of this group at sites along the Arizona/New Mexico border suggests that this group can be tentatively attributed to the West Zuni and Carrizo Wash areas.

Interestingly, WEST-1 consists primarily of St. John's Polychrome in contexts outside of the West Zuni and Carrizo Wash sub-regions, but within those sub-regions, the group is dominated by Cibola White Ware with a smaller amount of St. John's Polychrome. This pattern is likely due, in part, to the much higher overall frequency of St. John's Polychrome vessels in the compositional database from the El Morro Valley and Pescado Basin sub-regions. This may also suggest, however, that St. John's bowls produced in the West Zuni and Carrizo Wash areas were more commonly transferred across vast distances than Cibola White Ware vessels, which were primarily large jars. Potential explanations for the differential representation of wares within compositional groups attributed to different portions of the region are described in more detail in Chapter 5. The geological association of this compositional group is not clear, but the general similarities to the EMV-2 group perhaps suggest that distinct outcrops of Dakota sandstone or related Cretaceous clay bearing strata provided the materials for the production of these vessels.

WEST-2

WEST-2 consists primarily of vessels defined as Cibola Gray Ware and a small number samples classified as transitional gray/brown corrugated ceramics recovered almost exclusively from sites in the West Zuni and Carrizo Wash sub-regions. Based on the criterion of abundance, this group likely represents local production in both of these areas. The geologic association of this group is not readily apparent, but the strong distinction between WEST-2 and other groups which were likely produced using Cretaceous sandstone derived clays suggests that vessels within WEST-2 were likely produced using different materials. One possibility is the Tertiary Bidahochi formation which would have been readily available to the inhabitants of areas along the Arizona/New Mexico border.

Only two samples in this group were recovered outside of the West Zuni/Carrizo Wash area. These were both decorated sherds recovered from sites in the central Upper Little Colorado region. These sherds may represent exchanged vessels, vessels produced elsewhere using similar materials, or spurious assignments. Given the general consistency of types for almost all members of this group recovered from the West Zuni/Carrizo Wash area, production using similar materials or spurious assignments are perhaps the most likely explanations for the two non-local samples in this group.

AZ/NM

AZ/NM is a large group, primarily consisting of Zuni Glaze Ware vessels recovered from the West Zuni and central Upper Little Colorado areas. Many of the samples included in this group had previously been assigned to two separate compositional groups. These were Duff's (2002) Upper Little Colorado group 1 and his Ojo Bonito group 2 (also Schachner's [2007] OBD). Duff had previously attributed those two groups to production in the central Upper Little Colorado and West Zuni areas respectively. When Duff originally defined these groups, the number of available samples from the West Zuni region was small, and thus, he was forced to combine the two groups which he had attributed to the that area (Ojo Bonito 1 & 2) in order to make comparisons based on log-transformed element concentrations. With the newly expanded sample available for this study, it is now possible to compare each group individually. This comparison suggests that Duff's Upper Little Colorado 1 and Ojo Bonito 2 are not strongly distinguishable based on probabilities calculated using Mahalanobis distances or on element biplots. Although there is some tendency towards separation by region of recovery for a few elements (Figure A.10), many of the elements which could potentially be used to sub-divide the group may be influenced by diagenetic processes. Thus, in this study, I attribute this combined AZ/NM group to production in both the West Zuni and central Upper Little Colorado areas, which are the only areas where this group is found in the substantial frequencies.

Duff (2002) made two major assertions based on his original interpretation of the compositional distinctiveness of the Ojo Bonito 2 and Upper Little Colorado 1 groups described above. First, he argued that Zuni Glaze Ware was widely produced in the Upper Little Colorado region. This finding is not in question as other compositional groups exclusively associated with the Upper Little Colorado back up this interpretation (see below). However, Duff also argued that there was little exchange of ceramics between the West Zuni and the Upper Little Colorado areas during the Pueblo IV period despite their proximity. The combination of these previously separate groups for this study complicates the picture somewhat. Specifically, with the combined AZ/NM group, it is not possible to directly track the movement of vessels in this group between the

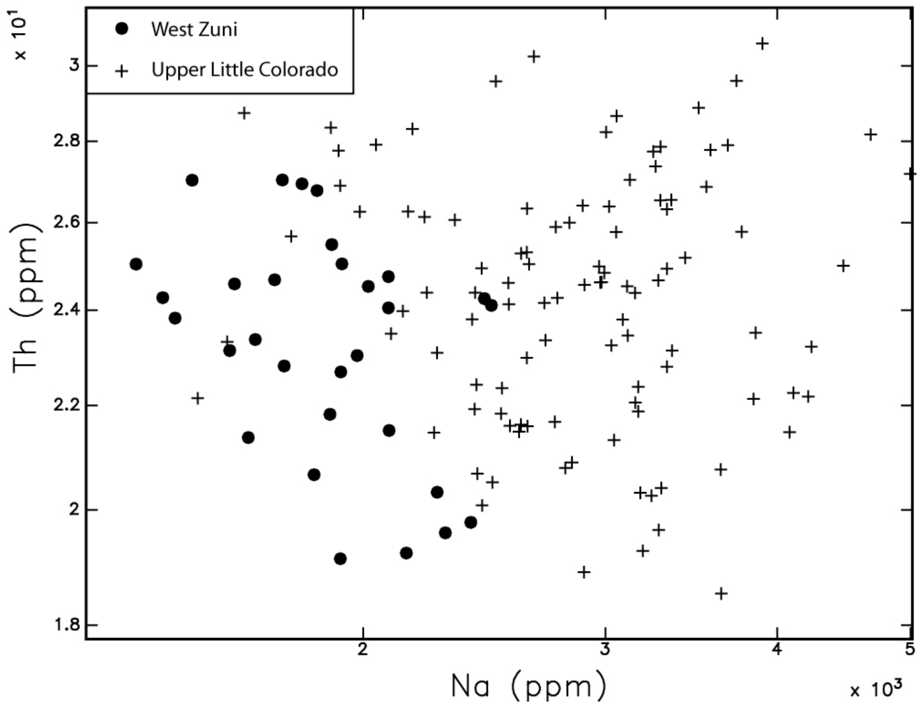

Figure A.10. Plot of the AZ/NM group based on the logged concentrations of Sodium (Na) and Thorium (Th) with symbols showing the region where each sample was recovered.

Upper Little Colorado and areas to the northeast. Despite this complication, I argue that there is still no reason to overturn Duff's (2002) original interpretation. Other compositional groups, including Zuni Glaze Ware, which were clearly produced in the same settlements in the Upper Little Colorado where samples within AZ/NM are common are virtually absent from contemporaneous sites in the West Zuni area.

To further evaluate the potential separation of this group by sub-region, I conducted a series of cluster analyses. First, principal coordinates scores were calculated for all members of this group based on the log-transformed concentrations of all 32 measured elements. I then conducted *K*-means cluster analysis on the standardized PCA scores for the first 8 principal components (accounting for approximately 90% of variation in the group as a whole). The two cluster solution divides samples into groups which are strongly dominated by samples recovered from the West Zuni and central Upper Little Colorado areas respectively (Figure A.11). This strong tendency for separation by region of recovery suggests that, although samples cannot be sub-divided using the most rigorous statistical methods, this large compositional group likely represents distinct production of Zuni Glaze Ware in the Upper Little Colorado and West Zuni region using compositionally similar materials. This apparent separation along with the lack of evidence for the movement of vessels between the Upper Little Colorado and West Zuni sub-regions based on other compositional groups suggests that most vessels within the AZ/NM group were probably local products where they were recovered.

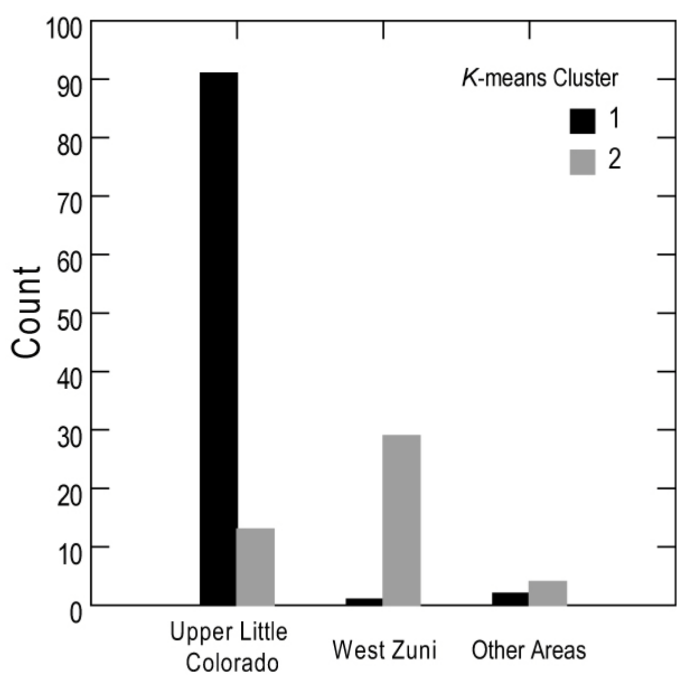

Figure A.11. Barplot of *K*-means clusters by region of recovery for the AZ/NM group.

ULC-2

This group was originally defined by Duff (2002) for his analysis of Pueblo IV period ceramic circulation in the Upper Little Colorado area. In the new analyses conducted for this study, this group is changed only slightly from Duff's original designation. All samples included within this group were recovered from Pueblo IV period sites in the central and northern Upper Little Colorado area strongly suggesting that members of this group were locally produced in those areas. This group is roughly evenly split between corrugated brown ware vessels and Roosevelt Red Ware decorated vessels. Duff (1999:7.30) suggests that the high concentration of iron in the compositional profile of samples within ULC-2 suggests that these vessels were produced using locally available clays from the Petrified Forest member of the Chinle formation. Examinations of PCA and element biplots reveal that the ULC-2 group shows a strong tendency towards separation into two sub-groups designated as ULC-2a and ULC-2b following Duff (2002; see Figure A.12). Three samples could not be assigned to either sub-group and are designated simply as ULC-2.

The ULC-2a group is the larger of the two sub-groups consisting primarily of corrugated brown ware sherds, Roosevelt Red Ware vessels, and a few examples of an unnamed White-on-Red type primarily recovered from the Table Rock Pueblo in the northern Upper Little Colorado (~69%). The remaining samples within this sub-group consist almost exclusively of decorated Roosevelt Red Ware vessels recovered from sites in the central Upper Little Colorado. The overall dominance of ULC-2a at the Table Rock Pueblo in terms of both

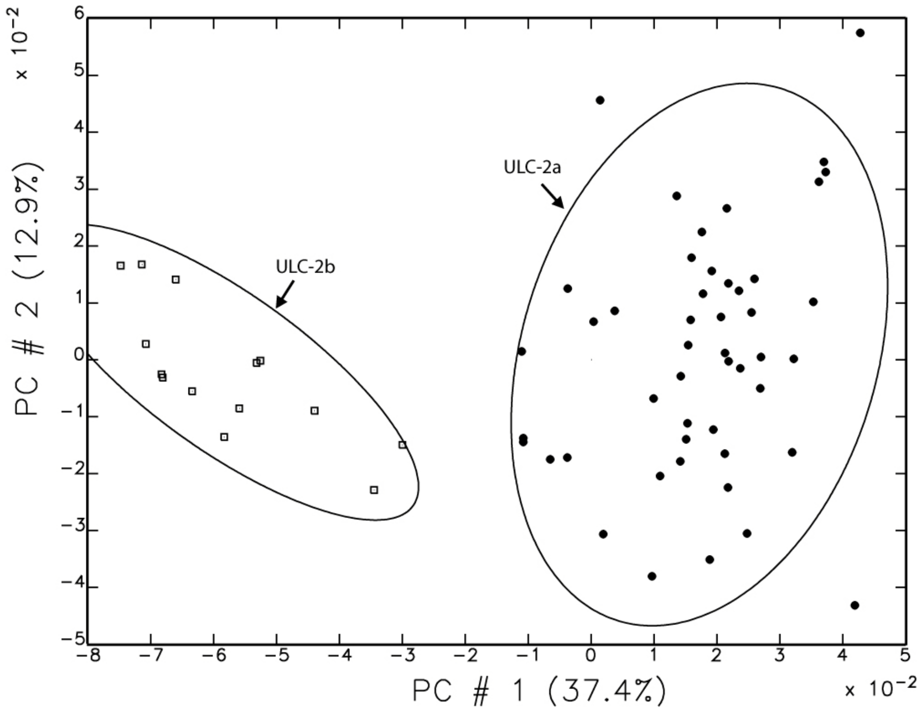

Figure A.12. PCA plot of the ULC-2a and ULC-2b sub-groups.

decorated and plainware samples strongly suggests local production in the northern Upper Little Colorado area near St. John's, Arizona. This determination is also supported by previous petrographic work conducted by Martin and others (1960:209; see also Duff 1999:7.30) comparing unpainted ceramics and locally available clays in the vicinity of Table Rock Pueblo.

Sub-group ULC-2b consists exclusively of corrugated brown ware vessels recovered primarily (~86%) from Baca Pueblo and Rattlesnake Point in the central Upper Little Colorado area near Lyman Lake, and a small number from Table Rock Pueblo. The dominance of this group almost exclusively at sites in the Lyman Lake area suggests local production in the general vicinity. Further, Duff (1999:7.30) notes that several members of this group have a distinctive, puplish paste which was frequently noted on plainware vessels during excavations at both

Baca Pueblo and Rattlesnake Point. Overall, this suggests that vessels within the ULC-2b sub-group were likely produced in a relatively small area within the central Upper Little Colorado area.

ULC-3a

This group was originally defined as a sub-group within a larger core compositional group designated as ULC-3 by Duff (2002). With the addition of the new samples for this study, ULC-3a is now large enough to be treated as an independent core group. The separation of ULC-3a from other closely related core groups (i.e., ULC-3b) is readily apparent on biplots of elements including cesium, rubidium, thorium, and uranium (Figure A.13). This group consists primarily of decorated ceramics and a small number of corrugated brown ware vessels primarily recovered from the Upper Little Colorado area. Approximately 70% of samples in this group were recovered from sites in the central Upper Little Colorado area dating to both the Pueblo III and Pueblo IV periods, including all of the unpainted samples within this group. The high relative frequency of ULC-3a in the central Upper Little Colorado area through time suggests that this group was likely locally produced in that general area. Based on comparisons with raw and archaeological clay samples, Duff (2002:121-124) posits that members of the ULC-3a group were likely produced using light firing Chinle formation clays widely available in the vicinity of central Upper Little Colorado sites. The wares represented in this group demonstrate that Zuni Glaze Ware, Cibola White Ware, as well as White Mountain Red Ware (Wingate Polychrome, St. John's

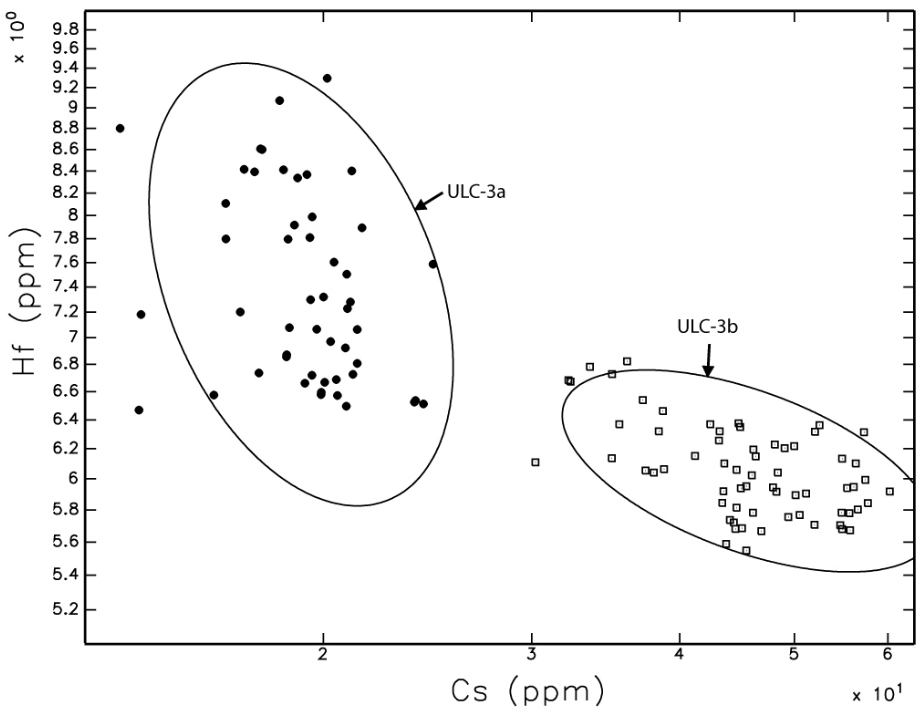

Figure A.13. Plot of the ULC-3a and ULC-3b sub-groups based on the logged concentrations of Cesium (Cs) and Hafnium (Hf).

Polychrome, Pinedale Polychrome, and Fourmile Polychrome) were all locally produced by the inhabitants of the Upper Little Colorado area.

ULC-3b

Like ULC-3a, the ULC-3b group was originally defined by Duff (2002) as a sub-group within a larger core compositional group (ULC-3), but is now large enough to be evaluated as a separate core group. This group consists almost exclusively of decorated ceramics including Cibola White Ware, Zuni Glaze Ware and White Mountain Red Ware types dating to both the Pueblo III and Pueblo IV periods. Approximately 62% of samples within this group were recovered from the southern Upper Little Colorado region including the Springerville area as well as sites along the major drainages flowing north from the White Mountains. In addition to this, four slipped and painted but unfired vessels from the Coyote Creek site (DeGarmo 1975) are members of this group. These unfired vessels include both Cibola White Ware and White Mountain Red Ware. The assignment of these unfired vessels to ULC-3b along with the high relative abundance of the group in the southern Upper Little Colorado strongly suggests local production in this area. These vessels were likely produced using light firing clays weathered from small Cretaceous outcrops present in the general vicinity of all sampled sites in the southern Upper Little Colorado area. ULC-3b is the most common compositional group attributed to the Upper Little Colorado area found outside of this sub-region including the West Zuni, Carrizo Wash, Mariana Mesa, and Mogollon Highlands areas.

ULC-4

This group was originally defined by Duff (2002). The ULC-4 core compositional group consists primarily of corrugated Brown Ware ceramics (~83%) and a smaller number decorated vessels. Approximately 96% of samples within this core group were recovered from sites dating to both the Pueblo III and Pueblo IV periods in the central and southern Upper Little Colorado region strongly suggesting local production in those areas. As Figure A.14 illustrates, this core group can be divided into two sub-groups designated as ULC-4ab and ULC-4c. ULC-4c is a small sub-group that is well separated on several element plots, PCA plots, and can be distinguished through group membership probabilities calculated on discriminant functions (see Duff 1999). The ULC-4c sub-group consists entirely of corrugated brown ware ceramics from the central

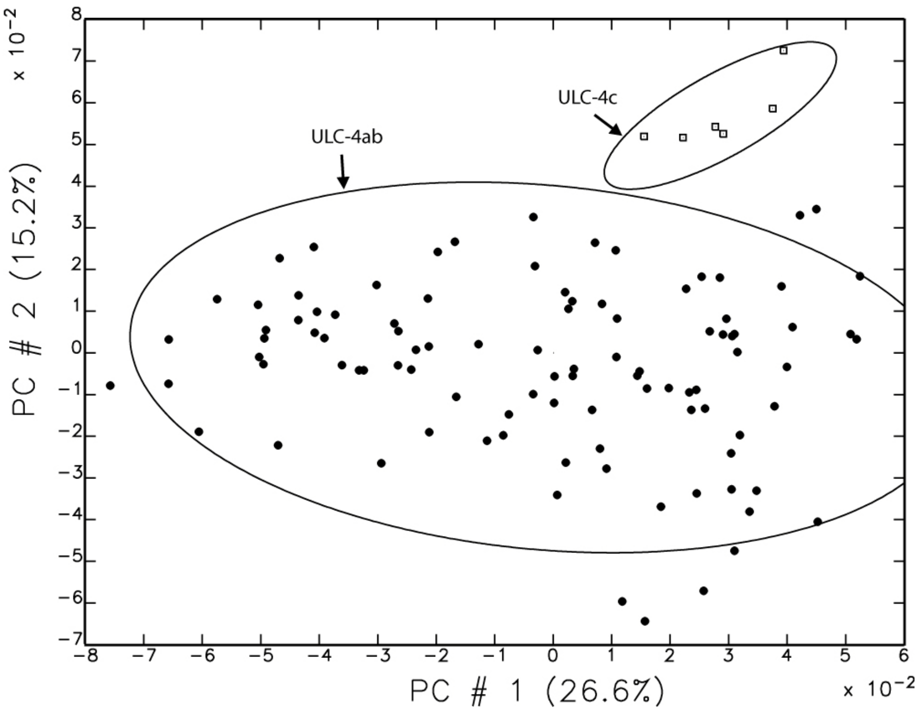

Figure A.14. PCA plot of the ULC-4ab and ULC-4c sub-groups.

Upper Little Colorado area and is assumed to have been produced there. The remaining sub-group (ULC-4ab) was originally divided into two sub-groups (ULC-4a and ULC-4b) by Duff (2002:124-125). With the addition of new samples for this study, the split between these two potential sub-groups is somewhat less distinct so this group was not further divided for the purposes of this study. The ULC-4ab sub-group is dominated by corrugated Brown Ware sherds but also includes a several Roosevelt Red Ware sherds and a very small amount of Cibola White Ware, White Mountain Red Ware, and Zuni Glaze Ware. Only a small number of samples from this group are found outside of the central and southern Upper Little Colorado areas but ULC-4ab is present at almost every site in the Mariana Mesa district and a single sherd in this group was recovered from the Garcia Ranch Pueblo in the Carrizo Wash area.

SOUTH

This final compositional core group consists exclusively of corrugated and plain Brown Ware vessels recovered from sites in the Upper Little Colorado and Mogollon Highlands areas. Like other Brown Ware groups defined in this study, the SOUTH compositional core group is elevated in iron and was likely produced using the widely available iron-rich volcanic derived clays found across most of the southern Cibola region. This group is compositionally similar to both the ULC-4 and MM-2 core groups, but can be distinguished by group membership probabilities calculated based on log-transformed element concentrations.

Examinations of element biplots of the SOUTH core group suggest that it can be divided into two sub-groups designated as S-ULC and S-BR (Figure A.15). The first sub-group, S-ULC, consists primarily (~90%) of corrugated Brown Ware vessels recovered from Pueblo III period sites along the major drainages flowing out of the White Mountains in the southern Upper Little Colorado area suggesting production in that zone. The few samples recovered from outside of this area all come from the Rim Valley Pueblo in the central Upper Little Colorado and include one corrugated Brown Ware and two sherds of McDonald Painted corrugated. Interestingly, McDonald Painted corrugated is most common in the Mountains to the west of the Upper Little Colorado area (Hays-Gilpin and Van Hardesveldt 1998). The inclusion of these samples in this group suggest that some McDonald Corrugated may have been locally produced in the Upper Little Colorado area but this may also represent vessels produced elsewhere using similar clays.

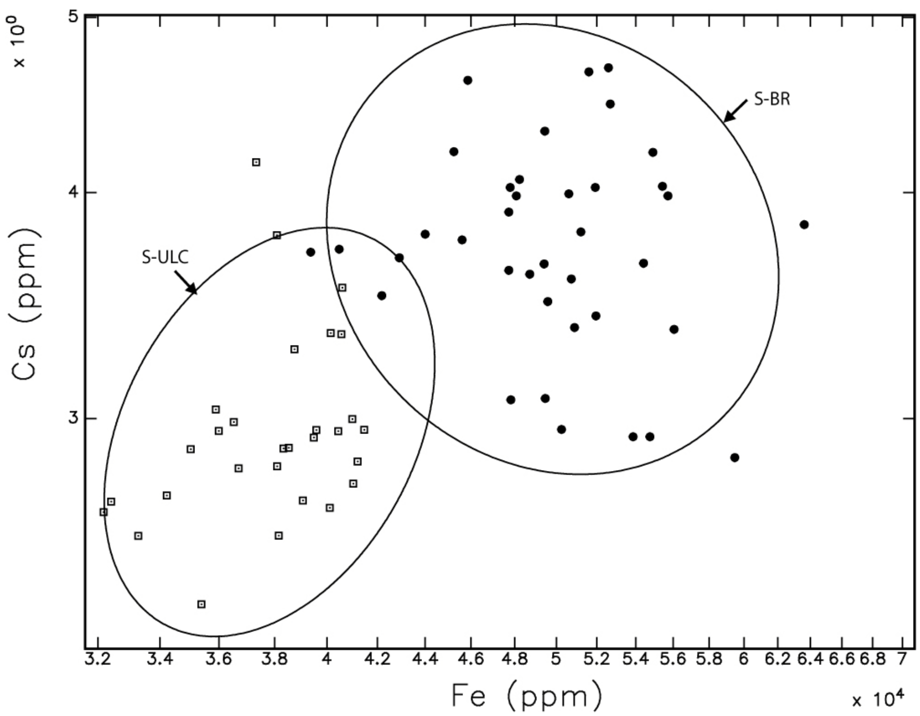

Figure A.15. Plot of the S-ULC and S-BR sub-groups based on the logged concentrations of Iron (Fe) and Cesium (Cs).

The second sub-group, designated as S-BR, consists primarily of corrugated vessels recovered from sites in the Mogollon Highlands area (~79%). Although the predominance of S-BR in the Mogollon Highlands sites may suggest local production in that area, this group is compositionally diverse and likely represents production at a somewhat broader scale possibly including multiple areas below the Mogollon Rim. The currently available sample is too small to address this issue directly, but there does appear to be some regional structure to the compositional profiles of samples within this group, perhaps suggesting that further sampling could help to sub-divide this group. The S-BR sub-group includes corrugated brown ware vessels as well as several Tularosa Fillet Rim bowls and a small number of McDonald Painted Corrugated vessels.

Tularosa Fillet Rim bowls are finely made, smudged vessels that are found almost exclusively at sites in the Mogollon Highlands area and often assumed to have been locally produced in the areas near Reserve, New Mexico (e.g., Martin et al. 1956; Rinaldo and Bluhm 1956; Rinaldo 1960). McDonald Painted Corrugated vessels are not present at most sites in the Mogollon Highlands (Huntley et al. 2011), so the few examples included in this group may have been produced outside of the Mogollon Highlands area, as it is defined for this study, using similar materials.

Provisional Compositional Groups

In addition to the larger core compositional groups described above, there were five somewhat smaller groups of samples that consistently clustered together on element and PCA biplots. These smaller groups of samples are defined as provisional compositional groups. Because these groups are so small, they cannot be evaluated using the most robust statistical methods for assessing group membership. Several of these groups are, however, compositionally unique and might represent the beginnings of new core compositional groups if additional samples are analyzed in the future. In this section, I briefly describe each of the provisional compositional groups defined for this study and the likely locus of production for each. Although less analytical weight is placed on the distribution of provisional groups, they are sometimes important in tracing ceramic production in portions of the region that have not yet been heavily sampled.

box-s

This small group was originally defined by Huntley (2004; 2008) and includes St. John's Polychrome, Zuni Glaze Ware, and Cibola Gray Ware vessels recovered primarily (~69%) from the Box S site along the Upper Nutria drainage in the Zuni area and likely represents local production in the vicinity of this site. This provisional group is compositionally similar to members of core compositional groups representing production in the Pescado Basin and El Morro Valley areas but is well separated on several element plots including alkali metals like cesium (Figure A.16). The geological association of this provisional group is unclear as several major Cretaceous geologic strata converge in the area around the Box S site. The only other area with samples within this provisional group is the El Morro Valley, primarily at the Mirabal site which is the closest sampled settlement to Box S.

emv-3

This small group was originally defined by Schachner (2007:127; EVR) and consists of a small number of Cibola Gray Ware and Cibola White Ware vessels recovered primarily from Pueblo III period sites in the El Morro Valley as well as a few in the Pescado Basin. This group is compositional similar to both EMV-1 and EMV-2 but is elevated in elements including tantalum and has lower concentrations of many rare earth elements (see Figure A.1). This group may have been produced using Chinle derived materials similar to those used to produce EMV-1. Do to the high frequency of this group in the El Morro Valley and the

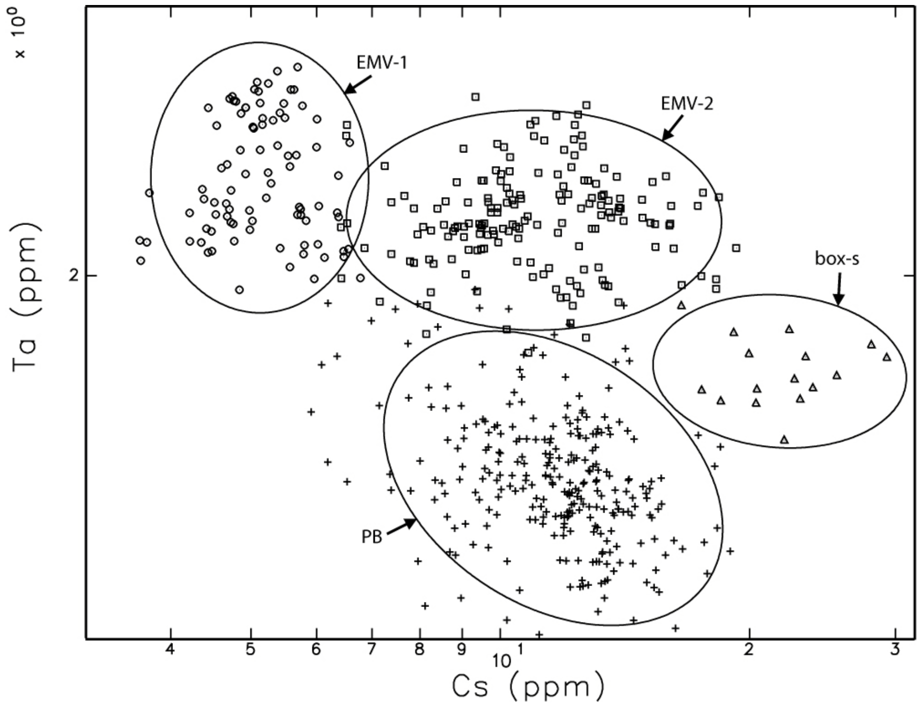

Figure A.16. Plot of the box-s, EMV-1, EMV-2, and PB groups based on the logged concentrations of Cesium (Cs) and Tantalum (Ta).

compositional similarities to the EMV-1 group, emv-3 is attributed to production in the El Morro Valley

lpv

This group was previously defined by Schachner (2007:128) and is unchanged after the analyses conducted here. This provisional group consists of a small number of Cibola Gray Ware and Zuni Glaze Ware samples from Pueblo IV period sites in the Pescado Basin and a smaller number of samples from the El Morro Valley. Two-thirds of the small number of samples within this group (6 of 9) were recovered from the Lower Pescado Village and Heshotauthla in the Pescado Basin area suggesting production in this area. This group is similar to other compositional groups attributed to the Pescado Basin area but is elevated in thorium and related elements (Figure A.17).

zuni-2

This group was first defined by Schachner (2007:126-127) and consists of a small number of samples of Cibola Gray Ware and Cibola White Ware recovered primarily from Pueblo III period sites. The highest proportion of samples in this group (8 of 17) including most of utilitarian vessels were recovered from the Pescado Basin area suggesting production in this zone or in nearby areas with similar geology. Members of this group have also been found in other areas long the Zuni River Valley and adjacent areas including Carrizo Wash, West Zuni, and the El Morro Valley. Schachner's (2007) original group was somewhat larger, but many of the samples originally attributed to his group are now members of the PLATEAU core group. Despite the compositional similarities to the PB group, zuni-2 can be distinguished based on element plots (see Figure A.17) as well as by probabilities of group membership calculated among closely related groups from the Pescado Basin using PCA scores and discriminant functions.

ulc-3-prov

This group consists exclusively of Zuni Glaze Ware, White Mountain Red Ware, and Cibola White Ware sherds recovered from the Casa Malpais and Hooper Ranch sites in the southern Upper Little Colorado region as well as one unfired vessel and one prepared clay ball recovered from Hooper Ranch. The location of recovery for this group and the archaeological clays strongly suggest

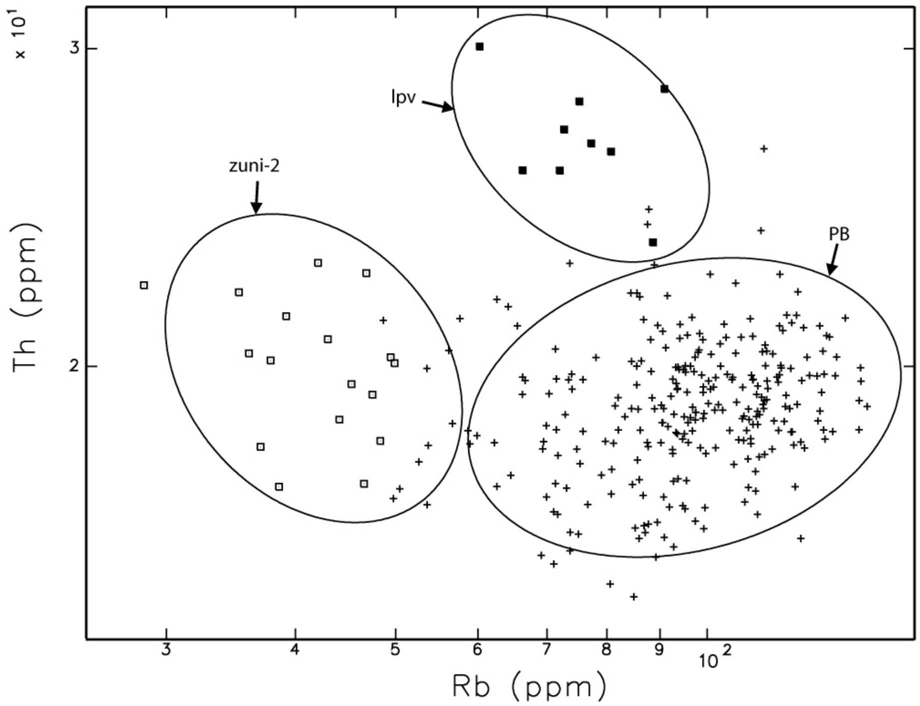

Figure A.17. Plot of the PB, zuni-2, and lpv groups based on the logged concentrations of Rubidium (Rb) and Thorium (Th).

production in the southern Upper Little Colorado area, possibly limited to the areas near Springerville, AZ. Many of the samples in ulc-3-prov were originally defined as members of Duff's ULC-3b sub-group. Although the samples within the provisional ulc-3 group are compositionally similar to the ULC-3b group defined in this study in terms of several elements, ULC-3b and ulc-3-prov are quite distinct in terms of other elements like tantalum and thorium (Figure A.18). This suggests that the separation of ulc-3-prov from ULC-3b is warranted. This provisional group is too small to be statistically evaluated using log-transformed elements, but the group is distinct from both ULC-3a and ULC-3b in terms of group membership probabilities calculated based on PCA scores and discriminant functions. Although ulc-3-prov is considered a provisional grouping due to its

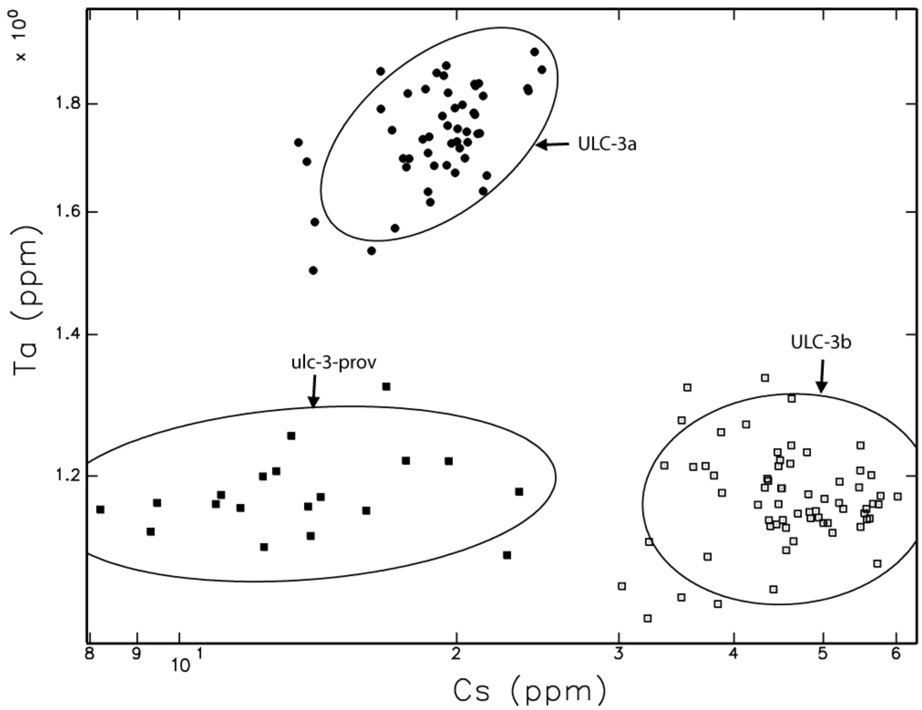

Figure A.18. Plot of the ULC-3a, ULC-3b, and ulc-3-prov groups based on the logged concentrations of Cesium (Cs) and Tantalum (Ta).

relatively small size, the coherence of this group and its association with a specific production area are fairly well established.

