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THE MINERALOGICAL AND CHEMICAL VARIABILITY OF CASAS GRANDES POLYCHROMES THROUGHOUT THE INTERNATIONAL FOUR CORNERS

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by

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Emma Lenore Britton

The Mineralogical and Chemical Variability of Casas Grandes Polychromes Throughout the International Four Corners

Paquimé (Casas Grandes) and its culturally associated hinterland span the International Four Corners, which includes southeastern corner of Arizona, the southernmost regions of New Mexico, the eastern edge of Sonora, and much of the modern state of Chihuahua. Through time, these geographic boundaries have been primarily determined through the presence of Casas Grandes polychromes which have acted as one of the defining features of their eponymous region (Brand 1935; Sayles 1936; Whalen and Minnis 2001a, 2012). Though these ceramics are accompanied by other traits, polychromes remain the only category of material culture not criticized for having a geographically spotty distribution. It is not surprising that from early in the history of Casas Grandes archaeology that polychromes have been a subject of many studies and academic discussions.

However, the current typology has not been fruitful in regard to traditional questions of temporal and spatial sensitivity. Some of the less well studied secondary characteristics, however, such as paste color and paint type, may be useful for addressing more current anthropological questions in that they probably represent

behavioral modes and communities of practice. Up until this point, such secondary characteristics have received little comprehensive attention. This dissertation represents an attempt to remedy breaches in our comprehensive understanding of Casas Grandes polychromes by presenting results from multiple characterization techniques focusing on describing paste and black paints.

Ultimately, my analyses revealed the fact that Casas Grandes potters adhere to a limited number of identifiable potting traditions regarding the manufacture of pigments and ceramic bodies. What is more, these recipes do not have direct relationships to one another but rather cross-cut formal types. Additionally, compositional paint groups and paste types do not directly correspond to one another.

Perhaps most significant, is clear evidence that these modes of procurement regarding raw clay types, specifically, appear to be a long-situated pattern of behavior. I can only speculate as to whether or not these procurement patterns have antecedents prior to AD 1150 when the Medio begins, though it seems most certain that they would. Most importantly, regardless of possible antecedents, this pattern long precedes the florescence of Paquimé.

Acknowledgments and Dedication:

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I also recognize those who supported me but are no longer with us, including Linda Cordell and Jane Kelley. Linda's formidable ability to network junior colleagues was impressive and I hope to emulate her example through my life. I regret that I have not become “the woman who is going to solve all our problems with Casas Grandes ceramics,” as Jane declared the first time we met, over the course of my dissertation. But I can only hope that her words will be prophetic throughout the rest of my professional life.

To my immediate cohort-mates, Mexican, Canadian, and American, I recognize your high levels of competence in the lab and field. I have confidence in the abilities of my immediate colleagues and maintain a deep respect for their contributions to Casas Grandes archaeology. As such, I look forward to the next fifty years of research in the region.

I am peculiarly grateful to a ridiculous cat and dog who have both stared at me adoringly and sat on me as I wrote and formatted. One of them fits much better than the other, but both are awkward.

Chapter 1:

Style, Practice, and Interaction in Ceramic Assemblages

Pottery is one of an archaeologist's stronger lines of evidence of past human behavior due to its ubiquitous and variable nature. Because they are generally chemically stable, ceramics preserve far better than their organic or metallic counterparts, which under most of Earth's surface conditions rot, rust, and otherwise disappear from the archaeological record. Traditionally, archaeologists have used the shift in frequencies of various ceramic attributes to create chronologies, which have been used in cultural historic theoretical frameworks to track specific groups of people and culture change through time (Binford 1972). However, the archaeological analysis of ceramics has grown over the past several decades continuing to be informed by various academic disciplines, moving studies beyond physical lines on a map and chronological sequences.

Due to their widespread use and diversity, ceramics have been used to study multiple aspects of human life. As noted by Shepard (1954) stylistic analyses, specifically, of ceramics is rich due to the fact that pottery "offers two media, the plastic and the graphic." However, the versatility of stylistic analyses has broadened further given the fact that archaeologists have shifted their understanding that changing ceramic styles are not just a passive proxy for temporal and spatial cultural variability (Shanks and Tilley 1987) but rather an active venue through which human behavior and meaning is recorded (Hodder 1985; Miller 1982; Shanks and Tilley 1987; Wobst 1977). This active interpretation of style has its roots in Wobst's (1977) work, which argues that style functions as a medium for the exchange of information. Though Wobst has been criticized because the topic of information exchange is broad, this perspective has moved studies of style from the passive to the active (Hegmon 1992).

With this broadening in understanding, stylistic analyses of ceramic design and technology exhibited a florescence through the 1990s (Rice 1996). Hegmon (1992) condenses the various archaeological definitions of the word "style" into two basic components, defining style as both a "way of doing something" in addition to an active choice made when given many alternatives. Works by Lechtman and Merrill (1977) and Lemonnier (1986, 1989) have explored the fact that not only are ceramics, and other, artifacts endowed with style themselves, but that the actions through which they are created are also highly stylized. Lechtman (1977) further defines this concept of "making" as technological style, through which social rules govern the production steps during craft production. Lechtman (1977) claims that the ability to produce any craft object is directly related to knowledge and understanding of belief systems, cultural identity, and social or political relationships. Thus, technology and production is not simply understood in economic terms, but is rather moved into a more complicated, and human, role.

Though these ideas and approaches have gained traction and been more fully developed in the last twenty years, some of the foundational elements in the previous paragraph have long-standing in the discipline. For example, Rouse (1960: 313, original source Rouse 1939) defines modes as “any standard, concept, or custom that governs the behavior of the artisans of a community, which they hand down from generation to generation, and which may spread from community to community over considerable distances.” According to Rouse (1960), modes may either be procedural, having to do with the way in which an artifact was made, or conceptual, the ideas of shape, decoration, and material-type to which the maker was aspiring.

Rouse argues that modes are a way of “doing or making” an artifact and it logically follows that sets of modes will track one another, as a single person or group of people will likely know how to “do and make” objects using similar processes that result in a finished object that we can recognize as representative of a “type.” Rouse specifically states that types generally consist of two or more modes, which are determined to be diagnostic by the archaeologist and can be organized systematically, intuitively, or statistically. In more contemporary literature, Rouse's (1960) modes, and more specifically his procedural modes, can be connected to the use of Leroi-Gourhan's *chaîne opératoire* by various scholars within the field of anthropology (Audouze 2002; Dobres 2000; Pelegrin et al. 1988).

These deep-seated foundational principles and more recent collective theoretical shifts in our understanding of ceramic styles have lent themselves to a reinvigorated set of studies focusing on communities of practice. Communities of practice, as Lyons and Clark (2012: 56) directly define them, “consist of co-participants with a shared history of learning, which implies social relations and issues of power, legitimacy (competency), and access to knowledge.” Identities within these communities are created through participation within groups. Wenger (1998; Wenger and Snyder 2000) identifies three core characteristics of communities of practice: mutual engagement, which implies “dense” social relationships centered around a certain activity, joint enterprise, wherein “accountability” is continuously negotiated between individuals, and shared repertoire, which implies that people are knowledgeable of the same kinds of tools, processes, and stories involved in their shared activity.

Given Rouses' argument and archaeology's current theoretical focus on practice, ceramic typologies shift from fossilized tools of culture historians to a meaningful resource for advocates of practice theory looking to identify anthropologically meaningful past human behaviors. By interrogating these modes, we can articulate with contemporary anthropological conversations, especially in regard to widespread Southwest ceramic styles like those discussed in the proceeding section.

Practice and Ceramic Styles in the Greater Southwest:

Though archaeologists are frequently cautioned with the cliché “pots do not equal a people," the fact that close social groups produce stylistic similarities has encouraged the culture historic theoretical stance that a set, or even a single type, of cultural remains could represent the genesis, migration, and existence of a culturally distinct group of people. As such, more nuanced archaeological understandings of style have greatly benefited archaeologically identifiable ceramic styles that have typically resisted the more classic uses of serving as geographic or temporal indicators. By and large, successful departures from these older perspectives have been a direct result of focusing on what are often already-identified traits (modes) of formal types and what these aspects tell us about human behaviors through time. Such refocus on ceramic production has been central for our developing understanding of Salado polychromes (also known as Roosevelt Red Wares) and White Mountain Red Wares in the American Southwest, for example. A discussion of these ceramic horizons, how they have been defined traditionally, and our changing understanding of what they represent is summarized, below. In using these case studies as examples of positive research trends, we can further our understanding of other geographically wide-ranging yet poorly understood collections of ceramics, such as Casas Grandes polychromes.

Salado Polychromes

The term Salado is most specifically used to describe a ceramic horizon, which includes Pinto, Gila (see Cliff, AD 1350-1450, for variant), and Tonto polychromes which are identified by a combination of red and white slipped treatments, the presence of organic black paints, and specific design elements superimposed upon a brown paste (Crown 1996; Lekson 2002). This suite of ceramics dates from approximately 1270 through the late 1300s with the latest type, Tonto Polychrome, manufactured no later than 1450 (Crown 1996). These ceramics are the only known set of ceramics to cross-cut three distinct cultural regions, the Ancestral Pueblo, the Mogollon, and the Hohokam, extending through the several modern states throughout the United States and Mexico, including southern Arizona, southwestern New Mexico, and northern Sonora and Chihuahua (Crown 1994, 1996; Lindsay and Jennings 1968; Young 1967, 1982). The Salado “heartland,” however, is defined by E. W. Haury as the Tonto Basin in central Arizona (see Figures 1.1 and 1.2; Crown 1996; Lekson 2002; Lincoln and Dean 2000; Simon et al. 1998).

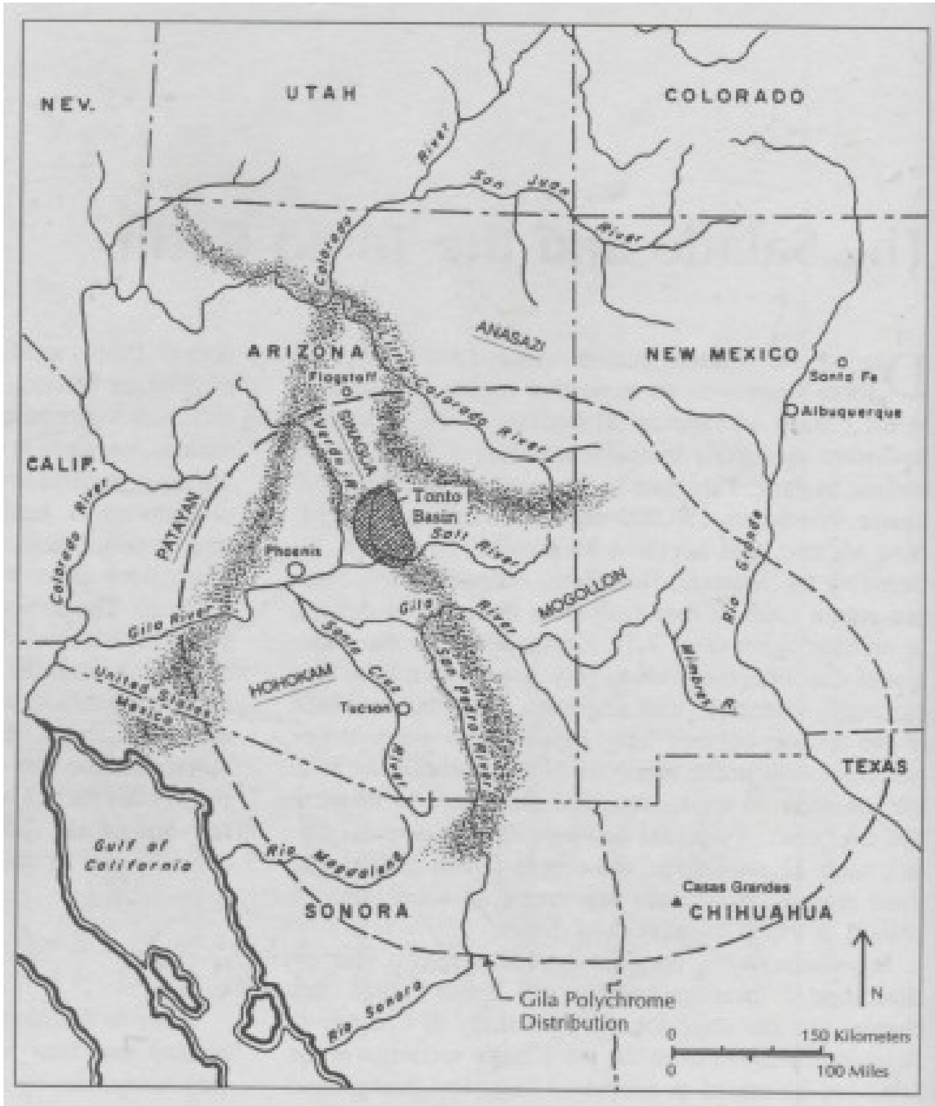


Figure 1.1: Map demonstrating the geographic extents of Gila Polychrome, one of the Salado polychrome types (Clark 2001).

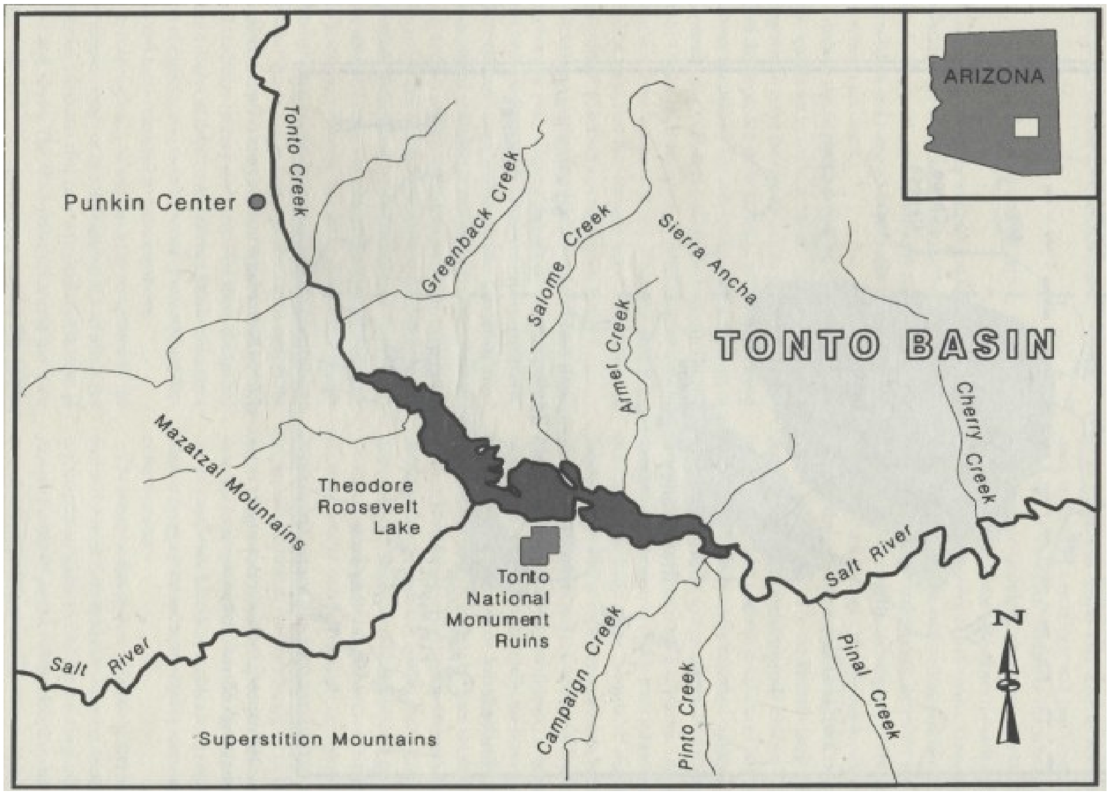


Figure 1.2: Map depicting the Tonto Basin, an area in modern central Arizona, that is typically thought to be the Salado "heartland" (Dean 2000).