Other Compositional Groups

After the primary analysis of the compositional dataset described in Chapter 4, all remaining unassigned samples were projected against additional compositional groups previously defined by researchers for studies focused on nearby areas in the Arizona Mountains and Silver Creek sub-regions (e.g., Scholnick 1998; Triadan 1997; Triadan et al. 2002; Zedeno 1994, 2002). In general, very few samples showed similarities to any of the compositional groups used in these previous studies. However, a total of 28 unassigned samples from the Upper Little Colorado area could be placed into two compositional groups defined by Triadan (1997; Triadan et al. 2002) for the Silver Creek area (designated as WMR-1 and WMR-3; see Table A.11). Most of these samples (26 of 28) were assigned to these same groups by Duff (1999) as well as Triadan and others (2002) in previous studies.

Triadan's (1997; Triadan et al. 2002) WMR-1 and WMR-3 groups primarily consist of samples of late White Mountain Red Ware (Cedar Creek Polychrome and Fourmile Polychrome) and a smaller amount of Kinishba Polychrome recovered from sites throughout the Silver Creek area and the Arizona Mountains. Due to the higher relative frequency of these types in the Silver Creek area as well as the lack of clays appropriate for producing these light paste wares across most of the Arizona Mountains, Triadan (1997:32-33; Triadan et al. 2002:94-95) associates the WMR-1 and WMR-3 compositional groups (as well as the WMR-2) with production in the Silver Creek area. Light firing, kaolinitic clays weathered from the extensive Cretaceous geologic formations in the Silver Creek drainage are the most likely materials used to produce the vessels in these groups.

All of the samples from the Upper Little Colorado area which could be assigned to the WMR-1 and WMR-3 groups were classified as Fourmile Polychrome vessels, a late White Mountain Red Ware type first produced after about A.D. 1325. Although Fourmile Polychrome was also likely locally produced in the Upper Little Colorado area, the vast majority of samples included in this study (82% of assigned Fourmile Polychrome samples) were attributed to production in the Silver Creek area. This is a somewhat larger proportion of non-local Fourmile Polychrome than that reported by Duff (2002:149), and suggests that the long-distance movement of White Mountain Red Ware vessels into the Upper Little Colorado area was probably relatively common during the late Pueblo IV period.

In addition to the comparisons conducted for this study, Duff (1999; 2002) also compared his unassigned samples from the Upper Little Colorado region to compositional data produced by Crown and Bishop (19991, 1994) for Roosevelt Red Ware vessels recovered from a number of regions across the southwest. The raw compositional data from the study by Crown and Bishop were not available for this study, but Duff's (1999:Table 8.5) comparison shows that a small number of Roosevelt Red Ware, brown ware, and other related types (n=16) recovered from the Upper Little Colorado area were possibly produced in the Arizona Mountains. All but one of these non-local samples were recovered from contexts that likely date to the late Pueblo IV period (ca. A.D. 1325-1400) after the period directly considered in this study.

Additional Details of Non-Core Group Assignment Procedure

In Chapter 4, I briefly described the procedures used to designate samples as non-core members of the larger core compositional groups using principal components analysis and discriminant functions. There are a few details of the methods used in this study which require additional explanation here. Specifically, before unassigned samples were projected against the core compositional groups, the core groups were divided into two sets. There is a strong tendency for division into two clusters for the core groups which is readily apparent on plots of element concentrations, PCA scores, and discriminant functions (Figure A.19). These clusters are also supported by cluster analyses conducted on element concentrations. Cluster 1 consists of core groups including light paste wares produced primarily in the northern portion of the study area (EMV-1, EMV-2, PLATEAU, WEST-1, WEST-2, and MM-1). Cluster 2 consists of core groups attributed to the southern portion of the study area for both light paste and dark paste wares (ULC-2, ULC-3a, ULC-3b, ULC-4, MM-2, and SOUTH). The AZ/NM group, which is associated with both the West Zuni and Upper Little Colorado areas, is somewhat transitional between these two sets, so it was included in both for the purposes of the non-core analyses conducted here.

All unassigned samples were projected against these two clusters of core compositional groups independently (Tables A.3 and A.4). Samples were considered non-core members of a group if they merited assignment in only one group across comparisons for both clusters. Beyond this, samples were only considered non-core members of the AZ/NM group if they merited inclusion for comparisons across both clusters. This procedure allowed for a greater total number of samples to be assigned as non-core members of groups than would be possible through a consideration all groups simultaneously because compositional groups within each cluster could be distinguished using fewer PCA dimensions.

Additional samples were also assigned as non-core members of compositional groups using canonical discriminant functions (Table A.5). This procedure was conducted considering all 13 core compositional groups together. A somewhat higher probability threshold was required for samples to be

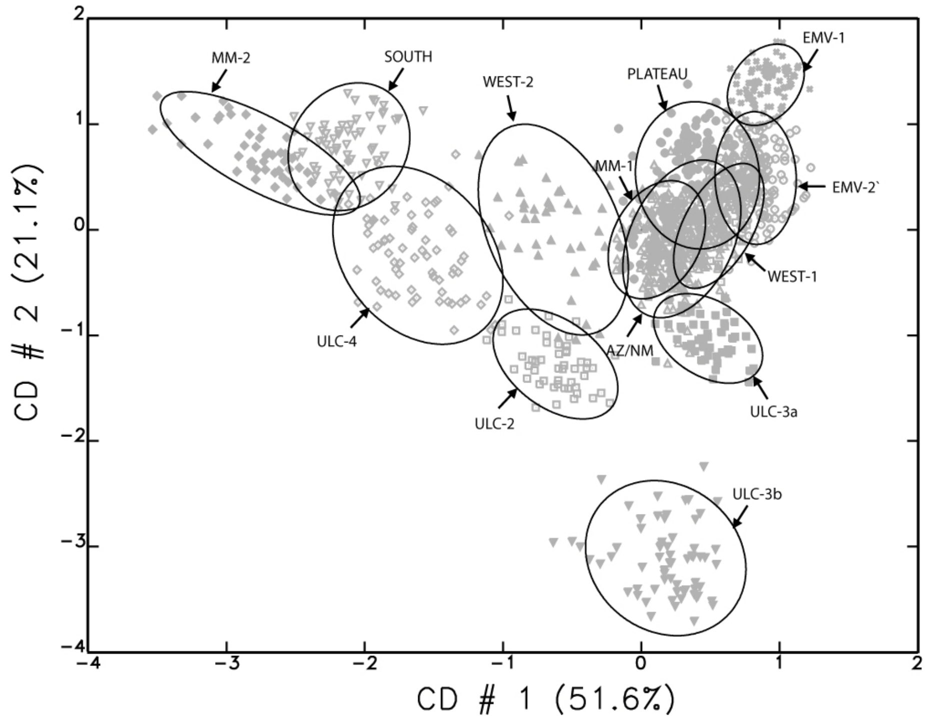

Figure A.19. CDA plot of all compositional core groups.

considered non-core members of groups based on discriminant functions compared with other methods (i.e., samples must have a probability of membership in one group that exceeds all other probabilities by at least an order of magnitude). Additional analyses not presented here demonstrate that, due this higher probability threshold, there is little difference in non-core group assignments based on either considerations of all groups simultaneously or considerations of the two clusters of core groups separately.

Table A.2. Posterior classification probabilities based on jackknifed Mahalanobis distances for the 13 core compositional groups and all unassigned samples.

Input data: 32 log-transformed element concentrations

EMV-1

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
CAP378	44.97	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH014	12.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH019	86.18	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH020	21.78	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH026	46.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH030	5.88	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH032	47.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH035	18.83	4.18	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH109	4.94	0.29	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC003	4.61	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC019	54.20	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC020	44.30	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC025	42.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC047	19.35	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC049	30.39	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC057	9.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC083	61.89	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC084	14.68	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC090	58.45	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC143	23.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC248	99.37	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC364	41.33	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC374	31.25	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC383	42.11	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC384	25.35	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC389	60.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC401	41.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC414	99.63	4.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC415	79.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC419	55.79	8.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC425	5.19	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC428	14.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC430	74.01	1.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC431	15.48	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC432	97.71	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC434	12.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC435	96.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC436	98.95	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC437	93.04	1.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC438	90.17	6.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC440	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC441	98.09	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC445	74.16	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC448	13.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC449	59.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC453	35.09	4.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC457	19.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC464	86.06	4.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC465	81.46	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC475	48.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC476	13.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC478	85.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC482	99.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EMV-1

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC484	96.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC485	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC487	40.92	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC489	54.56	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC496	30.31	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC506	12.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC509	47.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC518	87.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC521	92.46	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC522	64.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC523	44.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC524	65.31	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC527	95.12	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC530	94.72	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC531	33.91	3.41	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC537	71.31	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC538	95.09	7.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC544	49.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC546	14.59	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC548	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC550	8.35	0.06	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC560	85.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC582	55.95	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC588	21.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC589	27.84	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC592	55.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC611	56.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC616	96.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP221	15.88	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP232	7.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP235	14.17	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP240	83.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP243	9.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP254	4.40	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP262	34.49	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP419	91.84	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EMV-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID359	0.00	24.62	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID372	0.00	32.32	3.63	0.02	0.74	0.00	0.00	1.16	0.00	0.00	0.00	0.00	0.00
AID376	0.02	25.06	0.48	0.91	0.00	0.00	0.00	1.19	0.00	0.02	0.00	0.00	0.00
AID384	0.01	76.14	0.02	0.02	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00
CAP371	0.00	7.84	0.04	0.01	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP373	2.77	24.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP379	0.00	74.90	0.38	0.00	0.36	0.00	0.00	3.81	0.00	0.00	0.00	0.00	0.00
DLH013	0.00	39.79	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH016	0.31	16.69	0.02	0.04	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
DLH017	2.25	76.05	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH024	0.03	28.60	0.33	1.40	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00
DLH060	0.00	60.08	0.18	0.03	1.06	0.00	0.00	6.19	0.00	0.01	0.00	0.00	0.00
DLH091	0.00	31.11	0.54	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH092	0.01	5.69	0.01	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH101	0.00	74.86	0.25	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

EMV-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
DLH104	0.01	42.18	3.08	0.75	0.00	0.00	0.00	2.64	0.00	0.00	0.00	0.00	0.00
DLH105	0.00	71.10	0.04	0.27	1.64	0.00	0.00	4.98	0.00	0.00	0.00	0.00	0.00
DLH106	0.01	19.55	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
DLH111	0.00	13.66	0.00	0.02	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
DLH114	0.00	5.88	0.95	0.11	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH121	1.02	52.45	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH130	0.00	4.46	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
DLH131	0.00	11.47	0.05	0.03	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00
DLH132	0.00	4.05	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC006	0.00	6.02	0.00	0.95	0.03	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC007	0.00	92.42	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC017	0.00	26.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC021	0.00	5.92	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC026	0.00	75.42	1.17	0.05	0.03	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00
GSC027	0.00	7.34	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC028	0.03	99.34	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC029	0.00	5.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC034	0.00	63.48	0.17	0.09	1.27	0.00	0.00	9.50	0.00	0.00	0.00	0.00	0.00
GSC051	0.00	62.13	0.00	0.06	4.04	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
GSC063	0.00	97.32	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC066	0.00	89.17	0.00	0.05	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00
GSC078	0.00	90.74	0.01	0.54	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
GSC086	0.00	75.73	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC089	0.00	73.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC093	0.00	67.24	0.17	1.01	0.00	0.00	0.00	2.92	0.00	0.00	0.00	0.00	0.00
GSC095	0.00	47.79	1.20	0.41	0.00	0.00	0.00	8.61	0.00	0.00	0.00	0.00	0.00
GSC099	0.00	56.38	0.19	0.41	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00
GSC105	0.00	90.07	0.00	0.07	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00
GSC106	0.00	97.92	0.11	0.01	0.00	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.00
GSC107	0.00	31.28	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC109	0.00	91.70	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC110	0.00	65.33	0.32	0.05	0.00	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.00
GSC111	0.00	98.86	0.52	0.18	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
GSC114	0.00	31.22	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC116	0.00	99.66	0.16	0.34	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
GSC117	0.00	88.94	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC118	0.00	63.24	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
GSC121	0.00	99.41	0.00	0.33	0.02	0.00	0.00	5.60	0.00	0.00	0.00	0.00	0.00
GSC123	0.00	61.47	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC124	0.00	77.88	0.10	0.49	0.01	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00
GSC129	0.00	82.07	2.03	0.28	1.39	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
GSC130	0.00	60.68	0.10	0.00	0.37	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
GSC131	0.00	68.66	1.05	0.01	0.00	0.00	0.00	6.48	0.00	0.00	0.00	0.00	0.00
GSC133	0.00	96.91	0.28	0.36	6.79	0.00	0.00	3.30	0.00	0.00	0.00	0.00	0.00
GSC135	0.00	5.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC137	0.00	83.67	0.00	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC138	0.00	57.28	0.01	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC140	0.00	2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC145	0.00	48.15	3.61	0.33	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC146	0.00	96.25	2.24	0.02	0.04	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
GSC149	0.01	95.47	0.01	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC150	0.00	99.63	1.10	0.62	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00
GSC158	0.00	23.05	0.03	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC160	0.00	30.83	0.03	0.01	0.00	0.00	0.00	3.95	0.00	0.00	0.00	0.00	0.00
GSC203	0.00	31.41	0.00	0.24	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00
GSC212	0.01	79.98	0.44	0.03	0.23	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00
GSC221	0.00	34.91	8.42	0.23	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00

EMV-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC232	0.00	33.48	5.51	0.05	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC243	0.00	8.61	0.00	0.27	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC245	0.00	68.82	1.56	0.21	0.24	0.00	0.00	2.33	0.00	0.00	0.00	0.00	0.00
GSC246	0.00	96.77	0.10	0.00	0.43	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
GSC302	0.00	21.74	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
GSC315	0.00	28.45	0.00	0.03	0.01	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
GSC318	0.00	48.65	0.00	0.00	0.08	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
GSC322	0.00	78.15	0.02	0.00	0.06	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
GSC353	0.02	70.20	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC361	0.00	68.71	0.55	0.18	0.00	0.00	0.00	4.17	0.00	0.00	0.00	0.00	0.00
GSC362	0.00	67.81	0.49	3.58	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.00
GSC363	0.00	4.13	0.19	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
GSC368	0.00	12.20	0.07	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC371	0.00	10.44	0.90	0.19	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC385	0.00	51.81	0.00	0.29	0.30	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00
GSC386	0.00	90.41	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC390	0.00	91.73	0.07	0.36	0.07	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00
GSC391	0.00	83.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC396	0.00	2.80	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
GSC398	0.00	59.13	0.87	0.06	0.00	0.00	0.00	5.28	0.00	0.00	0.00	0.00	0.00
GSC400	0.38	90.85	0.02	0.06	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
GSC402	0.00	67.18	2.15	0.16	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC403	0.36	60.83	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC404	0.01	66.82	0.01	0.97	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
GSC406	1.52	80.84	0.28	0.01	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
GSC407	0.00	35.73	0.12	0.17	0.00	0.00	0.00	2.85	0.00	0.00	0.00	0.00	0.00
GSC408	0.00	4.71	1.37	0.04	0.14	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00
GSC411	0.00	53.37	2.27	0.01	0.52	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
GSC416	0.00	16.99	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC418	0.19	48.37	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC420	0.07	93.84	4.59	0.06	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
GSC424	0.00	90.99	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
GSC426	0.00	88.72	0.02	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00
GSC427	0.00	77.91	0.02	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
GSC433	0.00	4.24	0.00	0.05	0.22	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
GSC442	0.00	30.50	0.07	0.04	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00
GSC443	4.25	29.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC444	5.20	30.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC450	0.00	7.38	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC451	0.01	43.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC454	0.06	69.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC455	0.08	79.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC459	0.00	4.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC466	1.68	13.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC479	0.01	60.51	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC481	0.00	58.54	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC492	0.00	30.83	1.62	0.28	0.32	0.00	0.00	1.77	0.00	0.00	0.00	0.00	0.00
GSC495	0.00	75.59	4.51	0.73	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
GSC498	0.25	99.30	1.75	0.43	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00
GSC501	0.00	9.97	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC504	0.00	67.79	0.42	0.02	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00
GSC507	0.00	65.98	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC508	0.00	99.26	0.21	0.32	0.00	0.00	0.00	3.27	0.00	0.00	0.00	0.00	0.00
GSC519	0.00	8.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC525	0.00	2.27	0.00	0.15	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC528	0.00	58.15	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC529	0.01	22.33	3.30	2.02	0.01	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00

EMV-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC536	0.00	58.55	1.83	0.27	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
GSC539	0.02	68.88	0.26	0.04	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
GSC553	0.11	64.94	0.30	0.18	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC555	0.00	96.31	1.95	0.61	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
GSC579	0.00	36.59	0.00	0.01	0.05	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
GSC580	0.02	45.77	0.00	0.12	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00
GSC584	0.00	11.80	0.00	4.39	0.00	0.00	0.00	2.64	0.00	0.00	0.00	0.00	0.00
GSC591	0.00	25.73	0.54	0.03	0.12	0.00	0.00	2.67	0.00	0.00	0.00	0.00	0.00
GSC593	0.00	88.50	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC595	0.01	38.65	8.29	0.00	0.01	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00
GSC599	0.00	74.87	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC600	0.00	12.84	0.00	0.01	0.69	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
GSC603	0.00	6.48	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
GSC604	0.00	89.75	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC606	0.00	64.88	0.04	0.08	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00
GSC607	0.00	77.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC608	0.00	26.36	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
GSC609	0.00	8.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC620	0.00	82.24	0.00	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC621	0.00	4.34	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
GSC622	0.00	39.14	0.13	0.00	0.00	0.00	0.00	5.45	0.00	0.00	0.00	0.00	0.00
GSC624	0.00	9.19	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00
GSC625	0.00	26.09	0.10	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC626	0.00	6.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC629	0.00	71.50	0.02	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
GSC634	0.00	38.51	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC640	0.00	73.37	0.00	0.00	0.68	0.00	0.00	7.02	0.00	0.00	0.00	0.00	0.00
GSC643	0.00	18.08	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC644	0.00	45.40	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC646	0.00	58.95	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00
GSC654	0.00	27.26	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC655	0.00	36.24	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP227	0.00	6.57	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP236	2.75	26.88	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP247	0.00	18.23	0.40	0.31	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP249	0.00	27.70	1.38	1.02	0.01	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00
MAP250	0.05	57.69	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP251	0.00	32.79	0.01	0.06	0.39	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
MAP260	0.00	63.69	0.02	0.56	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
MAP261	0.00	15.66	0.86	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP385	0.00	56.09	1.76	0.03	1.45	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00

EMV

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
DLH015	45.66	37.85	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH018	73.78	14.28	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH022	11.64	26.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH023	3.87	2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH025	3.80	17.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH028	1.45	5.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH045	44.73	26.33	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC237	45.41	19.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC356	6.09	40.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC388	21.15	98.77	0.03	0.06	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00

EMV

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC405	2.84	3.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC417	85.55	58.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC421	3.56	15.99	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC429	26.98	65.09	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC452	68.03	39.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC456	59.66	12.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC458	20.31	19.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC460	36.38	42.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC461	89.63	45.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC468	43.41	31.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC469	96.50	38.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC471	95.27	41.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC472	22.31	52.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC483	3.74	21.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC540	8.13	4.62	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC556	52.08	31.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC561	45.60	47.47	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP242	10.13	8.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLATEAU

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID113	0.00	0.00	14.42	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID116	0.00	0.00	66.18	0.00	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID117	0.00	0.00	98.09	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID118	0.00	0.00	55.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID119	0.00	0.00	28.58	0.44	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00
AID120	0.00	0.00	11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
AID121	0.00	0.00	47.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID122	0.00	0.00	62.37	0.00	0.23	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID123	0.00	0.00	10.91	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID124	0.00	0.00	43.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID125	0.00	0.00	8.24	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID126	0.00	0.00	7.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID127	0.00	0.00	62.09	0.03	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00
AID128	0.00	0.00	48.77	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID129	0.00	0.00	56.10	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID130	0.00	0.00	86.99	0.01	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID132	0.00	0.00	53.78	0.00	0.04	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
AID133	0.00	0.00	72.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID134	0.00	0.00	6.92	0.00	0.09	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
AID135	0.00	0.00	24.55	0.04	0.32	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID240	0.00	0.00	51.29	0.00	0.17	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
AID345	0.00	0.00	41.81	0.00	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID368	0.00	0.00	35.07	0.00	0.06	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
AID369	0.00	0.00	87.91	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID370	0.00	0.00	50.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID371	0.00	0.00	67.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID373	0.00	0.00	99.80	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID374	0.00	0.00	55.41	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID377	0.00	0.00	29.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID381	0.00	0.00	58.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID382	0.00	0.00	12.90	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID383	0.00	0.00	96.93	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID578	0.00	0.00	26.62	0.01	0.00	0.00	0.00	0.38	0.00	0.01	0.00	0.00	0.00
CAP367	0.00	0.00	15.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLATEAU

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
CAP372	0.00	0.00	20.91	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP374	0.00	0.00	29.93	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP375	0.00	0.00	84.46	0.00	0.00	0.53	0.00	0.00	0.00	0.01	0.00	0.00	0.00
CAP384	0.00	0.00	71.95	0.00	0.03	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP385	0.00	0.00	75.71	0.00	3.03	0.20	0.00	0.02	0.00	0.01	0.00	0.00	0.00
CAP387	0.00	0.00	48.91	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP388	0.00	0.00	54.93	0.00	0.06	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP389	0.00	0.00	92.98	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP391	0.00	0.00	43.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP393	0.00	0.00	73.36	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP395	0.00	0.00	52.11	0.01	0.49	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
CAP397	0.00	0.00	88.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP403	0.00	0.00	83.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP404	0.00	0.00	46.84	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
CAP408	0.00	0.00	67.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP409	0.00	0.00	98.96	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP410	0.00	0.00	80.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP411	0.00	0.00	46.78	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP412	0.00	0.00	90.65	0.51	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
CAP413	0.00	0.00	40.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP414	0.00	0.00	17.45	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP416	0.00	0.00	20.62	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP418	0.00	0.01	32.67	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00
CAP421	0.00	0.00	7.63	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP422	0.00	0.00	62.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH002	0.00	0.00	6.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH011	0.00	0.00	41.77	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00
DLH041	0.00	0.00	30.87	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH050	0.00	0.00	16.56	0.00	0.59	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
DLH052	0.00	0.00	26.59	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH055	0.00	0.00	20.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH057	0.00	0.00	18.09	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH062	0.00	0.00	17.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH063	0.00	0.00	47.64	0.00	0.01	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00
DLH070	0.00	0.00	60.77	0.01	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH071	0.00	0.00	65.80	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH073	0.00	0.00	85.46	0.01	0.84	0.01	0.00	0.00	0.00	0.08	0.00	0.00	0.00
DLH075	0.00	0.00	91.54	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH076	0.00	0.00	27.46	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH077	0.00	0.00	89.57	0.18	0.00	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.00
DLH078	0.00	0.00	79.26	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH079	0.00	0.00	70.94	0.03	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH082	0.00	0.00	98.35	0.01	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH083	0.00	0.00	62.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH087	0.00	0.00	43.92	0.00	0.14	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
DLH088	0.00	0.00	83.25	0.53	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00
DLH090	0.00	0.00	44.71	0.09	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00
DLH095	0.00	0.00	89.99	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
DLH098	0.00	0.00	25.68	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
DLH100	0.00	0.00	77.38	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH102	0.00	0.00	92.72	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH110	0.00	0.00	18.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH116	0.00	0.00	59.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH119	0.00	0.00	40.32	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH120	0.00	0.00	81.33	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH123	0.00	0.00	40.75	0.00	0.10	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00
DLH124	0.00	0.00	48.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLATEAU

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
DLH125	0.00	0.00	94.83	0.04	0.20	0.14	0.00	0.00	0.00	0.03	0.00	0.00	0.00
DLH126	0.00	0.00	11.36	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH133	0.00	0.00	92.67	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
DLH134	0.00	0.00	23.13	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH135	0.00	0.00	44.87	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC002	0.00	0.00	72.26	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC004	0.00	0.00	97.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC005	0.00	0.00	15.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC010	0.00	0.00	99.11	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC013	0.00	0.00	68.38	0.03	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00
GSC015	0.00	0.00	77.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC024	0.00	0.00	14.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC032	0.00	0.00	26.89	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC040	0.00	0.00	60.65	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC042	0.00	0.00	65.03	0.00	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC043	0.00	0.00	93.97	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC044	0.00	0.00	6.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC050	0.00	0.00	73.29	0.06	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
GSC052	0.00	0.00	67.63	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC064	0.00	0.00	51.67	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
GSC068	0.00	0.00	99.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC069	0.00	0.00	100.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC070	0.00	0.00	85.54	0.00	0.22	1.72	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC071	0.00	0.00	47.74	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
GSC072	0.00	0.00	10.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC074	0.00	0.00	97.99	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC075	0.00	0.00	10.20	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC077	0.00	0.00	42.84	0.02	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
GSC079	0.00	0.00	55.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC082	0.00	0.00	12.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC091	0.00	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC092	0.00	0.00	16.69	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC100	0.00	0.00	60.79	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC101	0.00	0.00	44.44	0.01	0.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC104	0.00	0.00	77.89	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC115	0.00	0.00	30.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC119	0.00	0.00	15.12	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC122	0.00	0.00	12.32	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC134	0.00	0.00	79.04	0.01	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC151	0.00	0.00	10.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC155	0.00	0.00	21.22	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC159	0.00	0.00	8.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC161	0.00	0.00	14.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC163	0.00	0.00	11.42	0.01	0.71	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC165	0.00	0.00	23.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC166	0.00	0.00	95.27	0.03	0.12	1.83	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC167	0.00	0.00	73.04	0.03	0.01	0.86	0.00	0.00	0.00	0.07	0.00	0.00	0.00
GSC169	0.00	0.00	36.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC170	0.00	0.00	25.03	0.00	0.00	0.21	0.00	0.00	0.00	0.05	0.00	0.00	0.00
GSC171	0.00	0.00	92.50	0.00	0.62	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC173	0.00	0.00	82.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC174	0.00	0.00	42.27	0.57	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC175	0.00	0.00	7.10	0.00	0.02	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC181	0.00	0.00	31.49	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC182	0.00	0.00	42.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC185	0.00	0.00	11.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC200	0.00	0.00	20.48	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLATEAU

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC209	0.00	0.00	13.46	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC219	0.00	0.00	96.48	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00
GSC222	0.00	0.00	30.94	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC224	0.00	0.00	71.99	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC235	0.00	0.00	11.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC238	0.00	0.00	9.43	0.00	0.93	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC240	0.00	0.00	73.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC241	0.00	0.00	7.70	0.08	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC242	0.00	0.00	28.75	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC244	0.00	0.00	37.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC247	0.00	0.00	82.61	0.00	0.00	1.39	0.00	0.00	0.00	0.03	0.00	0.00	0.00
GSC250	0.00	0.00	98.08	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
GSC251	0.00	0.00	11.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC255	0.00	0.00	66.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC258	0.00	0.00	94.16	0.01	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC259	0.00	0.00	5.93	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC261	0.00	0.00	99.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC262	0.00	0.00	41.75	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC268	0.00	0.00	24.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC269	0.00	0.00	28.23	0.80	0.01	0.01	0.00	1.54	0.00	0.00	0.00	0.00	0.00
GSC272	0.00	0.00	11.87	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC274	0.00	0.00	20.71	0.55	0.90	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
GSC276	0.00	0.00	7.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC278	0.00	0.00	63.34	0.01	0.00	0.01	0.00	0.02	0.00	0.03	0.00	0.00	0.00
GSC280	0.00	0.00	60.19	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00
GSC287	0.00	0.00	57.38	0.54	0.00	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.00
GSC288	0.00	0.00	87.61	0.04	0.00	1.61	0.00	1.13	0.01	0.00	0.00	0.00	0.00
GSC294	0.00	0.00	97.73	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC296	0.00	0.00	80.72	0.00	0.44	0.67	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC299	0.00	0.00	88.20	0.01	1.30	4.30	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC300	0.00	0.00	59.81	0.10	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC305	0.00	0.00	7.53	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC307	0.00	0.00	27.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC314	0.00	0.00	12.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC320	0.00	0.00	10.11	0.00	0.00	0.19	0.00	0.00	0.01	0.00	0.00	0.00	0.00
GSC321	0.00	0.00	56.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC323	0.00	0.00	16.90	0.00	0.05	0.01	0.00	0.46	0.00	0.00	0.00	0.00	0.00
GSC328	0.00	0.00	78.50	0.32	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC330	0.00	0.00	17.66	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC331	0.00	0.00	67.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC333	0.00	0.00	71.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC336	0.00	0.00	12.74	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC347	0.00	0.00	21.25	5.13	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.00
GSC354	0.00	0.00	20.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC360	0.00	0.00	55.30	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC370	0.00	0.00	69.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC372	0.00	0.00	58.86	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC373	0.00	0.00	51.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC375	0.00	0.00	19.21	0.05	0.00	0.05	0.00	0.00	0.00	0.07	0.00	0.00	0.00
GSC376	0.00	0.00	34.28	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC381	0.00	0.00	74.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC393	0.00	0.00	12.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC395	0.00	0.00	59.14	0.01	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC399	0.00	0.00	10.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC413	0.00	0.00	42.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC447	0.00	0.00	69.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC470	0.00	0.00	88.47	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00

PLATEAU													
ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC488	0.00	0.00	20.93	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC491	0.00	0.00	97.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC493	0.00	0.00	55.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC494	0.00	0.00	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC502	0.00	0.00	47.99	0.00	0.00	0.32	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC512	0.00	0.00	92.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC514	0.00	0.00	24.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC516	0.00	0.00	20.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC517	0.00	0.00	8.38	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC533	0.00	0.00	14.39	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC545	0.00	0.13	11.81	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC566	0.00	0.00	26.62	0.00	0.21	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC568	0.00	0.00	18.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC569	0.00	0.00	11.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC570	0.00	0.00	98.85	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC571	0.00	0.00	80.63	0.00	0.04	0.32	0.00	0.00	0.00	0.01	0.00	0.00	0.00
GSC578	0.00	0.00	22.31	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC602	0.00	0.00	54.59	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC613	0.00	0.00	8.32	0.01	0.06	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.00
GSC619	0.00	0.00	32.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC627	0.00	0.00	99.86	0.00	0.00	0.57	0.00	0.00	0.00	0.18	0.00	0.00	0.00
GSC628	0.00	0.00	57.24	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC630	0.00	0.00	33.25	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC631	0.00	0.00	10.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC637	0.00	0.00	33.65	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC639	0.00	0.00	99.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP019	0.00	0.00	50.37	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP021	0.00	0.00	56.15	0.00	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP023	0.00	0.00	19.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP054	0.00	0.00	36.03	0.00	1.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP065	0.00	0.00	53.26	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
MAP066	0.00	0.00	81.59	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP130	0.00	0.00	24.27	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP133	0.00	0.00	65.49	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP148	0.00	0.00	55.89	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP151	0.00	0.00	26.54	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP159	0.00	0.00	5.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP165	0.00	0.00	38.45	0.04	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP170	0.00	0.00	60.69	0.31	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP175	0.00	0.00	45.82	0.10	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP187	0.00	0.00	56.89	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP195	0.00	0.00	64.41	0.50	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP200	0.00	0.00	60.72	1.68	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP201	0.00	0.00	83.66	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP203	0.00	0.00	95.98	0.00	0.00	1.28	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP204	0.00	0.00	14.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP208	0.00	0.01	58.20	0.44	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
MAP215	0.00	0.00	90.60	0.01	0.00	0.38	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP225	0.00	0.00	45.64	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
MAP226	0.00	0.00	12.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP229	0.00	0.00	18.60	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00
MAP230	0.00	0.00	25.10	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP231	0.00	0.00	13.16	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP234	0.00	0.00	9.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP239	0.00	0.00	39.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP241	0.00	0.00	35.98	0.26	0.20	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
MAP245	0.00	0.00	87.56	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLATEAU

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP246	0.00	0.00	98.49	0.00	0.00	4.71	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP248	0.00	0.00	84.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP253	0.00	0.00	9.87	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
MAP255	0.00	0.00	23.67	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP257	0.00	0.00	98.08	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
MAP258	0.00	0.00	61.94	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP265	0.00	0.00	43.42	0.00	0.00	0.22	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP268	0.00	0.00	14.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP271	0.00	0.00	78.03	0.41	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
MAP272	0.00	0.00	81.38	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP273	0.00	0.00	91.02	0.00	0.00	0.85	0.00	0.00	0.00	0.23	0.00	0.00	0.00
MAP275	0.00	0.00	44.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP276	0.00	0.00	63.09	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP278	0.00	0.00	11.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP280	0.00	0.00	85.50	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP281	0.00	0.00	44.89	0.01	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP286	0.00	0.00	83.59	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP290	0.00	0.00	38.95	0.00	0.00	0.03	0.00	0.00	0.00	0.14	0.00	0.00	0.00
MAP293	0.00	0.00	48.55	0.12	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP295	0.00	0.00	80.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP300	0.00	0.00	43.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP311	0.00	0.00	83.72	0.00	0.00	0.82	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP312	0.00	0.00	34.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP316	0.00	0.00	8.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP317	0.00	0.00	98.97	0.00	0.02	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP318	0.00	0.00	9.84	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP319	0.00	0.00	10.15	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP321	0.00	0.00	56.96	0.00	0.01	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP322	0.00	0.00	72.46	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP323	0.00	0.00	39.19	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP324	0.00	0.00	98.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP336	0.00	0.00	59.75	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP337	0.00	0.00	44.66	0.00	0.21	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP338	0.00	0.00	26.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP341	0.00	0.00	45.48	0.00	0.22	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP342	0.00	0.00	90.74	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP344	0.00	0.00	23.62	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP345	0.00	0.00	75.14	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP362	0.00	0.00	5.53	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP367	0.00	0.00	27.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP371	0.00	0.00	43.18	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP376	0.00	0.00	8.58	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP386	0.00	0.00	47.81	0.02	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP387	0.00	0.00	30.24	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP431	0.00	0.00	48.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP432	0.00	0.00	33.35	0.00	0.00	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP438	0.00	0.00	21.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP512	0.00	0.00	61.06	3.42	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP518	0.00	0.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP561	0.00	0.00	16.27	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP563	0.00	0.00	10.65	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP587	0.00	0.00	19.97	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WEST-1

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID059	0.00	0.00	3.33	27.72	2.31	0.00	0.00	4.50	0.00	0.01	0.00	0.00	0.00
AID641	0.00	0.00	0.45	48.77	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00
GSC023	0.00	0.00	1.31	39.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC038	0.00	0.00	3.25	28.11	0.02	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC098	0.00	0.00	1.99	40.18	0.37	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00
GSC126	0.00	0.00	0.00	97.99	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC127	0.00	0.00	0.12	91.96	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC152	0.00	0.03	0.71	55.23	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC195	0.00	0.00	0.29	86.60	1.31	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC273	0.00	0.00	0.00	4.82	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC341	0.00	0.00	0.04	20.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC380	0.00	0.00	0.00	99.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC510	0.00	0.00	0.01	15.54	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC564	0.00	0.00	0.50	72.60	0.07	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00
GSC565	0.00	0.00	0.70	97.06	1.00	0.00	0.00	1.09	0.00	0.02	0.00	0.00	0.00
GSC574	0.00	0.00	0.00	91.31	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC638	0.00	0.01	0.01	74.69	0.25	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC641	0.00	0.00	0.14	90.55	0.40	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
GSC645	0.00	0.00	0.00	55.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP134	0.00	0.00	0.01	41.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP142	0.00	0.00	0.03	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP153	0.00	0.00	0.80	8.91	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP160	0.00	0.00	0.00	18.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP163	0.00	0.00	0.04	19.40	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP166	0.00	0.00	0.00	55.89	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
MAP167	0.00	0.00	1.54	91.34	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP168	0.00	0.00	0.37	58.38	0.04	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
MAP174	0.00	0.00	0.37	82.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP177	0.00	0.00	0.05	44.99	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP178	0.00	0.00	0.33	21.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP181	0.00	0.00	5.72	98.51	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
MAP185	0.00	0.00	3.42	16.12	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
MAP186	0.00	0.00	2.11	56.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP188	0.00	0.00	1.16	13.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP189	0.00	0.00	0.11	34.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP194	0.00	0.00	0.03	14.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP205	0.00	0.00	0.76	39.62	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
MAP207	0.00	0.00	0.01	13.40	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP212	0.00	0.00	1.97	16.05	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
MAP214	0.00	0.00	0.00	50.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP511	0.00	0.00	0.62	49.95	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP513	0.00	0.00	0.06	11.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP514	0.00	0.00	0.50	52.70	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
MAP572	0.00	0.00	2.82	43.51	1.04	0.00	0.00	0.03	0.00	0.90	0.00	0.00	0.00
MAP585	0.00	0.00	0.00	47.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP597	0.00	0.00	1.69	31.51	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00

WEST-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID002	0.00	0.00	0.00	0.00	18.77	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
AID005	0.00	0.00	0.00	0.00	8.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID006	0.00	0.00	0.00	0.00	17.60	0.00	0.00	0.59	0.00	0.01	0.00	0.00	0.00
AID007	0.00	0.00	0.00	0.00	27.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID009	0.00	0.00	0.00	0.00	3.53	0.00	0.00	0.39	0.02	0.00	0.00	0.00	0.00
AID038	0.00	0.00	0.00	0.00	59.19	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
AID040	0.00	0.00	0.00	0.03	60.64	0.00	0.00	0.06	0.94	0.00	0.00	0.00	0.00
AID041	0.00	0.00	0.00	0.02	6.50	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
AID042	0.00	0.00	0.00	0.00	65.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WEST-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID044	0.00	0.00	0.00	0.00	15.89	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
AID046	0.00	0.00	0.00	0.00	35.59	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
AID302	0.00	0.00	0.00	0.08	26.72	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
GSC342	0.00	0.00	0.00	0.00	42.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC344	0.00	0.00	0.00	0.00	91.07	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00
GSC345	0.00	0.00	0.00	0.00	91.76	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
GSC346	0.00	0.00	0.00	0.00	30.28	0.00	0.00	0.25	0.06	0.00	0.00	0.00	0.00
GSC349	0.00	0.00	0.00	0.00	60.23	0.00	0.00	0.21	0.08	0.00	0.00	0.00	0.00
GSC350	0.00	0.00	0.00	0.15	7.58	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
MAP137	0.00	0.00	0.04	0.59	6.71	0.00	0.00	0.00	1.07	0.01	0.00	0.00	0.00
MAP144	0.00	0.00	0.00	0.00	17.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
MAP146	0.00	0.00	0.00	0.65	66.46	0.00	0.00	0.00	0.94	0.00	0.00	0.00	0.00
MAP156	0.00	0.00	0.03	0.01	86.12	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00
MAP176	0.00	0.00	0.00	0.00	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP179	0.00	0.00	0.00	0.01	56.49	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
MAP184	0.00	0.00	0.02	0.05	33.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP191	0.00	0.00	0.00	0.00	99.74	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
MAP197	0.00	0.00	0.00	0.00	84.90	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
MAP219	0.00	0.00	0.00	0.00	10.39	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00
MAP510	0.00	0.00	0.00	0.00	15.43	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
MAP565	0.00	0.00	0.00	0.00	83.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP566	0.00	0.00	0.00	0.01	99.84	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00
MAP573	0.00	0.00	0.00	0.01	66.92	0.00	0.00	0.00	0.22	0.00	0.00	0.02	0.00
MAP574	0.00	0.00	0.00	0.00	20.71	0.00	0.00	0.00	0.26	0.00	0.00	0.14	0.00
MAP576	0.00	0.00	0.00	0.00	20.61	0.00	0.00	0.00	0.07	0.00	0.00	0.01	0.00
MAP581	0.00	0.00	0.00	0.00	90.12	0.00	0.00	0.00	0.11	0.00	0.00	0.04	0.00
MAP584	0.00	0.00	0.00	0.00	67.26	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
MAP588	0.00	0.00	0.00	0.00	77.81	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00
MAP590	0.00	0.00	0.00	0.00	94.29	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
MAP591	0.00	0.00	0.00	0.00	93.40	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
MAP596	0.00	0.00	0.03	0.03	7.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MM-1

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
CAP394	0.00	0.00	0.63	0.00	0.00	37.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP396	0.00	0.00	0.00	0.00	0.00	99.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP398	0.00	0.00	0.00	0.00	0.00	81.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP402	0.00	0.00	0.00	0.00	0.00	9.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP419	0.00	0.00	0.00	0.00	0.00	97.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP420	0.00	0.00	0.00	0.00	0.00	92.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC202	0.00	0.00	0.00	0.00	0.01	26.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC204	0.00	0.00	0.00	0.00	0.00	9.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC205	0.00	0.00	0.07	0.00	0.02	67.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC208	0.00	0.00	0.00	0.00	0.00	97.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC213	0.00	0.00	0.00	0.00	0.00	72.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC214	0.00	0.00	2.53	0.00	0.00	68.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC216	0.00	0.00	0.00	0.00	0.01	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC656	0.00	0.00	0.00	0.00	0.00	35.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP020	0.00	0.00	0.01	0.00	0.00	47.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP313	0.00	0.00	0.38	0.00	0.00	40.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP314	0.00	0.00	5.85	0.00	0.00	91.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP315	0.00	0.00	0.13	0.00	0.00	25.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP320	0.00	0.00	0.00	0.00	0.00	18.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP325	0.00	0.00	0.00	0.00	0.00	13.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP361	0.00	0.00	0.00	0.00	0.00	31.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP364	0.00	0.00	2.95	0.00	0.01	12.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP372	0.00	0.00	0.00	0.00	0.00	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP375	0.00	0.00	1.20	0.00	0.00	29.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MM-1

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP378	0.00	0.00	0.00	0.00	0.00	43.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP379	0.00	0.00	0.03	0.00	0.00	7.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP381	0.00	0.00	5.23	0.00	0.24	84.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP382	0.00	0.00	0.63	0.00	0.00	74.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP384	0.00	0.00	0.00	0.00	0.00	75.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP388	0.00	0.00	7.32	0.00	0.00	95.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP389	0.00	0.00	0.02	0.00	0.01	79.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP390	0.00	0.00	0.00	0.00	0.00	15.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP391	0.00	0.00	0.00	0.00	0.00	5.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP393	0.00	0.00	0.00	0.00	0.00	61.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP395	0.00	0.00	0.27	0.00	0.00	99.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP396	0.00	0.00	0.00	0.00	0.00	6.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP397	0.00	0.00	0.00	0.00	0.00	63.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP399	0.00	0.00	0.00	0.00	0.00	8.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP400	0.00	0.00	0.00	0.00	0.00	5.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP426	0.00	0.00	2.18	0.00	0.02	21.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP429	0.00	0.00	4.03	0.00	0.04	97.29	0.00	0.00	0.00	0.00	0.00	0.02	0.00
MAP434	0.00	0.00	0.11	0.00	0.00	6.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP435	0.00	0.00	0.02	0.00	0.00	52.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP436	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP437	0.00	0.00	0.00	0.00	0.00	70.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP439	0.00	0.00	0.00	0.00	0.00	74.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP443	0.00	0.00	0.00	0.00	0.00	27.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP444	0.00	0.00	0.20	0.00	0.00	99.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP445	0.00	0.00	0.00	0.00	0.00	5.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MM-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC217	0.00	0.00	0.00	0.00	0.00	0.00	77.21	0.00	0.00	0.00	0.00	1.91	1.21
MAP131	0.00	0.00	0.00	0.00	0.00	0.00	92.25	0.00	0.00	0.00	0.00	0.07	0.01
MAP180	0.00	0.00	0.00	0.00	0.00	0.00	84.07	0.00	0.00	0.00	0.00	0.01	0.03
MAP296	0.00	0.00	0.00	0.00	0.00	0.00	90.42	0.00	0.00	0.00	0.00	0.00	0.00
MAP302	0.00	0.00	0.00	0.00	0.00	0.00	6.43	0.00	0.00	0.00	0.00	0.00	0.00
MAP305	0.00	0.00	0.00	0.00	0.00	0.00	59.82	0.00	0.00	0.00	0.00	0.86	0.01
MAP308	0.00	0.00	0.00	0.00	0.00	0.00	46.97	0.00	0.00	0.00	0.00	0.00	0.00
MAP310	0.00	0.00	0.00	0.00	0.00	0.00	90.79	0.00	0.00	0.00	0.00	0.00	0.00
MAP327	0.00	0.00	0.00	0.00	0.00	0.00	25.14	0.00	0.00	0.00	0.00	0.00	0.00
MAP328	0.00	0.00	0.00	0.00	0.00	0.00	30.50	0.00	0.00	0.00	0.00	0.00	0.00
MAP329	0.00	0.00	0.00	0.00	0.00	0.00	78.18	0.00	0.00	0.00	0.00	0.00	0.00
MAP332	0.00	0.00	0.00	0.00	0.00	0.00	6.86	0.00	0.00	0.00	0.00	0.00	0.00
MAP333	0.00	0.00	0.00	0.00	0.00	0.00	47.23	0.00	0.00	0.00	0.00	0.00	0.00
MAP334	0.00	0.00	0.00	0.00	0.00	0.00	80.70	0.00	0.00	0.00	0.00	0.00	0.00
MAP335	0.00	0.00	0.00	0.00	0.00	0.00	60.78	0.00	0.00	0.00	0.00	0.00	0.00
MAP348	0.00	0.00	0.00	0.00	0.01	0.00	48.76	0.00	0.00	0.00	0.00	7.18	3.68
MAP349	0.00	0.00	0.00	0.00	0.00	0.00	83.85	0.00	0.00	0.00	0.00	2.20	0.34
MAP354	0.00	0.00	0.00	0.00	0.00	0.00	63.82	0.00	0.00	0.00	0.00	0.25	0.03
MAP355	0.00	0.00	0.00	0.00	0.00	0.00	41.80	0.00	0.00	0.00	0.00	0.00	0.00
MAP358	0.00	0.00	0.00	0.00	0.00	0.00	7.19	0.00	0.00	0.00	0.00	0.00	0.00
MAP360	0.00	0.00	0.00	0.00	0.00	0.00	45.87	0.00	0.00	0.00	0.00	1.41	3.26
MAP401	0.00	0.00	0.00	0.00	0.00	0.00	17.12	0.00	0.00	0.00	0.00	4.05	0.19
MAP402	0.00	0.00	0.00	0.00	0.00	0.00	12.04	0.00	0.00	0.00	0.00	0.57	0.09
MAP403	0.00	0.00	0.00	0.00	0.00	0.00	10.70	0.00	0.00	0.00	0.00	0.07	0.25
MAP405	0.00	0.00	0.00	0.00	0.00	0.00	98.66	0.00	0.00	0.00	0.00	0.34	0.01
MAP406	0.00	0.00	0.00	0.00	0.00	0.00	79.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP408	0.00	0.00	0.00	0.00	0.05	0.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00
MAP409	0.00	0.00	0.00	0.00	0.00	0.00	23.02	0.00	0.00	0.00	0.00	0.00	0.00
MAP410	0.00	0.00	0.00	0.00	0.01	0.00	28.44	0.00	0.00	0.00	0.00	0.06	0.14
MAP411	0.00	0.00	0.00	0.00	0.00	0.00	98.15	0.00	0.00	0.00	0.00	0.00	0.00

MM-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP412	0.00	0.00	0.00	0.00	0.00	0.00	90.74	0.00	0.00	0.00	0.00	2.65	0.30
MAP413	0.00	0.00	0.00	0.00	0.00	0.00	20.96	0.00	0.00	0.00	0.00	0.00	0.00
MAP414	0.00	0.00	0.00	0.00	0.00	0.00	93.96	0.00	0.00	0.00	0.00	0.01	0.01
MAP415	0.00	0.00	0.00	0.00	0.00	0.00	6.70	0.00	0.00	0.00	0.00	0.47	0.02
MAP416	0.00	0.00	0.00	0.00	0.00	0.00	22.65	0.00	0.00	0.00	0.00	0.16	0.31
MAP417	0.00	0.00	0.00	0.00	0.00	0.00	46.31	0.00	0.00	0.00	0.00	4.92	0.07
MAP418	0.00	0.00	0.00	0.00	0.02	0.00	5.55	0.00	0.00	0.00	0.00	1.87	0.12
MAP421	0.00	0.00	0.00	0.00	0.01	0.00	22.18	0.00	0.00	0.00	0.00	3.69	0.71
MAP422	0.00	0.00	0.00	0.00	0.00	0.00	59.53	0.00	0.00	0.00	0.00	0.00	0.00
MAP423	0.00	0.00	0.00	0.00	0.00	0.00	10.71	0.00	0.00	0.00	0.00	0.00	0.00
MAP447	0.00	0.00	0.00	0.00	0.00	0.00	71.15	0.00	0.00	0.00	0.00	0.45	0.17
MAP448	0.00	0.00	0.00	0.00	0.00	0.00	83.17	0.00	0.00	0.00	0.00	2.69	0.09
MAP452	0.00	0.00	0.00	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00	0.00	0.00
MAP453	0.00	0.00	0.00	0.00	0.00	0.00	13.24	0.00	0.00	0.00	0.00	1.49	0.55
MAP454	0.00	0.00	0.00	0.00	0.03	0.00	18.69	0.00	0.00	0.00	0.00	1.17	1.62
MAP457	0.00	0.00	0.00	0.00	0.00	0.00	55.84	0.00	0.00	0.00	0.00	3.21	0.10
MAP458	0.00	0.00	0.00	0.00	0.00	0.00	97.37	0.00	0.00	0.00	0.00	3.07	0.74
MAP459	0.00	0.00	0.00	0.00	0.00	0.00	37.93	0.00	0.00	0.00	0.00	0.00	0.00
MAP460	0.00	0.00	0.00	0.00	0.01	0.00	65.99	0.00	0.00	0.00	0.00	0.01	0.00
MAP461	0.00	0.00	0.00	0.00	0.00	0.00	84.40	0.00	0.00	0.00	0.00	0.06	0.04
MAP462	0.00	0.00	0.00	0.00	0.00	0.00	70.32	0.00	0.00	0.00	0.00	0.00	0.02
MAP463	0.00	0.00	0.00	0.00	0.01	0.00	67.53	0.00	0.00	0.00	0.00	0.67	0.69

AZ/NM

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID020	0.00	0.00	0.01	0.03	0.00	0.01	0.00	4.42	0.00	0.02	0.00	0.00	0.00
AID022	0.00	0.00	0.00	0.02	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.00	0.00
AID025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.97	0.00	0.00	0.00	0.00	0.00
AID026	0.00	0.00	0.06	0.09	0.02	0.00	0.00	26.34	0.00	0.00	0.00	0.00	0.00
AID027	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.18	0.00	0.00	0.00	0.00	0.00
AID028	0.00	0.00	0.07	1.24	0.23	0.00	0.00	37.91	0.00	0.00	0.00	0.00	0.00
AID029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.92	0.00	0.00	0.00	0.00	0.00
AID031	0.00	0.00	4.20	0.00	0.06	0.00	0.00	83.24	0.01	0.01	0.00	0.00	0.00
AID032	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	0.00	0.00	0.00	0.00	0.00
AID033	0.00	0.00	4.28	0.09	0.01	0.01	0.00	41.66	0.00	0.00	0.00	0.00	0.00
AID034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.65	0.00	0.00	0.00	0.00	0.00
AID036	0.00	0.00	0.00	0.00	0.02	0.00	0.00	43.75	0.00	0.00	0.00	0.00	0.00
AID047	0.00	0.00	0.04	0.00	0.00	0.00	0.00	82.38	0.00	0.00	0.00	0.00	0.00
AID048	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.17	0.00	0.00	0.00	0.00	0.00
AID050	0.00	0.00	0.04	0.42	0.18	0.00	0.00	78.22	0.00	0.00	0.00	0.00	0.00
AID055	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.52	0.00	0.00	0.00	0.00	0.00
AID056	0.00	0.00	0.01	0.06	0.00	0.00	0.00	7.32	0.00	0.00	0.00	0.00	0.00
AID057	0.00	0.00	0.05	0.54	0.17	0.00	0.00	39.55	0.00	0.00	0.00	0.00	0.00
AID058	0.00	0.00	5.03	0.02	0.00	0.00	0.00	95.06	0.00	0.00	0.00	0.00	0.00
AID060	0.00	0.00	1.02	0.28	0.85	0.00	0.00	10.10	0.00	0.03	0.00	0.00	0.00
AID061	0.00	0.00	0.46	0.05	0.03	0.00	0.00	64.66	0.00	0.00	0.00	0.00	0.00
AID062	0.00	0.00	0.09	0.79	0.00	0.00	0.00	79.46	0.00	0.00	0.00	0.00	0.00
AID064	0.00	0.00	0.00	0.00	0.01	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00
AID065	0.00	0.00	0.74	0.03	0.03	0.00	0.00	89.41	0.00	0.07	0.00	0.00	0.00
AID066	0.00	0.00	2.17	0.02	0.01	0.00	0.00	88.92	0.00	0.03	0.00	0.00	0.00
AID068	0.00	0.00	0.00	0.56	0.02	0.00	0.00	64.21	0.00	0.00	0.00	0.00	0.00
AID069	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.27	0.00	0.00	0.00	0.00	0.00
AID070	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.21	0.00	0.00	0.00	0.00	0.00
AID071	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.97	0.00	0.00	0.00	0.00	0.00
AID089	0.00	0.00	0.00	0.06	0.00	0.00	0.00	69.00	0.00	0.00	0.00	0.00	0.00
AID090	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.00	0.00	0.00	0.00	0.00	0.00
AID092	0.00	0.00	0.00	0.02	0.10	0.00	0.00	43.53	0.00	0.00	0.00	0.00	0.00
AID093	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.45	0.00	0.00	0.00	0.00	0.00

AZ/NM

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID094	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.18	0.00	0.00	0.00	0.00	0.00
AID096	0.00	0.00	0.00	0.00	0.14	0.00	0.00	9.36	0.01	0.00	0.00	0.00	0.00
AID097	0.00	0.00	0.06	0.15	0.00	0.00	0.00	54.60	0.00	0.00	0.00	0.00	0.00
AID098	0.00	0.00	0.00	0.00	0.24	0.00	0.00	85.88	0.00	0.00	0.00	0.00	0.00
AID099	0.00	0.00	0.00	0.00	0.03	0.00	0.00	47.39	0.00	0.00	0.00	0.00	0.00
AID100	0.00	0.00	0.00	0.00	0.01	0.00	0.00	27.87	0.00	0.00	0.00	0.00	0.00
AID138	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.71	0.00	0.00	0.00	0.00	0.00
AID139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.20	0.00	0.00	0.00	0.00	0.00
AID140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.52	0.00	0.00	0.00	0.00	0.00
AID141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.15	0.00	0.00	0.00	0.00	0.00
AID142	0.00	0.00	2.00	0.00	0.00	0.00	0.00	93.83	0.00	0.00	0.00	0.00	0.00
AID148	0.00	0.00	0.00	0.00	0.03	0.00	0.00	24.55	0.00	0.00	0.00	0.00	0.00
AID161	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.19	0.00	0.17	0.00	0.00	0.00
AID162	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.78	0.00	0.00	0.00	0.00	0.00
AID164	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.51	0.00	0.00	0.00	0.00	0.00
AID228	0.00	0.00	0.00	0.03	0.00	0.00	0.00	48.80	0.00	0.00	0.00	0.00	0.00
AID229	0.00	0.00	0.00	0.00	0.03	0.00	0.00	77.46	0.00	0.00	0.00	0.00	0.00
AID232	0.00	0.00	0.17	0.01	0.00	0.00	0.00	39.85	0.00	0.00	0.00	0.00	0.00
AID233	0.00	0.00	2.07	0.00	0.00	0.00	0.00	77.89	0.00	0.00	0.00	0.00	0.00
AID241	0.00	0.00	0.08	0.01	0.00	0.00	0.00	10.91	0.00	0.00	0.00	0.00	0.00
AID243	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.85	0.00	0.00	0.00	0.00	0.00
AID245	0.00	0.00	0.00	0.01	0.00	0.00	0.00	91.00	0.00	0.00	0.00	0.00	0.00
AID246	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.20	0.00	0.00	0.00	0.00	0.00
AID247	0.00	0.00	4.03	0.00	0.29	0.00	0.00	88.47	0.00	0.00	0.00	0.00	0.00
AID248	0.00	0.00	2.31	0.04	0.01	0.00	0.00	29.30	0.00	0.00	0.00	0.00	0.00
AID249	0.00	0.00	0.27	0.00	0.00	0.00	0.00	87.77	0.01	0.11	0.00	0.00	0.00
AID250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.23	0.00	0.00	0.00	0.00	0.00
AID251	0.00	0.00	0.01	0.33	0.02	0.00	0.00	13.65	0.02	0.02	0.00	0.00	0.00
AID252	0.00	0.00	0.88	0.00	0.02	0.00	0.00	58.14	0.00	0.00	0.00	0.00	0.00
AID255	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.11	0.00	0.00	0.00	0.00	0.00
AID256	0.00	0.00	0.20	0.08	0.00	0.00	0.00	50.54	0.00	0.00	0.00	0.00	0.00
AID257	0.00	0.00	0.00	0.00	0.04	0.00	0.00	80.56	0.00	0.00	0.00	0.00	0.00
AID258	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.72	0.00	0.00	0.00	0.00	0.00
AID260	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.48	0.00	0.00	0.00	0.00	0.00
AID261	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.82	0.00	0.00	0.00	0.00	0.00
AID264	0.00	0.00	0.12	0.08	0.11	0.00	0.00	99.90	0.00	0.00	0.00	0.00	0.00
AID299	0.00	0.00	0.00	0.00	0.09	0.00	0.00	26.05	0.00	0.00	0.00	0.00	0.00
AID385	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.59	0.00	0.00	0.00	0.00	0.00
AID387	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.24	0.00	0.00	0.00	0.00	0.00
AID390	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.84	0.00	0.00	0.00	0.00	0.00
AID393	0.00	0.00	0.00	0.00	0.12	0.00	0.00	16.53	0.00	0.00	0.00	0.00	0.00
AID394	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.81	0.00	0.00	0.00	0.00	0.00
AID395	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.59	0.00	0.00	0.00	0.00	0.00
AID401	0.00	0.00	0.02	0.00	1.18	0.00	0.00	14.10	0.00	0.00	0.00	0.00	0.00
AID404	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.70	0.00	0.00	0.00	0.00	0.00
AID406	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.88	0.00	0.00	0.00	0.00	0.00
AID407	0.00	0.00	1.55	0.00	0.00	0.00	0.00	80.02	0.00	0.00	0.00	0.00	0.00
AID417	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.61	0.00	0.00	0.00	0.00	0.00
AID419	0.00	0.00	0.97	0.00	0.00	0.00	0.00	53.49	0.00	0.01	0.00	0.00	0.00
AID482	0.00	0.00	0.01	0.00	0.00	0.00	0.00	47.84	0.00	0.02	0.00	0.00	0.00
AID483	0.00	0.00	0.00	0.00	0.01	0.00	0.00	62.58	0.00	0.00	0.00	0.00	0.00
AID484	0.00	0.00	0.00	0.00	0.08	0.00	0.00	83.72	0.00	0.00	0.00	0.00	0.00
AID485	0.00	0.00	0.00	0.00	0.01	0.00	0.00	10.59	0.00	0.00	0.00	0.00	0.00
AID488	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.08	0.00	0.00	0.00	0.00	0.00
AID489	0.00	0.00	0.00	0.04	0.00	0.00	0.00	59.08	0.00	0.00	0.00	0.00	0.00
AID490	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.76	0.00	0.00	0.00	0.00	0.00
AID491	0.00	0.00	0.00	0.00	0.04	0.00	0.00	17.18	0.00	0.00	0.00	0.00	0.00
AID492	0.00	0.00	0.01	0.16	0.00	0.00	0.00	87.39	0.00	0.00	0.00	0.00	0.00
AID493	0.00	0.00	0.00	0.00	0.02	0.00	0.00	95.54	0.00	0.00	0.00	0.00	0.00
AID494	0.00	0.00	0.01	0.00	0.14	0.00	0.00	81.14	0.01	0.00	0.00	0.00	0.00
AID496	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.37	0.00	0.00	0.00	0.00	0.00
AID498	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.62	0.00	0.00	0.00	0.00	0.00

AZ/NM

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID499	0.00	0.00	0.00	0.00	0.21	0.00	0.00	99.30	0.00	0.00	0.00	0.00	0.00
AID500	0.00	0.00	0.01	0.01	0.00	0.00	0.00	83.80	0.00	0.00	0.00	0.00	0.00
AID501	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.23	0.00	0.00	0.00	0.00	0.00
AID502	0.00	0.00	0.00	0.00	0.13	0.00	0.00	83.08	0.00	0.00	0.00	0.00	0.00
AID503	0.00	0.00	0.00	0.00	0.02	0.00	0.00	88.33	0.00	0.00	0.00	0.00	0.00
AID504	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.22	0.00	0.00	0.00	0.00	0.00
AID505	0.00	0.00	0.00	0.00	0.01	0.00	0.00	48.96	0.00	0.00	0.00	0.00	0.00
AID508	0.00	0.00	0.00	0.00	0.64	0.00	0.00	10.31	0.00	0.00	0.00	0.00	0.00
AID510	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.96	0.00	0.00	0.00	0.00	0.00
AID511	0.00	0.00	0.05	0.00	3.16	0.00	0.00	87.94	0.00	0.00	0.00	0.00	0.00
AID512	0.00	0.00	0.00	0.00	0.06	0.00	0.00	37.45	0.00	0.00	0.00	0.00	0.00
AID561	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.61	0.00	0.00	0.00	0.00	0.00
AID562	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.44	0.00	0.00	0.00	0.00	0.00
AID563	0.00	0.00	0.00	0.00	0.13	0.00	0.00	42.04	0.00	0.00	0.00	0.00	0.00
AID565	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.81	0.00	0.00	0.00	0.00	0.00
AID568	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.56	0.00	0.00	0.00	0.00	0.00
AID570	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.88	0.00	0.00	0.00	0.00	0.00
AID571	0.00	0.00	0.01	0.00	0.00	0.00	0.00	28.69	0.00	0.00	0.00	0.00	0.00
AID572	0.00	0.00	0.00	0.01	0.00	0.00	0.00	8.80	0.00	0.00	0.00	0.00	0.00
AID577	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	0.00	0.00	0.00	0.00	0.00
AID579	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.78	0.00	0.00	0.00	0.00	0.00
AID586	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.38	0.00	0.00	0.00	0.00	0.00
AID617	0.00	0.00	0.00	0.00	0.40	0.00	0.00	85.17	0.00	0.00	0.00	0.00	0.00
AID623	0.00	0.00	0.19	0.00	0.06	0.00	0.00	96.66	0.00	0.00	0.00	0.00	0.00
AID624	0.00	0.00	0.00	0.00	0.06	0.00	0.00	81.59	0.00	0.00	0.00	0.00	0.00
AID633	0.00	0.00	0.00	0.00	0.00	0.00	0.00	92.33	0.00	0.00	0.00	0.00	0.00
AID634	0.00	0.00	0.00	0.00	0.10	0.00	0.00	97.46	0.00	0.00	0.00	0.00	0.00
AID645	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.93	0.00	0.00	0.00	0.00	0.00
AID654	0.00	0.00	0.00	0.00	0.03	0.00	0.00	89.10	0.00	0.00	0.00	0.00	0.00
AID656	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.29	0.00	0.00	0.00	0.00	0.00
AID665	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.29	0.00	0.00	0.00	0.00	0.00
AID668	0.00	0.00	5.16	0.29	3.75	0.00	0.00	99.69	0.00	0.00	0.00	0.00	0.00
AID669	0.00	0.00	0.01	0.24	0.00	0.00	0.00	5.87	0.00	0.00	0.00	0.00	0.00
AID682	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.95	0.00	0.00	0.00	0.00	0.00
AID694	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.40	0.00	0.00	0.00	0.00	0.00
AID696	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.77	0.00	0.00	0.00	0.00	0.00
AID699	0.00	0.00	0.87	0.00	0.41	0.00	0.00	7.30	0.00	0.00	0.00	0.00	0.00
AID740	0.00	0.00	0.20	0.00	0.00	0.00	0.00	98.03	0.00	0.00	0.00	0.00	0.00
GSC018	0.00	0.72	0.00	0.04	0.00	0.00	0.00	10.33	0.00	0.00	0.00	0.00	0.00
GSC183	0.00	0.00	5.20	0.21	0.45	0.00	0.00	36.26	0.00	0.00	0.00	0.00	0.00
GSC263	0.00	0.00	1.53	3.35	0.00	0.00	0.00	14.38	0.00	0.04	0.00	0.00	0.00
GSC365	0.00	1.80	1.08	0.00	0.04	0.00	0.00	29.99	0.00	0.00	0.00	0.00	0.00
GSC409	0.00	0.83	0.13	0.05	0.00	0.00	0.00	18.71	0.00	0.00	0.00	0.00	0.00
GSC598	0.00	0.00	0.02	0.91	0.01	0.00	0.00	9.80	0.00	0.00	0.00	0.00	0.00
MAP521	0.00	0.00	0.02	0.00	0.00	0.00	0.00	13.72	0.00	0.00	0.00	0.00	0.00

ULC-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID108	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	15.56	0.00	0.00	0.00	0.00
AID146	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	68.14	0.00	0.00	0.01	0.00
AID167	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.83	0.00	0.00	0.74	0.00
AID180	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	61.34	0.00	0.00	6.16	0.00
AID207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.30	0.00	0.00	0.11	0.00
AID214	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.32	0.00	0.00	0.90	0.00
AID271	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.49	0.00	0.00	0.00	0.00
AID273	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.88	0.00	0.00	0.03	0.00
AID389	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	98.08	0.00	0.00	0.12	0.00
AID398	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.93	0.00	0.00	0.16	0.00

ULC-2

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID458	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.04	0.00	0.00	0.20	0.00
AID459	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.16	0.00	0.00	1.31	0.00
AID461	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.20	0.00	0.00	0.42	0.00
AID464	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	79.57	0.00	0.00	0.05	0.00
AID465	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	51.89	0.00	0.00	0.62	0.00
AID466	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.14	0.00	0.00	0.14	0.00
AID467	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.84	0.00	0.00	0.27	0.00
AID468	0.00	0.00	0.00	0.04	1.14	0.02	0.00	0.00	90.61	0.00	0.00	0.22	0.00
AID469	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.27	0.00	0.00	0.04	0.00
AID470	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.28	0.00	0.00	0.00	0.00
AID471	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.03	0.00	0.00	0.45	0.00
AID472	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.80	0.00	0.00	0.21	0.00
AID473	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.69	0.00	0.00	0.14	0.00
AID474	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.58	0.00	0.00	0.06	0.00
AID477	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	50.55	0.00	0.00	0.00	0.00
AID478	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.18	0.00	0.00	0.03	0.00
AID480	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.53	0.00	0.00	0.19	0.00
AID513	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	23.68	0.00	0.00	0.03	0.00
AID515	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	95.12	0.00	0.00	0.27	0.00
AID516	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	10.27	0.01	0.00	0.45	0.00
AID517	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	55.76	0.00	0.00	0.03	0.00
AID518	0.00	0.00	0.00	0.05	3.71	0.02	0.00	0.00	80.98	0.00	0.00	0.01	0.00
AID519	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	94.18	0.00	0.00	2.61	0.00
AID527	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.37	0.00	0.00	0.30	0.00
AID528	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.99	0.00	0.00	1.04	0.00
AID530	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.87	0.00	0.00	0.28	0.00
AID533	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.54	0.00	0.00	0.64	0.00
AID534	0.00	0.00	0.00	0.00	1.16	0.00	0.00	0.00	39.89	0.00	0.00	0.00	0.00
AID535	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.55	0.00	0.00	0.02	0.00
AID611	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.74	0.00	0.00	0.44	0.00
AID620	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.29	0.00	0.00	0.86	0.00
AID622	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19	0.00	0.00	0.07	0.00
AID631	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	87.97	0.00	0.00	3.55	0.00
AID643	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.50	0.00	0.00	4.79	0.00
AID647	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	22.15	0.00	0.00	0.48	0.00
AID652	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.05	0.00	0.00	2.41	0.00
AID670	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.00	0.00	0.66	0.00
AID672	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.27	0.00	0.00	0.23	0.00
AID678	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.70	0.00	0.00	0.07	0.00
AID702	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	89.14	0.00	0.00	2.45	0.00