The term "Salado" was coined by Harold and Winifred Gladwin in 1935 who were attempting to differentiate between two settlement types and their respective material correlates in the Gila-Salt Basin (Crown 1996; Lekson 2002; Nelson and LeBlanc 1986). Sites in the Gila-Salt Basin that contained multistory adobe structures surrounding plazas, extended human burials, and Salado polychrome pottery did not fit the traditional Hohokam pattern and became known as Salado. These shifts and especially the distinct pottery style marked these sites as culturally discrete, leading archaeologists to begin looking for an influx of migrants into the area. As such, the term Salado ultimately became tied with not only pottery styles, but also a people (Crown 1996; Lekson 2002; Nelson and LeBlanc 1986).

According to the Gladwins, Salado immigrants arrived in the Tonto Basin by A.D. 1000 and came from the Little Colorado (Gladwin and Gladwin 1935; Crown 1996). These migrants helped characterize the Roosevelt phase, defined by the appearance of Pinto polychrome among other traits. These early migrants were then joined by others from the Kayenta Anasazi region, leading to the production of Gila polychrome. Similar interpretations based on immigration followed with Haury (1945) suggesting that Salado represented a blend of Mogollon and Anasazi people who had developed an independent culture in the White Mountain-Little Colorado area, before moving into the Tonto Basin, whereas Schroeder (1953) suggested that the Salado were a blend of Sinagua and Hohokam peoples.

Through time, archaeologists recognized that Salado polychromes occurred over a great geographic area outside of what was originally defined as the Salado heartland. However, when recovered outside of the Salado region it was generally assumed that these pots had been traded from the Salado heartland or that Salado migrants had brought these pots with them (see Grebinger 1976; Hayward and Masse 1976; Crown 1996). It was not until petrographic work from the 1950s was validated by other more-recent materials science techniques utilized by archaeologists and updated perspectives of ceramic styles that alternative explanations were needed for the origins and distributions of these finished vessels.

Early petrographic analysis of Gila polychrome sherds completed by Danson, an anthropologist, and Wallace, a geologist, indicated that Gila Polychrome was not manufactured in or disseminated from any one single place. Rather, petrographic analysis supported the interpretation that raw materials utilized to manufacture pottery were derived from a minimum of five distinct geologic sources (Danson and Wallace 1956). However, these results did not support the then-current theoretical framework and remained generally ignored in discussions of who the Salado people may have been (Crown 1996). However, continuing work in materials analysis (Crown 1996; Di Peso 1976; Gosser et al. 1998; Zedeño and Triadan 2000 among others) supported Danson and Wallace's (1956) early petrographic work that Salado polychromes throughout the Southwest are manufactured locally, rather than distributed from a regional center specializing in the ceramic production.

Using these data that support the prevalence of the local production of Salado wares as well as additional stylistic study of design elements (Crown 1994), Crown (1996) and Clark (2001) have suggested that Salado polychromes reflect an ideological movement (Crown 1996) and an economic strategy (Clark 2001) utilized by new arrivals to various communities throughout the Southwest. Crown (1996) argues that Salado polychromes reflect an attempt to create a new regional cult intended to socially integrate new immigrants into their adoptive communities. Alternatively, Clark (2001) argues that what appears to be a limited degree of specialization and standardization of Salado polychromes may be a result of immigrant female potters actively supplementing their new households economically by creating a surplus of pottery. Given that ownership of good arable land would have been likely dominated by those who were long-established within communities and the high probability that land inheritance was matrilineal (VanPool and VanPool 2006), newly arrived people (including women) would have found it difficult to become established in already-existing communities (also see Clark et al. 2013; VanPool and Savage 2010). Largely, Salado polychromes are still indicative of "a people," but what these distinct ceramic styles meant to and used by the people manufacturing them has become part of a more nuanced conversation regarding community formation in the American Southwest.

White Mountain Red Wares

White Mountain Red Wares (AD 1100-1400) represent a second long-recognized widely distributed set of ceramics in the American Southwest, from the Acoma area in New Mexico to the Mogollon Rim in east-central Arizona (Carlson 1970; Colton and Hargrave 1937; Duwe and Neff 2007) and include individual types referred to as Cedar Creek Polychrome, Fourmile Polychrome, Kintiel Polychrome, Pinedale Polychrome, Puerco Polychrome, Showlow Polychrome, Springerville Polychrome, St. Johns Polychrome, Techado Polychrome, and Wingate Polychrome. Several bichrome variants are recognized. Like Salado polychromes, they are recognizable by the presence of distinctive red slips, which is often well-polished. However, in contrast to Salado polychromes, white clays are used on bowl exteriors as a paint rather than a slipped backdrop (Carlson 1970). In regard to their ceramic pastes, White Mountain Red Wares are nearly always tempered with white, gray, and orange sherd (grog) fragments and frequently fire light white and buff colors, indicating the use of low iron clays, though there are some exceptions.

Originally, Carlson (1970) posited that stylistic distinction between White Mountain Redwares were indicative of distinct social units with changes in ceramic style reflecting cultural changes through time. He attributed these changes to population movements from the Cibola area of the upper Little Colorado River Valley to the Mogollon Rim area, influence from the ceramic tradition of the Hopi-Kayenta region, and later contact with northern Mesoamerica. However, by focusing on White Mountain Red Wares recovered from Grasshopper Pueblo and various other nearby sites (see Figure 1.3) Triadan and colleagues (Triadan 1997; Triadan et al. 1997) recognized at least four contemporary compositional groups that suggested some local manufacture of Red Mountain Redwares, in addition to import of finished vessels from elsewhere.

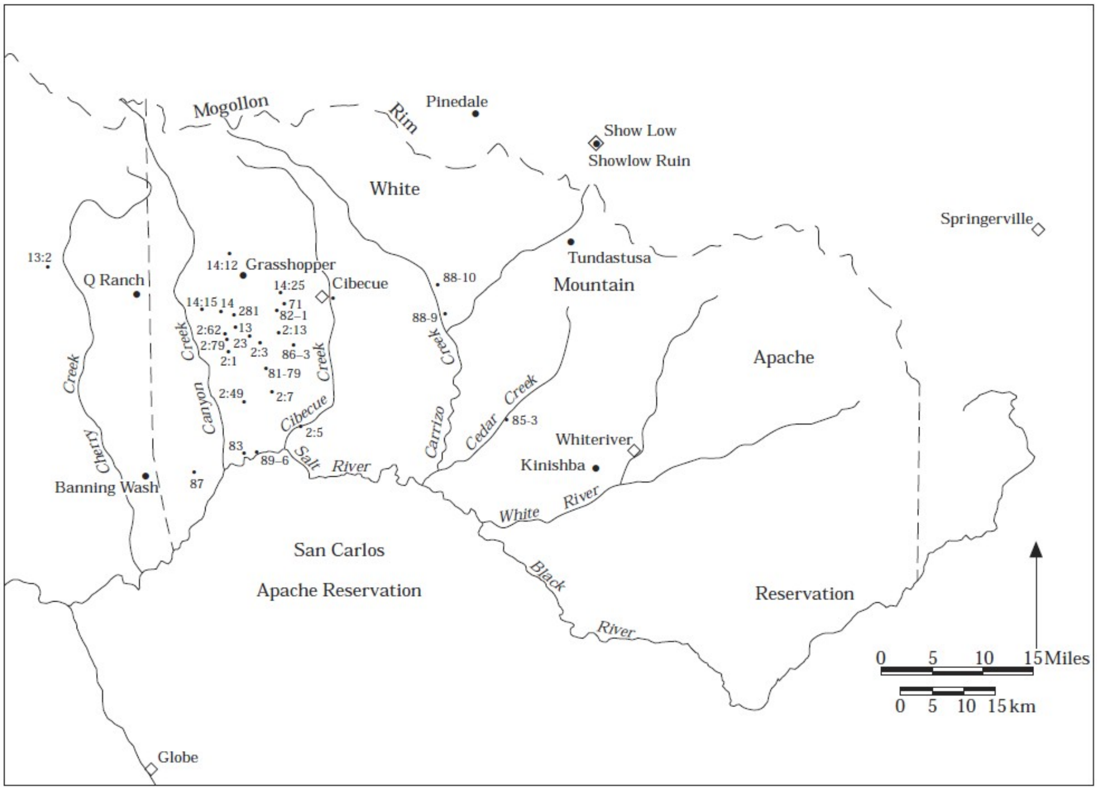


Figure 1.3: Location of Grasshopper Pueblo and its physical relationship to nearby sites (Triadan et al. 1997).

Triadan (1997) and her colleagues (Triadan et al. 1997) also noted that locally manufactured Red Mountain Redwares demonstrate clear technological shifts through time, indicating that sets of potters manufactured vessels using different paste recipes and eventually substituted non-local slip and paint materials for local ones. Since this time multiple paint (Duwe and Neff 2007; Fenn et al. 2006) and slip recipes (Duwe and Neff 2007) have added to the intricacy of our understanding of this otherwise seemingly cohesive set of ceramic styles. The diversity of these “ways of making” indicate that there are at least some potters who have direct knowledge of how to make White Mountain Redwares, while other competent potters mimic these styles through time, using their own knowledge sets. The production of early types of White Mountain Redwares may represent an initial migration of peoples, but its subsequent adaptation and production by others in conjunction with these vessels' clear unrestricted use across all social groups and in feasting contexts has been linked to the spread of the Katsina cult (Triadan 1997) during this time period. Arguably, these cohesive styles may represent community members' attempts to develop a similarly cohesive newly-invented community identity despite members' initial disparate backgrounds.

Discussion and Implications for Casas Grandes Polychromes:

More modern understandings of both Salado polychromes and White Mountain Red Wares are a direct result of archaeologists' refocusing on behaviorally meaningful aspects of these ceramics. These pottery types represent not just a people, but groups of people engaging in complex social actions. Rather than presuming that what we perceive as a cohesive decorative style as being a direct result of a limited number of production loci (and potters), materials analysis of pastes (Crown 1996; Danson and Wallace 1956; Di Peso 1976; Zedeño and Triadan 2000) have re-situated these ceramics into a more complex discussion of community formation in the Southwest. Similarly, the diversity of ways in which White Mountain Red Wares are manufactured through time, coupled with its outwardly appearing cohesive style, may have worked to bind newly-formed communities together (Duff 2002; Triadan 1997; Van Keuran 2001).

These two examples are far from the only widely-distributed pottery styles within the Greater Southwest. During the Late Precontact (AD 1275-1400), a period of demographic upheaval which included the depopulation of the Four Corners and Colorado Plateau and increased human populations in the Little Colorado and Rio Grande Valley area (Habicht-Mauche 2006), people from different ethnic, cultural, and linguistic backgrounds began to renegotiate and remake their social worlds together, leading to dramatic shifts in Pueblo life. Coincident with these social changes was also a shift in ceramic traditions, of which Salado polychromes and White Mountain Red Wares are examples. These new polychromes were distinct technologically with regard to paints chosen and firing conditions and aesthetically with an emphasis on iconographic imagery. They also were distributed over greater distances than earlier black-on-white ceramics and may have served significant functions outside of the domestic sphere (Habicht-Mauche 2006). New studies as to "how" these ceramics were made have clearly been productive in the past fifteen years.

However, such programs have yet to be satisfactorily completed in the Casas Grandes region, which is physically defined by a suite of eight distinct polychrome types. Discrete decorative traditions (see Chapter 3) have been identified and provided some insights, but they represent only one aspect of “how” these polychromes were made. My project is designed to explore the other behaviorally meaningful modes already identified by formal type descriptions, including paste variability and pigment type.

Many textbooks that focus on the American Southwest treat the Casas Grandes region as something of a footnote. In comparison to other archaeological cultures, to which entire chapters are dedicated, our current understanding of the Casas Grandes world is undermined by the dearth of completed archaeological projects. And frequently, field programs are disregarded as many are still designed to understand aspects of Casas Grandes communities considered to be basic background information elsewhere in the Greater Southwest. In completing this multi-method study of Casas Grandes polychromes I endeavor to bridge at least one aspect of archaeological research with the intention of not just understanding these polychromes within the contexts of existing conversations, but also potentially contributing to broadening our understandings of what ceramics could mean to people living within the world at that time.

Chapter 2:

Paquimé and its Neighbors

Paquimé, alternatively known as Casas Grandes, a designated UNESCO World Heritage site (in 1998), is situated on the west bank of the Río Casas Grandes within the Casas Grandes Valley (see Figure 2.1; Di Peso 1974; Whalen and Minnis 2003). Its culturally associated hinterland, commonly referred to as the Casas Grandes region, is less well-studied than its presumed regional capital and spans the International Four Corners, which includes southeastern corner of Arizona, the southernmost regions of New Mexico, the eastern edge of Sonora, and much of the modern state of Chihuahua. What is recognized as Casas Grandes proper extends south to Bachíniva at the Río Santa María, a cultural boundary that has been long recognized (Lumholtz 1902; Hewett 1908) and continues to be supported in on-going archaeological work (Kelley et al. 2004).