ULC-3a

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID137	0.00	0.00	0.03	0.39	0.00	0.00	0.00	0.10	0.00	38.03	0.00	0.00	0.00
AID159	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.06	0.00	0.00	0.00
AID165	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	68.81	0.00	0.00	0.00
AID175	0.00	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	98.28	0.00	0.00	0.00
AID182	0.00	0.00	0.38	0.07	0.00	0.00	0.00	0.00	0.00	2.09	0.00	0.00	0.00
AID183	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	83.48	0.00	0.00	0.00
AID197	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	6.87	0.00	0.00	0.00
AID231	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	59.54	0.00	0.00	0.00
AID242	0.00	0.00	1.72	1.18	0.86	0.00	0.00	0.01	0.00	53.85	0.00	0.00	0.00
AID266	0.00	0.00	0.29	0.94	0.00	0.00	0.00	2.19	0.00	9.83	0.00	0.00	0.00
AID279	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	13.06	0.00	0.00	0.00
AID282	0.00	0.00	0.06	0.12	0.05	0.00	0.00	0.00	0.00	8.27	0.00	0.00	0.00
AID291	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	88.73	0.00	0.00	0.00
AID292	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.99	0.00	0.00	0.00
AID294	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.81	0.00	0.00	0.00

ULC-3a

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID295	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	64.88	0.00	0.00	0.00
AID296	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	48.13	0.00	0.00	0.00
AID298	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	99.30	0.00	0.00	0.00
AID300	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	61.51	0.00	0.00	0.00
AID301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.81	0.00	0.00	0.00
AID304	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	6.46	0.00	0.00	0.00
AID305	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	85.32	0.00	0.00	0.00
AID308	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.01	0.00	12.07	0.00	0.00	0.00
AID310	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	3.99	0.00	0.00	0.00
AID415	0.00	0.00	0.00	3.01	0.00	0.00	0.00	0.00	0.00	7.46	0.00	0.00	0.00
AID416	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	0.00	0.00	0.00
AID446	0.00	0.00	0.89	1.33	0.00	0.00	0.00	0.07	0.00	99.71	0.00	0.00	0.00
AID448	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.51	0.00	0.00	0.00
AID449	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	60.45	0.00	0.00	0.00
AID450	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	5.27	0.00	0.00	0.00
AID451	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	92.67	0.00	0.00	0.00
AID454	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.85	0.00	0.00	0.00
AID552	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	65.20	0.00	0.00	0.00
AID554	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	92.59	0.00	0.00	0.00
AID616	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	25.78	0.00	0.00	0.00
AID632	0.00	0.00	0.04	0.05	0.00	0.00	0.00	0.00	0.00	6.81	0.00	0.00	0.00
AID646	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.23	0.00	0.00	0.00
AID679	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	64.86	0.00	0.00	0.00
AID680	0.00	0.00	0.12	1.91	0.00	0.00	0.00	0.00	0.00	43.58	0.00	0.00	0.00
AID691	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.27	0.00	0.00	0.00
AID708	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	52.75	0.00	0.00	0.00
AID709	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.92	0.00	0.00	0.00
AID710	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	3.40	0.00	0.00	0.00
MAP026	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	86.68	0.00	0.00	0.00
MAP103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.63	0.00	0.00	0.00
MAP105	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	99.72	0.00	0.00	0.00
MAP108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.48	0.00	0.00	0.00
MAP113	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.46	0.00	0.00	0.00
MAP121	0.00	0.00	0.03	0.34	0.00	0.00	0.00	0.00	0.00	14.54	0.00	0.00	0.00
MAP122	0.00	0.00	1.10	0.22	0.00	0.00	0.00	0.00	0.00	81.72	0.00	0.00	0.00
MAP545	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	27.85	0.00	0.00	0.00

ULC-3b

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID559	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	97.03	0.00	0.00
AID567	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.35	0.00	0.00
AID580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.57	0.00	0.00
AID584	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.03	0.00	0.00
AID728	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	6.95	0.00	0.00
AID744	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	3.99	0.00	0.00
GSC201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.84	0.00	0.00
GSC332	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.95	0.00	0.00
GSC335	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	23.74	0.00	0.00
GSC659	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.61	0.00	0.00
MAP029	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.49	0.00	0.00
MAP036	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.66	0.00	0.00
MAP041	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.13	0.00	0.00
MAP042	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	80.03	0.00	0.00
MAP043	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.38	0.00	0.00
MAP045	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	51.06	0.00	0.00
MAP048	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.81	0.00	0.00
MAP050	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.90	0.00	0.00
MAP051	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.31	0.00	0.00

ULC-3b

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP053	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.03	0.00	0.00
MAP055	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.05	0.00	0.00
MAP056	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.30	0.00	0.00
MAP063	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	2.88	0.00	0.00
MAP074	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.76	0.00	0.00
MAP115	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	10.91	0.00	0.00
MAP125	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	99.38	0.00	0.00
MAP126	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.41	0.00	0.00
MAP213	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	76.64	0.00	0.00
MAP468	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	20.06	0.00	0.00
MAP469	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.23	0.00	0.00
MAP470	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.35	0.00	0.00
MAP471	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.28	0.00	0.00
MAP473	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.98	0.00	0.00
MAP474	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	85.67	0.00	0.00
MAP475	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.81	0.00	0.00
MAP476	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.90	0.00	0.00
MAP477	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	71.47	0.00	0.00
MAP478	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	81.85	0.00	0.00
MAP479	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.40	0.00	0.00
MAP480	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	15.75	0.00	0.00
MAP482	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.64	0.00	0.00
MAP483	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.83	0.00	0.00
MAP485	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	89.16	0.00	0.00
MAP486	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.48	0.00	0.00
MAP487	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.19	0.00	0.00
MAP499	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.67	0.00	0.00
MAP519	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	40.96	0.00	0.00
MAP526	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.04	0.00	0.00
MAP532	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.30	0.00	0.00
MAP533	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.63	0.00	0.00
MAP544	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	0.00	0.00
MAP547	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	83.07	0.00	0.00
MAP548	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.17	0.00	0.00
MAP549	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.88	0.00	0.00
MAP550	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.78	0.00	0.00
MAP554	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.52	0.00	0.00
MAP556	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	46.68	0.00	0.00
MAP557	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.69	0.00	0.00
MAP558	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	41.64	0.00	0.00
MAP560	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	90.03	0.00	0.00
MAP567	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.20	0.00	0.00
MAP570	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	78.22	0.00	0.00
MAP577	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.87	0.00	0.00
MAP580	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.37	0.00	0.00
MAP589	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.05	0.00	0.00

ULC-4

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.45	0.00
AID150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	56.63	0.00
AID168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.65	0.00
AID173	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.26	0.00
AID174	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.46	0.15
AID178	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.27	0.00
AID184	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.88	0.01
AID185	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.63	0.10

ULC-4

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID186	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.88	0.03
AID187	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.08	0.00
AID188	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.44	0.00
AID189	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.21	0.00	0.00	85.48	0.00
AID191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.71	0.00
AID192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.64	0.00
AID193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.34	0.00
AID196	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.40	0.00
AID200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	78.21	0.00
AID201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.34	0.00
AID202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.12	0.00
AID203	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.24	0.00
AID205	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.69	0.00
AID210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	5.38	0.00
AID213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.08	0.00
AID217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.00
AID218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.29	0.35
AID219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.54	0.00
AID221	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	93.17	0.00
AID272	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.73	0.00
AID275	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.35	0.00
AID409	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	22.02	0.00
AID411	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.45	0.00
AID589	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	7.66	0.77
AID592	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.72	0.02
AID593	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.42	0.00
AID595	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.14	0.00
AID596	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.68	0.00
AID597	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.71	0.01
AID599	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90.92	0.00
AID601	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	70.08	0.00
AID602	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.50	0.00
AID613	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.93	0.00	0.00	82.65	0.00
AID628	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.40	0.00
AID629	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.69	0.00
AID635	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.09	0.00
AID636	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	74.10	0.00
AID639	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.49	0.00
AID644	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.75	0.00
AID651	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.17	0.00
AID671	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.03	0.00
AID675	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	62.92	0.00
AID716	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.93	0.00
AID717	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.07	0.00
AID718	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.57	0.00
AID719	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	58.88	0.36
AID720	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.75	0.00
AID721	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	85.05	0.00
AID722	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.41	0.01
MAP109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.47	0.77
MAP112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.78	1.55
MAP117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.24	0.00
MAP123	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.84	2.98
MAP298	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	46.54	0.00
MAP330	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.49	0.00
MAP356	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.67	0.00
MAP530	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.45	0.07
MAP536	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.40	0.25
MAP592	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	46.03	0.00

SOUTH

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	93.32
MAP002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	89.74
MAP003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.63
MAP004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.90
MAP005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.10
MAP007	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	65.02
MAP008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.54
MAP009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.32
MAP010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00
MAP011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.80
MAP012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.70
MAP013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.31
MAP014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.80
MAP031	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	57.09
MAP034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	79.74
MAP037	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.89
MAP038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.88
MAP046	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	10.02
MAP047	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.99
MAP059	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
MAP061	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	65.91
MAP062	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.98
MAP067	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.94
MAP068	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.10
MAP069	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.79
MAP073	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.40
MAP075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.58	18.93
MAP076	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	78.11
MAP094	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	74.47
MAP099	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	5.46
MAP104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	5.96
MAP106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	68.89
MAP110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	50.85
MAP111	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	12.17
MAP116	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	82.07
MAP119	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	43.93
MAP124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	4.49
MAP488	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	97.12
MAP489	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	53.85
MAP490	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	76.93
MAP491	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	5.64
MAP492	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	32.15
MAP493	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	97.25
MAP494	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	88.83
MAP495	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.86
MAP496	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	45.83
MAP497	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	60.30
MAP498	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	91.15
MAP500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	96.45
MAP501	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.93
MAP502	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	85.13
MAP503	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	97.73
MAP504	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	98.34
MAP505	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.25
MAP527	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	30.60
MAP529	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	54.31
MAP535	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.47
MAP537	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.25	64.44
MAP539	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	61.40
MAP552	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	84.18
MAP575	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	56.74

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID008	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID011	0.00	0.00	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID013	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.84	0.00	0.01	0.00	0.00	0.00
AID014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID015	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID017	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID019	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID024	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00
AID030	0.00	0.00	21.88	0.19	0.02	0.00	0.00	56.38	0.00	0.03	0.00	0.00	0.00
AID035	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID037	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID039	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID043	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID045	0.00	0.00	0.00	0.00	1.38	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00
AID049	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID051	0.00	1.43	16.43	0.38	5.23	0.00	0.00	63.37	0.00	0.00	0.00	0.00	0.00
AID052	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID053	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID054	0.00	0.00	0.01	0.03	0.24	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00
AID063	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID067	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID088	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00
AID091	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID095	0.00	0.00	0.00	0.04	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.00	0.00
AID101	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
AID104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID105	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
AID106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.01	0.00
AID111	0.00	0.00	4.82	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
AID112	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID114	0.00	0.01	26.46	0.63	2.11	0.00	0.00	60.05	0.00	0.00	0.00	0.00	0.00
AID115	0.00	0.00	0.00	0.02	2.68	0.00	0.00	7.00	0.00	0.00	0.00	0.00	0.00
AID131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID143	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00
AID145	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID147	0.00	0.00	0.28	0.04	0.03	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00
AID149	0.00	0.00	15.52	0.05	0.51	0.00	0.00	98.15	0.00	0.13	0.00	0.00	0.00
AID153	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID160	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00
AID163	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00
AID166	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID170	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID171	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
AID172	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID176	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
AID177	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
AID179	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID194	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID195	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID198	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.88	0.00	0.00	7.50	0.00
AID199	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.31	0.00	0.00	18.59	0.00
AID204	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00
AID206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.61	0.00	0.00	27.86	0.00
AID208	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID209	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID212	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.84	0.00	0.00	8.63	0.00
AID215	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00
AID220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID222	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID223	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID224	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID225	0.00	0.00	11.97	0.00	0.60	0.00	0.00	96.35	0.00	0.00	0.00	0.00	0.00
AID226	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
AID227	0.00	0.00	14.99	0.32	0.04	0.00	0.00	92.78	0.00	0.27	0.00	0.00	0.00
AID230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID234	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
AID235	0.00	0.00	0.00	0.16	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID236	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID237	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID238	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID239	0.00	0.00	0.04	0.00	1.17	0.00	0.00	0.75	0.00	0.09	0.00	0.00	0.00
AID244	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID253	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00
AID254	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID259	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID262	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00
AID263	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
AID265	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID267	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID268	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID269	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
AID270	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID274	0.00	0.00	0.00	0.04	4.28	0.00	0.00	0.00	7.46	0.01	0.00	0.00	0.00
AID277	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AID278	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
AID281	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID283	0.00	0.00	0.00	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID285	0.00	0.00	23.26	0.00	0.29	0.00	0.00	90.20	0.01	0.04	0.00	0.00	0.00
AID287	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID288	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID289	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID290	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
AID293	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID297	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID303	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00
AID306	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00
AID307	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID309	0.00	0.00	0.00	0.00	0.02	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID336	0.00	0.04	0.01	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
AID337	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID338	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID339	0.01	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID340	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID341	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID342	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID343	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID344	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID346	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID347	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID348	0.00	0.00	0.22	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID349	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID351	0.00	0.00	0.01	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID352	0.00	0.00	0.16	0.00	0.02	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID353	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID354	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID355	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
AID356	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AID357	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID358	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID360	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID361	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AID362	0.00	0.00	0.12	0.00	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID363	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID365	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AID366	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00
AID367	0.00	0.00	3.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID375	0.00	0.00	0.03	0.00	0.17	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID378	0.00	16.44	13.98	0.01	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00
AID379	0.00	0.01	0.17	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
AID380	0.00	48.22	12.31	0.05	0.00	0.00	0.00	1.99	0.00	0.01	0.00	0.00	0.00
AID386	0.00	0.00	65.96	0.01	0.00	0.00	0.00	97.28	0.00	0.52	0.00	0.00	0.00
AID391	0.00	0.00	40.08	1.78	0.00	0.00	0.00	76.17	0.00	0.24	0.00	0.00	0.00
AID392	0.00	0.62	11.82	0.00	0.01	0.00	0.00	68.51	0.00	0.00	0.00	0.00	0.00
AID396	0.00	0.00	0.00	0.03	0.40	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.00
AID397	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	3.76	0.00	0.00	34.74	0.00
AID399	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
AID400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.87	0.00	0.00	4.54	0.00
AID402	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID403	0.00	0.51	5.50	0.00	0.00	0.00	0.00	32.24	0.00	0.00	0.00	0.00	0.00
AID410	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.62	0.00
AID412	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00
AID413	0.00	0.00	20.76	0.02	0.00	0.00	0.00	73.45	0.00	6.30	0.00	0.00	0.00
AID414	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID418	0.00	0.00	69.89	67.56	0.00	0.00	0.00	7.93	0.00	0.15	0.00	0.00	0.00
AID420	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID438	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID439	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID441	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID443	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID447	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID452	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
AID453	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID455	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
AID456	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID457	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.67	0.00	0.00	9.58	0.00
AID460	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
AID462	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00
AID463	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID475	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	2.13	0.00
AID476	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
AID479	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.00	0.00	0.00	0.00
AID481	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID486	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID487	0.00	0.00	12.17	0.01	0.00	0.00	0.00	79.50	0.00	0.07	0.00	0.00	0.00
AID495	0.00	0.00	38.63	0.08	0.00	0.00	0.00	32.91	0.00	0.77	0.00	0.00	0.00
AID497	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

AID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID506	0.00	0.00	0.00	0.00	0.01	0.00	0.00	1.49	0.00	0.03	0.00	0.00	0.00
AID507	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.40	0.00
AID509	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID514	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.00
AID520	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID521	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID522	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.83	0.00
AID523	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00
AID524	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID525	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID526	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
AID529	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.12	0.00
AID531	0.00	0.00	0.08	0.09	36.96	0.01	0.00	0.00	66.12	0.01	0.00	0.06	0.00
AID532	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID536	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
AID537	0.00	0.00	0.01	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID538	0.00	0.00	0.06	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID539	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
AID540	0.00	0.00	0.00	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID541	0.00	0.00	3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID545	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID546	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID547	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID548	0.00	0.00	3.11	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID549	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID550	0.00	0.00	2.97	0.00	1.66	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
AID551	0.00	0.00	4.48	0.01	0.01	3.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID553	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID555	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID556	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
AID557	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00
AID558	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
AID560	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID564	0.00	0.00	2.37	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID566	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID569	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID573	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID574	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00
AID575	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
AID576	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00
AID581	0.00	0.00	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID582	0.00	0.00	10.25	0.02	0.02	0.00	0.00	91.53	0.00	0.00	0.00	0.00	0.00
AID583	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00
AID585	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
AID587	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID590	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00
AID591	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.00
AID594	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID598	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00
AID600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93	0.00
AID603	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
AID604	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID607	0.00	0.00	0.00	0.00	0.15	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID609	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID610	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
AID612	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00
AID614	0.00	0.00	8.09	0.00	0.00	0.00	0.00	98.97	0.00	0.00	0.00	0.00	0.00
AID615	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.05	0.00	0.83	0.00	0.00	0.00
AID618	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID619	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
AID621	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
AID625	0.00	0.00	24.97	0.00	0.01	0.00	0.00	79.07	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID626	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.18	0.00
AID627	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID630	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00
AID637	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID638	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID640	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID642	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID649	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID650	0.00	0.00	0.85	0.00	1.10	0.07	0.00	1.75	7.78	0.01	0.00	0.00	0.00
AID653	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	0.00	0.00
AID655	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.01	0.00
AID658	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID659	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID660	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID661	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID662	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID663	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00	0.00	6.64	0.00
AID664	0.00	0.00	0.00	0.01	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID666	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
AID667	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID673	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
AID674	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID676	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
AID677	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID681	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
AID683	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID689	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID690	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID692	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
AID693	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
AID695	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID697	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID698	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID700	0.00	0.00	0.08	0.00	0.01	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00
AID701	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	1.72	0.00	0.00	0.32	0.00
AID703	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID706	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.12	0.00	0.00	0.15	0.00
AID707	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID713	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
AID714	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID715	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID723	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	2.48	0.01
AID724	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID725	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID726	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID727	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID729	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID730	0.00	0.00	0.00	1.26	0.00	0.00	0.00	0.01	0.00	0.36	0.00	0.00	0.00
AID731	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID732	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID733	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
AID734	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID735	0.00	0.00	22.30	3.45	0.00	0.00	0.00	60.78	0.00	0.00	0.00	0.00	0.00
AID736	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID737	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00
AID738	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
AID739	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID741	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID742	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID743	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID745	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID746	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID747	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID748	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID749	0.00	0.00	5.19	0.02	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP368	0.05	84.86	15.07	0.00	0.01	0.00	0.00	4.04	0.00	0.00	0.00	0.00	0.00
CAP369	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP370	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP377	0.00	0.00	0.03	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP381	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP382	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP383	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP386	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP390	0.00	47.70	0.02	0.00	0.00	0.00	0.00	19.75	0.00	0.00	0.00	0.00	0.00
CAP392	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP399	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP400	0.00	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP401	0.00	0.00	0.10	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP405	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
CAP406	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP407	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP415	0.00	0.00	3.60	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP417	0.00	0.00	8.72	0.00	0.00	3.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH003	0.00	0.03	0.00	0.72	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
DLH004	0.00	10.08	25.55	2.03	2.17	0.00	0.00	13.62	0.00	0.00	0.00	0.00	0.00
DLH005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH006	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH007	0.00	0.03	0.00	2.12	0.06	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00
DLH008	0.00	0.00	1.84	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH009	0.00	0.00	0.08	0.14	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
DLH010	0.00	0.01	0.00	0.15	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH012	0.00	0.00	0.52	0.00	0.02	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
DLH021	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH027	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH029	0.00	0.01	0.00	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH031	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH033	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH036	0.00	0.00	0.27	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH037	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH039	0.00	0.00	0.02	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH040	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
DLH042	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH043	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH044	0.00	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH048	0.00	0.42	0.00	0.03	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH049	0.00	13.29	2.26	0.02	16.96	0.00	0.00	1.70	0.00	0.05	0.00	0.00	0.00
DLH051	0.00	5.14	0.69	0.01	2.49	0.00	0.00	0.02	0.00	0.08	0.00	0.00	0.00
DLH053	0.00	0.05	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH054	0.00	3.08	0.20	2.70	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH056	0.00	0.25	0.00	1.02	0.01	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00
DLH058	0.00	0.99	0.01	0.11	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH059	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH061	0.00	38.02	0.00	0.08	3.28	0.00	0.00	9.17	0.00	0.00	0.00	0.00	0.00
DLH064	0.00	0.96	0.70	0.02	0.06	0.00	0.00	0.28	0.00	0.01	0.00	0.00	0.00
DLH065	0.00	0.00	1.09	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH066	0.00	4.12	0.04	0.12	0.00	0.00	0.00	3.25	0.00	0.00	0.00	0.00	0.00
DLH067	0.00	0.00	3.21	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH068	0.00	22.12	10.74	0.01	0.03	0.00	0.00	14.92	0.00	0.00	0.00	0.00	0.00
DLH069	0.00	0.00	1.23	0.00	0.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH072	0.00	0.00	0.02	0.20	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH074	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
DLH080	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH081	0.00	0.00	0.01	0.42	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH084	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH085	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH086	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH089	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
DLH093	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH094	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH096	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH097	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH099	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH107	0.00	0.00	0.13	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH108	0.00	18.20	0.00	0.01	0.31	0.00	0.00	8.77	0.00	0.00	0.00	0.00	0.00
DLH112	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH113	0.00	0.03	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH115	0.00	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH117	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH118	0.00	0.01	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH122	0.00	0.00	1.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH127	0.00	0.66	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH128	0.00	3.79	0.17	1.39	0.01	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
DLH129	0.00	1.69	0.29	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
DLH136	0.00	0.00	0.01	0.11	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH137	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH138	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH139	0.00	0.00	0.61	0.00	0.01	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00
DLH140	0.08	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH141	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC001	0.00	0.00	0.14	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC008	0.00	0.00	60.46	5.89	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
GSC009	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC011	0.00	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
GSC012	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC014	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC031	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC033	0.00	0.00	40.88	22.06	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC036	0.00	0.00	2.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC037	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC039	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC041	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC045	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC046	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC048	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC053	0.00	1.33	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC054	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC055	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC056	0.00	0.00	0.45	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC058	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC059	0.00	0.00	2.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC060	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC061	0.00	9.27	0.60	0.02	0.10	0.00	0.00	14.58	0.00	0.00	0.00	0.00	0.00
GSC062	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC065	0.00	0.00	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC067	0.00	0.00	0.44	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC073	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC076	0.00	0.00	0.17	1.90	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
GSC080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC081	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC085	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC087	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC088	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC094	0.00	0.00	1.08	0.53	0.42	0.00	0.00	3.01	0.00	0.00	0.00	0.00	0.00
GSC096	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC097	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC102	0.00	0.00	4.08	0.07	0.02	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC103	0.00	28.84	1.73	0.58	0.00	0.00	0.00	40.92	0.00	0.00	0.00	0.00	0.00
GSC108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC112	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC113	0.00	1.63	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC125	0.00	30.38	0.00	0.08	0.00	0.00	0.00	20.51	0.00	0.00	0.00	0.00	0.00
GSC128	0.01	68.43	12.92	0.04	0.00	0.00	0.00	60.12	0.00	0.00	0.00	0.00	0.00
GSC132	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC139	0.00	0.00	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC141	0.00	34.13	29.67	0.07	22.33	0.00	0.00	45.91	0.00	0.00	0.00	0.00	0.00
GSC142	0.00	2.44	6.75	0.00	0.00	0.00	0.00	1.35	0.00	0.00	0.00	0.00	0.00
GSC144	0.00	80.86	0.07	0.80	0.02	0.00	0.00	9.25	0.00	0.00	0.00	0.00	0.00
GSC147	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC148	0.00	46.98	91.84	1.07	5.55	0.00	0.00	85.62	0.00	0.02	0.00	0.00	0.00
GSC153	0.00	0.00	44.64	0.01	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC154	0.00	0.04	11.00	0.19	0.00	0.00	0.00	1.57	0.00	0.00	0.00	0.00	0.00
GSC156	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC162	0.00	0.00	0.45	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC164	0.00	0.00	1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC168	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC172	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC176	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC177	0.00	0.00	0.24	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC178	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC179	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC180	0.00	0.00	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC184	0.00	0.00	2.97	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC186	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC187	0.00	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC188	0.00	0.00	3.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC189	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC191	0.00	0.01	48.75	11.29	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00
GSC192	0.00	0.00	9.46	1.98	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00
GSC193	0.00	0.00	2.18	0.01	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC194	0.00	0.00	3.79	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC196	0.00	0.00	0.17	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC197	0.00	0.00	16.29	0.02	0.01	0.00	0.00	3.61	0.00	0.00	0.00	0.00	0.00
GSC198	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC199	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC206	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
GSC207	0.03	31.01	8.30	0.02	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	0.00
GSC210	0.00	0.00	27.92	0.00	0.04	33.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC211	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
GSC215	0.00	74.82	35.29	1.11	0.10	0.00	0.00	35.57	0.00	0.00	0.00	0.00	0.00
GSC218	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC220	0.00	8.74	0.30	0.00	0.02	0.00	0.00	23.74	0.00	0.00	0.00	0.00	0.00
GSC223	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC226	0.00	0.41	0.00	0.00	0.07	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00
GSC227	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC228	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC229	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC231	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC233	0.00	0.57	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC234	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC236	0.00	0.00	2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC239	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC249	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC252	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC253	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC254	0.00	0.00	2.93	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC256	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC257	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC260	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC264	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
GSC265	0.00	0.00	2.58	0.00	0.01	0.00	0.00	0.13	0.00	0.01	0.00	0.00	0.00
GSC266	0.00	0.00	2.48	0.00	0.00	0.00	0.00	1.28	0.00	0.02	0.00	0.00	0.00
GSC267	0.00	0.00	0.06	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC270	0.00	0.01	29.03	7.30	0.01	0.00	0.00	52.26	0.00	0.00	0.00	0.00	0.00
GSC271	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC275	0.00	0.00	0.96	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC277	0.00	0.00	0.10	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC279	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC281	0.00	0.00	86.29	0.05	0.00	0.01	0.00	36.72	0.00	0.02	0.00	0.00	0.00
GSC282	0.00	0.00	1.52	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00
GSC283	0.00	0.00	0.64	0.01	0.01	0.03	0.00	0.23	0.00	0.00	0.00	0.00	0.00
GSC284	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC285	0.00	0.00	25.87	0.01	0.01	0.01	0.00	33.11	0.00	0.02	0.00	0.00	0.00
GSC286	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC289	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC290	0.00	0.00	0.00	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC291	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC292	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC293	0.00	0.00	0.20	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC295	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC297	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC298	0.00	1.37	0.02	0.45	0.02	0.00	0.00	7.63	0.00	0.00	0.00	0.00	0.00
GSC301	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC303	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC304	0.00	95.20	1.40	0.07	0.00	0.00	0.00	38.45	0.00	0.00	0.00	0.00	0.00
GSC306	0.00	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC308	0.00	0.59	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC309	0.00	0.07	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC311	0.00	0.13	0.13	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC316	0.00	45.28	0.02	0.00	0.01	0.00	0.00	16.15	0.00	0.00	0.00	0.00	0.00
GSC317	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC319	0.00	0.00	4.19	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC324	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC325	0.00	0.00	4.32	0.05	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
GSC326	0.00	0.00	41.47	32.38	0.00	0.02	0.00	0.78	0.00	0.02	0.00	0.00	0.00
GSC327	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC329	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC334	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC337	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC338	0.00	0.08	13.09	0.66	0.00	0.00	0.00	1.92	0.00	0.00	0.00	0.00	0.00
GSC339	0.00	0.01	0.70	0.01	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00
GSC340	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC343	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC348	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC351	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00	0.00	0.00	0.00
GSC352	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
GSC355	0.00	0.00	0.96	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC357	0.00	74.98	11.17	12.55	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00
GSC358	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC359	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC366	0.09	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC367	0.00	0.05	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC369	0.01	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC377	0.00	2.31	0.13	0.37	0.54	0.00	0.00	7.61	0.00	0.00	0.00	0.00	0.00
GSC378	0.00	59.22	14.45	0.19	0.08	0.00	0.00	1.94	0.00	0.00	0.00	0.00	0.00
GSC379	0.00	0.00	2.32	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC382	0.00	76.81	0.01	0.24	0.00	0.00	0.00	17.48	0.00	0.00	0.00	0.00	0.00
GSC387	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC392	0.00	23.20	0.77	0.37	0.00	0.00	0.00	77.59	0.00	0.00	0.00	0.00	0.00
GSC394	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC397	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC410	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC412	0.00	84.99	32.49	6.02	0.00	0.00	0.00	52.33	0.00	0.08	0.00	0.00	0.00
GSC422	17.51	27.14	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC423	3.80	4.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC439	0.35	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC446	2.73	11.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC462	92.76	16.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC463	80.09	16.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC467	46.03	33.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC473	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC474	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC477	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC480	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC486	0.00	0.11	0.01	0.19	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
GSC490	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC497	0.00	0.00	0.65	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
GSC499	0.00	0.00	1.80	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC500	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC503	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC505	2.09	9.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC511	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC515	0.00	0.00	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC520	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC526	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC532	0.18	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC534	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC535	0.00	99.17	4.83	0.51	0.06	0.00	0.00	29.50	0.00	0.00	0.00	0.00	0.00
GSC541	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC542	0.00	0.00	0.56	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC543	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
GSC547	0.00	1.00	23.35	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC549	0.00	0.00	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC551	0.00	0.00	0.09	0.15	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00
GSC552	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC554	0.00	0.00	0.23	0.97	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00
GSC557	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC558	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC559	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC562	37.42	14.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC563	0.00	95.35	3.48	0.00	6.73	0.00	0.00	43.62	0.00	0.00	0.00	0.00	0.00
GSC567	0.00	1.02	0.10	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
GSC572	0.00	0.00	1.04	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC573	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC575	0.74	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC576	0.00	0.00	2.35	0.01	0.08	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
GSC577	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC581	0.00	0.00	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC583	0.00	0.43	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC585	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC586	0.00	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC587	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC594	0.00	98.99	0.00	0.00	0.00	0.00	0.00	11.67	0.00	0.00	0.00	0.00	0.00
GSC596	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC597	0.00	50.38	2.86	0.03	0.00	0.00	0.00	12.37	0.00	0.00	0.00	0.00	0.00
GSC601	0.00	98.84	0.01	0.00	0.00	0.00	0.00	17.22	0.00	0.00	0.00	0.00	0.00
GSC605	0.00	42.28	8.19	0.37	0.28	0.00	0.00	35.23	0.00	0.00	0.00	0.00	0.00
GSC610	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC612	0.00	1.53	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC614	0.00	0.00	0.93	10.76	0.04	0.00	0.00	0.51	0.00	0.08	0.00	0.00	0.00
GSC615	0.00	1.12	0.02	0.31	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC617	0.00	0.16	0.18	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC618	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC632	0.00	0.00	1.05	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC633	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
GSC635	0.00	0.00	3.61	0.00	0.10	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC636	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC642	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC647	0.00	59.09	0.35	0.00	0.00	0.00	0.00	18.29	0.00	0.00	0.00	0.00	0.00
GSC648	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC649	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC650	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC651	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC652	0.00	55.11	48.51	21.24	0.00	0.00	0.00	5.29	0.00	0.00	0.00	0.00	0.00
GSC653	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC657	0.00	0.00	1.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC658	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC660	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC661	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
MAP015	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP016	0.00	0.00	0.05	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP017	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP018	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
MAP022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP025	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	0.00	0.00	0.00
MAP027	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP028	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP032	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.23
MAP033	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP039	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP040	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
MAP044	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP049	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP052	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP057	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61
MAP058	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP060	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
MAP064	0.00	0.00	0.18	0.01	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP070	0.00	0.00	3.70	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP071	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
MAP072	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MAP077	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP078	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP079	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP080	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP081	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP082	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP083	0.00	0.00	0.32	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP084	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP085	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP086	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP087	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP088	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
MAP089	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.67	8.55
MAP090	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP091	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP092	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP093	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP095	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.64	2.22
MAP096	0.00	0.00	0.05	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
MAP097	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP098	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13	0.10
MAP100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP101	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
MAP102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP107	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP118	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.47	13.15
MAP120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP127	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.45	12.68
MAP128	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP129	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP132	0.00	0.00	44.16	0.01	0.00	0.00	0.00	14.25	0.00	0.01	0.00	0.00	0.00
MAP135	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
MAP136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP138	0.00	0.00	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP139	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP140	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP141	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP145	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP147	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP149	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP150	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP152	0.00	0.00	0.90	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP154	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
MAP155	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP157	0.00	0.00	3.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP158	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP161	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP162	0.00	0.39	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP164	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP169	0.00	0.00	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP171	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP172	0.00	0.00	0.00	0.28	0.02	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00
MAP173	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP183	0.00	0.00	2.47	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP190	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP192	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP193	0.00	0.00	15.54	83.20	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP196	0.00	0.00	0.71	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP198	0.00	0.00	1.03	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP199	0.00	0.00	0.59	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP206	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP209	0.00	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP210	0.00	0.00	2.25	0.72	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
MAP211	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP216	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP218	0.00	0.00	0.12	2.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP220	0.00	0.00	2.42	7.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP222	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP223	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP224	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP228	0.00	0.03	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP233	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP237	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP238	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP252	0.00	0.00	0.04	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP256	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP259	0.00	0.00	0.18	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP263	0.00	4.63	1.07	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP264	0.00	0.00	0.46	0.01	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00
MAP266	0.00	1.65	1.43	0.06	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
MAP267	0.00	0.00	4.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP269	0.00	0.00	0.63	0.07	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP270	0.00	0.00	0.01	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP274	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP277	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP279	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP283	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP284	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
MAP285	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP287	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP288	0.00	0.00	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP289	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP291	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP292	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP294	0.00	0.00	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP297	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.82	0.02
MAP299	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00
MAP301	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	4.00	14.68
MAP304	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
MAP306	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
MAP309	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP326	0.00	0.00	0.09	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP339	0.00	0.00	95.90	0.00	0.00	21.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP340	0.00	0.00	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP343	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP346	0.00	0.00	0.00	0.00	0.00	0.00	21.04	0.00	0.00	0.00	0.00	6.58	0.00
MAP347	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MAP350	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP353	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP359	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP363	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP365	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP366	0.00	0.00	56.64	0.00	0.00	7.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP368	0.00	0.00	68.29	0.00	0.00	37.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP369	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP370	0.00	0.00	0.07	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP373	0.00	0.00	5.56	0.00	0.00	66.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP374	0.00	0.00	49.59	0.00	0.00	53.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP377	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP380	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP383	0.00	0.00	15.78	0.00	0.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP392	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP394	0.00	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP398	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP404	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MAP407	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00
MAP420	0.00	0.00	0.00	0.00	0.00	0.00	22.25	0.00	0.00	0.00	0.00	10.01	0.36
MAP424	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP425	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00
MAP427	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP428	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP430	0.00	0.00	0.05	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP433	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP440	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP441	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP442	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP446	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.06	0.00
MAP449	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MAP450	0.00	0.00	0.00	0.00	0.01	0.00	0.78	0.00	0.00	0.00	0.00	3.65	1.25
MAP451	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP455	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
MAP456	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP464	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP465	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP472	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP481	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP484	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00
MAP506	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP507	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP508	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP509	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP515	0.00	0.00	2.51	7.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP516	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP517	0.00	0.00	1.93	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP520	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP522	0.00	0.00	15.82	27.15	0.75	0.00	0.00	0.01	0.00	0.17	0.00	0.00	0.00
MAP523	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP524	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP525	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP528	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.28	6.03
MAP531	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00
MAP534	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42	6.35
MAP538	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
MAP540	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.99	86.57
MAP541	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.07
MAP542	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.00	0.00
MAP543	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP546	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
MAP551	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.26	0.00
MAP553	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP555	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP559	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP562	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15
MAP564	0.00	0.00	17.94	9.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP568	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP569	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP571	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP578	0.00	0.00	10.10	2.78	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP579	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP582	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP583	0.00	0.00	4.23	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP586	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00
MAP593	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP594	0.00	0.00	2.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Core Unassigned

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
MAP595	0.00	0.00	0.17	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP598	0.00	0.00	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
MAP599	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table A.3. Posterior probabilities based on jackknifed Mahalanobis distances for non-core members of compositional groups EMV-1, EMV-2, PLATEAU, WEST-1, WEST-2, MM-1, and AZ/NM assigned using PCA.