Interregionally, Paquimé is recognized as a major peripheral center of both the American Southwest and northwestern Mesoamerica and is thought to have been a prominent component of the human landscape from approximately AD 1150 to 1450 (Dean and Ravesloot 1993). However, the manner in which Paquimé interacted with its hinterland, the American Southwest, and Mesoamerica is a subject of on-going debate (Lekson 1999a; McGuire 1993; Riley 1993; Whalen and Minnis 2001a, 2003, 2009).

Figure 2.1: Approximate location of Paquimé (Casas Grandes)(Whalen and Minnis 2003).

The first part of this chapter is dedicated to the archaeological work that has been accomplished in the Casas Grandes region. Chihuahuan archaeology is distinctly uneven in nature resulting from an episodic history of archaeological work. This likely is the product of several contributing factors including language barriers and the political boundaries between the United States and Mexico (Punzo 2003). Mexican archaeologists are more likely to focus on better-funded and prestigious research in the core Mesoamerican region, while American scholars in the Southwest likely find it more straightforward in terms of bureaucracy and language to work within the United States.

Additionally, the border area has been a politically unstable region punctuated by eruptions of violence linked to drug and human trafficking. Whereas the reasons for sporadic attention are multiple and plainly convoluted, northwestern Mexican archaeology merits modern consideration. In recent times, academic attention and funds seem to be refocusing on northwestern Mexico, permitting archaeologists a more optimistic attitude to the plausibility and overall increase in scale of future work (Punzo 2003).

Studies focusing on the Paleoindian (see Carpenter and Sánchez 2012; Gaines and Sánchez 2009, among others) throughout Northern Mexico and the Archaic period (see Hard and Roney 2002, 2004; Hard et al. 2006; Roney and Hard 2002, among others) within the state of Chihuahua remain somewhat in their infancy. Our understandings of the subsequent Ceramic periods are much more profound, but they are still regionally disjointed and incomplete. The earliest of the Ceramic period studies were completed by professional anthropologists during the early half of the 20th century, though many of these were surveys of the region rather than systematic, large-scale excavations.

After something of a dormancy during the Great Depression and war years, large-scale excavation projects became much more commonplace. The prime example of this is the large and long term Joint Casas Grandes Project (JCGP), an internationally collaborative project spearheaded by the Amerind Foundation of

Dragoon, Arizona and the National Institute of Anthropology and History of Mexico (INAH).

The JCGP was followed by a 30-year period of relative archaeological inactivity, which has most recently been reinvigorated by works completed by Christine and Todd VanPool (2007, among others), Whalen and Minnis (2001a, 2009, among others), and Jane Kelley and her colleagues (see Kelley and Phillips 2017; MacWilliams and Kelley 2004, among others). Additional collaborative excavations between INAH and the University of New Mexico (lead by Robert Leonard) were undertaken beginning 1994. However, the results from this latter project have been as of yet incompletely published (see Newell and Gallaga 2004).

The first major component of this chapter will review the known archaeological research completed in the Casas Grandes region, divided into modern historical eras. The second summarizes archaeological interpretations of Paquimé and its hinterland. By understanding both how the Casas Grandes region flourished and its consequent relationships with adjacent culture areas, archaeologists continue to develop a more complete understanding of the complex history of both intra- and inter-regional interactions.

Discovering Paquimé

The first written records of the ruins of Paquimé from a European perspective were made in 1584 by Baltazar de Obregón, who was one of the first Spanish explorers to describe the then-barely-ruined buildings of Paquimé. When Obregón encountered the site, the structures stood six and seven stories in height and the walls were painted with various colors (Hammond and Rey 1929 as referenced in Whalen and Minnis 2001a). In his often-quoted passage, Obregón writes:

> "There are many houses of great size, length, and height. They are of six and seven stories, with towers and walls like fortresses for protection and defense against the enemies who undoubtedly used to make war on the inhabitants. The houses contained large and magnificent patios paved with enormous and beautiful stones resembling jasper. There were knife-shaped stones which supported the wonderful and big pillars of heavy timbers brought from far away. The walls of the houses were whitewashed and painted in many colors and shades with pictures of the buildings. The structures had a kind of adobe wall. However, it was mixed and interspersed with stone and wood, this combination being stronger and more durable than boards" (Hammond and Rey 1929).

After this initial description, however, Paquimé was largely forgotten by scholars until the late 1800s. Nineteenth and early 20th century interest included contributions by John Bartlett (1854), Hubert H. Bancroft (1886), Adolf F. Bandelier (1890), A. Hooton Blackiston (1905; 1906a; 1906b; 1906c; 1908; 1909), Carl Lumholtz (1891a; 1891b; 1902; 1903), and J. Warren Weiseheimer (1917) (summarized in Minnis and Whalen 2004; Whalen and Minnis 2001a; VanPool and VanPool 2007). Whalen and Minnis (2001a) also note that early observations were not limited to Southwestern U.S. archaeologists. Mexican archaeologists who made note of Casas Grandes include Eduardo Noguera (1926) and Carmen Robles (1929), who spent time in the area during the 1920s. However, much of the published work from the time period was cursory with the notable exception of some more comprehensive reports, including those by Bandelier and Lumholtz.

Like Obregón, Bandelier (1892) describes the ruins as being multistory structures, which he determined from the variation in vertical mound height rather than standing walls as during the late 1800s. Bandelier also noted that ceramics from the site exhibited a wide variety and complexity in manufacture and decorative techniques, which he concludes to be indicative of professional skill. In addition to the ubiquitous and distinct ceramic types, Bandelier recorded the presence of large amounts of whole shell as well as shell and turquoise beads, which provided the first evidence that Paquimé participated heavily in long-distance exchange systems. Furthermore, Bandelier provided a written account of the sophisticated canal irrigation system within and around the site. According to Doolittle (1993), Bandelier's observations regarding Paquimé's canal systems are the most extensive and will likely, now, be the most complete in the area, given the fact that much of the area surrounding Paquimé has given way to modern agricultural fields.

Lumholtz's (1902) work in the Casas Grandes region differed significantly from previous and contemporary accounts, foreshadowing more modern studies of the area. He did not focus exclusively on Paquimé, but rather on the region as a whole. Lumholtz noted that Casas Grandes polychromes were found not only at Paquimé, but in the Rio Casas Grandes Valley, the Piedras Verdes drainage, the Palanganus Valley, and at many other sites throughout the region. He used this situation as a proxy of cultural integration and this distribution of polychromes has become the archaeological definition of the Casas Grandes area. However, while his surface collections produced many archaeological artifacts, Lumholtz's research was not ultimately reported in a manner that is either easily accessible or comparable to more modern studies. While straightforward, Lumholtz's reports are generally vague, with descriptions of artifacts lacking greater cultural interpretations (Lumholtz 1902).

Surveys and Excavations of the Early 20th Century:

Following Lumholtz's surface collections, several American Southwesternists published on Chihuahuan polychrome pottery types, including Hewett (1908), Kidder (1916), and Chapman (1923). However, most of these studies were based on existing museum collections that were often of dubious provenience. Also, most of these collections were obtained from sites in the U.S. Southwest rather than from sites deeper within the Casas Grandes region.

Modern geographically extensive reconnaissance within the Casas Grandes region did not take place until the 1920s and 1930s, when Brand (1933, 1935) surveyed large areas of northwestern Mexico and the southern part of the American Southwest. He described many sites, some of which no longer exist due to agricultural development, and he made surface collections that consisted primarily of sherds. Importantly, Brand (1933, 1935), like Lumholtz, chose not to focus his study on Paquimé itself but rather on the surrounding area attempting to define the Casas Grandes sphere of interaction through the geographic distribution of ceramic types. Another survey by Sayles (1936a, 1936b) and supported by the Gladwin's Gila

Pueblo Project, is similar to Brand's, though Sayles' is more geographically extensive. Sayles' collections form the basis of my dissertation, and his work and collections are discussed later in more detail.

This early emphasis on survey projects typified studies from the early half of the last century, but excavations of Casas Grandes type sites were not unknown. For example, some of the first unsystematic excavations focusing on ceramic period sites in the Casas Grandes region, though unorthodox, took place from 1916 through 1917 during General John Joseph Pershing's Punitive Expedition (Porcayo 2008). General Pershing's goals did not include archaeological research but rather the apprehension of the Mexican revolutionary, General Francisco “Pancho” Villa, after his attack on Columbus, New Mexico. While General Pershing's expedition was fruitless in regard to its actual purpose, the company of soldiers did undertake some of the first archaeological excavations on nearby Casas Grandes sites in an effort to stave off boredom and poor moral. Artifacts were sent to Washington D.C., a fact that remains a source of political tension between the United States and Mexico today (Porcayo 2008). Unfortunately, the archaeological materials and field documents contributed little to the academic literature at the time, and few archaeologists have accessed the collections since they were accessioned. Carey's (1931) work in the Corralitos area north of Paquimé also represents another example of an excavated site prior to the JCGP. Lister (1946) also completed surveys while focusing his excavation efforts on cave sites in the Sierra Madre (1953, 1958).

The Second Half of the 20th Century:

After a hiatus, as stated, the first highly organized, official excavations to take place at Paquimé were undertaken by the JCGP, a collaborative project launched in 1956. Charles C. Di Peso, director of the Amerind Foundation, supervised the excavations and Eduardo Contreras, INAH's representative in the project, was in charge of mapping and structural preservation. Fieldwork lasted from 1958 until 1961, and included some excavations at nearby sites and reconnaissance of the general area.

Minnis and Whalen (2004) observe that the JCGP was one of the largest archaeological projects ever undertaken at that time in either the American Southwest or Northwest Mexico. It was also one of the few undertakings up until that point in the Casas Grandes region that was more than exploratory, going beyond site survey and surface collections (Minnis and Whalen 2004). The excavated portions of Paquimé revealed many structures, plaza areas, ballcourts, effigy mounds that have the forms of a cross, bird, and serpent, as well as a technologically complex water canal and drainage system (Di Peso 1974; Whalen and Minnis 2001a; VanPool and VanPool 2007). Reconnaissance included surveys of the rest of the valley and nearby mountainous areas (Di Peso 1974). A few sites encountered during survey were also excavated, including the Convento site, the Reyes I and Reyes II sites, and the Casa de Robles site, providing data for time periods before as well as after the establishment of Paquimé (VanPool and VanPool 2007).

Laboratory analysis of the materials recovered from the fieldwork continued for thirteen more years, the final work culminating in a report comprised of eight volumes (Di Peso 1974; Di Peso et al. 1974). Over 800,000 ceramic sherds and several thousand artifacts were analyzed during this time (Di Peso 1974). Analysis included dendrochronology, carbon-14 dating, obsidian hydration dating, and palynology. The dendrochronology resulted in the first Mexican tree-ring chronology. Whereas the site report implies that more samples were collected, only ten carbon-14 samples were analyzed during post-excavation work (Di Peso 1974). These dates were presented uncalibrated and little reliance was placed on them. The dates produced through obsidian hydration analysis have also come under recent scrutiny, because they do not correlate with the new chronology derived from re-analysis of construction beams (Dean and Ravesloot 1993).

Academic research during the JCGP emphasized the presence and study of elite goods recovered from Paquimé. These artifacts include turquoise, copper bells, and scarlet macaws (Di Peso 1974). Additionally, during the last day of his excavations at Paquimé, Di Peso (1974) encountered a room where over two tons of marine shell had been cached. Subsequent analysis of this shell has concluded that these shells were imported from the western coasts of Mexico (Bradley 1993; 1999). Direct evidence for copper smelting in the Casas Grandes region is absent, and we know that metallurgy of this kind was not present in the Southwest until after contact, indicating that copper bells were probably imported from the south (Epstein 1991;

Vargas 1994; 1995; 1999). These artifacts supported Di Peso's interpretations of Paquimé as a prominent intermediary controlling interactions between the American Southwest, the supplier of turquoise, and Mesoamerica, the proposed supplier of copper and macaws.

The data gathered and analyzed from Paquimé and the surrounding areas during the JCGP, were used to construct a chronology that was ultimately split into six temporal periods: Preceramic (times prior to 1 AD), Plainware (AD 1 to 700), Viejo (AD 700 to 1060), Medio (AD 1060 to 1340), Tardío (AD 1340 to 1660), and Españoles (AD 1660 to 1821)(Di Peso 1974). Di Peso suggested that the Preceramic period was typified by specialized big game hunting of mammoth and bison, similar to other peoples in North America, that gradually converted to a more generalized hunting-and-gathering strategy after the disappearance of many big game species. During the Plainware period, peoples became more sedentary, depending in a limited capacity, on domesticated crops, such as corn (Di Peso 1974; VanPool and VanPool 2007). However, continuing excavations in the area have begun to unravel the preceding chronology, Di Peso's sequences largely being rejected by those currently working within the region. Current understandings of time periods and associated sites and individuals is presented, below.

Viejo Period (AD 600-1150):

Regardless of whether or not Di Peso's originally elaborate chronology is accepted by archaeologists, the earliest Ceramic Era sites are still attributed to the Viejo period. This period and its associated sites are vaguely typified by "houses-in-pits" and pithouse villages that demonstrate an increased dependence on maize as an agricultural staple and are identified by a suite of textured and red-on-brown ceramics (Di Peso 1974; Stewart et al. 2005). Viejo sites also exhibit changes in non-residential architecture, with settlements emerging around community houses, a term Di Peso likely borrowed from Mesoamerican literature of the era used to describe structures designed as community meeting places. Also noted was a shift in burial customs, which includes a change in body positioning as well as the incorporation of burial goods (Di Peso 1974).

Later Viejo period sites contain non-local objects, such as Mimbres Black-on-White ceramics, copper, and marine shell (Di Peso 1974). Viejo period sites are 1-2 hectares at the most. The vast majority of these sites occur within river valleys, though others are scattered throughout the uplands as well as desert lowlands (Whalen and Minnis 2001a). Since the majority of Viejo period sites are sub-surface pithouse structures, they are difficult to identify without close attention to areas of increased concentrations of surface artifact collections. What is more, many river valley Viejo sites may be overlain by successive occupations of the Medio period, as both periods favored the same river-valley locations.

The first widely recognized Viejo period sites originally excavated by the JCGP (Di Peso 1974) include the Convento, the Los Reyes No. 1, and the Los Reyes No. 2 sites. To date, the Convento site (AD 900 to 1150), centered around a community house, is the largest Viejo period site recorded in the Casas Grandes region. Additionally, Di Peso identified indications of Viejo period occupation at Paquimé (Di Peso 1974; VanPool and VanPool 2007). More recently, the identification of Viejo period sites, throughout the Casas Grandes region has been completed through surveys by Phelps (1998), Whalen and Minnis (2001a), Pailes (1980), and Douglas and César Quijada (2000, 2004). Follow up excavations and further analysis of these sites, however, are lacking. Based on the the JCGP's Convento excavations, Whalen suggests that the Viejo Period, as defined by Di Peso (1974), is likely what Southwest archaeologists refer to as the Late Pithouse and Pithouse-to-Pueblo Transition periods (personal communication 2016).