Input data: PCs 1-20 accounting for 98% of total variance

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	AZ/NM
			EMV-1				
AID338	11.90	0.02	0.00	0.00	0.00	0.00	0.00
AID339	6.11	0.10	0.00	0.00	0.00	0.00	0.00
AID340	9.70	1.53	0.01	0.00	0.00	0.00	0.00
AID358	13.51	0.07	0.00	0.00	0.00	0.00	0.00
DLH021	16.78	0.04	0.00	0.00	0.00	0.00	0.00
GSC422	41.79	9.77	0.01	0.00	0.00	0.00	0.00
GSC423	5.47	1.35	0.00	0.00	0.00	0.00	0.00
GSC446	16.24	1.32	0.00	0.00	0.00	0.00	0.00
GSC462	96.80	6.86	0.01	0.00	0.00	0.00	0.00
GSC463	73.06	11.97	0.00	0.00	0.00	0.00	0.00
GSC467	68.40	10.60	0.00	0.00	0.00	0.00	0.00
GSC505	66.51	3.56	0.00	0.00	0.00	0.00	0.00
GSC526	5.21	0.00	0.00	0.00	0.00	0.00	0.00
GSC562	81.78	8.52	0.01	0.00	0.00	0.00	0.00
GSC590	59.10	1.42	0.00	0.00	0.00	0.00	0.00
GSC642	23.16	0.00	0.00	0.00	0.00	0.00	0.00
GSC650	35.02	0.00	0.00	0.00	0.00	0.00	0.00
MAP244	90.00	6.66	0.00	0.00	0.00	0.00	0.00
			EMV-2				
MAP263	0.00	37.45	0.23	0.14	0.04	0.00	0.10
GSC647	0.00	55.52	0.68	0.07	0.03	0.00	3.85
GSC594	0.00	83.05	1.09	0.07	0.01	0.00	10.52
GSC583	0.00	64.41	0.01	0.00	0.00	0.00	0.01
GSC567	0.00	17.25	0.77	0.00	0.00	0.00	0.06
GSC382	0.00	44.26	3.75	0.01	0.00	0.00	1.95
GSC378	0.01	86.62	6.95	0.00	0.00	0.00	15.69
GSC377	0.00	52.95	0.48	0.26	0.01	0.00	3.24
GSC357	0.00	73.19	11.57	0.51	0.01	0.00	1.22
GSC316	0.00	39.38	1.31	0.00	0.03	0.00	7.13
GSC304	0.00	96.40	6.24	0.14	0.28	0.00	10.61
GSC220	0.00	26.29	2.13	0.00	0.00	0.00	4.07
GSC207	0.04	52.15	5.38	0.00	0.00	0.00	4.77
GSC113	0.00	6.25	0.00	0.00	0.00	0.00	0.00
GSC053	0.00	18.35	0.00	0.02	0.00	0.00	0.00
GSC046	0.00	86.44	0.01	0.00	0.00	0.00	0.04
GSC016	0.00	9.73	0.00	0.00	0.00	0.00	0.00
DLH129	0.00	14.10	1.42	0.00	0.02	0.00	0.01
DLH127	0.00	2.76	0.00	0.00	0.00	0.00	0.00
DLH115	0.00	17.65	0.59	0.01	0.02	0.00	1.99
DLH066	0.00	15.39	0.39	0.24	0.01	0.00	0.37
DLH034	6.98	67.34	3.26	0.00	0.00	0.00	0.01
			PLATEAU				
AID019	0.00	0.00	18.02	6.73	0.03	0.00	1.29
AID163	0.00	0.00	10.47	0.00	0.10	0.00	0.00
AID367	0.00	0.00	6.29	0.02	0.00	0.00	0.00
AID375	0.00	0.00	74.04	0.00	0.00	0.17	0.00
CAP400	0.00	0.00	34.16	0.01	0.00	0.00	0.00
DLH001	0.00	0.00	34.81	0.00	0.00	0.03	0.00
DLH005	0.00	0.00	10.47	0.00	0.00	0.00	0.01
DLH006	0.00	0.00	4.17	0.00	0.00	0.00	0.00
DLH036	0.00	0.00	34.63	0.00	0.00	0.01	0.00
DLH044	0.00	0.00	88.12	0.00	0.00	0.01	0.00
DLH059	0.00	0.00	50.15	0.00	0.00	0.00	0.00
DLH065	0.00	0.00	45.70	0.00	0.00	0.00	0.00
DLH067	0.00	0.00	22.20	0.00	0.01	0.00	0.13
DLH074	0.00	0.00	38.43	0.00	0.00	0.00	0.00
DLH084	0.00	0.00	18.47	0.00	0.00	0.00	0.00
DLH107	0.00	0.00	5.21	0.00	0.00	0.01	0.00
DLH138	0.00	0.00	16.32	0.01	0.00	0.00	0.00

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	AZ/NM
GSC001	0.00	0.00	13.91	0.00	0.00	0.10	0.00
GSC008	0.00	2.34	76.93	3.53	0.00	0.00	1.37
GSC041	0.00	0.00	12.43	0.00	0.00	0.00	0.00
GSC065	0.00	0.00	34.66	0.00	0.00	0.08	0.00
GSC067	0.00	0.00	30.00	0.00	0.00	0.00	0.00
GSC102	0.00	0.00	16.92	0.01	0.00	0.00	0.00
GSC112	0.00	0.00	13.48	0.00	0.00	0.00	0.00
GSC132	0.00	0.00	7.63	0.00	0.00	0.03	0.00
GSC156	0.00	0.00	9.65	0.00	0.00	0.00	0.00
GSC162	0.00	0.00	12.40	0.02	0.00	0.00	0.00
GSC187	0.00	0.00	17.83	0.00	0.00	0.00	0.00
GSC188	0.00	0.00	15.06	0.00	0.00	0.00	0.00
GSC192	0.00	0.00	15.38	0.35	0.00	0.00	0.04
GSC193	0.00	0.00	7.08	0.00	0.00	0.02	0.00
GSC234	0.00	0.00	8.95	0.00	0.00	0.00	0.00
GSC236	0.00	0.00	47.16	0.00	0.00	0.00	0.00
GSC239	0.00	0.00	31.61	0.00	0.00	0.00	0.00
GSC254	0.00	0.05	5.40	0.00	0.00	0.00	0.70
GSC265	0.00	0.00	6.49	0.08	0.00	0.00	0.13
GSC301	0.00	0.00	10.88	0.00	0.00	0.03	0.00
GSC306	0.00	0.00	9.06	0.00	0.00	0.00	0.00
GSC311	0.00	1.23	26.28	0.10	0.17	0.00	0.41
GSC327	0.00	0.00	33.66	0.00	0.00	0.00	0.00
GSC329	0.00	0.00	60.97	0.45	0.00	0.00	0.00
GSC338	0.00	0.01	11.01	0.00	0.12	0.00	0.44
GSC497	0.00	0.00	8.59	0.00	0.00	0.00	0.00
GSC500	0.00	0.00	40.58	0.00	0.00	0.00	0.00
GSC515	0.00	0.00	7.84	0.00	0.00	0.00	0.00
GSC542	0.00	0.00	8.66	0.00	0.00	0.03	0.00
GSC557	0.00	0.00	8.46	0.00	0.00	0.00	0.00
GSC576	0.00	0.00	28.32	0.00	0.00	0.00	0.02
GSC632	0.00	0.00	5.87	0.00	0.00	0.00	0.00
GSC635	0.00	0.00	14.43	0.00	0.00	0.00	0.00
GSC657	0.00	0.00	59.32	0.00	0.00	0.00	0.00
MAP070	0.00	0.00	8.39	0.00	0.00	0.01	0.00
MAP141	0.00	0.00	10.13	0.00	0.00	0.00	0.00
MAP147	0.00	0.00	17.90	0.68	0.00	0.00	0.00
MAP152	0.00	0.12	13.32	0.05	0.00	0.00	0.00
MAP157	0.00	0.00	48.46	0.00	0.00	0.00	0.00
MAP162	0.00	1.81	36.72	0.00	0.00	0.00	2.17
MAP164	0.00	0.00	6.08	0.00	0.02	0.00	0.00
MAP171	0.00	0.00	6.51	0.01	0.00	0.00	0.20
MAP183	0.00	0.00	45.80	0.00	0.00	0.25	0.00
MAP199	0.00	0.00	20.58	0.07	0.00	0.00	0.05
MAP210	0.00	0.00	8.19	0.25	0.01	0.00	3.77
MAP220	0.00	0.00	8.21	0.20	0.00	0.00	0.00
MAP256	0.00	0.00	9.06	0.00	0.00	0.02	0.00
MAP267	0.00	0.00	31.09	0.00	0.00	0.00	0.00
MAP274	0.00	0.00	24.06	0.00	0.00	0.00	0.00
MAP282	0.00	0.02	5.68	0.41	0.00	0.00	0.12
MAP339	0.00	0.00	98.22	0.00	0.00	18.78	0.00
MAP370	0.00	0.00	12.58	0.00	0.00	0.11	0.00
MAP433	0.00	0.00	7.37	0.00	0.00	0.08	0.00
MAP579	0.00	0.00	17.73	0.00	0.00	0.00	0.14
WEST-1							
GSC094	0.00	0.00	0.08	3.92	0.00	0.00	1.86
GSC614	0.00	0.00	0.33	5.24	0.00	0.00	0.69
GSC648	0.00	0.00	0.01	75.91	0.00	0.00	0.13
MAP193	0.00	0.00	16.81	95.04	0.04	0.00	0.13
MAP515	0.00	0.00	0.66	21.79	0.08	0.00	0.00
MAP578	0.00	0.00	0.89	6.07	0.03	0.00	0.00
WEST-2							
AID037	0.00	0.00	0.00	0.00	10.81	0.00	0.00
AID045	0.00	0.00	0.00	0.00	31.06	0.00	0.00
GSC343	0.00	0.00	0.00	0.00	2.85	0.00	0.00
GSC348	0.00	0.00	0.00	0.00	38.40	0.00	0.00
MAP192	0.00	0.00	0.00	0.00	24.44	0.00	0.00

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	AZ/NM
MAP506	0.00	0.00	0.06	0.00	10.40	0.00	1.73
MM-1							
CAP376	0.00	0.00	10.17	0.00	0.00	56.08	0.00
CAP386	0.00	0.00	0.12	0.00	0.00	34.90	0.00
CAP392	0.00	0.00	0.00	0.00	0.00	8.79	0.00
MAP353	0.00	0.00	0.03	0.00	0.01	10.53	0.00
MAP363	0.00	0.00	0.00	0.00	0.00	4.94	0.00
MAP365	0.00	0.00	0.22	0.00	0.00	17.82	0.00
MAP373	0.00	0.00	0.70	0.00	0.00	69.54	0.00
MAP442	0.00	0.00	0.00	0.00	0.00	4.94	0.00
AZ/NM							
AID012	0.00	0.00	0.01	0.00	0.00	0.00	33.76
AID024	0.00	0.00	0.00	0.03	0.00	0.00	3.17
AID115	0.00	0.00	0.09	2.79	0.01	0.00	87.68
GSC339	0.00	0.00	0.68	0.11	0.00	0.00	2.76

Table A.4. Posterior probabilities based on jackknifed Mahalanobis distances for non-core members of compositional groups AZ/NM, ULC-2, ULC-3a, ULC-3b, ULC-4, MM-2, and SOUTH assigned using PCA.

Input data: PCs 1-6 accounting for 92% of total variance

ANID	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	MM-2	SOUTH
				AZ/NM			
AID095	29.32	0.00	0.28	0.00	0.00	0.00	0.00
AID225	99.93	0.00	0.00	0.00	0.00	0.00	0.00
AID392	87.53	0.00	0.00	0.00	0.00	0.00	0.00
AID403	33.30	0.00	0.00	0.00	0.00	0.00	0.00
AID481	78.99	0.00	0.00	0.00	0.00	0.00	0.00
AID487	37.23	0.00	0.00	0.00	0.00	0.00	0.00
AID582	88.82	0.00	0.00	0.00	0.00	0.00	0.00
AID625	52.58	0.00	0.00	0.00	0.00	0.00	0.00
AID667	44.62	0.00	0.00	0.00	0.00	0.00	0.00
AID698	28.71	0.00	0.00	0.00	0.00	0.00	0.00
AID735	43.73	0.00	0.00	0.00	0.00	0.00	0.00
				ULC-2			
AID110	0.00	3.81	0.00	0.13	0.13	0.00	0.00
AID176	0.00	19.95	0.00	0.00	0.00	0.00	0.00
AID236	0.00	28.60	0.00	0.01	0.00	0.00	0.00
AID274	0.00	40.75	0.00	0.00	0.08	0.00	0.00
AID457	0.00	49.91	0.00	0.01	8.02	0.00	0.00
AID460	0.00	21.67	0.00	0.07	0.74	0.00	0.00
AID475	0.00	20.32	0.00	0.07	0.35	0.00	0.00
AID520	0.00	16.10	0.00	0.00	0.02	0.00	0.00
AID522	0.00	23.51	0.00	0.05	0.02	0.00	0.00
AID531	0.05	5.77	0.94	0.00	0.05	0.00	0.00
AID701	0.00	74.74	0.00	0.01	1.72	0.00	0.00
				ULC-3a			
AID147	0.32	0.00	23.12	0.00	0.00	0.00	0.00
AID223	2.39	0.00	18.88	0.00	0.16	0.00	0.00
AID414	0.69	0.00	17.01	0.00	0.00	0.00	0.00
AID455	1.24	0.00	13.61	0.00	0.00	0.00	0.00
AID681	0.13	0.00	35.59	0.00	0.00	0.00	0.00
AID692	0.03	0.00	63.03	0.00	0.00	0.00	0.00
AID693	0.04	0.00	28.09	0.00	0.00	0.00	0.00
AID726	0.11	0.00	41.76	0.00	0.00	0.00	0.00
MAP025	0.00	0.00	17.38	0.00	0.00	0.00	0.00
MAP083	0.06	0.00	27.92	0.00	0.00	0.00	0.00
MAP084	0.99	0.00	5.27	0.00	0.54	0.00	0.00
MAP096	0.93	0.00	75.08	0.00	0.00	0.00	0.00
				ULC-3b			
AID101	0.00	0.00	0.00	6.41	0.00	0.00	0.00
AID160	0.00	0.00	0.00	58.72	0.00	0.00	0.00
AID172	0.00	0.00	0.00	4.80	0.00	0.00	0.00
AID556	0.00	0.00	0.00	59.46	0.01	0.00	0.00
AID557	0.00	0.00	0.00	15.12	0.00	0.00	0.00
AID558	0.00	0.00	0.00	3.32	0.00	0.00	0.00
AID574	0.00	0.00	0.00	10.65	0.00	0.00	0.00
AID575	0.00	0.00	0.00	13.91	0.00	0.00	0.00
AID585	0.00	0.01	0.00	28.50	0.14	0.00	0.00
AID733	0.00	0.00	0.00	72.02	0.00	0.00	0.00
AID736	0.00	0.00	0.00	73.45	0.00	0.00	0.00
AID737	0.00	0.00	0.00	13.51	0.00	0.00	0.00
AID738	0.00	0.00	0.00	45.91	0.02	0.00	0.00
AID739	0.00	0.00	0.00	75.08	0.00	0.00	0.00
AID746	0.00	0.00	0.00	56.92	0.00	0.00	0.00
AID747	0.00	0.00	0.00	35.23	0.00	0.00	0.00
MAP039	0.00	0.00	0.00	5.45	0.00	0.00	0.00
MAP049	0.00	0.00	0.00	4.01	0.00	0.00	0.00
MAP060	0.00	0.00	0.00	22.31	0.00	0.00	0.00
MAP484	0.00	0.00	0.00	92.01	0.00	0.00	0.00
MAP542	0.00	0.00	0.00	12.68	0.00	0.00	0.00

ANID	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	MM-2	SOUTH
MAP543	0.00	0.00	0.00	6.17	0.00	0.00	0.00
MAP546	0.00	0.00	0.00	2.97	0.00	0.00	0.00
MAP553	0.00	0.06	0.00	34.46	0.03	0.00	0.00
ULC-4							
AID171	0.00	0.00	0.00	0.04	14.59	0.00	0.00
AID190	0.00	0.00	0.01	0.00	30.99	0.00	0.00
AID216	0.00	0.00	0.00	0.00	15.24	0.00	0.00
AID269	0.00	0.00	0.00	0.00	42.97	0.00	0.00
AID278	0.00	0.15	0.00	0.00	31.91	0.00	0.00
AID290	0.00	0.09	0.00	0.00	29.58	0.00	0.00
AID303	0.00	0.00	0.08	0.00	9.23	0.00	0.00
AID306	0.00	0.00	0.03	0.00	9.66	0.00	0.00
AID396	0.00	1.46	0.00	0.00	27.17	0.00	0.00
AID400	0.00	3.23	0.00	0.01	70.03	0.00	0.00
AID410	0.00	0.02	0.00	0.00	21.72	0.00	0.00
AID412	0.00	0.00	0.00	0.00	33.02	0.00	0.00
AID462	0.00	0.00	0.00	0.00	49.34	0.00	0.16
AID476	0.00	0.00	0.00	0.00	94.10	0.00	0.00
AID507	0.00	0.00	0.00	0.00	30.45	0.00	0.00
AID529	0.00	0.00	0.00	0.00	22.60	0.00	0.00
AID590	0.00	0.00	0.00	0.00	10.14	0.00	0.00
AID594	0.00	0.00	0.00	0.00	61.50	0.00	0.00
AID612	0.00	0.04	0.00	0.00	38.66	0.00	0.00
AID640	0.01	0.00	0.05	0.00	2.76	0.00	0.00
AID662	0.00	0.00	0.00	0.04	18.46	0.00	0.00
AID666	0.02	0.00	0.00	0.00	17.46	0.00	0.00
AID673	0.00	1.42	0.00	0.01	39.97	0.00	0.00
AID713	0.00	0.00	0.00	0.00	34.25	0.00	0.00
MAP098	0.00	0.00	0.00	0.00	44.63	0.01	2.33
MAP120	0.00	0.00	0.00	0.00	38.90	0.00	0.87
MAP127	0.00	0.00	0.00	0.00	84.51	0.79	10.68
MAP301	0.00	0.00	0.00	0.00	19.68	3.43	0.26
MAP352	0.00	0.00	0.00	0.00	3.46	0.04	0.00
MAP456	0.00	0.00	0.00	0.00	73.02	0.00	0.00
MAP531	0.00	0.00	0.00	0.00	7.49	0.00	0.80
MAP534	0.00	0.00	0.00	0.00	50.49	0.04	10.65
MAP538	0.00	0.00	0.00	0.00	28.09	0.00	6.21
MAP551	0.00	0.00	0.00	0.00	85.76	0.00	0.00
MM-2							
MAP032	0.00	0.00	0.00	0.00	0.63	3.97	0.25
MAP304	0.00	0.00	0.00	0.00	0.11	19.78	0.33
MAP306	0.00	0.00	0.00	0.00	0.02	91.10	1.77
MAP347	0.00	0.00	0.00	0.00	0.00	7.17	0.01
MAP350	0.00	0.00	0.00	0.00	0.00	89.60	0.73
MAP359	0.00	0.00	0.00	0.00	0.14	30.56	6.43
MAP404	0.00	0.00	0.00	0.00	0.00	5.83	0.01
MAP420	0.00	0.00	0.00	0.00	0.52	94.48	5.56
MAP424	0.00	0.00	0.00	0.00	0.00	16.54	0.00
MAP446	0.00	0.00	0.00	0.00	0.11	85.45	3.20
MAP449	0.00	0.00	0.00	0.00	0.00	9.28	0.00
MAP450	0.00	0.00	0.00	0.00	8.19	82.10	0.62
MAP451	0.00	0.00	0.00	0.00	1.22	75.07	11.42
MAP455	0.00	0.00	0.00	0.00	0.00	36.01	0.56
SOUTH							
AID104	0.00	0.00	0.00	0.00	0.66	0.00	43.39
AID598	0.00	0.00	0.00	0.00	3.09	2.95	48.07
MAP006	0.00	0.00	0.00	0.00	3.76	0.00	42.59
MAP088	0.00	0.00	0.00	0.00	0.54	1.67	55.82
MAP095	0.00	0.00	0.00	0.00	13.17	2.16	95.01
MAP528	0.00	0.00	0.00	0.00	1.76	1.71	43.00
MAP540	0.00	0.00	0.00	0.00	15.18	0.23	86.91
MAP541	0.00	0.00	0.00	0.00	0.53	0.00	36.46

Table A.5. Posterior probabilities based on jackknifed Mahalanobis distances for non-core members of all 13 core compositional groups assigned using canonical discriminant functions.

Input data: CDs 1-12

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
EMV-1													
AID342	5.12	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID361	5.65	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID750	9.13	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH093	20.77	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC060	11.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC080	80.16	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC081	12.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC366	29.54	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC369	40.63	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC394	62.46	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC397	5.97	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC651	67.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EMV-2													
AID336	0.01	13.26	0.01	0.24	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
AID355	0.02	12.21	0.03	0.02	0.01	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00
AID356	0.16	11.25	0.04	0.04	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00
AID378	0.00	41.09	0.91	0.01	0.09	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00
AID379	0.00	3.17	0.03	0.04	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
AID380	0.00	55.26	8.79	0.02	0.08	0.00	0.00	5.57	0.00	0.00	0.00	0.00	0.00
DLH009	0.00	56.29	0.03	0.17	0.00	0.00	0.00	5.44	0.00	0.00	0.00	0.00	0.00
DLH027	2.12	72.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH061	0.00	73.59	0.29	0.30	0.02	0.00	0.00	8.06	0.00	0.00	0.00	0.00	0.00
GSC055	0.00	6.42	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC144	0.00	83.82	1.08	0.43	0.00	0.00	0.00	3.21	0.00	0.00	0.00	0.00	0.00
GSC367	0.00	5.88	0.43	0.02	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00
GSC486	0.02	3.28	0.37	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC596	0.00	36.08	0.03	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00
GSC601	0.00	88.39	0.08	0.66	0.00	0.00	0.00	7.82	0.00	0.00	0.00	0.00	0.00
GSC618	4.91	32.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC653	0.00	25.47	0.11	0.15	0.01	0.00	0.00	1.26	0.00	0.00	0.00	0.00	0.00
MAP266	0.00	26.97	0.70	0.19	0.02	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00
PLATEAU													
AID341	0.00	0.00	9.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID346	0.00	0.00	9.18	0.00	0.39	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID349	0.00	0.00	92.84	0.00	0.28	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID351	0.00	0.00	16.62	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID352	0.00	0.00	84.26	0.00	0.01	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID353	0.00	0.00	10.55	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID354	0.00	0.00	81.70	0.01	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID366	0.00	0.00	7.45	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP406	0.00	0.00	7.33	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
DLH008	0.00	0.00	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC164	0.00	0.00	47.25	0.00	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC177	0.00	0.00	8.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC229	0.00	0.00	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC271	0.00	0.00	22.36	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC293	0.00	0.00	38.85	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC297	0.00	0.00	24.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC319	0.00	0.00	66.23	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC358	0.00	0.00	14.61	0.00	0.00	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC379	0.00	0.00	30.40	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC499	0.00	0.00	7.93	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC573	0.00	0.00	17.08	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GSC577	0.00	0.00	26.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GSC633	0.00	0.00	47.40	0.00	4.51	0.29	0.00	0.01	0.00	0.00	0.00	0.00	0.00

ANID	**EMV-1**	**EMV-2**	**PLAT**	**WEST-1**	**WEST-2**	**MM-1**	**MM-2**	**AZ/NM**	**ULC-2**	**ULC-3a**	**ULC-3b**	**ULC-4**	**SOUTH**
MAP017	0.00	0.00	5.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP190	0.00	0.00	10.98	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP209	0.00	0.00	6.21	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP237	0.00	0.00	53.86	1.05	0.12	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
MAP270	0.00	0.00	20.29	0.22	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
MAP288	0.00	0.00	16.16	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP291	0.00	0.00	6.83	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP294	0.00	0.00	16.98	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP380	0.00	0.00	29.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP427	0.00	0.00	16.08	0.00	0.01	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00
MAP594	0.00	0.00	20.21	0.40	0.00	0.00	0.00	0.32	0.00	1.35	0.00	0.00	0.00
MAP595	0.00	0.00	20.02	0.02	0.01	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00
						WEST-1							
MAP172	0.00	0.00	0.00	26.42	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
MAP198	0.00	0.00	2.30	87.83	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.00
MAP522	0.00	0.00	5.32	61.72	0.90	0.00	0.00	0.75	0.00	8.65	0.00	0.00	0.00
						WEST-2							
AID008	0.00	0.00	0.00	0.00	20.87	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.00
AID054	0.00	0.00	1.15	0.01	11.18	0.00	0.00	1.98	0.00	0.00	0.00	0.00	0.00
AID650	0.00	0.00	0.09	0.00	23.86	0.00	0.00	2.55	0.06	0.00	0.00	0.01	0.00
MAP508	0.00	0.00	0.00	0.00	27.79	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
						MM-1							
CAP401	0.00	0.00	0.34	0.00	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAP417	0.00	0.00	1.00	0.00	0.00	9.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP398	0.00	0.00	0.00	0.00	0.00	16.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAP593	0.00	0.00	1.21	0.00	0.03	10.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
						MM-2							
MAP033	0.00	0.00	0.00	0.00	0.00	0.00	28.92	0.00	0.00	0.00	0.00	0.00	0.00
MAP303	0.00	0.00	0.00	0.00	0.00	0.00	24.42	0.00	0.00	0.00	0.00	0.02	0.02
MAP307	0.00	0.00	0.00	0.00	0.00	0.00	17.14	0.00	0.00	0.00	0.00	0.43	0.03
MAP331	0.00	0.00	0.00	0.00	0.00	0.00	34.52	0.00	0.00	0.00	0.00	0.52	0.09
MAP346	0.00	0.00	0.00	0.00	0.00	0.00	89.67	0.00	0.00	0.00	0.00	2.15	0.83
MAP351	0.00	0.00	0.00	0.00	0.00	0.00	79.46	0.00	0.00	0.00	0.00	1.29	0.29
MAP357	0.00	0.00	0.00	0.00	0.00	0.00	32.65	0.00	0.00	0.00	0.00	1.45	0.18
MAP407	0.00	0.00	0.00	0.00	0.00	0.00	3.98	0.00	0.00	0.00	0.00	0.00	0.00
MAP562	0.00	0.00	0.00	0.00	0.00	0.00	3.99	0.00	0.00	0.00	0.00	0.03	0.71
MAP586	0.00	0.00	0.00	0.00	0.00	0.00	24.90	0.00	0.00	0.00	0.00	0.00	0.01
						AZ/NM							
AID011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.78	0.00	0.00	0.00	0.00	0.00
AID015	0.00	0.00	0.23	0.01	0.18	0.00	0.00	12.80	0.00	0.00	0.00	0.00	0.00
AID021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.53	0.00	0.00	0.00	0.00	0.00
AID049	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.25	0.00	0.00	0.00	0.00	0.00
AID088	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.95	0.00	0.00	0.00	0.00	0.00
AID226	0.00	0.00	0.93	0.00	0.00	0.00	0.00	40.13	0.00	0.00	0.00	0.00	0.00
AID253	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.43	0.00	0.00	0.00	0.00	0.00
AID262	0.00	0.00	0.12	0.49	0.00	0.00	0.00	45.97	0.00	0.00	0.00	0.00	0.00
AID263	0.00	0.00	0.02	0.00	0.00	0.00	0.00	6.50	0.00	0.00	0.00	0.00	0.00
AID268	0.00	0.00	0.00	0.03	0.00	0.00	0.00	4.84	0.00	0.00	0.00	0.00	0.00
AID386	0.00	0.00	3.90	0.08	0.07	0.00	0.00	59.99	0.00	0.30	0.00	0.00	0.00
AID576	0.00	0.00	0.00	0.10	0.00	0.00	0.00	28.84	0.00	0.00	0.00	0.00	0.00
AID614	0.00	0.00	0.80	0.00	0.07	0.00	0.00	76.38	0.00	0.00	0.00	0.00	0.00
DLH089	0.00	0.00	0.00	0.07	0.00	0.00	0.00	8.50	0.00	0.00	0.00	0.00	0.00
						ULC-2							
AID177	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.16	0.00	0.00	0.07	0.00
AID514	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	3.90	0.00	0.00	0.09	0.00
AID655	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	10.35	0.00	0.00	0.02	0.00
AID706	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	43.81	0.00	0.00	0.15	0.00

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
						ULC-3a							
GSC206	0.00	0.00	0.02	0.01	0.10	0.00	0.00	0.10	0.00	28.81	0.00	0.00	0.00
GSC211	0.00	0.00	0.17	0.00	0.03	0.00	0.00	0.30	0.00	36.58	0.00	0.00	0.00
						ULC-3b							
MAP081	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.98	0.00	0.00
						ULC-4							
AID206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	29.42	0.00
AID224	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.91	0.00
AID591	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.91	0.00
AID627	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.87	0.00
AID660	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	2.28	0.00
						SOUTH							
AID723	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00	0.00	0.00	6.23	55.07
MAP022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	5.38
MAP071	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.37

Table A.6. Posterior probabilities based on jackknifed Mahalanobis distances for the PB and CEB sub-groups of the PLATEAU core compositional group.