Despite the fact that Viejo period sites have been recorded through the Casas Grandes region, rigorous Viejo period archaeology up until the last several years has been focused more towards the west-central portion of Chihuahua, headed by Jane Kelley, Joe Stewart, and their colleagues through the Proyecto Arqueólogico Chihuahua (PAC)(see Figure 2.2). Significantly, the original purpose of the PAC intended to focus on the Casas Grandes region's abrupt southern boundary at the Laguna Bustillos basin in an effort to better explain the apparent shift in architectural traditions, namely the absence of above-ground puebloan architecture typical of the

Medio period (MacWilliams and Kelley 2004). Consequently, identification of Viejo period sites was not the primary goal of the project but rather a bi-product of surveying the study area for later occupations. Despite the project's original intents, the PAC has contributed to continuing efforts to increase our understanding of what Viejo period sites look like.

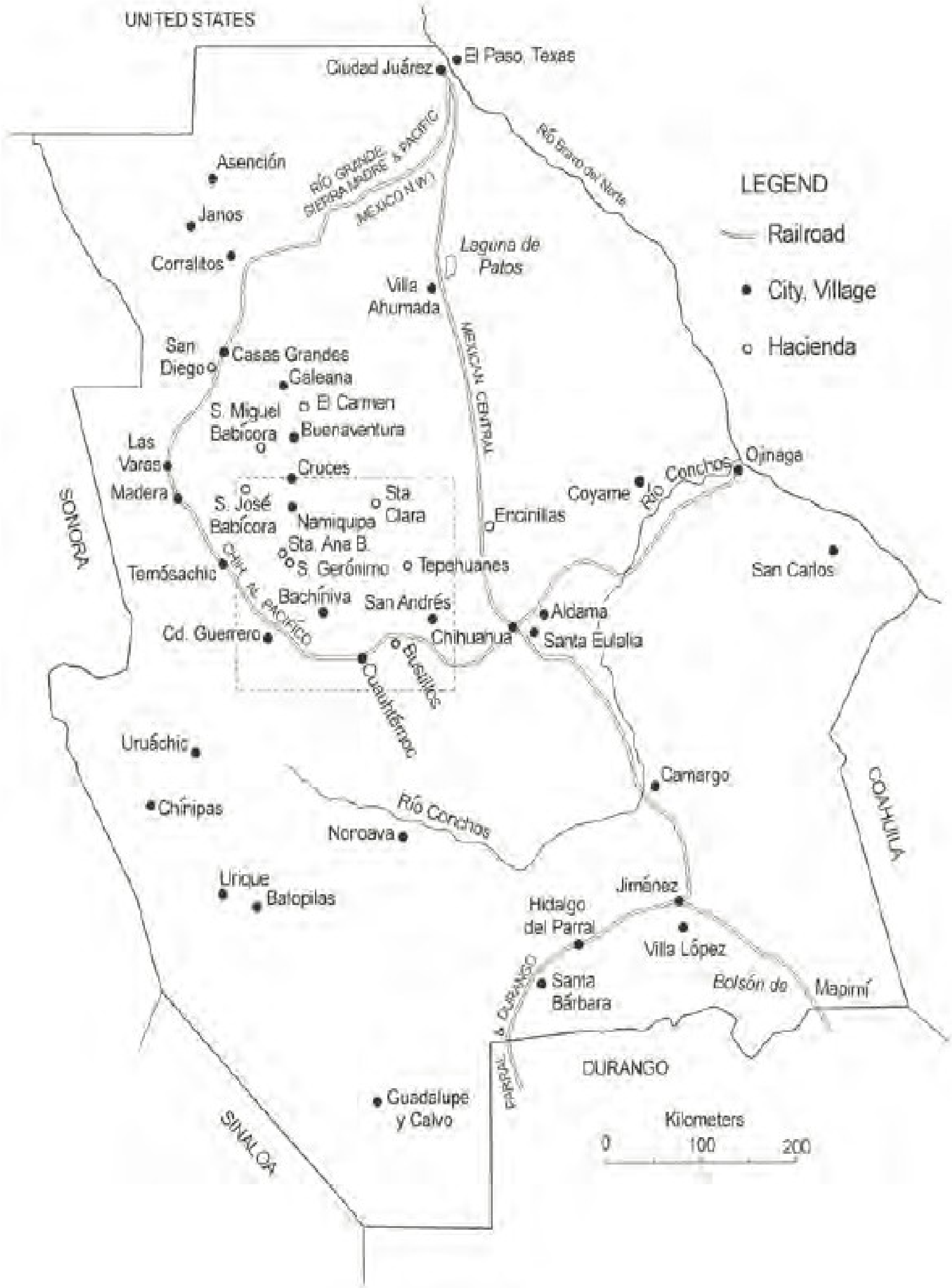


Figure 2.2: Map of the approximation of the PAC research area, adapted from Wasserman (1984:2)(Kelley et al. 2011).

The PAC's research area extends from the Babícora Basin in the northwest to Laguna Bustillos, Laguna Las Mexicanas, and Laguna San Rafael basins in the south (Kelley et al. 1999). Sites located in the southern part of the PAC's research area, within the Laguna Bustillos, Laguna Las Mexicanas, and Laguna San Rafael basins, have been identified as “non-Chihuahuan” (Kelley et al. 1999) and are referred to in more recent literature as La Cruz sites and dated between AD 800 and 1225 (MacWilliams and Kelley 2004). La Cruz sites are typified by pithouses and above ground *jacal* (mud-and-stick) structures, dependence on agricultural products, and a preponderance of plainware ceramics (Kelley at al. 1999; MacWilliams and Kelley 2004). What distinguishes these sites from contemporary Viejo period sites of the Chihuahua Culture are differences in geographic site location and the complete absence of Di Peso's red-on-brown Viejo period pottery types (Kelley et al.1999). La Cruz sites lack an obvious “community house,” as described by Di Peso, and the haphazard nature of trash discard in addition to the absence of evidence of extensive refurbishing of pithouses have lead archaeologists to suggest that these sites did not experience long term occupation (MacWilliams and Kelley 2004). Ultimately, La Cruz sites' relationships with their northern Casas Grandes and southern neighbors remain ambiguously defined and incompletely understood (MacWilliams and Kelley 2004).

Of the 122 sites record by the PAC, a number of true Chihuahuan culture, Viejo period sites have been identified within the northern section of the study area

(Kelley et al. 1999; MacWilliams and Kelley 2004; Stewart et al. 2004, 2005). Five of these Viejo sites have been excavated: Ch-218 (the Calderón Site), Ch-254, Ch-240 (the Riquette Site), Ch-272, and Ch-159 (El Zurdo) (Stewart et al. 2005). Significantly, Ch-159 is a predominantly Medio period site, with pre-Medio occupation hypothesized based on the presence of Viejo-like ceramics and architectural remnants that are atypical of Medio period sites. The remaining sites, Ch-272, Ch-218, Ch-254, and Ch-240, are small sites that have been definitively identified as pure Viejo occupations based on the prevalence of Viejo period ceramic types (Stewart et al. 2005). Sites Ch-218, Ch-254, and Ch-240 have all revealed one or more pit structures, though many of these residential structures exhibit extensive destruction from modern agricultural practices such as plowing. Excavations at Ch-272 have revealed no evidence of any structures whatsoever (Stewart et al. 2005).

Generally, researchers have described the lithic assemblages from these Viejo period sites as being indistinguishable from those of better known Medio sites (Stewart et al. 2005). Botanical remains have indicated an unsurprising emphasis on corn, beans, and squash (Stewart et al. 2005), whereas preliminary zooarchaeological evidence indicates that the people occupying these five sites engaged in “garden hunting” (see Hodgetts 1996) based on the prevalence of small mammals represented by the assemblages. Aside from Classic Mimbres Black-on-White sherds and minor numbers of shell pendants, it appears that most artifacts are of local manufacture (Stewart et al. 2005). Novel or unique recoveries from these Viejo period sites include one dog burial, from Ch-240, and one anthropomorphic figurine of basalt (Stewart et al. 2005).

Though the PAC more than doubled the number of excavated Viejo period sites, our understanding of the Viejo period itself remains far from complete. The PAC concluded its work in 2000, but work on Viejo sites in the south has been recently continued by Jerimy Cunningham from the University of Lethbridge, building directly from the PAC's previous work. Michael Searcy from Brigham Young University and Todd Pitezel of the Arizona State Museum are focusing on areas closer to Paquimé. Fieldwork has commenced with both teams and is on-going with final results as of yet unpublished, but with updates being communicated through conferences (see Cunningham 2009; Searcy 2014).

Medio Period (AD 1150-1450):

In contrast to the Viejo and all other previous periods, the Medio period (ca. AD 1150- 1450) has seen considerably more academic attention through time. Whereas much more focus and effort has been direct at Medio period sites, these efforts have been indisputably overshadowed by the JCGP's excavations at Paquimé. It is not a terrible exaggeration to say that there are, in effect, two archaeological histories of the Medio period: the JCGP's Medio period, based on excavations at Paquimé and subsequent interpretations of those data, and those based on excavations and interpretations created through studies conducted at other sites in the region. This is not to say that there are not considerable agreements between the conclusions of the JCGP and those from more recent fieldwork. Instead, it seems that Paquimé has remained seemingly special among Medio period sites whereas other Medio period sites may provide broader insights into trends that occurred throughout the Casas Grandes region rather than within a single context. However, to dismiss Paquimé entirely would be remiss.

Generally, the Medio period is marked by a notable increase in overall community size and numbers within the Casas Grandes region (Di Peso 1974; Whalen and Minnis 2001a; VanPool and VanPool 2007). As with Paquimé, larger communities are often located along major river systems. Medio period communities are typified by above-ground pueblo architecture, with larger sites containing complex architectural features such as ball courts and, most notably in the case of Paquimé, platform mounds. Additionally, Medio period sites are noted for goods that indicate increasingly important and complex long-distance relationships, to the north, south, and west. These goods include marine shell, two separate species of macaws, foreign ceramics from northern neighbors, copper bells and ornaments, and, to a much lesser degree, turquoise (Di Peso 1974; Whalen and Minnis 2001a; VanPool and VanPool 2007). Additionally, the Medio period is marked by the autochthonous introduction of polychromes and polished black pottery (Powell 2006). Decorated Casas Grandes ceramics, overall, began to take the form of jars, rather than bowls, which had been typical in earlier time periods (Powell 2006).

Given the detailed and extensive work at Paquimé, the Medio period is the best known within Chihuahuan archaeology and originally was broken into three phases: the Buena Fé, the Paquimé, and, finally, the Diablo (Di Peso 1974). These phases are based entirely on the JCGP's work at Paquimé and have not stood up to scrutiny as the Medio period has become better understood (Whalen and Minnis 1999, 2001a, 2001b, 2009; Schaafsma and Riley 1999).

Whalen and Minnis (2009) argue that Di Peso's phases are meaningless and should be removed from ongoing use. Specifically, Di Peso (1974) based his phases on perceived architectural differences, not on ceramic assemblages. Whalen and Minnis (2009, 2012) have suggested an alternative to Di Peso's elaborate set of phases, partitioning the Medio Period into two parts: early and late. The early part of the Medio Period spans from approximately AD 1150-1200 until ~1275-1300, and the later half of the Medio Period is punctuated by the introduction of a new ceramic style, Ramos Polychrome, which persists until approximately AD 1450. Whalen and Minnis (2009) determined this late appearance of Ramos Polychrome through excavations of stratified middens at Site 204. Their early-late division is also supported by work completed by Kelley and her colleagues in more west-central Chihuahua.

At Paquimé, Ramos Polychrome occurs under the floors of nearly all buildings. As Whalen and Minnis (2009, 2012) have determined that Ramos Polychrome only occurs around AD 1300, which implies that the building of Paquimé itself occurred quickly and during the later half of the Medio Period. As such, deriving a fine-scale set of phases from Paquimé is likely untenable. This position is supported by Dean and Ravesloot's (1994) earlier reanalysis of tree rings at Paquimé.

Some significant sites that have been excavated since the JCGP include Site 204, the Tinaja site, recognized originally by Brand (1933, 1935), but excavated by Whalen and Minnis (2009). Site 204 is located approximately 17 km to the west of Casas Grandes in the Tinaja Valley, which contains a seasonal stream. Whalen and Minnis (2009) note that Site 204 is in a direct line of site with Cerro Moctezuma, a likely shrine or communication point site referred to as an *atalaya*. Site 204 is dominated by Mound A, with two additional small room blocks, Mound B and C, located to the east and west, all of which Whalen and Minnis (2009) estimate to have added up to 220 rooms. A midden is located to the north of Mound A. Two large ovens and an I-shaped ball court are also present at Site 204. Given the presence of these ovens and the ball court, Whalen and Minnis (2009) suggest that Site 204 would have served as center for ritual activity.

Smaller sites excavated by Whalen and Minnis (2009) include Site 317, a small site composed of three small, room block mounds and two ovens. This site suffered heavy damage from having been transected by a bulldozer before Whalen and Minnis' survey in 1994 (2009). However, the bulldozed section of the site provided an extensive stratigraphic profile, revealing a single pit structure more typical of the Viejo period beneath the more evident Medio period rooms. Another small site (231) excavated by Whalen and Minnis (2009) is composed of a single, small room block. Adobe walls at this site were notably thin and irregular, and the site ultimately demonstrated indications of having been heavily looted.

Site 242, located approximately 10 km south of Sites 231 and 317, consists of a single room block mound (Whalen and Minnis 2009). However, Site 242 is unusual in that the room block is notably tall, and the site has the largest and most elaborate I-shaped ball court outside of Paquimé itself. Additionally, around the primary mound are multiple C-shaped stone features, which Whalen and Minnis (2009) have interpreted as temporary housing units that possibly were used to accommodate corvée labor. South of Site 242 is a large system of *trincheras*, or low stone terraces that would have been utilized in agriculture. These features cover nearly 100,000 sq m and this had led Whalen and Minnis (2009) to suggest that Site 242 served as both a ritual and administrative center responsible for the production of foodstuffs.

Additional excavated Medio period sites include Villa Ahumada (Cruz Antillón and Maxwell 1999; Cruz Antillón et al. 2004), Galeana (Cruz Antillón et al. 2004), Casa Chica (Cruz Antillón et al. 2004), Cuarenta Casas (Guevara S. 1984, 1985, 1986), and many more sites (see Stewart et al. 2004; Whalen and Minnis 2009). Regional surveys have focused on identifying non-site integrative features such as *atalayas*, that are interpreted as either shrines or communication towers (Swanson 2003), and ball courts, whether they be attached or independent of larger archaeological sites (Whalen and Minnis 1996).

Changing Interpretations:

Excavations from the second half of the 20^{th} Century have been productive in establishing the current conversations about relations between Paquimé and its neighbors. These discussions can be subdivided into interregional and intraregional research agendas. Additionally, studies focusing on specific aspects of Casas Grandes communities have added to what we know of Paquimé, its hinterland, and the way in which sites related not only to Paquimé, but also to one another.

Interregional Discussions

The archaeological interpretation that long dominated the Casas Grandes discourse is that provided by Di Peso (1974). After the conclusion of the JCGP excavations in 1961, Di Peso "took a bold and different stand" (McGuire 1993: 23) against Southwesternists' traditional archaeological views of Northern Mexico. Rather than a passive, underdeveloped reflection of the American Southwest, Di Peso suggested that Paquimé was the result of intense Mesoamerican intrusion in the area. Minnis and Whalen (2004) refer to this idea as a "patron empire."

According to Di Peso, Paquimé was a result of several pulses of activity by Mesoamerican *pochteca*, an elite traveling merchant class historically identified within Aztec society. They interacted with the peoples of what was referred to as the "Gran Chichimeca," a vaguely defined region of Northern Mexico that we now understand to have included multiple groups of culturally distinct peoples. Paquimé was supposedly established for the benefit of the *pochteca* in their efforts to facilitate the turquoise trade with the American Southwest. Di Peso based his interpretation on the sudden appearance of ideological concepts such as ball courts and Mesoamerican-like deities such as Quetzalcoatl. Di Peso's viewpoint is reinforced visually as the site report for Paquimé was ultimately illustrated using Mesoamerican Codex-style art, a fact that made J. Charles Kelley (1993) refer to it as "The Codex Di Peso."

Originally, according to Di Peso (1974), Toltec agents were sent to Northern Mexico in search of sources of turquoise, establishing an indirect trade network, which inadvertently introduced the Gran Chichimeca to the cult of Quetzalcoatl (also see McGuire 1993). While Di Peso (1974) determined that this relationship was indirect, he also posited that the relationship between the Toltec and the American Southwest eventually led to interactions with Chaco Canyon, culminating in the construction of Pueblo Bonito (also see McGuire 1993).

According to Di Peso, by AD 1000 after the disintegration of the Toltec empire, *pochteca* from the Mixteca-Puebla culture of central Mexico were similarly sent into Northern Mexico, this time deliberately setting up Paquimé as an *entrepôt* to facilitate trade with the American Southwest (also see McGuire 1993). During this interaction Di Peso (1974) argues that Paquimé took on its Mesoamerican flavor, with the pochteca directing the construction of ball courts, effigy mounds, and sophisticated irrigation networks (also see McGuire 1993). Additionally, Di Peso (1974) suggested that the pochteca introduced the inhabitants of Gran Chichimeca to the concept of human sacrifice. Di Peso based his interpretation on skeletal remains recovered from Paquimé, which included necklaces made of human phalanges (also see McGuire 1993). Finally, Di Peso (1974) argues, after three hundred years of oppression, the Gran Chichimeca violently overthrew the foreign pochteca, culminating in a social revolution that left Paquimé, and much of the area around it, in flames.

Di Peso's interpretation was a direct rejection of more traditional and long-standing archaeological observations from early archaeologists (see Bartlett 1854; Bancroft 1886; Bandelier 1890; Blackiston 1905, 1906a, 1906b, 1906c, 1908, 1909; Chapman 1923; Hewett 1908; Kidder 1916; Lumholtz 1891a, 1891b, 1902, 1903; Weissheimer 1917) who noted the similarities in ceramic and architectural styles with societies in the American Southwest. Southwestern archaeologists, working with these observations and under a diffusionist framework, generally dismissed Northern Mexico as being the underdeveloped periphery of the more-sophisticated San Juan "hub," a region in the American Southwest which has seen considerably archaeological research.

Schaafsma and Riley (1999) attribute this diffusionist framework to the "San Juan hypothesis," in which peoples from the San Juan drainage obtained maize agricultural from the south (Mesoamerica) and proceeded to socially develop essentially in isolation, giving rise to all of the cultures now recognized in the American Southwest. Schaafsma and Riley (1993) suggest that this outdated position persists. They support their position by showing how syntheses of archaeology in the American Southwest produced in the late 1980s and 1990s, such as *Dynamics of Southwest Prehistory* (Cordell and Gumerman, eds. 1989), *Themes in Southwest Prehistory* (Gumerman, ed. 1994), and *Understanding Complexity in the Prehistoric Southwest* (Gumerman and Gell-Mann, eds. 1994), continue to make only the most passing references to archaeological cultures in Northern Mexico. This observation may be unfair, however, given that the limited nature of excavations and data produced in Northern Mexico inhibited synthetic and sophisticated conversations about the two areas.

Updating Di Peso's (1974) interpretation, VanPool (2003) shifted the focus of Paquimé's southern connections away from central Mesoamerica to Western Mexico as a source of cultural and economic influence that may have shaped the development of the Casas Grandes world (also see continuing works such as VanPool and VanPool 2007 for examples). VanPool suggests (2007) that the Casas Grandes world is a result of the combination of a native Mogollon base, coupled with a distinct Western Mexican social influence. These Western Mexican influences include the introduction of I-shaped ball courts, the importation of copper bells and marine shell, as well as institutionalized leadership by shaman-priests, most specifically as represented iconographically on Ramos Polychrome. The VanPools are far from the first to associate Chihuahuan communities with West Mexico. Rather, the connection between West Mexico and the Greater Southwest has been made by J. Charles Kelley

(1974) and Carroll L. Riley (1980, 1982, 2005, 2008) over a long period of time, and is a position more-recently advocated for by Michael Mathiowetz (2011).

More recent article titles contributed to the Casas Grandes literature by Southwestern archaeologists include “Was Casas a Pueblo?” (Lekson 1999a), expressing continuing academic interest on the part of Southwestern archaeologists and the Casas Grandes region's uncomfortable similarities with the American Southwest. As Lekson (1999a) writes, Paquimé has shifted in Southwesternists' viewpoints from being a “Pueblo II *cause*” to a “Pueblo IV *effect*” (Lekson's emphasis: 85).

Lekson assumes the position of being a proponent of Paquimé as a Puebloan site and takes the viewpoint a step further, establishing Paquimé as a place of rebirth for the Southwestern civilization of Chaco (Lekson 1999b; also see summary by Whalen and Minnis 2003). Lekson reconstructs an ancestral relationship between the the Southwestern culture centered in Chaco Canyon and Paquimé, and after the decline of Chaco, the presumed elite that controlled the northern area moved to a nearby site (Aztec) and similarly ruled this site until it, too, declined in power. Ultimately, the Chaco-Aztec elites continued to migrate south and founded Paquimé. According to Lekson, the three sites form a geographic line that points back to Chaco, symbolizing the elites' point of origin. As with Di Peso's, Lekson's interpretation still necessitates the influence of outside forces for the foundation of Paquimé, but Lekson incorporates the evidence of elite goods at the site. He argues that by utilizing

Mesoamerican symbols of wealth and power, the migrant Chacoan elites legitimized their political control.

Despite the fact that much work has refocused on Paquimé and its hinterland as an entity in and of itself, rather than being an appendage in a far-reaching system, discussions of how Northern Mexico, and specifically the Casas Grandes area itself, integrated Mesoamerica with the American Southwest, has not been completely abandoned (see Wilcox et al. 2008). For example, multiple authors (e.g. Brew 1943; P. Schaafsma 1999 see Wilcox 2008 for complete list) have identified Mesoamerican deities, such as Tlaloc, in Northwestern Mexico and north in the American Southwest. Additionally, Hays-Gilpin and Hill (1999) have identified flowery-world imagery, a Proto-Aztecan cosmological construct most commonly identified within Mesoamerica, in the American Southwest. Some authors have suggested that Pueblo elites coopted Mesoamerican cosmological elements to legitimize their power (see Schaafsma and Riley 1999; Riley 2005; Furst 1966). Northwestern Mexico has continued to be invoked as the corridor through which these cosmological elements would have passed.

Intraregional Discussions

The fact that Paquimé, the largest site in the region, maintained highly elaborate structures in addition to other characteristics such as exotic copper bells and marine shell, discussed previously, makes the area undoubtedly "complex." However, much of the academic research published on the topic of complexity in the Casas Grandes region has been preoccupied with “why” the series of sites exists at all, specifically focusing on inter-regional concepts, rather than “how” the sites were structured both internally and regionally.

Though Di Peso never completely abandoned his interpretation of Paquimé as a *pochteca entrêpot*, his final theoretical contributions included the adoption of world-systems analysis, moving away from why Casas Grandes developed more towards questions of how it behaved as a regional cultural entity (1980; 1983, also see Riley 1993). Di Peso's adoption of world-systems theory was likely in response to Pailes and Whitecotton's (1979) model of the Mesoamerican World Economy, an adaptation of Immanuel Wallerstein's model for the origins of the modern capitalist world system. World-systems analysis is geographically holistic, transdisciplinary, and structuralist with a focus on social power hierarchies (Hall 2000). World-systems analysis is a reaction to universally holistic, determinist, a-historic social science theories, and Wallerstein is careful to emphasize that world-systems analysis is not a fully-fledged theory. Wallerstein regards world-systems analysis more as a “critique of many of the premises of existing social sciences, as a mode of what I have called 'unthinking social science'” (1996: 1).

Wallerstein rejects the use of world-systems analysis as an over-arching social theory, writing that “[w]orld-systems analysis is not a paradigm of historical social science. It is a call for a debate about the paradigm” (2000: 148). World-systems analysis addresses how the processes involved in the actual system affect the dynamics of the components within its social structures and how these changes in individual components in turn affect the entire system (Hall 2000). According to Wallerstein's (1974) world-systems analysis there are three main structural positions within a world economy: core, periphery, and semiperiphery. Core areas consist of multiple competing states that have significant levels of class and occupational difference (Wallerstein 1974). In contrast, peripheries specialize in the production of raw materials being utilized by the core area (Wallerstein 1974). Semiperipheries, however, are the linchpin in Wallerstein's entire world system, providing the area with stability. As he writes:

> "These areas play a role parallel to that played, *mutatis mutandis*, by middle trading groups in an empire. They are collection points of vital skills that are often politically unpopular. These middle areas partially deflect the political pressures which groups primarily located in peripheral areas might otherwise direct against core-states and the groups which operate within and through their state machineries. On the other hand, the interests primarily located in the semiperiphery are located outside the political arena of the core-states, and find it difficult to pursue the ends in political coalitions that might be open to them were they in the same political arena" (Wallerstein 1974: 310).

Despite Wallerstein's objection to the use of world-systems by other social scientists within other contexts, this framework has become a more generalized archaeological model that makes the analysis applicable to a greater variety of ancient societies (Santley and Alexander 1992). Importantly, Wallerstein has admitted that world economies can exist outside of a capitalist mode of production (Pailes and Whitecotton 1979). In the modern, world system, Wallerstein sees profit as being the primary motive. Pailes and Whitecotton (1979) argue that surplus and unequal exchange are equally important. Pailes and Whitecotton (1979) in their construction of the Mesoamerican World Economy places central Mexican states, including Teotihuácan, Tula, and the Toltec empire as the core areas in different points in history, and the American Southwest as the periphery. Pailes and Whitecotton (1979) look to Sinaloa as a possibility as a semiperipheral area. Through the 1970s, Di Peso had also become interested in Wallerstein's world-systems analysis and it is no doubt that Pailes and Whitecotton's inference regarding Northwestern Mexico encouraged Di Peso's keynote speech at the Thirteenth Annual Meetings of the Society for Historical Archaeology (SHA), which was ultimately published 1983, shortly after Di Peso's death (see Riley 1993). Though world-system theory has been heavily criticized as inapplicable in most prehistoric contexts, aspects of Wallerstein's approach have been used productively within archaeological research programs.

After it became obvious through reanalysis of the chronology associated with the Casas Grandes area (Dean and Ravesloot 1993) that Paquimé does not neatly coincide with the establishment of any Mesoamerican empire and its presumed *pochteca* merchant class, Whalen and Minnis (2001a) adopted some of the more productive aspects of world-systems theories. They have also sought to abandon the presupposed “distant origin” foundations of Chihuahuan culture and are now attempting to deal with Paquimé and its associated sites as being a result of autochthonous development.

Whalen and Minnis (2001a) categorize sites surrounding Paquimé into three geographic zones but place the center of their model at Paquimé itself. Whalen and Minnis (2001a) use site size hierarchies, monumental architecture, frequency of integrative facilities, and presence of elite goods to construct three levels of core-periphery interaction. Each level is geographically more distant from Paquimé and was influenced to a lesser degree. "Inner Zone" sites (within 30 km of Paquimé) are interpreted as having been dominated by the center, though these smaller settlements maintain relationships with one another as well. These sites tend to be small, with two notable exceptions, and contain architectural features such as building style and the presence of ball courts and ovens which are typical of Paquimé. Evidence of macaw keeping, primarily pens, has also been documented at a few Inner Zone sites (Minnis et al. 1993; Whalen and Minnis 2001a).

The "Middle Zone" sites (30 to 60 km from Paquimé) tend to be smaller on average than those located in the Inner Zone and "integrative facilities" like ball courts and large ovens are rare or absent. Only one simple open ball court was identified in the Middle Zone. There are few clear indicators of direct relationships between sites in the Middle Zone, according to Whalen and Minnis (2001a). All sites beyond 60 km from Paquimé are part of the "Outer Zone" and lack significant integration with Paquimé, though the project focused the Outer Zone to a much lesser degree.

However, a strict interpretation of the core-periphery framework as Di Peso would have it with a primate center from which all cultural aspects emanate, diffuse, and gradually diminish is not entirely successful. Whalen and Minnis (2009) demonstrate that Site 204, an Inner Zone site, was contemporary with Paquimé and, more importantly, exhibited components that preceded it. Early Medio components of Site 204 support the position that Paquimé is unlikely to be the inventor of some traits we have used to define the Casas Grandes world. Also, as Lekson (1999b) points out, the Joyce Well site, located on the northern-most periphery of the Casas Grandes region in the boot-heel of New Mexico, is well-known for its ball court. While this may be true, the Joyce Well site also dates to the Late Medio (Schaafsma et al. 2002) and many aspects of the core-periphery model place significance on features that are already known to have patchy distribution across the Casas Grandes region. And what level this distribution is a product is both temporal and geographic patterns of behavior is currently unclear.