Input data: 32 log-transformed elements

				PB				
ANID	**PB**	**CEB**	**ANID**	**PB**	**CEB**	**ANID**	**PB**	**CEB**
AID113	37.96	0.06	DLH077	84.94	4.02	GSC182	53.29	0.01
AID116	61.90	0.09	DLH078	86.62	0.33	GSC185	30.18	0.00
AID117	97.12	4.55	DLH079	77.72	0.50	GSC187	4.42	2.93
AID118	56.80	0.06	DLH082	99.53	1.16	GSC188	21.26	0.00
AID120	12.20	0.01	DLH083	72.96	3.36	GSC200	30.48	0.00
AID121	43.04	0.05	DLH087	35.32	0.03	GSC209	11.72	0.03
AID122	76.81	0.03	DLH088	53.87	1.04	GSC235	21.53	2.09
AID123	10.93	0.08	DLH095	93.19	0.31	GSC236	21.03	0.01
AID124	33.93	0.01	DLH098	23.47	1.00	GSC238	8.29	0.00
AID125	12.90	0.09	DLH100	81.97	8.64	GSC239	3.65	0.00
AID126	17.24	0.07	DLH102	97.97	0.00	GSC242	50.49	0.00
AID127	75.62	0.08	DLH110	26.79	0.00	GSC244	35.95	3.14
AID128	65.02	0.00	DLH116	55.98	17.61	GSC247	90.12	0.02
AID129	77.47	0.03	DLH119	50.41	0.00	GSC265	1.46	0.01
AID130	87.50	0.71	DLH120	73.35	0.80	GSC268	44.84	0.01
AID132	51.25	0.13	DLH123	69.97	0.00	GSC272	24.28	2.49
AID133	81.31	0.07	DLH124	59.74	0.00	GSC276	13.57	0.00
AID135	59.71	4.06	DLH125	94.76	0.03	GSC288	91.91	0.05
AID240	29.30	2.49	DLH126	15.13	0.00	GSC294	97.75	0.01
AID345	52.81	0.04	DLH133	89.10	7.56	GSC296	88.31	0.06
AID367	3.42	0.03	DLH138	2.93	0.00	GSC299	91.75	0.37
AID368	48.49	0.63	GSC002	72.18	1.75	GSC301	6.00	0.00
AID369	86.78	0.00	GSC004	97.33	0.30	GSC305	22.11	0.30
AID370	51.58	0.00	GSC005	21.14	0.02	GSC306	6.53	0.00
AID371	75.19	0.03	GSC010	98.72	0.88	GSC307	51.30	0.00
AID373	99.31	0.20	GSC015	77.56	0.01	GSC314	23.85	0.00
AID374	55.87	0.07	GSC032	28.03	0.18	GSC319	10.76	0.00
AID377	34.86	10.87	GSC040	82.61	5.05	GSC320	19.70	0.01
AID381	63.74	0.04	GSC042	72.17	0.09	GSC323	31.10	0.22
AID382	20.46	0.40	GSC043	86.40	0.00	GSC328	87.99	1.75
AID383	98.79	2.34	GSC044	19.88	0.08	GSC330	13.96	1.78
AID578	28.64	0.51	GSC064	75.09	1.25	GSC331	69.68	26.78
CAP367	26.30	0.10	GSC065	14.52	0.00	GSC333	77.95	1.43
CAP372	42.34	0.00	GSC068	99.67	0.35	GSC336	42.98	0.00
CAP374	79.51	0.00	GSC069	100.00	0.54	GSC347	8.04	0.79
CAP375	91.02	8.43	GSC070	89.94	0.07	GSC354	20.22	0.13
CAP384	58.76	0.86	GSC071	63.40	0.00	GSC360	63.32	0.00
CAP385	71.03	0.71	GSC072	22.45	0.31	GSC370	85.86	1.49
CAP387	61.20	0.00	GSC074	98.58	5.07	GSC375	5.06	0.76
CAP388	75.45	0.00	GSC075	10.59	1.02	GSC376	48.85	0.07
CAP389	95.25	0.18	GSC082	29.08	0.00	GSC379	2.07	0.41
CAP391	63.30	0.02	GSC091	10.68	0.78	GSC381	88.29	0.61
CAP393	83.03	19.83	GSC092	23.59	6.84	GSC393	38.03	0.00
CAP395	72.63	0.77	GSC100	60.52	0.14	GSC395	66.69	4.36
CAP412	70.62	21.39	GSC104	84.83	0.00	GSC399	10.73	0.20
CAP414	30.58	0.27	GSC115	52.65	0.00	GSC413	27.82	0.00
DLH011	48.22	0.14	GSC119	34.47	0.00	GSC488	24.63	0.16
DLH036	4.11	0.00	GSC122	34.82	0.00	GSC491	96.43	0.27
DLH041	38.78	3.14	GSC159	10.32	0.10	GSC493	74.33	0.07
DLH050	6.02	0.01	GSC161	32.96	0.00	GSC494	52.35	0.00
DLH052	33.55	1.30	GSC163	24.25	0.00	GSC497	3.35	0.00
DLH055	13.90	0.23	GSC164	6.57	0.00	GSC499	7.76	1.25
DLH057	34.51	0.00	GSC165	48.99	0.00	GSC500	8.74	0.29
DLH062	34.70	2.94	GSC166	97.31	0.01	GSC502	72.10	0.12
DLH063	25.34	0.67	GSC167	84.11	0.01	GSC514	36.03	0.05
DLH065	10.44	2.89	GSC169	46.06	0.52	GSC515	6.02	0.01
DLH067	2.43	1.45	GSC170	39.13	0.00	GSC516	38.98	0.01
DLH071	79.03	2.26	GSC171	98.26	0.00	GSC517	4.97	0.03
DLH073	87.46	6.16	GSC173	69.75	0.99	GSC566	37.52	3.27
DLH075	95.93	1.83	GSC175	15.55	0.00	GSC568	32.39	0.10
DLH076	30.20	5.55	GSC181	74.30	0.00	GSC570	99.39	0.00

ANID	PB	CEB
GSC571	84.97	0.08
GSC578	26.88	0.00
GSC602	67.25	0.02
GSC627	99.76	7.56
GSC628	65.59	1.77
GSC630	31.41	1.32
GSC632	7.08	0.03
GSC633	5.90	0.01
GSC635	4.23	0.00
GSC637	40.21	0.00
GSC639	97.62	0.00
GSC657	7.75	0.01
MAP019	77.83	0.00
MAP021	43.81	0.09
MAP023	26.69	0.20
MAP054	46.83	0.74
MAP065	63.89	0.00
MAP066	92.29	0.00
MAP070	7.05	0.15
MAP130	17.31	0.00
MAP133	73.31	0.01
MAP148	68.60	0.09
MAP151	29.14	0.14
MAP157	6.99	0.34
MAP164	3.73	0.03
MAP165	65.35	0.04
MAP170	78.26	0.17
MAP171	5.76	0.13
MAP175	65.83	0.86
MAP183	17.91	0.00
MAP187	75.96	7.09
MAP195	72.90	0.38
MAP200	72.03	0.23
MAP201	95.77	0.01
MAP203	97.22	13.45
MAP209	4.17	0.21
MAP210	5.05	0.00
MAP215	93.51	9.85
MAP225	34.00	0.57
MAP226	18.07	0.17
MAP229	10.57	0.37
MAP230	37.11	0.15
MAP231	31.40	0.00
MAP234	12.19	0.02
MAP239	40.44	1.26
MAP241	35.00	0.33
MAP245	89.48	0.00
MAP246	99.37	0.02
MAP248	93.56	0.54
MAP257	96.12	0.08
MAP258	86.40	0.14
MAP265	50.84	0.31
MAP267	24.15	0.00
MAP268	14.92	0.24
MAP272	87.60	0.75
MAP273	97.37	0.66
MAP275	62.19	0.04
MAP276	68.32	6.78
MAP278	31.67	0.04
MAP280	81.74	0.01
MAP281	53.98	0.00
MAP286	80.83	0.02
MAP290	31.06	0.02
MAP294	2.30	0.00
MAP295	92.69	2.25
MAP311	91.98	6.76
MAP312	38.73	0.00

ANID	PB	CEB
MAP316	8.04	0.00
MAP317	98.66	0.01
MAP318	12.98	0.58
MAP319	10.21	0.30
MAP322	75.47	0.28
MAP323	55.57	0.10
MAP324	99.48	0.85
MAP336	59.86	0.00
MAP337	56.71	0.14
MAP338	55.79	2.24
MAP339	98.47	0.00
MAP341	35.16	0.68
MAP342	92.98	0.23
MAP344	27.01	0.01
MAP345	83.79	1.85
MAP362	13.22	0.00
MAP367	30.48	0.00
MAP370	3.69	0.01
MAP371	58.02	1.67
MAP376	14.80	0.00
MAP386	53.56	0.05
MAP387	26.25	0.00
MAP431	50.17	0.00
MAP432	51.22	0.28
MAP433	2.26	0.95
MAP438	30.82	0.46
MAP518	21.04	1.60
MAP561	22.90	0.03
MAP563	20.99	0.26

ANID	CEB PB	CEB
CAP397	0.00	91.52
CAP400	0.00	25.98
CAP403	0.00	35.93
CAP406	0.00	53.62
CAP408	0.01	41.42
CAP409	1.90	50.50
CAP410	0.00	93.71
CAP413	0.00	91.42
CAP418	0.04	91.63
CAP421	0.00	35.86
CAP422	0.00	34.99
GSC024	0.00	70.78
GSC050	0.73	45.58
GSC052	0.00	57.26
GSC077	0.00	26.90
GSC079	0.00	70.35
GSC155	0.01	78.02
GSC222	0.00	62.78
GSC224	0.00	62.79
GSC250	2.80	76.85
GSC251	0.11	23.75
GSC254	0.00	6.08
GSC255	0.00	44.13
GSC258	1.08	81.79
GSC259	0.51	66.71
GSC261	0.01	98.21
GSC262	0.01	85.29
GSC321	0.00	35.40
GSC447	0.00	23.85
GSC470	0.00	53.17
GSC557	0.00	9.17
GSC613	0.02	42.47
GSC619	0.00	28.34
MAP220	0.00	36.09

ANID	PB	CEB
MAP255	6.51	16.03
MAP256	0.06	22.83
MAP271	0.16	51.86
MAP300	0.00	42.87
MAP579	0.18	6.25

Table A.7. Posterior probabilities based on jackknifed Mahalanobis distances for the non-core members of the PB and CEB sub-groups of the PLATEAU core compositional group.

Input data: PCs 1-12 accounting for 93% of total variance

PB

ANID	PB	CEB
AID163	21.77	0.79
AID346	76.52	6.10
AID352	88.57	2.39
AID354	26.30	0.03
AID375	96.05	2.85
DLH044	77.11	0.20
DLH059	35.99	0.04
DLH074	22.10	0.01
DLH084	8.50	0.01
DLH107	18.27	0.01
GSC001	28.60	0.05
GSC101	11.35	0.17
GSC102	38.23	0.05
GSC132	55.79	0.03
GSC193	90.98	1.20
GSC240	56.94	1.26
GSC271	93.70	2.67
GSC297	14.09	0.03
GSC329	58.80	0.84
GSC358	51.05	7.59
GSC573	1.38	0.11
MAP141	30.50	0.07
MAP147	8.34	0.30
MAP190	61.33	0.11
MAP199	30.12	0.30
MAP270	3.39	0.00
MAP274	62.98	1.00
MAP291	15.90	0.63
MAP321	28.86	0.07
MAP380	9.05	0.10

CEB

ANID	PB	CEB
GSC192	0.02	38.09
GSC545	0.02	7.18
MAP159	0.93	44.47
MAP162	0.07	24.60
MAP208	1.10	55.46
MAP282	0.01	18.09
MAP587	0.26	23.33

PLATEAU - not assigned to core sub-group

ANID	PB	CEB
AID019	0.16	44.57
AID119	14.37	9.80
AID134	0.62	1.32
AID341	1.39	3.51
AID349	98.99	0.28
AID351	26.38	0.14
AID353	78.11	2.69
AID366	25.55	18.78
CAP404	38.86	6.71
CAP411	20.45	12.08
CAP416	59.83	8.84

ANID	PB	CEB
DLH001	46.35	2.00
DLH005	29.54	45.87
DLH006	10.63	1.61
DLH008	10.29	0.01
DLH090	16.98	4.08
DLH134	21.77	17.42
DLH135	4.47	17.56
GSC013	1.74	11.82
GSC041	24.55	0.33
GSC067	35.64	37.58
GSC112	37.61	0.50
GSC151	12.73	4.25
GSC156	11.81	0.26
GSC162	14.41	2.60
GSC177	3.29	0.22
GSC219	40.11	68.55
GSC229	0.03	0.00
GSC234	0.01	1.27
GSC269	6.55	4.84
GSC274	8.29	27.05
GSC278	0.72	28.40
GSC280	3.45	52.93
GSC311	4.34	8.73
GSC327	24.37	0.05
GSC338	0.21	0.20
GSC512	66.74	7.83
GSC533	56.64	20.41
GSC542	8.21	3.33
GSC569	17.01	15.79
GSC576	32.30	8.39
GSC577	1.19	0.01
MAP017	0.14	0.00
MAP152	0.01	0.82
MAP204	25.89	4.64
MAP237	65.82	0.41
MAP253	4.17	6.92
MAP288	2.53	0.33
MAP427	0.10	0.95
MAP512	23.75	1.78
MAP594	0.31	0.37
MAP595	0.03	0.30

Table A.8. Posterior probabilities based on jackknifed Mahalanobis distances for core and non-core members of the PB, CEB, and P-EMV sub-groups of the PLATEAU compositional group.

Input data: CDs 1-2

ANID	PB	CEB	P-EMV
	PB		
AID113	44.01	0.00	0.00
AID116	23.53	0.00	0.00
AID117	73.11	0.00	0.00
AID118	15.64	0.00	0.00
AID120	48.52	0.01	0.01
AID121	1.03	0.00	0.00
AID122	48.32	0.00	0.00
AID123	3.82	0.93	0.04
AID124	0.71	0.00	0.00
AID125	51.79	0.01	0.00
AID126	77.13	0.00	0.00
AID127	44.91	0.02	0.01
AID128	42.06	0.00	0.00
AID129	81.08	0.00	0.00
AID130	77.35	0.00	0.00
AID132	35.65	0.02	0.01
AID133	32.44	0.02	0.00
AID135	83.81	0.03	0.01
AID240	11.38	0.41	0.01
AID345	50.51	0.00	0.00
AID367	9.77	0.00	0.00
AID368	33.22	0.00	0.00
AID369	7.81	0.00	0.00
AID370	43.69	0.01	0.01
AID371	56.58	0.00	0.00
AID373	30.97	0.00	0.00
AID374	61.52	0.04	0.01
AID377	9.32	0.00	0.00
AID381	74.75	0.02	0.01
AID382	68.54	0.01	0.01
AID383	70.53	0.00	0.00
AID578	33.16	0.24	0.01
CAP367	73.63	0.04	0.01
CAP372	82.54	0.01	0.01
CAP374	49.06	0.01	0.01
CAP375	64.37	0.02	0.01
CAP384	4.30	0.00	0.00
CAP385	34.07	0.17	0.01
CAP387	87.94	0.00	0.00
CAP388	54.41	0.00	0.00
CAP389	86.46	0.00	0.00
CAP391	35.11	0.00	0.00
CAP393	90.11	0.02	0.00
CAP395	62.70	0.07	0.01
CAP412	3.74	1.81	0.03
CAP414	46.06	0.00	0.00
DLH002	47.99	0.02	0.01
DLH011	49.39	0.04	0.01
DLH036	58.66	0.00	0.00
DLH041	91.70	0.00	0.00
DLH050	0.33	0.08	0.00
DLH052	5.18	0.00	0.00
DLH055	23.63	0.01	0.00
DLH057	22.53	0.00	0.00
DLH062	88.00	0.00	0.00
DLH063	9.65	0.42	0.01
	PB		
DLH065	58.40	0.00	0.00
DLH067	50.01	0.03	0.01
DLH071	91.88	0.01	0.00
DLH073	17.05	0.01	0.01
DLH075	79.63	0.01	0.00
DLH076	11.07	0.00	0.00
DLH077	11.47	0.05	0.00
DLH078	91.21	0.00	0.00
DLH079	84.72	0.02	0.01
DLH082	83.66	0.00	0.00
DLH083	64.36	0.00	0.00
DLH087	34.65	0.22	0.01
DLH088	4.42	1.79	0.02
DLH095	48.44	0.01	0.01
DLH098	9.56	0.06	0.00
DLH100	69.33	0.00	0.00
DLH102	84.05	0.01	0.00
DLH110	15.05	0.00	0.00
DLH116	21.92	0.02	0.01
DLH119	96.03	0.01	0.01
DLH120	18.43	0.48	0.01
DLH123	70.82	0.00	0.00
DLH124	6.89	1.21	0.02
DLH125	65.81	0.03	0.00
DLH126	38.83	0.13	0.01
DLH133	76.21	0.00	0.00
DLH138	4.70	0.75	0.04
GSC002	22.11	0.14	0.01
GSC004	94.35	0.01	0.00
GSC005	27.83	0.00	0.00
GSC010	24.36	0.00	0.00
GSC015	8.65	0.00	0.00
GSC032	60.35	0.07	0.01
GSC040	97.14	0.01	0.01
GSC042	25.06	0.15	0.02
GSC043	28.70	0.02	0.01
GSC044	25.71	0.01	0.01
GSC064	76.79	0.00	0.00
GSC065	59.66	0.00	0.00
GSC068	35.77	0.06	0.00
GSC069	99.89	0.01	0.00
GSC070	34.73	0.05	0.00
GSC071	76.98	0.03	0.01
GSC072	70.33	0.01	0.01
GSC074	90.87	0.00	0.00
GSC075	23.93	0.00	0.00
GSC082	18.68	0.00	0.00
GSC091	12.95	0.00	0.00
GSC092	69.64	0.00	0.00
GSC100	79.33	0.00	0.00
GSC104	31.06	0.09	0.01
GSC115	39.42	0.01	0.01
GSC119	26.76	0.01	0.01
GSC122	91.84	0.00	0.00
GSC159	53.40	0.00	0.00
GSC161	77.34	0.00	0.00
	PB		
GSC163	38.45	0.10	0.01
GSC164	57.41	0.00	0.00
GSC165	78.58	0.01	0.01
GSC166	28.20	0.19	0.02
GSC167	43.83	0.16	0.01
GSC169	93.32	0.00	0.00
GSC170	77.26	0.04	0.01
GSC171	90.29	0.01	0.01
GSC173	1.47	0.00	0.00
GSC175	67.62	0.00	0.01
GSC181	86.62	0.00	0.00
GSC182	25.90	0.00	0.01
GSC185	17.83	0.02	0.01
GSC187	29.44	0.23	0.01
GSC188	50.30	0.00	0.00
GSC200	48.17	0.13	0.01
GSC209	64.89	0.03	0.00
GSC235	35.39	0.00	0.00
GSC236	34.53	0.00	0.00
GSC238	16.36	0.00	0.00
GSC239	18.35	0.00	0.00
GSC242	12.08	0.00	0.00
GSC244	66.74	0.02	0.00
GSC247	75.86	0.03	0.01
GSC265	31.25	0.01	0.00
GSC268	65.46	0.00	0.00
GSC272	94.83	0.02	0.01
GSC276	63.07	0.06	0.01
GSC288	57.48	0.09	0.01
GSC294	58.50	0.07	0.01
GSC296	80.45	0.00	0.00
GSC299	11.94	0.05	0.02
GSC301	34.21	0.01	0.00
GSC305	86.37	0.02	0.01
GSC306	11.39	0.01	0.01
GSC307	77.41	0.00	0.00
GSC314	8.23	0.00	0.00
GSC319	20.42	0.00	0.00
GSC320	62.77	0.00	0.00
GSC323	63.05	0.03	0.00
GSC328	71.14	0.01	0.01
GSC330	31.86	0.12	0.01
GSC331	25.12	0.35	0.01
GSC333	49.02	0.11	0.01
GSC336	18.56	0.03	0.00
GSC347	4.54	0.96	0.01
GSC354	2.30	0.00	0.00
GSC360	32.53	0.00	0.00
GSC370	91.98	0.00	0.00
GSC375	8.88	0.02	0.00
GSC376	93.12	0.01	0.01
GSC379	27.10	0.20	0.01
GSC381	68.39	0.01	0.00
GSC393	94.29	0.00	0.00
GSC395	43.70	0.10	0.01
GSC399	84.38	0.00	0.00

ANID	PB	CEB	P-EMV
	PB		
GSC413	2.85	0.39	0.04
GSC488	34.68	0.17	0.01
GSC491	12.88	0.00	0.00
GSC493	41.07	0.00	0.00
GSC494	18.72	0.01	0.00
GSC497	26.51	0.07	0.02
GSC499	97.99	0.01	0.00
GSC500	46.69	0.01	0.01
GSC502	81.20	0.01	0.00
GSC514	67.68	0.03	0.00
GSC515	25.61	0.00	0.00
GSC516	15.13	0.01	0.00
GSC517	19.01	0.49	0.01
GSC566	83.93	0.02	0.01
GSC568	52.35	0.11	0.01
GSC570	35.72	0.00	0.00
GSC571	76.21	0.01	0.01
GSC578	31.59	0.07	0.01
GSC602	91.65	0.01	0.00
GSC627	50.94	0.08	0.01
GSC628	34.80	0.03	0.00
GSC630	13.68	0.00	0.00
GSC631	62.66	0.00	0.00
GSC632	61.80	0.04	0.01
GSC633	69.02	0.00	0.00
GSC635	15.97	0.54	0.01
GSC637	84.82	0.00	0.00
GSC639	23.64	0.00	0.00
GSC657	71.62	0.05	0.01
MAP019	72.04	0.03	0.01
MAP021	1.54	0.00	0.00
MAP023	16.83	0.00	0.00
MAP054	49.85	0.06	0.01
MAP065	29.58	0.01	0.01
MAP066	68.38	0.01	0.00
MAP070	10.61	0.62	0.03
MAP130	32.44	0.11	0.02
MAP133	54.22	0.00	0.00
MAP148	28.21	0.01	0.01
MAP151	42.50	0.01	0.00
MAP157	2.40	0.00	0.00
MAP164	75.16	0.03	0.01
MAP165	20.02	0.00	0.00
MAP170	52.94	0.07	0.01
MAP171	88.85	0.02	0.00
MAP175	84.09	0.01	0.01
MAP183	72.89	0.02	0.01
MAP187	51.87	0.10	0.01
MAP195	13.80	0.01	0.01
MAP200	83.72	0.01	0.00
MAP201	39.04	0.00	0.01
MAP203	40.04	0.00	0.00
MAP209	15.93	0.59	0.01
MAP210	44.28	0.02	0.01
MAP215	80.60	0.00	0.00
MAP225	24.29	0.01	0.00
MAP226	82.24	0.00	0.00
MAP229	7.92	1.04	0.02
MAP230	46.75	0.05	0.00
MAP231	86.20	0.02	0.00
MAP234	77.16	0.00	0.00
MAP239	39.65	0.00	0.00
MAP241	25.15	0.17	0.02

ANID	PB	CEB	P-EMV
	PB		
MAP245	79.16	0.00	0.00
MAP246	97.83	0.01	0.00
MAP248	32.07	0.02	0.01
MAP257	11.75	0.10	0.00
MAP258	99.79	0.01	0.00
MAP265	87.76	0.01	0.00
MAP267	89.04	0.00	0.00
MAP268	14.20	0.00	0.00
MAP272	49.22	0.00	0.00
MAP273	74.88	0.00	0.00
MAP275	81.34	0.01	0.00
MAP276	58.73	0.00	0.00
MAP278	39.17	0.00	0.00
MAP280	37.53	0.17	0.01
MAP281	75.92	0.04	0.01
MAP286	45.35	0.00	0.00
MAP290	55.15	0.09	0.01
MAP294	4.94	0.00	0.00
MAP295	56.22	0.01	0.01
MAP311	58.09	0.01	0.00
MAP312	60.33	0.00	0.00
MAP316	41.66	0.00	0.00
MAP317	59.32	0.08	0.01
MAP318	91.66	0.02	0.01
MAP319	10.09	0.00	0.00
MAP322	37.69	0.00	0.00
MAP323	77.22	0.00	0.00
MAP324	49.39	0.00	0.00
MAP336	94.46	0.02	0.01
MAP337	82.49	0.01	0.01
MAP338	20.58	0.00	0.00
MAP339	73.11	0.01	0.00
MAP341	16.26	0.00	0.00
MAP342	89.39	0.00	0.00
MAP344	31.98	0.00	0.00
MAP345	69.50	0.00	0.00
MAP362	79.29	0.00	0.00
MAP367	87.23	0.01	0.00
MAP370	45.56	0.00	0.00
MAP371	87.81	0.01	0.00
MAP376	51.78	0.00	0.01
MAP386	80.30	0.00	0.00
MAP387	14.32	0.00	0.00
MAP431	39.11	0.03	0.01
MAP432	65.77	0.01	0.00
MAP433	79.52	0.04	0.01
MAP438	45.65	0.00	0.00
MAP518	26.66	0.01	0.01
MAP561	95.97	0.01	0.01
MAP563	42.25	0.00	0.00
AID163	38.96	0.00	0.00
AID346	2.76	0.00	0.01
AID352	71.09	0.00	0.00
AID354	10.14	0.00	0.00
AID375	8.34	0.00	0.00
DLH044	0.25	0.00	0.01
DLH059	16.18	0.00	0.00
DLH074	79.99	0.03	0.01
DLH084	6.71	0.28	0.03
DLH107	75.46	0.01	0.00
GSC001	8.94	0.00	0.00
GSC101	65.93	0.06	0.01
GSC102	59.39	0.00	0.00

ANID	PB	CEB	P-EMV
	PB		
GSC132	11.97	0.00	0.01
GSC193	32.72	0.26	0.01
GSC240	44.98	0.15	0.01
GSC271	32.65	0.00	0.00
GSC293	72.96	0.00	0.00
GSC297	73.47	0.00	0.00
GSC329	19.80	0.28	0.02
GSC358	10.78	0.00	0.00
GSC573	96.01	0.01	0.01
MAP141	59.10	0.00	0.00
MAP147	28.88	0.30	0.01
MAP190	31.98	0.00	0.00
MAP199	32.09	0.15	0.01
MAP270	6.97	0.06	0.02
MAP274	49.80	0.02	0.01
MAP291	80.49	0.03	0.01
MAP321	19.98	0.00	0.00
MAP380	5.33	0.28	0.01

ANID	PB	CEB	P-EMV
	CEB		
CAP397	0.00	50.53	0.01
CAP400	0.00	9.32	0.11
CAP403	0.00	66.39	0.06
CAP406	0.00	72.25	0.01
CAP408	0.00	65.05	0.10
CAP409	0.00	70.62	0.05
CAP410	0.00	42.64	0.04
CAP413	0.00	60.00	0.02
CAP418	0.00	86.76	0.01
CAP421	0.00	47.49	0.00
CAP422	0.00	51.96	0.01
GSC024	0.00	71.93	0.01
GSC050	0.00	65.98	0.10
GSC052	0.00	70.23	0.01
GSC077	0.00	78.38	0.02
GSC079	0.00	63.71	0.01
GSC155	0.00	4.09	1.84
GSC222	0.00	95.13	0.02
GSC224	0.00	78.63	0.01
GSC250	0.00	18.06	0.01
GSC251	0.00	3.56	0.00
GSC254	0.00	88.62	0.02
GSC255	0.00	50.49	0.01
GSC258	0.00	89.87	0.05
GSC259	0.00	36.30	0.02
GSC261	0.00	87.18	0.01
GSC262	0.00	70.05	0.01
GSC321	0.00	61.26	0.01
GSC447	0.00	64.54	0.01
GSC470	0.00	77.31	0.02
GSC557	0.01	8.61	0.19
GSC613	0.00	42.55	0.13
GSC619	0.00	45.87	0.01
MAP220	0.00	43.44	0.16
MAP255	0.05	9.31	0.02
MAP256	0.04	0.93	0.21
MAP271	0.00	4.27	1.67
MAP300	0.00	23.03	0.01

ANID	PB	CEB	P-EMV
CEB			
MAP579	0.00	30.58	0.02
GSC192	0.00	39.11	0.24
GSC545	0.00	95.74	0.04
MAP159	0.00	15.43	0.01
MAP162	0.00	40.53	0.10
MAP208	0.13	11.53	0.03
MAP282	0.00	43.26	0.23
MAP587	0.03	19.80	0.04

ANID	PB	CEB	P-EMV
P-EMV			
DLH070	0.00	0.00	71.17
GSC008	0.00	0.29	4.64
GSC134	0.00	0.02	68.09
GSC174	0.00	0.03	44.68
GSC241	0.00	0.00	81.74
GSC300	0.00	0.00	15.12
GSC372	0.00	0.00	47.28
GSC373	0.00	0.00	37.03
MAP293	0.00	0.00	70.22

ANID	PB	CEB	P-EMV
PLATEAU - no sub-group			
AID019	2.24	1.08	0.05
AID119	46.70	0.14	0.01
AID134	32.48	0.00	0.01
AID341	0.03	3.52	0.01
AID349	0.92	0.00	0.00
AID351	0.49	0.00	0.00
AID353	0.65	0.00	0.01
AID366	1.41	0.00	0.00
CAP404	2.06	3.15	0.03
CAP411	0.55	5.94	0.05
CAP416	0.10	12.97	0.04
DLH001	6.09	0.96	0.03
DLH005	1.92	0.84	0.06
DLH006	0.01	0.38	0.00
DLH008	0.12	0.04	0.00
DLH090	12.47	0.11	0.02
DLH134	0.15	0.43	0.10
DLH135	0.02	19.55	0.03
GSC013	0.00	10.16	0.80
GSC041	0.17	0.01	0.02
GSC067	1.75	3.49	0.03
GSC112	0.00	0.02	0.06
GSC151	13.69	0.01	0.00
GSC156	0.34	0.00	0.00
GSC162	4.90	1.34	0.01
GSC177	88.99	0.02	0.01
GSC219	0.00	15.88	0.19
GSC229	1.06	0.00	0.00
GSC234	0.00	71.45	0.02

ANID	PB	CEB	P-EMV
PLATEAU - no sub-group			
GSC269	6.17	1.43	0.02
GSC274	0.41	7.01	0.05
GSC278	0.00	34.17	0.06
GSC280	0.01	22.99	0.07
GSC311	3.32	2.27	0.02
GSC327	0.37	0.00	0.00
GSC338	0.00	22.36	0.49
GSC512	63.83	0.02	0.00
GSC533	0.49	6.76	0.03
GSC542	13.30	0.16	0.02
GSC569	47.90	0.13	0.01
GSC576	19.50	0.34	0.02
GSC577	1.46	0.00	0.00
MAP017	32.63	0.00	0.00
MAP152	0.00	6.64	1.57
MAP204	39.22	0.06	0.01
MAP237	1.57	2.47	0.01
MAP253	8.58	0.65	0.03
MAP288	29.66	0.19	0.01
MAP427	1.33	0.27	0.05
MAP512	0.60	4.84	0.02
MAP594	0.00	7.98	0.01
MAP595	0.13	0.67	0.12

Table A.9. Posterior probabilities based on jackknifed Mahalanobis distances for MM-1a and MM-1b sub-groups of the MM-1 core compositional group.

Input data: PCs 1-6 accounting for 91% of total variance

ANID	MM-1a	MM-1b
	MM-1a	
CAP376	53.55	0.28
CAP386	5.52	0.02
CAP392	20.61	0.00
CAP394	71.64	0.58
CAP401	70.80	0.73
GSC204	43.10	0.11
GSC205	74.51	5.39
GSC214	42.67	20.05
MAP020	25.24	7.69
MAP313	20.49	1.06
MAP314	45.61	0.07
MAP315	98.18	0.42
MAP325	26.68	0.00
MAP353	4.59	0.05
MAP361	22.26	0.00
MAP363	19.42	0.00
MAP364	88.38	0.40
MAP365	24.91	0.00
MAP372	90.78	0.00
MAP375	47.44	0.17
MAP378	30.48	0.00
MAP379	51.32	0.20
MAP381	73.29	0.94
MAP382	98.80	0.50
MAP388	68.16	0.12
MAP390	66.88	0.05
MAP391	98.01	0.00
MAP398	20.26	0.00
MAP400	75.59	0.00
MAP426	42.03	0.07
MAP429	57.63	0.91
MAP434	12.89	0.09
MAP435	43.47	3.54
MAP445	9.08	0.00

ANID	MM-1a	MM-1b
	MM1-b	
CAP396	0.00	52.92
CAP398	0.00	69.16
CAP402	0.00	87.01
CAP419	0.00	79.27
CAP420	0.02	50.33
GSC202	0.64	29.80
GSC208	0.32	47.32
GSC213	0.67	38.05
GSC216	0.07	0.52
GSC656	0.34	98.77
MAP320	0.00	80.39
MAP373	0.03	67.58
MAP384	0.08	84.99
MAP389	0.62	37.47
MAP393	0.00	49.55
MAP395	0.02	75.52
MAP396	0.06	34.04
MAP397	0.06	37.39
MAP399	0.00	8.20
MAP436	0.00	0.84
MAP437	0.00	44.97
MAP439	0.00	4.40
MAP442	0.00	49.56
MAP443	0.00	83.46
MAP444	0.11	96.39

Table A.10. Posterior probabilities based on jackknifed Mahalanobis distances for ULC-2a and ULC-2b sub-groups of the ULC-2 core compositional group.

Input data: PCs 1-6 accounting for 80% of total variance

ANID	**ULC-2a**	**ULC-2b**
	ULC-2a	
AID108	12.61	1.59
AID110	2.74	0.04
AID146	96.73	0.59
AID167	85.58	0.40
AID176	42.61	0.01
AID236	3.44	0.15
AID271	36.75	2.14
AID273	96.03	0.16
AID274	82.75	0.05
AID389	74.53	8.68
AID457	29.20	0.19
AID458	66.43	0.29
AID459	80.84	0.04
AID460	0.26	0.00
AID461	43.62	0.11
AID464	62.88	0.38
AID465	61.99	0.02
AID466	67.86	0.12
AID467	18.32	1.06
AID468	97.77	0.14
AID469	12.21	0.05
AID470	58.56	0.24
AID471	78.87	0.12
AID472	48.70	0.08
AID473	91.83	0.37
AID474	82.34	0.54
AID475	48.70	0.05
AID477	40.06	0.04
AID478	58.20	0.09
AID480	56.85	0.03
AID513	25.27	0.01
AID514	5.20	0.04
AID515	93.77	0.35
AID516	50.30	0.51
AID517	38.19	0.01
AID518	66.84	0.04
AID519	98.79	0.15
AID522	24.80	0.11
AID530	10.62	0.00
AID531	41.68	12.14
AID533	45.70	0.11
AID534	37.69	13.76
AID535	79.85	0.12
AID655	0.08	0.01
AID678	82.22	1.66
AID701	91.63	0.87
AID702	71.23	1.03
AID706	29.62	1.80

ANID	**ULC-2a**	**ULC-2b**
	ULC-2b	
AID180	0.10	92.16
AID207	0.09	59.72
AID214	0.09	58.23
AID398	1.26	48.60
AID527	6.49	71.12
AID528	7.76	17.77
AID611	0.01	37.08
AID620	0.00	86.17
AID622	0.00	4.54
AID631	0.00	11.54
AID643	0.09	66.29
AID652	0.02	88.24
AID670	0.00	9.24
AID672	0.01	58.90

Table A.11. Posterior probabilities based on Mahalanobis distances for S-ULC and S-BR sub-groups of the SOUTH core compositional group.

Input data: PCs 1-8 accounting for 86% of total variance

ANID	**S-BR**	**S-ULC**
	S-BR	
AID104	20.57	0.00
MAP001	99.09	0.01
MAP002	55.79	0.00
MAP003	57.19	0.00
MAP004	8.89	0.00
MAP005	93.10	0.00
MAP006	67.80	0.00
MAP007	60.48	0.68
MAP008	69.97	0.01
MAP009	49.92	0.01
MAP010	10.66	0.00
MAP011	98.19	0.00
MAP012	89.89	0.00
MAP013	26.51	0.00
MAP014	12.55	0.01
MAP022	0.03	0.00
MAP031	27.63	0.56
MAP034	80.95	0.00
MAP037	59.35	0.00
MAP038	17.19	0.00
MAP047	49.57	0.00
MAP059	71.29	0.00
MAP061	95.82	4.53
MAP062	90.45	0.06
MAP067	86.20	0.03
MAP068	75.96	0.00
MAP069	47.46	0.00
MAP071	2.10	0.00
MAP073	94.49	0.01
MAP075	48.25	0.07
MAP076	99.36	0.06
MAP094	6.50	0.00
MAP095	28.40	1.87
MAP106	20.60	0.00
MAP110	25.75	0.00
MAP124	2.85	0.03
MAP535	66.01	0.01
MAP540	57.65	2.44

ANID	**S-BR**	**S-ULC**
	S-ULC	
AID598	1.09	12.04
MAP088	0.05	20.21
MAP099	0.53	2.42
MAP104	15.52	37.61
MAP111	1.56	4.38
MAP116	7.81	37.20
MAP119	19.68	46.53
MAP488	0.24	59.38
MAP489	0.80	59.91
MAP490	0.03	66.28
MAP491	12.53	92.95
MAP492	6.77	60.95
MAP493	0.49	99.41
MAP494	4.56	69.04
MAP495	0.00	36.21
MAP496	6.58	93.55
MAP497	0.01	41.05
MAP498	0.40	72.69
MAP500	7.92	70.43
MAP501	3.61	60.17
MAP502	0.07	76.99
MAP503	0.06	56.55
MAP504	1.12	48.93
MAP505	0.37	92.54
MAP527	6.56	26.98
MAP528	2.85	25.60
MAP529	5.72	45.17
MAP537	3.82	26.26
MAP541	1.32	3.14

Table A.12. Posterior probabilities based on jackknifed Mahalanobis distances for WMR-1, WMR-2, and WMR-3 compositional group defined by Triadan (1997; Triadan et al. 2002) along with newly assigned samples from the primary compositional database.

Input data: 30 log-transformed element concentrations (Sr and Zr omitted)

ANID	WMR-1	WMR-2	WMR-3
	WMR-1		
DTB062	61.92	0.00	0.00
DTB065	30.69	0.00	0.00
DTCC537	24.14	0.00	0.05
DTCC544	32.46	0.00	0.01
DTF023	37.45	0.00	0.00
DTF027	24.32	0.00	0.00
DTF052	85.54	0.00	0.42
DTF233	70.27	0.00	0.00
DTH653	23.63	0.00	0.00
DTH665	17.35	0.00	0.00
DTK123	95.51	0.00	0.00
DTK124	87.09	0.00	0.33
DTK258	98.77	0.00	0.00
DTK259	98.68	0.00	0.00
DTK267	50.51	0.00	0.85
DTK405	94.16	0.00	0.00
DTK408	92.15	0.00	0.00
DTK411	52.51	0.00	0.00
DTK417	6.69	0.00	0.00
DTK418	53.28	0.00	0.00
DTK419	58.45	0.00	0.00
DTK420	40.55	0.00	0.00
DTK426	82.38	0.00	0.02
DTK428	61.07	0.00	0.00
DTK430	58.42	0.00	3.78
DTK433	51.62	0.00	0.00
DTK445	15.27	0.00	0.00
DTK446	92.07	0.00	0.00
DTK447	38.40	0.00	0.00
DTK448	55.77	0.00	0.00
DTK449	97.87	0.00	0.00
DTK452	13.53	0.00	0.00
DTK455	89.42	0.00	0.00
DTK456	97.80	0.00	0.00
DTK457	80.89	0.00	0.00
DTK462	13.26	0.00	0.00
DTK465	92.13	0.00	0.00
DTK467	17.10	0.00	0.00
DTK483	11.07	0.00	0.00
DTK488	90.38	0.00	0.00
DTK508	6.04	0.00	0.00
DTK512	1.25	0.00	0.00
DTK515	32.41	0.00	0.00
DTK516	7.49	0.00	0.00
DTK517	36.84	0.00	0.00
DTK527	51.57	0.00	0.00
DTK529	6.62	0.00	0.00
DTK532	38.41	0.00	0.00
DTK533	10.81	0.00	0.00
DTL080	24.03	0.00	0.00
DTP216	5.00	0.00	0.00
DTP223	93.54	0.00	0.12
DTP231	55.40	0.00	0.00
DTP312	93.10	0.00	0.00
DTP313	96.08	0.00	0.00
DTPP670	43.31	0.00	0.00
DTPP672	17.19	0.00	0.01
DTPP677	26.28	0.00	0.00

ANID	WMR-1	WMR-2	WMR-3
	WMR-1		
DTPP678	14.97	0.18	0.03
DTPP684	25.93	0.00	0.11
DTPP689	3.78	0.00	0.00
DTPP706	56.02	0.00	0.01
DTPP713	32.47	0.00	0.00
DTPP715	39.66	0.00	0.13
DTPP716	97.21	0.00	0.01
DTR178	40.04	0.00	0.00
DTR190	43.55	0.00	0.00
DTR196	25.37	0.00	0.00
DTR198	39.54	0.00	0.00
DTR202	66.12	0.00	0.02
DTR211	13.62	0.00	0.00
DTR276	19.49	0.00	0.00
DTR563	70.40	0.00	0.00
DTR564	0.01	0.00	0.00
DTR565	97.20	0.00	0.00
DTR567	56.34	0.00	0.00
DTR568	77.55	0.00	0.00
DTR569	67.18	0.00	0.00
DTR574	14.82	0.00	0.00
DTR575	99.87	0.00	0.00
DTR576	90.44	0.00	0.00
DTR577	63.79	0.00	0.00
DTR578	98.37	0.00	0.00
DTR579	97.07	0.00	0.00
DTR580	25.38	0.00	0.00
DTR583	53.34	0.00	0.00
DTR584	7.03	0.00	0.00
DTR585	84.72	0.00	0.15
DTR586	50.76	0.00	0.02
DTR587	95.81	0.00	0.00
DTR588	5.46	0.00	0.00
DTR589	4.20	0.00	0.00
DTR594	46.23	0.00	0.00
DTR595	1.19	0.00	0.00
DTR597	21.04	0.00	0.00
DTR599	1.27	0.00	0.00
DTR602	26.69	0.00	0.00
DTR607	33.74	0.00	0.00
DTR627	35.89	0.00	0.00
DTR636	33.38	0.00	0.00
DTW082	80.47	0.00	0.00
DTZ072	80.85	0.00	0.00
DTZ073	93.63	0.00	0.00
DTZ074	92.64	0.00	0.00

ANID	WMR-1	WMR-2	WMR-3
	WMR-2		
DTB059	1.02	83.70	0.00
DTB070	0.13	99.43	0.00
DTCC546	0.26	46.69	0.00
DTK415	0.55	41.11	0.00
DTK442	0.37	7.21	0.00
DTK451	0.33	6.90	0.00
DTK458	0.00	71.90	0.00
DTK519	6.06	62.73	0.00

ANID	WMR-1	WMR-2	WMR-3
	WMR-2		
DTK525	0.11	5.79	0.00
DTK528	0.00	21.71	0.00
DTK531	1.09	17.04	0.00
DTK536	3.74	22.98	0.00
DTL076	8.37	31.34	0.00
DTP220	0.03	47.43	0.00
DTP221	0.09	55.45	0.00
DTP222	2.75	70.26	0.00
DTP238	0.06	97.74	0.00
DTP240	0.00	22.37	0.00
DTP242	0.06	95.32	0.00
DTP243	0.00	10.31	0.00
DTP316	0.32	0.63	0.00
DTP321	0.58	32.22	0.00
DTP322	0.13	5.88	0.00
DTPP688	0.03	1.70	0.00
DTPP691	0.36	43.92	0.00
DTPP694	0.01	17.88	0.00
DTPP697	0.05	21.71	0.00
DTPP707	0.25	60.42	0.00
DTPP709	0.31	8.15	0.00
DTR151	0.01	51.05	0.00
DTR154	1.22	44.11	0.00
DTR155	4.68	33.67	0.00
DTR156	0.23	58.24	0.00
DTR158	0.23	33.09	0.00
DTR159	1.57	75.68	0.00
DTR172	0.00	95.47	0.00
DTR177	1.66	98.15	0.00
DTR181	0.18	89.56	0.00
DTR182	1.46	94.84	0.00
DTR208	0.02	93.66	0.00
DTR212	1.19	93.77	0.00
DTR213	0.02	25.44	0.00
DTR214	2.82	93.67	0.00
DTR215	0.43	93.10	0.00
DTR260	1.34	82.14	0.00
DTR262	0.06	10.76	0.00
DTR263	0.00	40.07	0.00
DTR269	7.79	44.90	0.00
DTR284	0.00	23.55	0.00
DTR285	0.07	53.64	0.00
DTR286	0.01	94.55	0.00
DTR287	3.13	50.84	0.00
DTR289	0.48	7.62	0.00
DTR290	0.26	97.06	0.00
DTR291	0.48	47.39	0.00
DTR292	0.27	81.86	0.00
DTR294	11.22	99.99	0.00
DTR304	0.23	94.81	0.00
DTR308	7.89	18.61	0.00
DTR309	2.47	10.72	0.00
DTR592	3.47	16.26	0.00
DTR608	0.25	12.82	0.00
DTR615	0.01	2.18	0.00
DTR623	0.13	94.06	0.00
DTR625	10.74	34.27	0.00
DTR626	1.00	30.06	0.00
DTR632	0.37	12.06	0.00
DTR633	0.02	21.42	0.00
DTR634	0.38	62.78	0.00

ANID	WMR-1	WMR-2	WMR-3
	WMR-3		
DTCC538	0.35	0.00	41.47
DTCC539	3.97	0.00	96.37
DTCC540	0.02	0.00	83.40
DTCC545	0.16	0.00	37.17
DTCC547	0.00	0.00	10.26
DTCC550	2.84	0.00	97.96
DTF022	0.06	0.00	95.02
DTF024	0.00	0.00	34.18
DTF028	1.18	0.00	96.45
DTF031	0.00	0.00	25.43
DTF032	2.21	0.00	25.48
DTF038	0.00	0.00	59.16
DTF040	0.00	0.00	87.08
DTF041	0.09	0.00	30.41
DTF043	2.27	0.00	77.04
DTF046	1.63	0.00	30.53
DTF050	10.11	0.00	76.88
DTF051	2.05	0.00	85.11
DTF134	1.22	0.00	16.26
DTF135	4.52	0.00	92.33
DTF136	0.90	0.00	31.69
DTF137	5.48	0.00	99.98
DTF226	1.11	0.00	80.12
DTH639	1.99	0.00	77.66
DTH642	5.40	0.00	5.81
DTH643	0.01	0.00	45.34
DTH647	2.25	0.00	41.29
DTH649	0.81	0.00	44.19
DTH650	0.01	0.00	35.02
DTH656	1.06	0.00	51.64
DTH657	0.00	0.00	18.49
DTH664	0.00	0.00	25.57
DTH666	0.00	0.00	2.68
DTK189	0.62	0.00	6.68
DTK416	0.72	0.00	91.01
DTK429	1.51	0.00	85.19
DTK431	0.02	0.00	37.95
DTK432	1.96	0.00	78.98
DTK434	3.20	0.00	46.30
DTK435	0.92	0.00	5.23
DTK439	2.71	0.00	32.42
DTK444	0.05	0.00	29.92
DTK463	0.18	0.00	32.86
DTK489	0.00	0.00	54.15
DTK490	0.13	0.00	21.00
DTK492	9.29	0.00	86.96
DTK495	0.22	0.00	33.14
DTK496	7.43	0.00	62.02
DTK498	0.45	0.00	91.93
DTK499	0.63	0.00	54.33
DTK502	0.19	0.00	25.13
DTK505	0.35	0.00	63.68
DTK507	0.01	0.00	45.68
DTK510	2.59	0.00	46.72
DTK521	0.12	0.00	17.29
DTK523	0.09	0.00	8.28
DTK524	0.00	0.00	54.87
DTK526	0.00	0.00	30.14
DTK530	0.01	0.00	88.44
DTP298	0.07	0.00	23.25
DTP314	0.02	0.00	15.25
DTP323	1.15	0.00	87.05
DTPP698	0.32	0.00	18.11
DTR162	0.11	0.00	88.08
DTR164	3.02	0.00	34.60
DTR168	3.74	0.00	52.12

ANID	WMR-1	WMR-2	WMR-3
	WMR-3		
DTR200	0.00	0.00	57.78
DTR255	0.76	0.00	90.17
DTR279	0.72	0.00	46.00
DTR282	0.19	0.00	11.23
DTR307	0.00	0.00	44.61
DTR590	0.00	0.00	24.40
DTR591	0.00	0.00	56.42

ANID	WMR-1	WMR-2	WMR-3
	WMR-3		
DTR605	0.03	0.00	20.39
DTR614	0.35	0.00	53.90
DTR619	0.01	0.00	2.52
DTR624	0.06	0.00	61.64
DTR635	0.07	0.00	18.11

Samples assigned to WMR-1 from primary compositional database

ANID	WMR-1	WMR-2	WMR-3
	WMR-1		
AID151	12.43	0.00	0.84
AID436	52.27	0.00	0.05
AID440	24.23	0.00	0.00
AID444	26.65	0.00	0.01
AID648	26.73	0.00	0.01

Samples assigned to WMR-3 from primary compositional database

ANID	WMR-1	WMR-2	WMR-3
	WMR-3		
AID152	0.00	0.00	39.69
AID154	0.00	0.00	6.07
AID155	0.02	0.00	87.60
AID156	0.15	0.00	31.91
AID157	9.27	0.00	10.43
AID158	0.01	0.00	51.75
AID280	0.01	0.00	3.00
AID284	1.00	0.00	5.31
AID286	0.08	0.00	53.44
AID388	0.00	0.00	1.81
AID405	1.22	0.00	21.27
AID408	0.00	0.00	74.80
AID437	0.21	0.00	2.66
AID442	0.01	0.00	1.85
AID445	0.00	0.00	6.81
AID542	0.00	0.00	1.25
AID543	0.00	0.00	2.20
AID544	0.03	0.00	4.67
AID684	0.12	0.00	6.76
AID685	0.01	0.00	16.83
AID686	0.00	0.00	21.34
AID687	0.00	0.00	23.58
AID688	0.00	0.00	16.70

Table A.13. Posterior probabilities based on jackknifed Mahalanobis distances for raw clays and temper samples in all core compositional groups.

Input data: 32 log-transformed element concentrations

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
AID311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID316	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID317	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID320	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID321	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID322	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID323	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID324	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID325	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID326	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID327	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID328	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID329	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID330	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID331	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID332	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID333	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID334	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID605	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID606	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID608	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID751	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID752	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AID753	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00
AID754	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
BJM052	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM053	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM054	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM055	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM056	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM057	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM058	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM059	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM060	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM061	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM062	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM063	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM064	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM065	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM066	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM067	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM068	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM069	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM070	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM071	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM072	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM073	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM074	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM075	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM076	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM077	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ANID	EMV-1	EMV-2	PLAT	WEST-1	WEST-2	MM-1	MM-2	AZ/NM	ULC-2	ULC-3a	ULC-3b	ULC-4	SOUTH
BJM078	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM079	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM080	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM117	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM184	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM185	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM186	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM187	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM188	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM189	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM194	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM195	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM196	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM197	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM198	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM199	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BJM200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH046	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH047	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH142	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH143	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH144	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH146	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DLH147	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX B

UTILITARIAN CERAMIC TECHNOLOGICAL ANALYSIS CODING SHEET

CIBOLA CERAMIC TECHNOLOGICAL ANALYSIS

This document provides descriptions of each of the variables to be measured in these analyses and the specific categories or units to be used. If a particular variable is not applicable to a sherd, place an X in that variable on the coding form so that we can be sure that it was not left off by accident.

VARIABLES MEASURED ON ALL BODY SHERDS

1) Clay Color:
A sub-sample from each site will be coded by me using Munsell charts. This variable is not included in the quantitative analyses.

0 – **indeterminate**
1 – **Cibola Gray Ware**
2 – **Mogollon Brown Ware**
3 – **gray/brown - Puerco Valley Gray Ware**
99 – **other –** specify in notes

2) Vessel Portion:

0 – **indeterminate**
1 – **body sherd**
2 – **rim sherd**
3 – **basal sherd**
4 – **rim and body sherd**
5 – **base and body sherd**
6 – **complete/nearly complete vessel**
99 **– other –** specify in notes

3) Type (primary treatment):
A majority of sherds will fit into one of the categories below. If a sherd does not fit into any of these categories, code it as "other" and write a description in the notes field. These variables are not included in the quantitative analyses.

0 – **indeterminate**
1 – **indented corrugated –** indented corrugated sherd
2 – **zoned corrugated** – both plain and indented coils are visible (transition at coils)
3 – **patterned corrugated** – both plain and indented coils (transition across coils)
4 – **plain corrugated** – coils without any kind of indentations
5 – **clapboard corrugated** – wide or narrow clapboard corrugations (see illustrations)
6 – **plainware –** smoothed surface
7 – **obliterated corrugated –** corrugated surface with partially obliterated coils (see photos)
99 – **other –** specify in notes

4) Type of indentations:
This category only applies to indented, zoned, and patterned corrugated sherds.

0 – **indeterminate –**indentations clearly visible, type undetermined

1 – **finger/finger nail**– finger print/nail marks clearly visible between or across coils
3 – **tool** – tooled indentations
99 – **other/multiple** – specify in notes

5) Direction of indentation:
This variable relates to the direction of the indentations in relation to the coils used to form the vessel. As with the variable above, this is only measured on indented, zoned, and patterned corrugated sherds. See example sherds.
0 – **indeterminate**
1 – **parallel –** the indentation is parallel with the coils (i.e., the finger was held parallel to the direction of the coils)
2 – **perpendicular –** the indentation is perpendicular to the coils
3 – **oblique –** the indentation is between parallel/perpendicular

6) Indentation Alignment:
This variable relates to whether or not indentations are aligned between coils. This variable is only measured on indented, zoned, and patterned corrugated sherds.
0 – **indeterminate**
1 – **aligned** – indentations are vertically aligned between coils
2 – **unaligned** – indentations are not vertically aligned between coils
3 – **diagonally aligned** – indentation clearly diagonally aligned

7) Type of surface elaborations:
This variable refers secondary surface elaborations that are applied after the vessel is formed. The list below includes most of the secondary surface treatments that you are likely to encounter. If you encounter a surface treatment not included here, code this sherd as "other" and write a description in the notes field.
0 – **none/indeterminate** – no secondary surface elaboration visible
1 – **incised** – surface is incised
2 – **punctate** – the surface of the sherd has be punched with a sharp tool
3 – **appliqué** – A secondary form has been applied to the
99 – **other/multiple** – specify in the notes

8) Vessel form:
The type of vessel. Use one of the following categories. If a sherd does not fit any of these categories, code it as "other" and describe it in the notes field.
0 – **indeterminate**
1 – **jar**
2 – **bowl**
3 – **ladle/scoop**
4 **– seed jar**
5 **– effigy**
6 **– pitcher**
7 – **miniature vessel**
99 – **other** – specify in notes

9) Presence/Absence of smudging:
This variable refers to the presence or absence of smudging. Smudging is most common on the interior surface of bowls. It characterized as a black, waxy feeling, and reflective surface that is usually highly polished.

0 – **indeterminate**
1 – **smudging absent**
2 – **smudging present**

10) Interior surface treatment:

0 – **indeterminate**
1 – **rough** – temper protrudes from unsmoothed surface
2 – **scraped –** scrape/drag marks where temper protrudes
3 – **smoothed –** Smooth but not shiny, a few streaks/marks may be visible
4 **– polished –** surface is clearly polished with little to no temper protruding
99 – **other –** specify in notes

11) Sooting:
This variable refers to the presence or absence of sooting, defined as a dark carbon residue.

0 **– indeterminate**
1 **– present on exterior only**
2 **– present on interior only**
3 **– present on both surfaces**
4 **– present on broken edges of sherd**
5 **– no sooting present**

12) Vessel wall thickness (cm):
This variable refers to the thickness of the thickest portion of the sherd. This is measured using the digital calipers. Do not measure this variable on rim or base sherds. Average of 3 measurements.

13) Width of indentations (cm):
This variable refers to the width of indentations at the widest point. This is measured using the digital calipers. Three indentations are measured for each sherd which will later be averaged.

14) Depth of indentations (cm):
This variable refers to the difference between the deepest portion of an indentation and the top of the adjacent coil. Three indentations are measured which will later be averaged. This is measured using the digital depth gauge.

15) Coil width (cm):
This variable provides an estimate of the average size of coils for each sherd. This is the average of three measures from coil juncture to coil juncture.

16) Number of indentations per sq cm:
This variable refers to the number of indentations per square cm of vessel surface. This is measured by placing the 3x3 cm cardboard cutout over a sherd

and recording the number of indentations that are fully visible. If measuring a zoned or patterned corrugated sherd, make sure that unindented portions of the vessel are not visible through the cardboard cutout.

17) Proportion of obliterated coils:
This variable refers to the proportion of coils that are obliterated. Obliteration refers to the smoothing of coil junctures so that they are only visible through the indentations. This variable is measured by counting the total number of coils and obliterated coils visible.

VARIABLES ONLY MEASURED ON RIM SHERDS

The following variables are measured only for rim and base sherds. Write these variables on the back of the form along with the ID letter.

18) Rim radius (cm):
This variable refers to the radius of the vessel opening. This is measured using the rim radius template chart.

19) Distance to coils (cm):
This variable refers to the distance from the top of the rim to the first exposed coil. This is measured using a flexible rule.

20) Rim form:
This variable refers to the general form of the rim in cross-section. Draw rim on back of form.

0 – **indeterminate**
1 – **flared**
2 – **incurved**
3 – **straight collar**
4 – **straight rim**
5 – **other** – specify in notes and draw

VARIABLE ONLY MEASURED ON BASAL SHERDS

21) Direction of coils:
This variable refers to the direction that coils when looking at the bottom of the vessel from the exterior.

0 – **indeterminate**
1 – **clockwise**
2 – **counter-clockwise**

Cibola Ceramic Technological Analysis

Site ______________________ **Date** ______________________

Prov. ______________________ **Recorder** ____________________

ID	Clay Color	Part	Type	Indt Type	Direc	Indt Algn	Elab	Form	Smg	Inter surf	Soot	Thck	Indent Width			Depth of Indent			Coil Width			Indnt / cm	Oblit # coils	Oblit # oblit

Write any additional notes on the back of this form along with the ID. Rim and base variables on the back of this form. Page ___ of ___

APPENDIX C

ADDITIONAL DOCUMENTATION OF CERAMIC TECHNOLOGICAL CHARACTERIZATIONS

As described in Chapter 6, the methods for quantifying variation in corrugated and plain ware ceramics used in this study require that the complex relationships among the variables be assessed. This appendix provides a brief description of the methods and heuristics used to identify and account for interrelationships among the continuous and non-continuous variables included in this study. I conclude by presenting summary data for the technological clusters produced in Chapter 6.

Assessing Variable Interrelationships

Continuous Variables

The 13 variables selected as the maximum set to be included in the quantitative analyses presented in Chapter 6 include a total of 6 continuous variables. The potential relationships among these variables can be assessed using Pearson's product-moment correlation coefficient (Pearson's *r*). Table C.1 below shows the values of Pearson's *r* for comparisons between for samples included in this analysis. A small number of far outliers in the distributions of each variable were removed before calculating these values.[1] Figure C.1 displays scatter plots of the first 5 continuous variables.[2]

As Table C.1 and Figure C.1 illustrate, there are a few relatively strong positive correlations among the variables included in this analysis. This could potentially be used to argue for the exclusion certain variables from the quantitative analyses. It is first necessary, however, to further assess the site level relationships among each continuous variable. To do this, values of Pearson's *r* were calculated independently for each site with more than 15 samples with non-

Table C.1. Pearson's correlation coefficients (*r*) among all continuous variables for all samples. Relatively high values are highlighted.

	THICK	WIDTH	DEPTH	COILS	PER
WIDTH	0.056				
DEPTH	0.251	0.508			
COILS	-0.064	0.409	0.233		
PER	0.026	-0.631	-0.424	-0.658	
OBLIT	-0.022	-0.066	-0.134	0.025	0.017

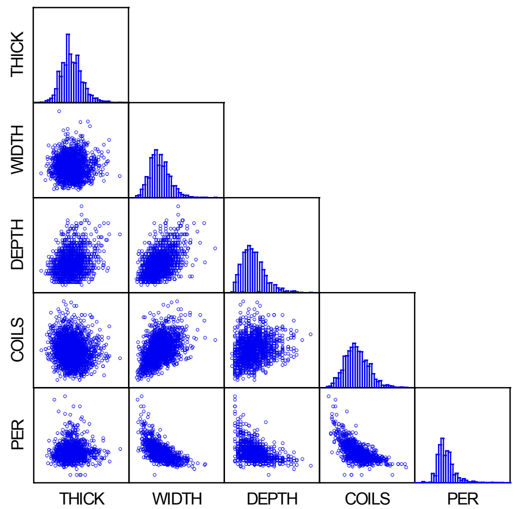

Figure C.1. Scatter plots of relationships among continuous variables.

missing data. Table C.2 shows the standard deviation of the values of *r* among the sites and Table C.3 shows the total range of *r* values among sites.

As Tables C.2 and C.3 illustrate, both the standard deviations and ranges of Pearson's *r* coefficients for each variable comparison among sites are relatively high. In fact, in several cases, relationships among two variables may be positive for one site assemblage and negative for another. This suggests that the relationships among these variables are extremely complex and varied and are not simply a product of the physical constraints of corrugated ceramic production. For example, it is true that across all samples vessels with wider indentations

Table C.2. Standard deviations of Pearson's correlation coefficients for variable comparisons among all sites.

	THICK	WIDTH	DEPTH	COILS	PER
WIDTH	0.165				
DEPTH	0.144	0.138			
COILS	0.165	0.166	0.199		
PER	0.154	0.124	0.148	0.103	
OBLIT	0.180	0.131	0.068	0.175	0.213

Table C.3. The range of Pearson's correlation coefficients for variable comparisons among all sites.

	THICK	WIDTH	DEPTH	COILS	PER
WIDTH	0.676				
DEPTH	0.482	0.662			
COILS	0.707	0.634	0.977		
PER	0.685	0.453	0.644	0.379	
OBLIT	0.744	0.553	0.416	0.651	0.688

(WIDTH) tend to have fewer indentations per square centimeter (PER). This makes sense as wider indentations will necessarily take up more space and thus, occur in lower numbers per unit area. At the same time, this relationship is much more pronounced among vessels found at some settlements than others. This suggests that potters producing the vessels in different portions of the study area were choosing the spacing between indentations somewhat differently. Thus, although these two variables (WIDTH and PER) are related, they still likely preserve evidence for somewhat different technological decisions. Overall, the lack of consistent relationships among variables at the site level suggests that the inclusion of all of the original continuous variables is warranted, although the potential effects of including or excluding correlated variables should be tested.

Presence/Absence, Nominal, and Ordinal Variables

Assessing the relationships among the non-continuous variables included in this analysis requires somewhat different methods than those described above. The maximum set of variables considered in the quantitative analysis described in Chapter 6 includes 7 presence/absence, nominal, and ordinal variables. The relationships among these variables can be assessed using the *Goodman-Kruskal's* λ coefficient. *Goodman-Kruskal's* λ is a measure of association among nominal variables (or variables that can be treated nominally) based on the proportionate reduction of error achieved by using the value of an independent variable to estimate the value of a dependant variable (Goodman and Kruskal 1954, 1959, 1963). *Goodman-Kruskal's* λ is calculated based on a two-way table of the potential states of the independent variable against the potential states of the dependant variable as:

$$\lambda = \frac{|\sum(f_i) - f_d|}{n - f_d}$$

where f is highest frequency for each of the i classes of the independent variable, f_d is the frequency of the modal value for the dependant variable, and n is the total number of samples without missing data. *Goodman-Kruskal's* λ ranges from 0.0 to 1.0 and the λ value can be interpreted similarly to Pearson's r, as the proportion of predictor error that is reduced by incorporating knowledge of the independent variable. For example, a value of λ = 0.75 indicates that knowledge of the independent variable improves the chance that a predictor would assign the correct value to the dependant variable by 75%. This improvement is defined in relation to the expected number of cases that would be correctly classified by simply assigning all cases the modal value of the dependant variable.

Table C.4 shows values of *Goodman-Kruskal's* λ among pairs of each of the seven non-continuous variables included in this study. *Goodman-Kruskal's* λ is an asymmetrical statistic so both the upper and lower portions of the matrix need to be considered separately. For example, knowing whether or not a vessel is smudged (SMDG) improves the chances of correctly assessing the nominal value of interior smoothing (INTR) by 40.7%, but knowing the value of interior smoothing only improves the chance of assessing smudging by 18.7%. This makes intuitive sense because smudging a vessel usually requires that the surface be highly polished or at least smoothed but polishing a vessel does not require that it be smudged. In general, *Goodman-Kruskal's* λ values for all of the variable comparisons included here are quite low. The two highest values for comparisons between smudging and interior surface smoothing described above are not particularly strong nor is this association symmetrical. Overall, the results presented here suggest that the inclusion of all of the presence/absence, nominal, and ordinal variables is warranted.

Additional Notes

As the brief discussion and statistical tests of variable correlation and association presented above suggest, the inclusion of all of the original variables selected for quantitative analysis is defensible as long as the potential effects of each variable are considered. In addition to the tests described above, the results presented in Chapter 6 were further assessed by removing individual variables,

Table C.4. Values of *Goodman-Kruskal's λ* for all non-continuous variables included in this analysis. Relatively high values are highlighted.

		Independent Variables						
		I TYPE	DIREC	ALIGN	ELAB	PATT	SMDG	INTR
Dependant Variable	I TYPE	1	0.003	0.000	0.000	0.000	0.000	0.031
	DIREC	0.000	1	0.000	0.000	0.000	0.000	0.000
	ALIGN	0.000	0.026	1	0.000	0.000	0.000	0.000
	ELAB	0.031	0.012	0.000	1	0.000	0.004	0.015
	PATT	0.025	0.019	0.000	0.000	1	0.000	0.000
	SMDG	0.000	0.011	0.000	0.000	0.000	1	0.187
	INTR	0.000	0.036	0.000	0.000	0.000	0.407	1

groups of variables, and entire classes of variables at a time to determine whether or not certain variables (or variable classes) were driving the overall results. As discussed briefly in Chapter 6, although the specific ceramic technological clusters defined differ depending on which variables are included, the overall patterns of *relative* similarity among sites and sub-regions are robust to the inclusion or exclusion of any set of variables. This suggests that the initial analyses presented in Chapter 6, based on the full set of 13 selected variables, can be seen as an appropriate characterization of patterns of relative similarity in ceramic technology across the Cibola region.

Summary Data for Ceramic Technological Clusters

In this final section, I present a series of figures (Figures C.2-C.12) displaying the distribution of values for the variables described above within each of the ten technological clusters defined in Chapter 6. These results are based on the maximal set of thirteen variables included in the quantitative analyses.

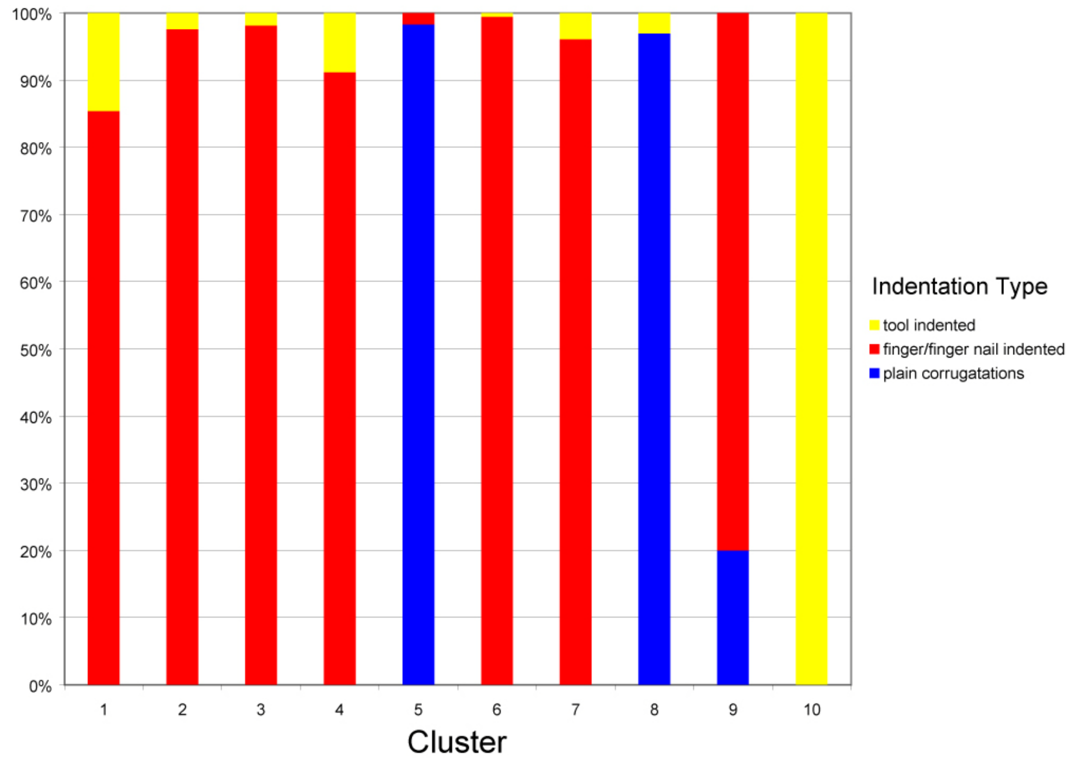

Figure C.2. Indentation type by technological cluster.

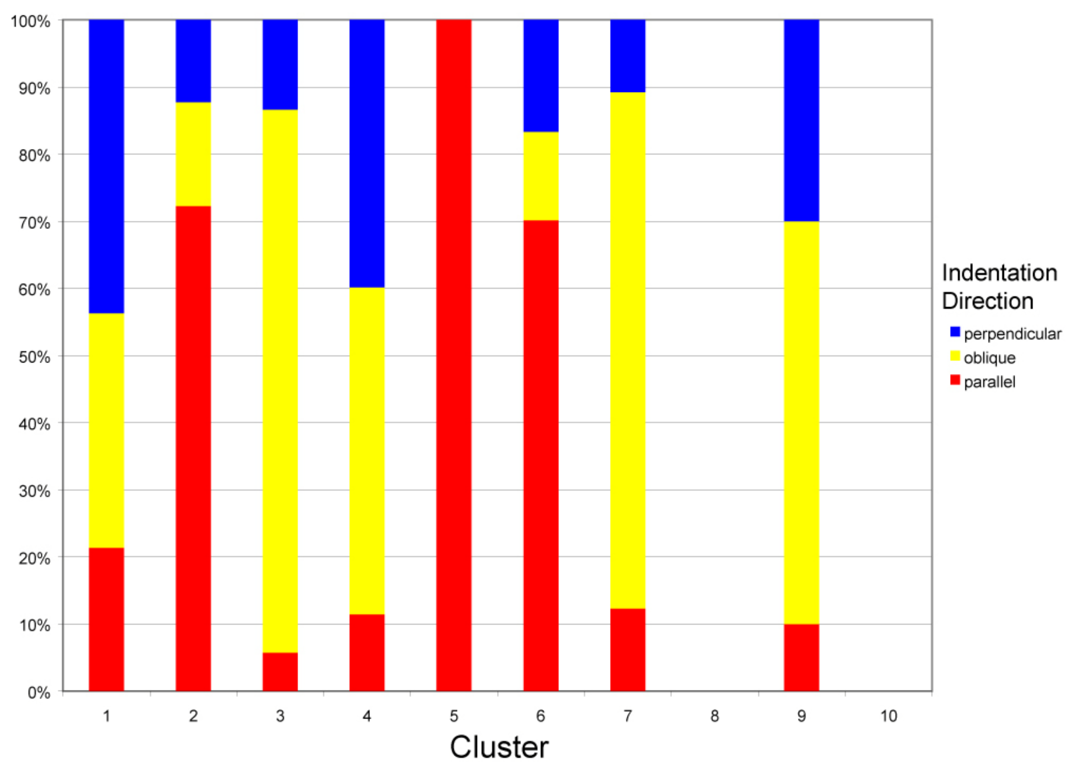

Figure C.3. Indentation direction by technological cluster.