Recently, after several excavation seasons within the Core Zone, Whalen and Minnis (2009) have continued to identify problems with the strict core-periphery model. After extensive regional survey of the Core Zone and excavations at select sites, Whalen and Minnis conclude that features said to characterize the Core Zone are not uniformly distributed across sites. Some concerns, such as the absence of most of these features from most sites, regardless of size and located within 15 km of Paquimé were noted fairly early (Whalen and Minnis 2001a). These features make a reappearance in sites located 15-30 km of Paquimé. Though not citing peer polity models explicitly, Whalen and Minnis suggest that this uneven distribution of ball courts, especially, and other elite features indicates a lack of absolute control on the part of Paquimé. They suggest, for example, that ball courts may have been used to publicly stage ritualized rivalries between competing factions within the Casas Grandes world (2009).

Additional Lines of Evidence of Internal Organization

Archaeologists working within the Casas Grandes region have largely refocused away from interregional to those more intraregional discussions presented above. All of the characteristics mentioned previously, turquoise, macaws, ballcourts, and copper bells, have fascinated past and present archaeologists and scream of far-reaching powerful, external connections. Nevertheless, a component of Casas Grandes society that has been particularly troublesome is the fact that there is little material evidence of centralized leadership or political control. To date there are no representations of individuals who could be identified as “kings” or “rulers” of any kind, though C. VanPool (2001) and VanPool and VanPool (2007) have made a case for shaman-priest-kings. Despite this fact, and in spite of Whalen and Minnis' older work exploring peer polity models, a prevailing trend in all research agendas has been the recognition of Paquimé's physical prominence and the possible social and economic control it may have exerted over its hinterland.

A regional survey, the Reconocimiento Regional Paquimé (RRP), completed by Whalen and Minnis in the late 1980s recorded site size and distribution across the landscape. Using data from this project, Whalen and Minnis in two sets of papers describe the overbuilt architecture, with walls many times thicker than is necessary, of sites located at the outermost edges of the Core Zone (2001b; 2006). These outlying overbuilt sites are accompanied by large upland farm plots in two of the three identified cases. Whalen and Minnis argue that these sites are administrative centers established by Paquimé, serving to create stockpiles of food stuffs against the probability of crop failure in other parts of the region (2001b; 2006).

Another paper that utilizes data collected from the RRP is Swanson's article, "Documenting Prehistoric Communication Network: A Case study in the Paquimé Polity" (2003). Hilltop features, generally called *atalayas* (Spanish for "watchtower"), dot the points of higher elevation around Paquimé. Whether these features were used for signaling with fire or reflective surfaces is unclear. However, Swanson finds, through the use of Geographic Information Systems (GIS), that the main *atalaya* associated with Paquimé, called Cerro de Moctezuma, does not have a direct line of site with every other *atalaya* in the immediate vicinity. Though Swanson does conclude that this indicates that Paquimé would not be able to maintain direct control of information exchange between and over all the settlements directly in its shadow (2003), he stops short of writing that this lesser degree of information control may suggest that Paquimé is less significant in regard to regional integration.

VanPool and Leonard (2002), based on their analyses of utilitarian basalt metates, proposed that regional craft specialization provides another line of evidence for Paquimé's economic and political control of its hinterland. The authors assert that there are two basic metate types in the Casas Grandes area: highly finished square bottom and rougher round bottom metates. It is noted by VanPool and Leonard that square bottom metates are highly regularized and stockpiled at Paquimé. Based on the fact that highly finished square bottom metates are stockpiled and some people at Paquimé used round bottom metates instead of those that are more highly finished, VanPool and Leonard make the somewhat weak interpretation that these two metate types may have been markers of social rank, with finished square bottom metates indicating higher rank than round bottom metates (2002).

Conclusions:

Though the archaeological history of the Casas Grandes region is nowhere near as robust as its neighboring northern and southern culture areas, the preceding synopses have presented a diverse group of studies, the majority of which have focused on the various mechanisms that support interpretations of cohesive social integration within the Casas Grandes world. However, clearly missing from the previous discussions are studies focusing on ceramic technology, despite the fact that the polychrome suite is the single unifying material evidence of Casas Grandes sites. In understanding how pottery can inform archaeologists regarding migration, community formation, and regional integration, we can develop a better understanding of human relationships internal to the region as well as how the area fits anthropological narratives within the Greater Southwest.

Specifically, the Casas Grandes world is characterized by eight polychrome types (Ramos Polychrome, Babícora Polychrome, Carretas Polychrome, Dublán, Corralitos Polychrome, Villa Ahumada Polychrome, Escondida Polychrome, and Huerígos) and these ceramic styles remain the only ubiquitous, pervasive, and unifying factor for the entire geographic area (Brand 1935; Whalen and Minnis 2001a) (for type descriptions see Appendix A). Given this distribution, data on ceramic technology appear to be ideally suited to studies investigating regional interactions within the Casas Grandes world. But despite the polychromes' unifying effect on the Casas Grandes region, academic discussions of these ceramics are anything except resolved. Rather, much of the research is sporadic, rarely comparable, and frequently contradictory. A complete discussion of these data and the conclusions drawn from them is presented in the following chapter.

Chapter 3:

Polychromes and the Casas Grandes World

Through time, Casas Grandes polychromes have acted as one of the defining features of their eponymous region (Brand 1935; Sayles 1936; Whalen and Minnis 2001a, 2012). Though these ceramics are accompanied by other traits including ball courts, atalayas, and macaw-keeping (see Whalen and Minnis 1996, 1999, 2001a, 2001b; VanPool and VanPool 2003, among others), polychromes remain the only category of material culture not criticized for having a geographically spotty distribution. Whereas the suite of eight polychrome types is found throughout the Casas Grandes world, it is Ramos Polychrome that has been used to define the geographic extent of the region (Brand 1935; Whalen and Minnis 2001a). As such, it is not surprising that from early in the history of Casas Grandes archaeology that polychromes have been a subject of many studies and academic discussions.

Time and Space:

Initially, archaeologists approached studies of Casas Grandes polychromes heavily influenced by the fact that many were trained in the American Southwest. Early archaeologists, including Brand (1933), Sayles (1936a, 1936b), Carey (1931), and Lister (1946), among others, sought to extend Southwest culture historical frameworks south of the international border. By creating ceramic typologies, archaeologists organized the polychromes stylistically (see Figure 3.1) in ways that had been successful further north (see Kidder 1924; Nelson 1916), and they widely assumed that Casas Grandes polychromes would serve as a tool to help archaeologists arrange sites in time, with the presence, absence, and frequencies of various polychrome types leading to the creation of useful relative chronologies (see Ford 1962; Ritchie and McNeish 1949). In addition to the creation of a regional chronology, distributions of polychrome ceramics were also thought to aid in the identification of geographic cultural boundaries (see Childe 1929), both between Casas Grandes peoples and their neighbors within the Greater Southwest as well as internally within the region.

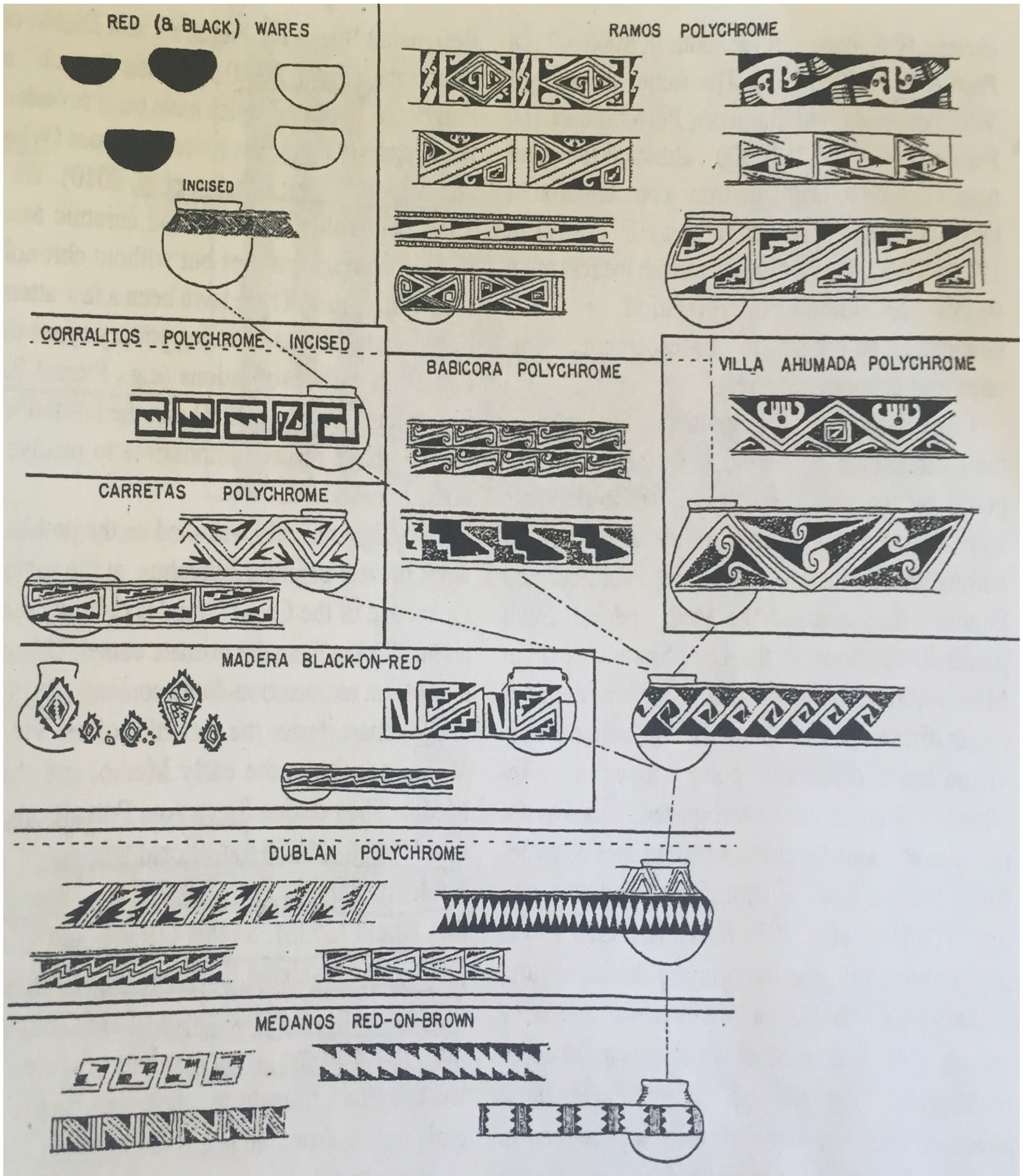


Figure 3.1: Sayles' (1936b) stylistic sequence for Casas Grandes polychromes.

However, in contrast to stratigraphic excavations and the sherd tabulations in the American Southwest (Kidder 1927; Nelson 1916), early projects within Chihuahua relied on collections of pottery from the wind-swept surfaces of the desert (see Brand 1933; Sayles 1936a, 1936b; Carey 1931). The dearth of diachronic projects was not for lack of trying on the part of archaeologists, though, but rather seems to be a product of the archaeological record itself. Both Brand (1933) and Lister (1946) noted a distinct absence of middens on Casas Grandes sites. This is a significant limitation, as these stratified trash deposits have been a staple for understanding diachronic changes in the American Southwest. The paucity of Casas Grandes area midden deposits has since been reconfirmed by Whalen and Minnis (2001a) during their regional surveys. Within the Casas Grandes world, therefore, surface collections became more common than in the north simply because the cultural patterns within those sites indicated a marked departure from expectations formed from experience in the Southwest. There, H.P. Mera (1940) was able to construct relative chronologies based on surface collections, but similar attempts in the Casas Grandes region have been less successful, as discussed below.

The paucity of significant middens has created a void in ceramic data in the Casas Grandes area, with fine-grained temporal divisions and their associated frequencies of ceramic types being essentially absent from most projects. This lack of detailed temporal data significantly crippled archaeologists' early attempts to associate frequencies of ceramic types useful for organizing sites chronologically.

However, some early archaeologists do make note of broad trends in type frequencies through time.

For example, Lister (1946) notes an overall increase in Ramos Polychrome through time, while Playas Red declines. More modern attempts to discern temporal sensitivities include those by Pitezel (2000) and Rakita and Raymond (2003) who have combined Di Peso and colleagues' (1974: vol. 6) sherd counts from the Joint Casas Grandes Project (JCGP) centered on Paquimé and Dean and Ravesloot's (1993) reanalysis of tree rings from that same project.

Pitezel (2000) concludes that Playas Red, Babícora Polychrome, and Escondida Polychrome appear to decrease through time, Corralitos Polychrome, Plainwares, and Madera Black-on-Red increase through time, and Ramos Polychromes remains constant. Rakita and Raymond (2003) conclude that, overall, there appears to be a weak relationship between the passage of time and sherd frequencies while recognizing a few broad patterns. For example, they identify Babícora and Villa Ahumada Polychromes as being more common during Early Medio times, whereas Corralitos and Escondida Polychromes are apparently later. In contrast, they argue that Ramos Polychrome persists throughout the entire Medio Period. Whalen and Minnis (2009) review these previous attempts at seriation and identify temporal patterns, suggesting that Paquimé may serve as a poor choice for determining temporal sensitivities in polychromes, as it is likely the site was built over a short period of time and has a complex depositional history.

The concern that Paquimé may not be the most appropriate site through which to examine change through time, and therefore not a site that will produce interpretations that are representative of the Casas Grandes region as a whole, is clearly one shared and has led researchers to consider sherd counts acquired from sites outside of Paquimé. Rakita and Raymond (2003), as well as Larkin, Kelley, and Hendrickson (2004), have extended the question of ceramic frequencies through time into collections and excavations from other sites. Rakita and Raymond (2003), using Brand's (1933) surface collections from many sites across the region, suggest that Villa Ahumada Polychrome may be an early polychrome type across multiple regions, and that its frequency appears to decrease through time, which echoes their observations of the same ceramic type at Paquimé.