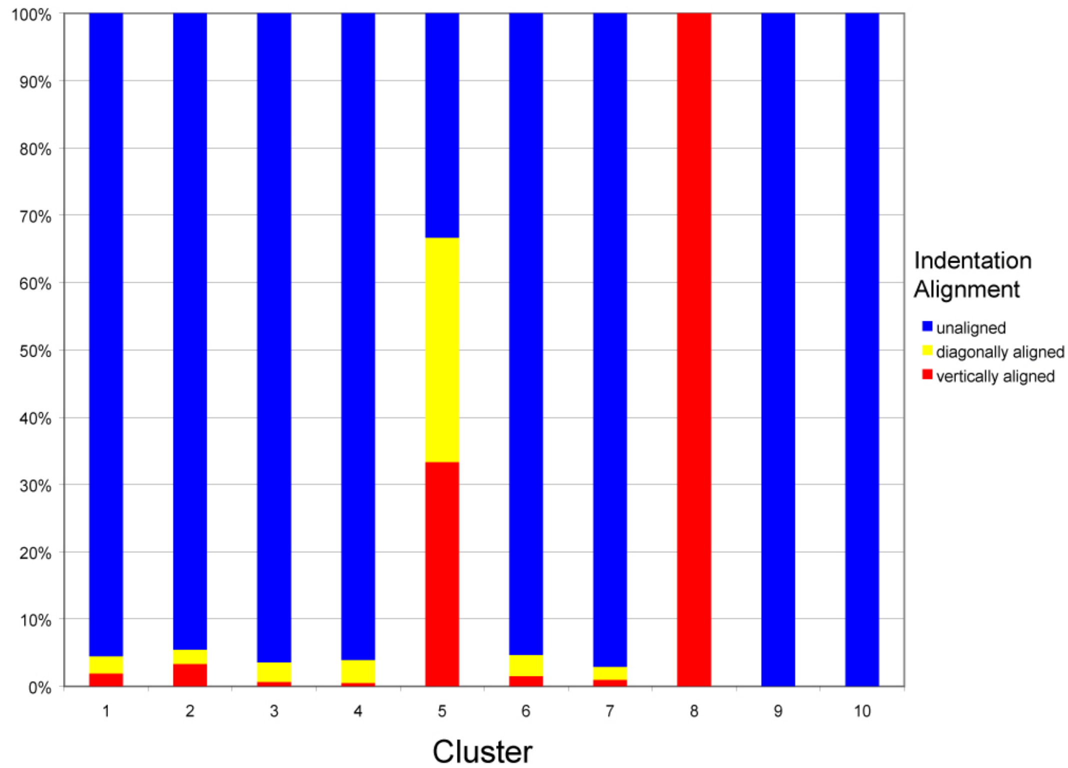

Figure C.4. Indentation alignment by technological cluster.

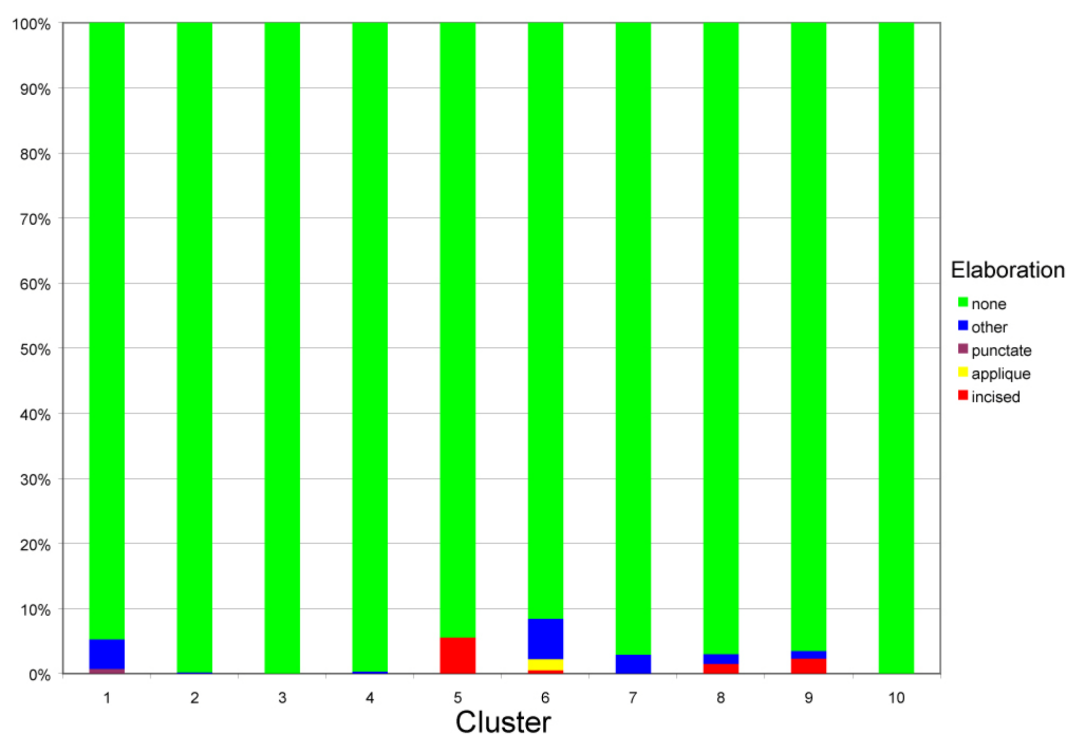

Figure C.5. Surface elaboration by technological cluster.

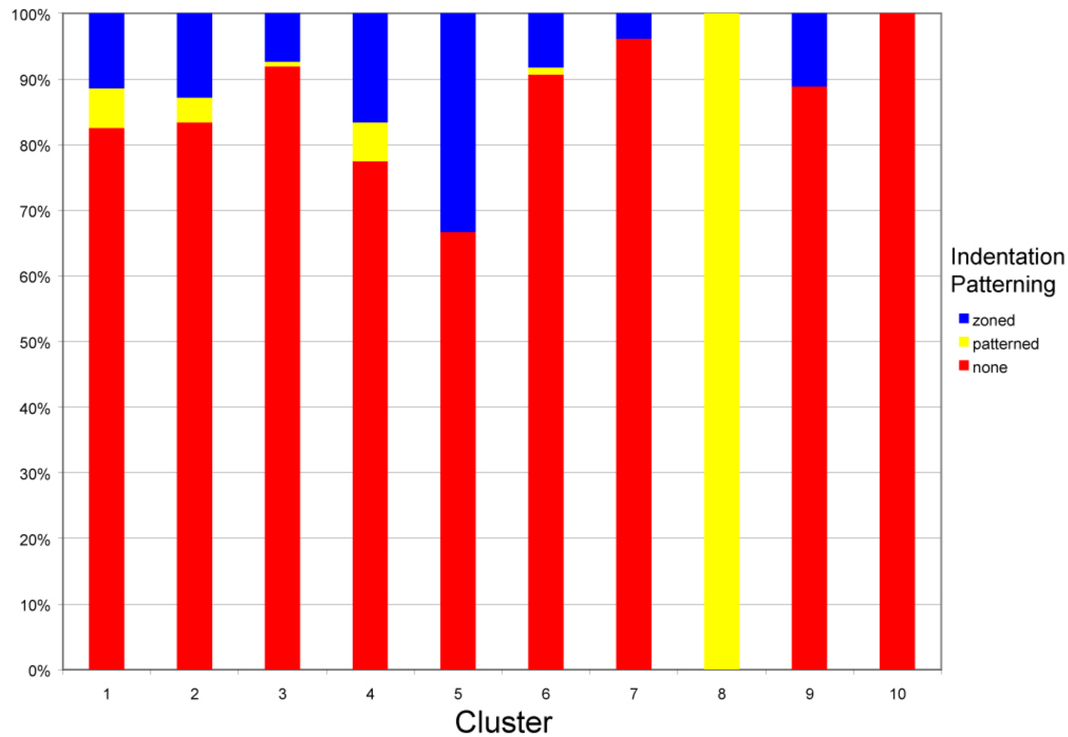

Figure C.6. Indentation patterning by technological cluster.

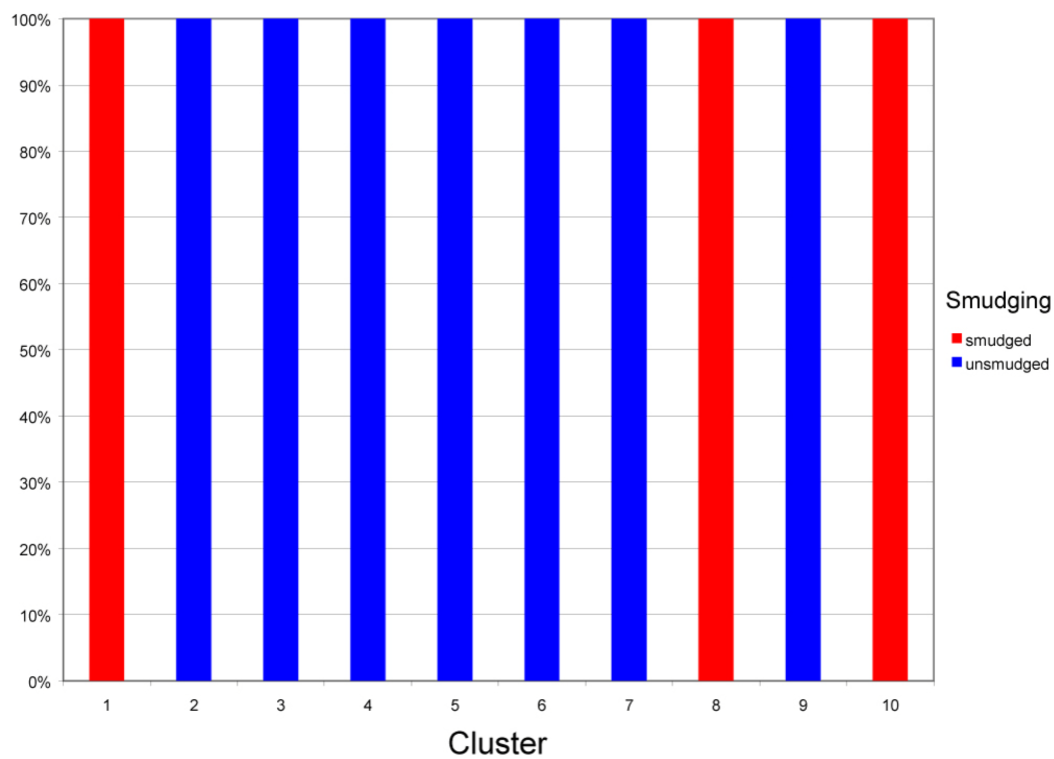

Figure C.7. Smudging by technological cluster.

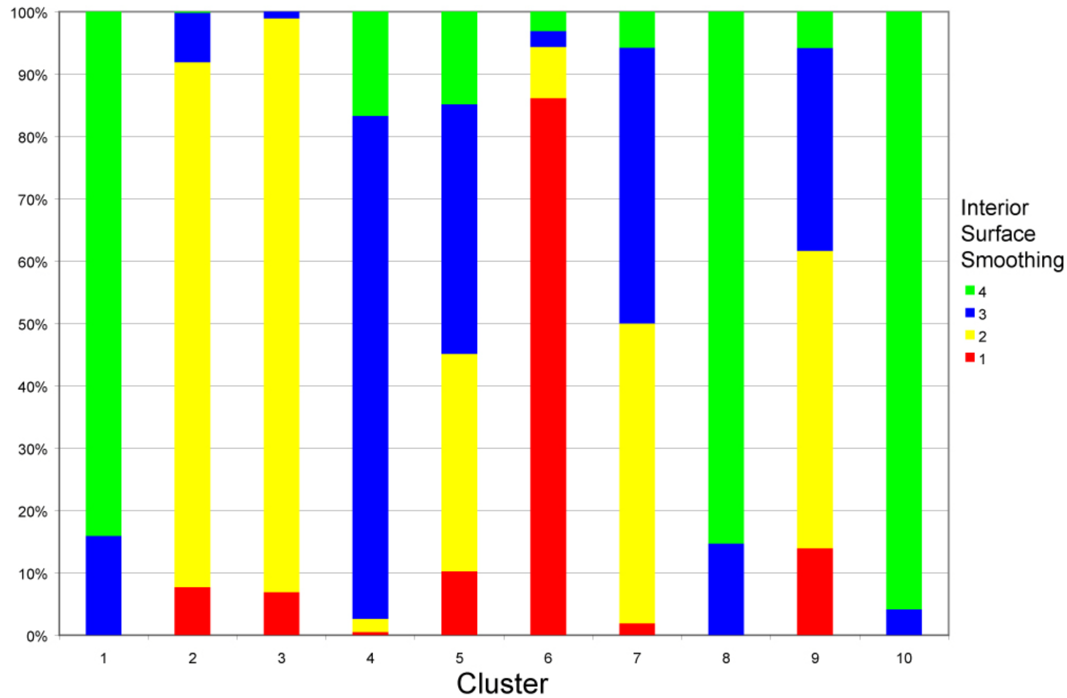

Figure C.8. Interior surface smoothing by technological cluster.

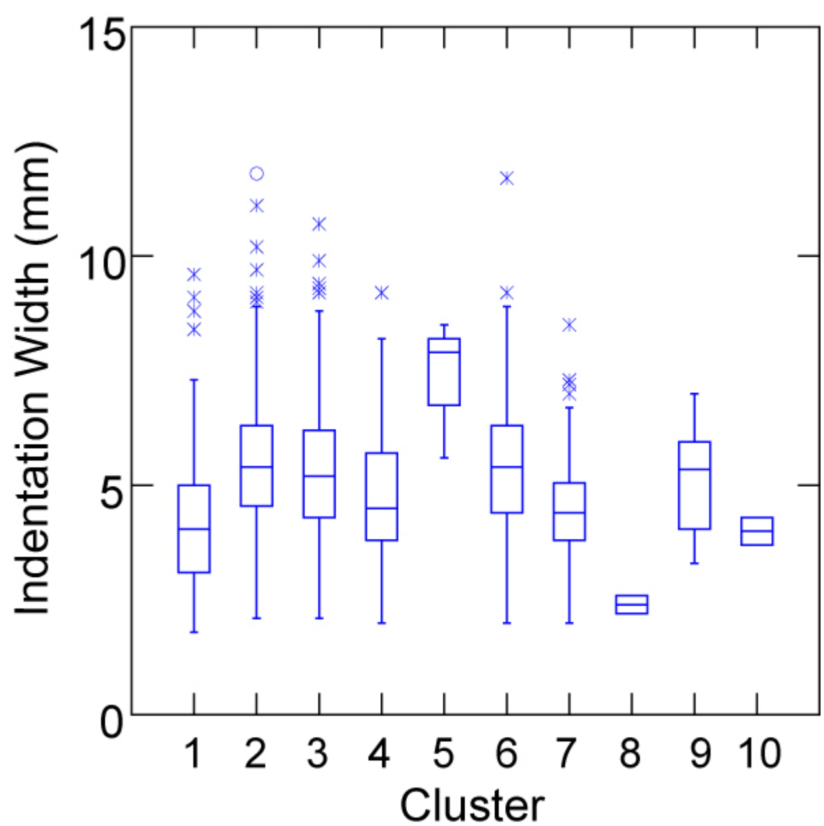

Figure C.9. Indentation width by technological cluster.

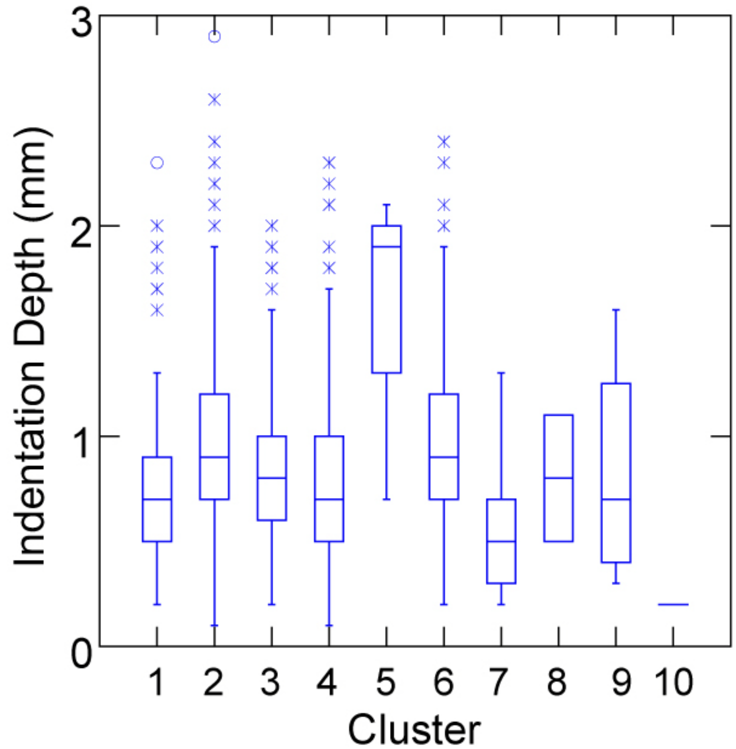

Figure C.10. Indentation depth by technological cluster.

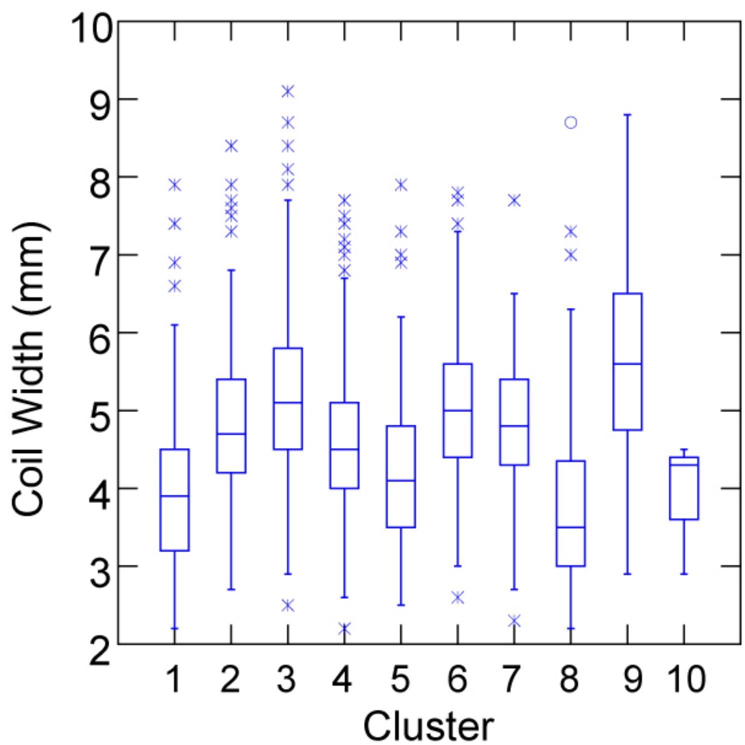

Figure C.11. Coil width by technological cluster.

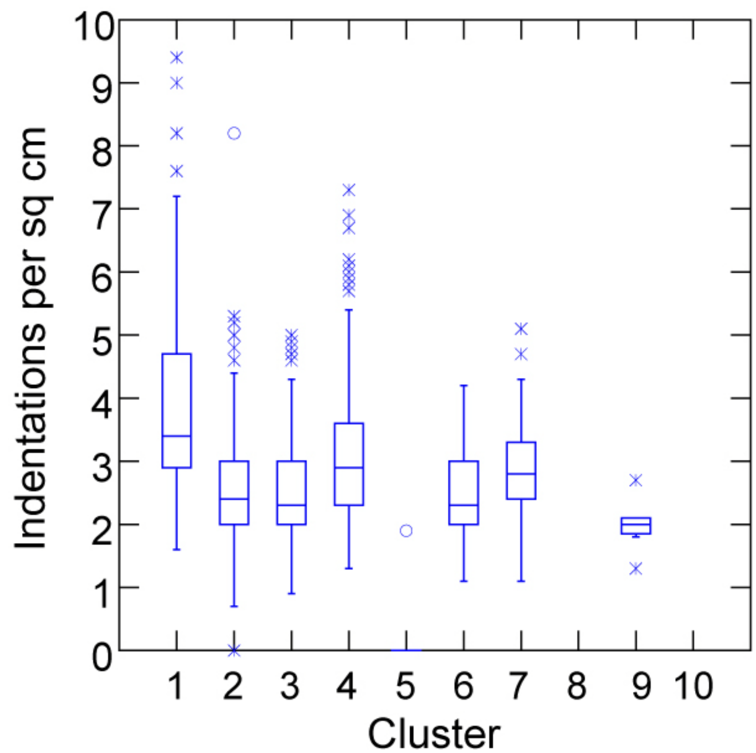

Figure C.12. Indentations per square centimeter by technological cluster.

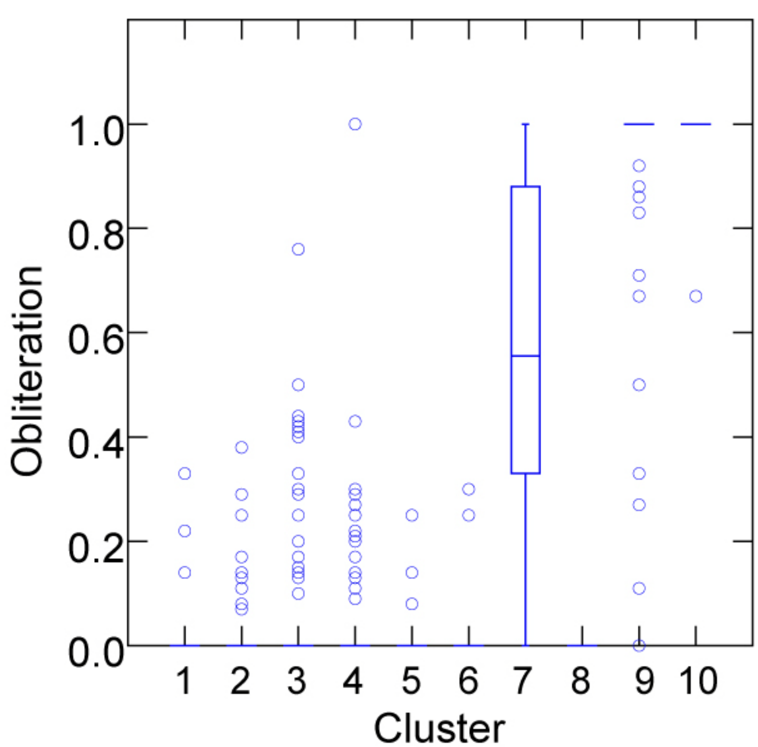

Figure C.13.Obliteration by technological cluster.

Appendix C Notes

[1] Outliers were identified by examining boxplots of individual continuous variables.

[2] Obliteration was not included in this figure as the great majority of samples were assigned a value of 0.0 making visual representations of inter-variable relationships less useful.

APPENDIX D

CODING CRITERIA FOR CERAMIC DESIGN ANALYSES

This appendix provides additional details and coding criteria for the two ceramic design analyses presented in Chapter 8; 1) design element coding focused on early White Mountain Red Ware vessels and 2) the repeated design configuration analysis focused on Zuni Glaze Ware and late White Mountain Red Ware. Appendix E provides the raw data and tabulations based on these analyses.

Design Element Analysis

As described in Chapter 8, a series of specific design elements and attributes were defined and coded for a large sample of early White Mountain Red Ware bowls recovered from sites across the study area. Table D.1 provides the codes used for these data and Figures D.1-D.6 show examples where relevant.

Table. D.1. Codes used for design element analysis in Chapter 8.

Vessel Level Designations			
Exterior Color	Interior Color	Design Placement (Figure D.1)	Bounding Lines (Figure D.2)
1- W/R	1- W/R	1- unit	0- none
2- B/R	2- B/R	2- single band	1- top only
3- W&B/R	3- W&B/R	3- multi-level band	2- bottom only
4- B w/ W outlines	4- B w/ W outlines	99- other	3- top/bottom
5- W w/ B outlines	5- W w/ B outlines		4- sectioned
6- B/W/R	6- B/W/R		99- other
7- B/W	7- B/W		
99- other	99- other		

Element Level Designations			
Primary Element (Figure D.3)	Element Fill (Figure D.4)	Element Interaction (Figure D.5)	Sec. Element (Figure D.6)
1- terrace/step	1- solid	1- isolated	1- terrace/step
2- rect. scroll	2- hatched	2- running	2- dots
3- triangular scroll	3- hollow	3- interlocking	3- hook
4- circ. scroll	4- corbelled	4- nested	4- linking line
5- simple lines	5- line outlined	5- attached	5- linking corbel
6- triangle/zig-zag	6- complex	99- other	99- other
7- rect./diamond	99- other		
8- inter. bracket			
9- hand/paw			

Figure D. 1. Examples of each design placement code.

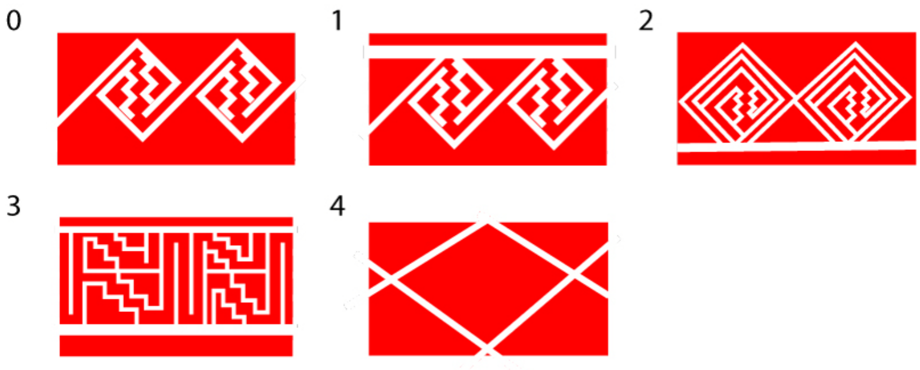

Figure D.2. Examples of each bounding line code.

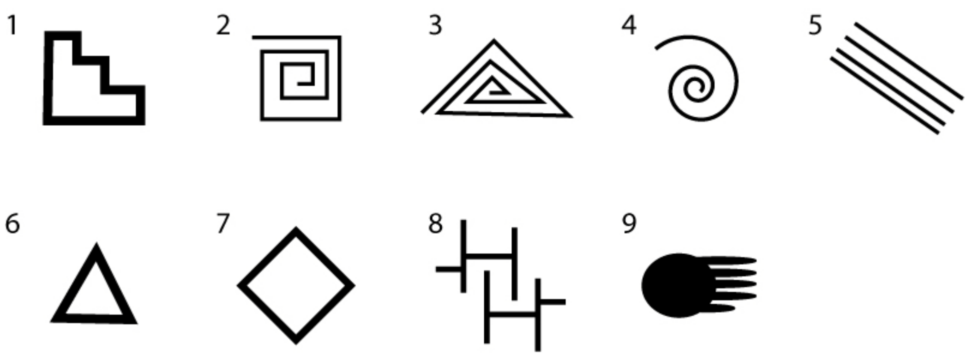

Figure D.3. Examples of the 9 most common primary design elements.

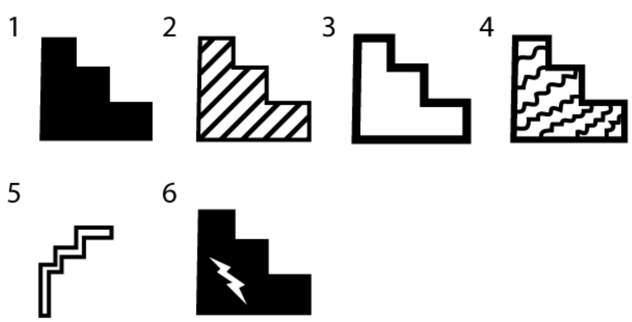

Figure D.4. Examples of element fill codes.

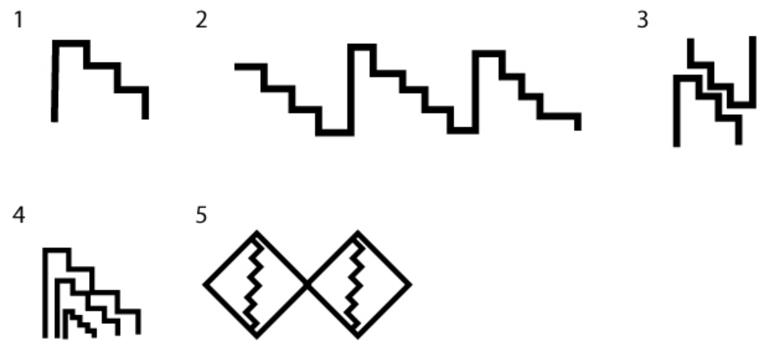

Figure D.5. Examples of element interaction codes.

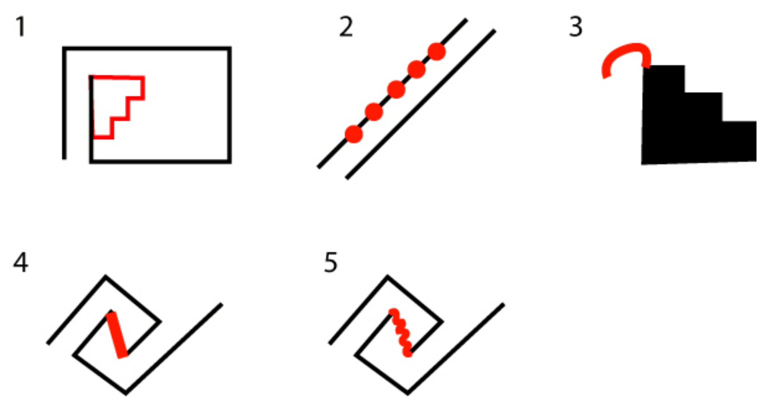

Figure D. 6. Examples of the most common secondary element codes (shown in red).

Identifying Repeating Design Configurations

Chapter 8 describes the methods used to identify and quantify repeated design configurations (design families) for a large sample of Zuni Glaze Ware (Heshotauthla and Kwakina Polychrome) and late White Mountain Red Ware (Pinedale Black-on-red and Polychrome) vessels. Figure D.7. shows one example from each of the design families defined for this study as well as the frequencies of each.

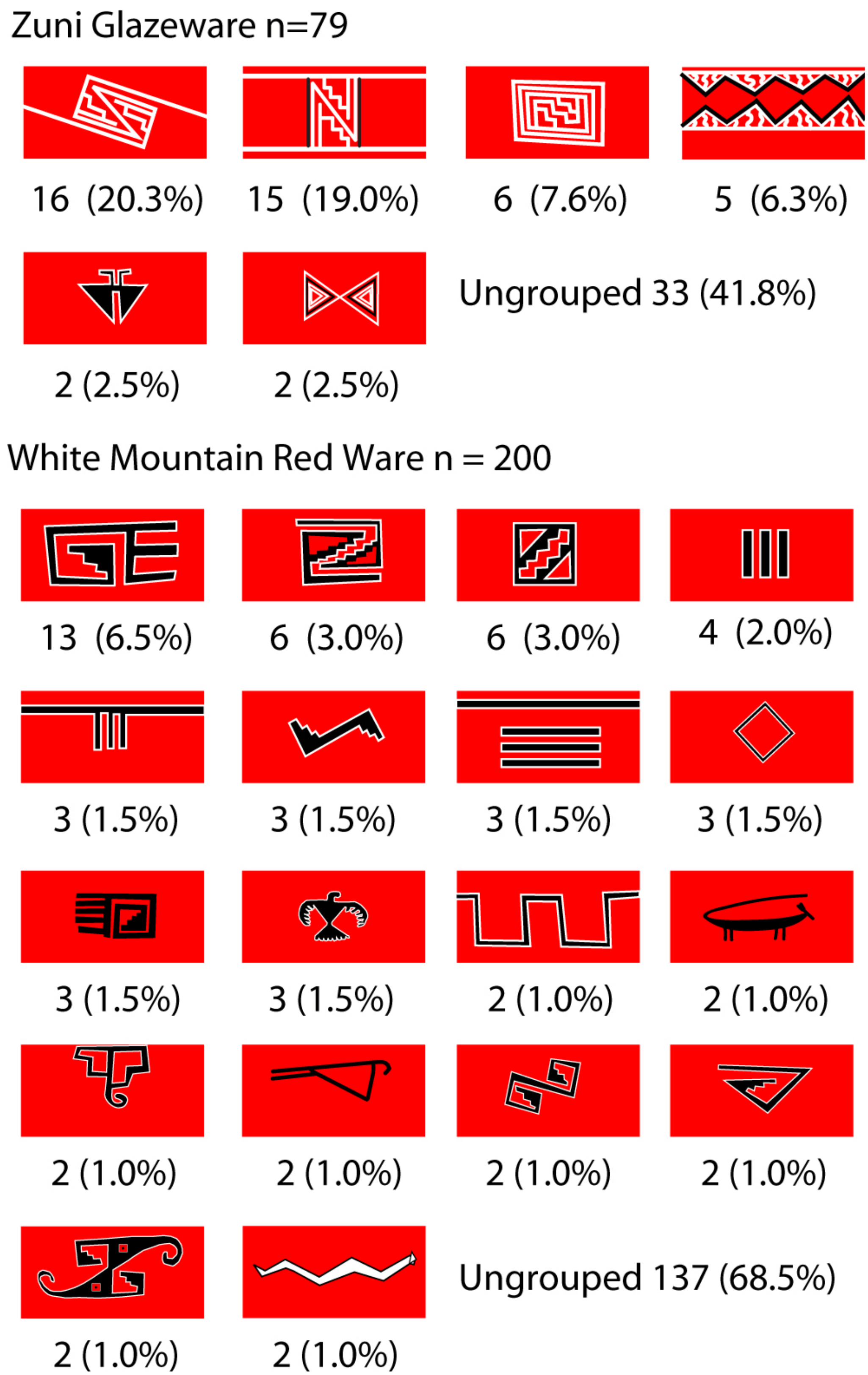

Figure D.7. Examples and frequencies of all design families.

APPENDIX E

RAW DATA AVAILABILITY

Electronic versions of the raw data files and R scripts used in this dissertation are available through the Digital Archaeological Record (tDAR) data repository http://www.tdar.org.

Permanent link to raw data and coding sheets associated with this dissertation: http://core.tdar.org/project/368796

Electronic versions of the INAA data presented in Chapters 4 and 5 are also available through the Archaeometry Laboratory of the University of Missouri Research Reactor (MURR).

http://archaeometry.missouri.edu/datasets/datasets.html