Meanwhile, Larkin, Kelley, and Hendrickson's works based in more west-central Chihuahua support the likelihood that Babícora Polychrome is the oldest polychrome type, as originally asserted by Brand (1933), Sayles (1936a, 1936b), and Gladwin (1936). However, they do not support Rakita and Raymond's (2003) assertion that Villa Ahumada Polychrome is early, though they concur with Pitezel (2000) that Madera Black-on-Red is more frequent in the Late Medio (Larkin, Kelley, and Hendrickson 2004). Whalen and Minnis' (2009) work with a midden of considerable depth at Site 204 suggests that Babícora, Dublán, and Villa Ahumada polychromes are common in earlier stratigraphic deposits, whereas Ramos Polychrome is entirely absent. However, there appears to be no single ceramic type that is diagnostic of “early” deposits though Dublán Polychrome may be the closest to an Early Medio marker. Rather, they suggest that combinations of different percentages of polychrome types may be necessary to determine “early” or “late” deposits. A visual summary of these conclusions is provided in Table 3.1.

Study:	Lister (1946)	Pitezel (2000)	Rakita and Raymond (2003)	Larkin, Kelley, Hendrickson (2004)	Whalen and Minnis (2009)
Formal Types:					
Ramos Polychrome	Increases through time		Consistent throughout Medio Period		Identified as appearing during the Late Medio Period (post AD ~1275-1300)
Babícora Polychrome		Decreases through time	Common during Early Medio Period	Identified as the oldest polychrome type	Early and Late Medio. More common during Early Medio Period
Escondida Polychrome		Decreases through time	Occurs during Late Medio Period		Late Medio
Corralitos Polychrome		Increases through time	Occurs during Late Medio Period		Late Medio
Madera Black-on-Red		Increases through time		More frequent during Late Medio Period	Exclusively Late Medio
Villa Ahumada Polychrome			Common during Early Medio Period, decreases through time		Early and Late Medio
Dublán Polychrome					Most common during Early Medio Period

Table 3.1: Observations from various studies of polychrome frequency through time.

Despite the fact that pottery within the Casas Grandes region does not appear to lend itself to the creation of straight-forward battleship curves, there are a few aspects of Casas Grandes polychromes' relationship with time that most researchers can agree with. First, most all researchers agree that Babícora Polychrome is likely the oldest polychrome type in the Casas Grandes region (Brand 1933; Larkin, Kelley, and Hendrickson 2004; Sayles 1936a, 1936b; Gladwin 1936). Ramos Polychrome is recognized as becoming part of the suite after about AD 1280, though many polychrome styles are present in only Late Medio deposits (Whalen and Minnis 2009: 120). A more-recently identified subtype, White-Paste Babícora Polychrome, which shares the sloppy painting style of standard Babícora Polychrome and the fine white-firing paste of Ramos Polychrome, has been recognized by Whalen and Minnis (2009; 2012) as a sort of intermediary between these two pottery styles, though no firm date-of-first-appearance has been assigned to this variant. Its presence in Early Medio deposits, though, has been well-established (Whalen and Minnis 2009: 120). The Medio period ranges somewhere between AD ~1150 through the mid-1400s (see Whalen and Minnis 2009; Stewart et al. 2004, 2005 for full discussions of the variations in accepted dates), and the remaining polychrome types appear to coexist alongside one another throughout the Late Medio.

Though these statements are widely agreed upon, they hardly constitute the precision necessary to create ceramic sequences as fine as those in the American Southwest. Whalen and Minnis (2012) provide an explanation for this absence in typical chronologic sensitivity, arguing that an original long-lived early polychrome assemblage was characterized by a simplistic design style with thick, sloppy lines. This early design style is joined, but not replaced, by a later design style with fine lines and whose origins are coincident with the rise of Paquimé. However, this second, later design style is short-lived, and thus not particularly useful to frequency seriation.

Frustrated by the apparent lack of seriation sequences produced by archaeologists through the 1930s, a situation that obviously remains today, Di Peso and his colleagues established a new direction when they started work through the JCGP in 1958. They focused on space rather than time, a position that is arguably more appropriate for the data existing then. The JCGP's approach differed from their predecessors in that Di Peso rejected the archaeological gaze from the American Southwest peering south across the international border. Instead, he redirected that gaze to looking north from Mesoamerica. Though he ultimately adopted and refined the typologies established by earlier archaeologists such as Brand (1935) and Sayles (1936a, 1936b), Di Peso's (1974) position that Paquimé and its hinterland was ultimately a product of Mesoamerican influence broke from the assumption that Casas Grandes pottery types were products of one another, sharing a local, lock-step developmental sequence. Polychrome technology came from elsewhere and would therefore naturally exhibit a lack of continuity with earlier ceramic traditions. Though our current understanding of the Casas Grandes world now refutes this assumption, it did refocus archaeologists' attention away from the frustrations of seriation to developing a better understanding of how these ceramics could be more spatially sensitive.

Carpenter (2002) uses Brand's (1933, 1943) ceramic counts to suggest that polychrome styles may be tied to sub-regions within the Casas Grandes area (see Figure 3.2). Carpenter (2002) argues that Babícora Polychrome dominates in the southern regions of the Casas Grandes world, whereas Villa Ahumada Polychrome is more-eastern, Huérigos and Carretas polychromes are more northern, and Ramos Polychrome is most common within a 50 km radius of Paquimé itself. Complicating this story, Rakita and Raymond (2003) in that same regional survey, note that Villa Ahumada Polychrome's shifts in frequencies may not be uniform throughout the Casas Grandes world. However, Brand's (1933) data are inherently problematic in that his dissertation does not use modern typological descriptions, lumping, for example, the two distinct types that we now recognize as Ramos and Babícora Polychrome under the more generic type description of "Casas Grandes Polychrome." As this collection has not been reevaluated, it is impossible to say whether or not Brand's collection supports the geographic affiliations of polychrome types proposed by Carpenter (2002).

Carpenter's (2002) suggestions are supported, though, by Larkin and colleagues (2004), using their own data as well as data of others, agreeing that Ramos Polychrome may be geographically tied to the "core" area around Paquimé itself, while Villa Ahumada Polychrome is an eastern polychrome type, Carretas, Huerigos, and Corralitos Polychromes are northern types, and Babícora Polychrome is most characteristic of the south of Paquimé.

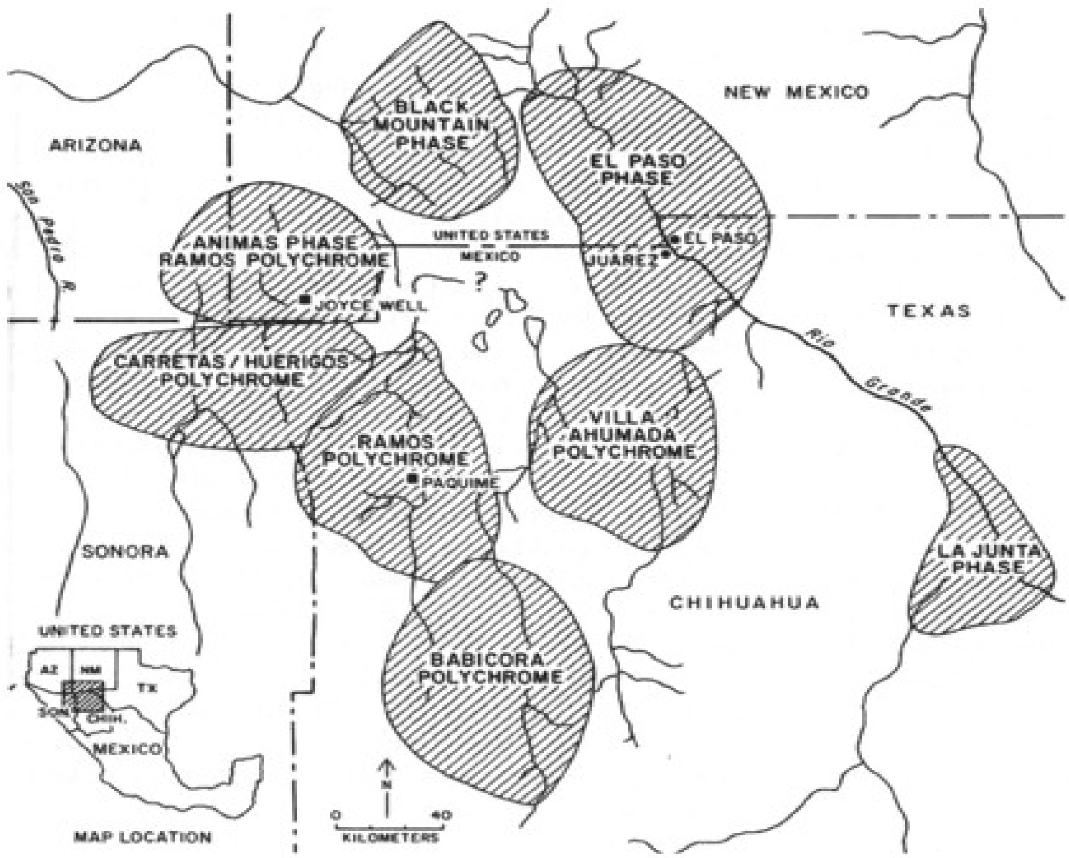


Figure 3.2: Carpenter's (2002) suggested geographic distributions of Casas Grandes polychrome types.

Shifts towards Models of Regional Integration:

By refocusing on geographic relationships within the Casas Grandes region, archaeologists starting in the 1990s and on through today can use the possibility of geographic information inscribed upon these pieces of pottery to answer questions of regional integration and the possibilities of social structures such as peer polities (Whalen and Minnis 1996, 1999, 2009, among others), craft specialization (Di Peso et al. 1974: vol. 6; Sprehn 2003; Woosley and Olinger 1993, among others), and cosmology (Whalen 2013; VanPool and VanPool 2007 among others), as created, defined, and reinforced by shared practices. As with other regionally-based studies, discussed in Chapter 2, many of these analyses have sought to gain a better understanding of the relationships of Casas Grandes sites both to Paquimé as well as to one another.

Several studies have worked towards defining these inter-site relationships. For example, utilizing X-ray Florescence (XRF), Woosley and Olinger (1993) analyzed 146 Ramos Polychrome sherds from Paquimé and 175 sherds from fourteen other Casas Grandes sites. They determined that there is a strong and consistent chemical signature for Ramos Polychrome sherds, across the region. Arguing that it is unlikely that all potters in the area utilized the same clay source, Woosley and Olinger (1993) state that specialists centered at Paquimé were the primary producers of this polychrome type.

However, Carpenter (2002) refutes the suggestion that Paquimé acts as a hub of Ramos Polychrome production. Utilizing petrographic analysis of Ramos Polychrome sherds at the Joyce Well site, the northern-most Casas Grandes type site, Carpenter (2002) asserts that Ramos Polychrome recovered from the Joyce Well site was made locally rather than being imported from Paquimé. However, the Joyce Well site, located in the boot heel of New Mexico is located about 150 km to the north of Paquimé. A natural attenuation of Paquimé's influence and control would appear to be an acceptable reality over such great distance.

Triadan and colleagues (2005, 2017) similarly contradict the notion that Ramos Polychrome was a ceramic type made by specialists centered at Paquimé. Using instrumental neutron activation analysis (INAA) on 655 Ramos, Babícora, and Villa Ahumada Polychrome sherds from thirty-one Casas Grandes sites, Triadan and her coauthors determined that multiple paste compositions cross-cut all three formal types. This indicates that neither Ramos Polychrome nor the other formal types they analyzed could be associated with a clear, single source of production. These data do not seem to support a model of specialized polychrome pottery production centered at Paquimé, but rather they seem to suggest that multiple polychrome types were made at different production centers throughout the Casas Grandes region. This study is further supported by Sprehn's (2003) study utilizing stylistic data, who similarly provides an argument for multiple production centers.

Importantly, these contradictory interpretations of Chihuahuan polychromes are partially due to the fact that ceramic studies within the area are both few and rarely utilize complementary data sets or techniques. Additionally, there remains an underlying assumption that polychrome types were manufactured in places where they are most common, an assumption that has resulted in academic critique (see Douglas 1995; Minnis 1984, 1989 for critiques). In addition, I add my own concern that little attention has been given to the social contexts in which Chihuahuan polychromes were produced, exchanged, and used, which would aide in the greater understanding of how social relationships within the Casas Grandes world were constituted, both locally and regionally.

New Directions for Characterization Studies:

By and large, I argue that characterization studies of Casas Grandes ceramics have been overly focused on linking specialized production to a centralized political hierarchy, and thereby defining social structures. Rather than defining structure, I want to change the terms of this debate and instead focus on what ceramic production and distribution indicates about how social relations are constructed within and between communities. This shift moves conversations of Casas Grandes polychromes away from static views of social structures to a more dynamic analysis of social process. Ceramics are not simply static reflections of unified regional socio-political structures, but rather plastic mediums through which people actively engaged with and renegotiated social situations (Hodder 1985).

Previous characterization studies have relied heavily on sampling strategies based on formal type. And while typologies, such as Di Peso, Rinaldo, and Fenner's (1974: vol. 6), are not inherently wrong, they have become outdated tools in current anthropological discourse. This is due to the fact that the formal types created by such classifications lack the cultural significance being pursued by current archaeologists. Whereas the current Casas Grandes stylistic typology has not been particularly fruitful in regard to traditional questions of temporal and spatial sensitivity, some of the less well-studied secondary characteristics such as differences in paste may be useful for addressing more current anthropological questions in that they likely represent behavioral modes. As stated in Chapter 1, Rouse's (1939, 1960) modes can be re-mobilized productively in conjunction with emerging applications of Practice Theory (see Bourdier 1977: Giddens 1979) in Southwestern ceramic studies, which have centered on the identification and discussion of communities of practice (Habicht-Mauche 2006; also see Dobres and Robb 2000; Dornan 2002; Roscoe 1993 for more general adaptations of Practice Theory within the field of archaeology).

During their construction of the present Casas Grandes typology, Di Peso and his colleagues (1974: vol. 6) identified a series of attributes such as paste, temper, and decorative techniques and elements that appeared to be associated with each polychrome type. However, the way in which the JCGP organized their sherds was likely based on what Sinopoli (1991) refers to as an “intuitive” classification process. Sherds that share similarities with one another are grouped together until such a point where greater homogeneity within groups exists than between them. After the groups are satisfactorily homogeneous, they are designated a type. Types are described in terms of a standard set of attributes such as paste, temper, finish, and decoration though these are not necessarily the attributes used to sort the sherds in the first place. As such, their values had large overlap between the various Casas Grandes polychromes, and they have become a source of frustration for many ceramicists attempting to organize Casas Grandes collections. For example, the presence of glaze-like black paint is a diagnostic attribute distinguishing Huerigos from Villa Ahumada Polychrome. Whereas black paint type is entirely relevant to Huerigos and Villa Ahumada identification, it is only somewhat important when distinguishing between Carretas and Babícora, as glaze-like paint is not explicitly excluded by Babícora's formal type description but is simply uncommon. As another example, brown or orange pastes are distinctive of Babícora and Carretas Polychrome, respectively. Differences in paste color are entirely unimportant, however, when distinguishing Huerigos and Villa Ahumada polychromes, but are significant when identifying Babícora, Ramos, and Carretas polychromes. The final formal type designation is due to a collection of attributes (modes) which are assigned significance in a relatively arbitrary manner.

However, whereas the typology itself may assign significance arbitrarily to any one attribute, that does not mean that this particular aspect of pottery within the Casas Grandes world *was* culturally significant. Rather, potters' conscious, unconscious, and subconscious choices (see Wobst 1999) in raw clays, the processing of those clays, and pigment manufacture are culturally situated and negotiated daily practices which leave indelible patterns within the archaeological record. It is my goal to focus on the ceramic pastes and the black pigments associated with these ceramic bodies in an attempt to begin to describe potential procedural modes and how they may have been shared throughout the Casas Grandes world.

Modal Perspectives:

To some extent, recent studies of Casas Grandes polychromes have begun to shift more towards the identification and pursuit of modes, most especially in stylistic analyses. The largest body of data, recently reviewed by Whalen and Minnis (2012), are those based on stylistic observations that have deep roots in the Casas Grandes literature: design layout (see Chapman 1923; Di Peso et al. 1974: vol. 6; Kidder 1916) and line-work, often denoted by previous type names, such as “Fine Polychrome” (Carey 1931). Significantly, whereas quality of line-work, design layout, and motifs all play some part in formal type descriptions (full type descriptions as they are used in the course of my dissertation are provided in Appendix A), none are absolutely diagnostic for any one type, though there are clearly correlations between these stylistic attributes and formal ceramic types. These are ways of doing or making “proper” pottery within the Casas Grandes world.

For example, Ramos Polychrome is almost always typified by fine line-work, with black lines outlining red elements, and could be considered a diagnostic attribute of the type, whereas Babícora Polychrome by coarser line-work. However, the Paquimé-variant of Babícora Polychrome, as described by Di Peso, Rinaldo, and Fenner (1974: vol. 6) exhibits fine line-work similar to Standard Ramos Polychrome, indicating that line-work correlates with formal types, but does not necessarily determine them. Di Peso and colleagues (1974: vol. 6) quantify fine-line work as being less than 1 to 1.4 millimeters (mm) in width, whereas thick lines vary between 2 and 3 mm. In addition to wide variation in line thickness, Di Peso, Rinaldo, and Fenner (1974: vol. 6) find that thick-lined vessels are often typified by a sloppy style, with lines lacking uniformity in width throughout the vessels and overlapping one another as they intersect.

Similarly, Di Peso and his colleagues (1974: vol. 6) find that simplistic banded or continuous design layouts of geometric elements typify Babícora, Villa Ahumada, Dublán and Corralitos Polychromes. These are regarded as simpler ceramic styles. In contrast, paneled, quadripartite layouts are typically associated with Ramos and with fine-lined variants of Babícora and Villa Ahumada Polychromes, which are all considered more complex (Di Peso et al. 1974: vol. 6). Di Peso, Rinaldo, and Fenner (1974: vol. 6) also found that sloppy, thicker line-work are generally more associated with banded design layouts, whereas fine-lined vessels are much more likely to exhibit a quadripartite design layout. However, fine-lined vessels demonstrate the most variety in design layout styles, further adding to the impression that fine-lined vessels, such as Ramos and Huerigos Polychrome exhibit greater complexity than others such as Dublán Polychrome (Di Peso et al. 1974: vol. 6).

Though less explicitly discussed, Di Peso and his colleagues (1974: vol. 6) also noted long-recognized patterns in motif variety and complexity as being more commonly associated with “finer” and more complex pottery designs, which includes Ramos Polychrome. This observation continues to be upheld in later studies including those completed by Whalen and Minnis (2009).

The use of design layout, types of line-work, and motifs, as modes, though, has been more recently taken up by Hendrickson (2000, then published 2003) who stylistically split whole Casas Grandes vessels from museum collections through the use of two terms: Design Horizon A and Design Horizon B. Hendrickson (2003) defines Design Horizon A by continuous layouts, simplistic, repetitive motifs, and red motifs lacking a black outline. Design Horizon B, in contrast, is defined by quadripartite design layouts, complex motifs (including zoomorphic designs), and red elements outlined in black.

Hedrickson (2003) used these two designations to study Ramos, Babícora, and Villa Ahumada polychromes. From its type-description and associated diagnostic attributes, Ramos Polychrome falls into the Design Horizon B category. In comparison, Babícora and Villa Ahumada Polychromes fall into both Design Horizon A and B (Hendrickson 2003), an aspect that is captured by Di Peso and his colleagues' multiple variants (1974: vol 6). Design Horizon A typifies the vast majority of Babícora and Villa Ahumada Polychromes, with non-typical Design

Horizon B vessels being uncommon but present (Hendrickson 2003). Whereas both Design Horizons A and B are clearly composed of a bundle of three modes (design layout, type of line-work, and motif types), it is significant to note that each mode variant is mutually exclusive of one another and the three different modes are given equal weight.

Though Hendrickson (2003) himself does not explicitly include line-width as part of Design Horizons A or B, Whalen and Minnis (2012) observe that Hendrickson's Design Horizon A corresponds with thick-lined, sloppy styles, whereas Design Horizon B conforms closely with “Ramos”-style precise, thin-lined vessels. This association is supported by VanPool (2003), in her analysis of “Paquimé style” vessels (Design Horizon B and fine-lined, Ramos-style vessels identified by the JCGP), and “non-Paquimé style” vessels (Design Horizon A and thick-lined vessels identified by the JCGP).

Whalen and Minnis (2012) turn to questions of what Ramos Polychrome, and more specifically Design Horizon B, meant and how it functioned within Casas Grandes society. Importantly, this shift in focus privileges only a few ceramics after about AD 1300, ignoring the majority of Chihuahuan ceramics in any given assemblage. This attention is largely due to the fact that Design Horizon B ceramics exhibit two levels of symbols, whereas Design Horizon A ceramics, of which the vast majority of Chihuahuan ceramics can be assigned, exhibit only one. The first level of symbols, exhibited by both, include interlocking scrolls, triangles, “ticked” lines, and the opposition of hatched and solid elements (Whalen and Minnis 2012). Whalen and Minnis (2012) argue that this type of decoration is simplistic, learned through repetition, and does not carry complicated information (see Hegmon 1992; Kintigh 1985; Plog 1990; Wiessner 1985), in contrast to later design styles. Design Horizon B, and therefore Ramos Polychrome, exhibits much more complex sets of anthropomorphic and zoomorphic images, which have lead most all researchers to agree that these designs likely represent ritual life within the Casas Grandes world (see Crown 1994; Di Peso 1974; Moulard 2005; Rakita 2009; Sprehn 2003; Townsend 2005; VanPool 2003; VanPool and VanPool 2007; Walker 2002; Whalen and Minnis 2012).

At this point, almost all researchers can agree that these pots, with the introduction of a new Design Horizon, represent a shift in ideological tenants (Whalen and Minnis 2012), a concept Whalen and Minnis relate to Crown's (1994) “Southwestern Cult.” Furthermore, Whalen and Minnis (2012), among others (see Rakita 2009; VanPool and VanPool 2007), have tied these complex, ritually charged images with mid-level societies and increasing social complexity. Whalen and Minnis cite multiple authors (see Crown 1994; Earle 1997; Hegmon 1992; Howey and O'Shea 2009; Rakita 2009; Renfrew 2007; Rodning 2009; Walker 2002) that have argued that similar sets of iconographies throughout the human past have been manipulated by societies' elite persons in an effort to legitimize their power in mid-level societies.

This relationship between Design Horizon B and social complexity is supported by Sprehn's (2003) work with 699 whole pots from museum collections. Sprehn (2003) argues that Paquimé had Ramos Polychrome vessels that were more standardized in form and better-made than its neighbors, though she concedes that well-made Ramos Polychrome was not exclusive to Paquimé. However, importantly, her analyses do suggest that at least some Ramos Polychrome vessels may have been made by specialists, who may have been encouraged or sponsored by the elite, a classic hallmark used by archaeologists as a possible indicator of social complexity (see Earle 1993, among others).

Conclusions:

This trend in the identification of modes and their use in stylistic studies are leading archaeologists along previously under-explored paths. Technological studies, however, have lagged behind stylistic analyses considerably. It is my goal to focus on the ceramic pastes and pigments in an attempt to begin to explore what the production and distribution of Casas Grandes polychrome pots can tell us about social relationships both within and between Casas Grandes communities. Variations in paste have been long-recognized as a significant attribute associated with these polychromes (Di Peso et al. 1974). Texturally distinct pigments such as glaze-paints have been recognized, though they enjoy less significance across all formal types. However, based on my field observations of the variety of textures exhibited by black paints used to decorate Casas Grandes polychromes, I will extend my attention to the various paint recipes used to decorate polychromes throughout the Casas Grandes region. I will further discuss sampling strategies and methodologies in the following chapter.

Chapter 4:

Collections and Sampling Strategies

The intent of my dissertation is to begin to understand procedural modes exhibited by Chihuahuan polychromes throughout the Casas Grandes region in hopes of starting to develop a better understanding of how the human behaviors that generate these identifiable modes develop and change through space and time. As such, I elected to work with a regionally-based ceramic collection and a secondary set of materials recovered from site-based stratigraphic excavations.

Regional site reconnaissance studies, frequently with associated surface collections of artifacts including ceramics, have been performed relatively recently through the mid-1980s and 1990s. These include studies by Whalen and Minnis (2001a, 2009) and Kelley's crew and their work through the Proyecto Arqueológico Chihuahua (PAC)(see Kelley 2003, 2008; Kelley et al. 1999). However, regional studies have a long history within Casas Grandes archaeology, as illustrated by discussions in the previous two chapters (see Brand 1935; Carey 1931; Sayles 1936a, 1936b), and these older surveys encompass significantly larger areas than modern surveys, though were less intensive in their coverage. I have elected to work with one of these historic collections, specifically Sayles' 1933 (see 1936a, 1936b) regional survey and surface collections, for several practical as well as intellectual reasons.

Site-based stratigraphic excavations within the Casas Grandes world generally have experienced a shorter history within the discipline of archaeology, with some notable exceptions (see Carey 1931; Lister 1958; Lumholtz 1891). However, the beginning of robust site-based archaeological programs can best be tied to the beginning of the the JCGP (Di Peso 1974), and this work experienced a significant increase through the 1990s (see Kelley 2003, 2008; Whalen and Minnis 2001a, 2009; Van Pool et al. 2009 among others). In an effort to integrate a site-based perspective to my regional data, I also elected to work with excavated ceramics from Whalen and Minnis' (2009) work at Site 204.

E.B. Sayles' Survey and Surface Collections:

Practically speaking, one of the beneficial aspects of many historic collections, including Sayles', is that they are housed in the United States rather than Mexico. The ceramic collections made by Whalen and Minnis (2001a, 2009) and Kelley (Kelley 2003, 2008; Kelley et al. 1999) are currently housed in Chihuahua, Mexico either in the Instituto Nacional de Antropología e Historia's storage facilities in Chihuahua City or Pueblo Casas Grandes. Having collections available within United States borders greatly facilitates research as travel to Mexico and necessary export permits, which can be time consuming and costly, are not necessary.

Significantly, despite the fact Sayles' work started in 1933, before the international border was effectively closed and during an era where attitudes towards the legalities of culture heritage were less stringent, Sayles did both request and receive the appropriate permissions from the Mexican government to conduct his research, collect artifacts, and house those materials within the United States. Though there are many collections of Casas Grandes materials, including pottery, housed within the United States, working with some carries concerns of questionable professional ethics and responsibilities. Sayles' collections, though, are currently legally in the care of the Arizona State Museum at the University of Arizona.

However, though Sayles' collection has been largely available for over eighty years, relatively few people have spent much time with the materials. Some published studies, such as Rakita and Raymond (2003) and Carpenter (2002) have attempted to make use of the material, but these works have not greatly added to our understanding of the existing collection. Other researchers have worked with the collection, though this work has not been completed and published. Despite these efforts, Sayles' collection remains in much in the same condition and status as it has for the past eighty years. Sherds remained untyped and are organized by site and sometimes by test pit unit levels. Other artifact classes, such as lithics and organic materials, have been re-housed in other more appropriate facilities within the museum, but there is little modern documentation.

This overall lack of attention is at least partly due to the fact that Sayles never fully published his results making it difficult to establish a starting point from which to develop more intricate, modern research agendas. It is difficult to create detailed plans without basic information, such as sherd type tabulations. Two publications

(Sayles 1936a, 1936b) are associated with and cited during discussions of this work. However, one provides Sayles' modern descriptions of site types, largely based on architectural features visible during survey and few test pit excavations (Sayles 1936a). The second delivers written descriptions of Sayles' pottery types (1936b). However, neither publication details Sayles' survey strategy, method of sampling, or preliminary tallies of pottery or other artifact types collected. And though Sayles' (1936a) publication details site types, it primarily limits itself to generalized descriptions and gross regional patterns with little interpretation.

Though a complete, written publication detailing Sayles' work and final thoughts on the survey is wanting, he did maintain extensive documentation from his work in the field. These materials are archived at the Arizona State Museum Library and Archives. They include site forms, which were relatively unusual during the time and era, field journals, photographs, letters, telegrams, and other written communications, detailing correspondence between Sayles, Harold and Winifred Gladwin, and the Mexican government.

Sayles' survey was part of the Gladwins' Gila Pueblo Project, and he attempted a systematic survey of the Casas Grandes area, in keeping with the rest of the Project, by assigning an arbitrary grid system to map quadrants, covering much of the modern state of Chihuahua and the eastern-most edges of the state of Sonora. Some of these sites, including many located in eastern Sonora, were visited and had surface collections made by a man named Mr. Alves, according to Sayles' site forms. Sites were assigned a letter designation corresponding to the largest quadrant, followed by two numbers matching smaller grid sections (i.e. Sites D:8:1, E:9:12, and I:9:11). Importantly, these numbers have no bearing on modern site designations assigned and maintained by INAH.

Though there are considerable archival material associated with Sayles' collections, he failed to draft a detailed map appropriately describing all sites' physical locations. Accurate topographic maps were largely unavailable until after World War II, so the absence of accurate map covering such great distance is largely unsurprising. A map plotting sites Sayles identified as “type sites,” is provided in one of his articles (1936b)(see Figure 4.1), though it only includes twelve sites. More up-to-date maps have been created, courtesy of MacWilliams and Hard (unpublished, see Figure 4.2), who have attempted to reverify site locations in the field, with some limited success.

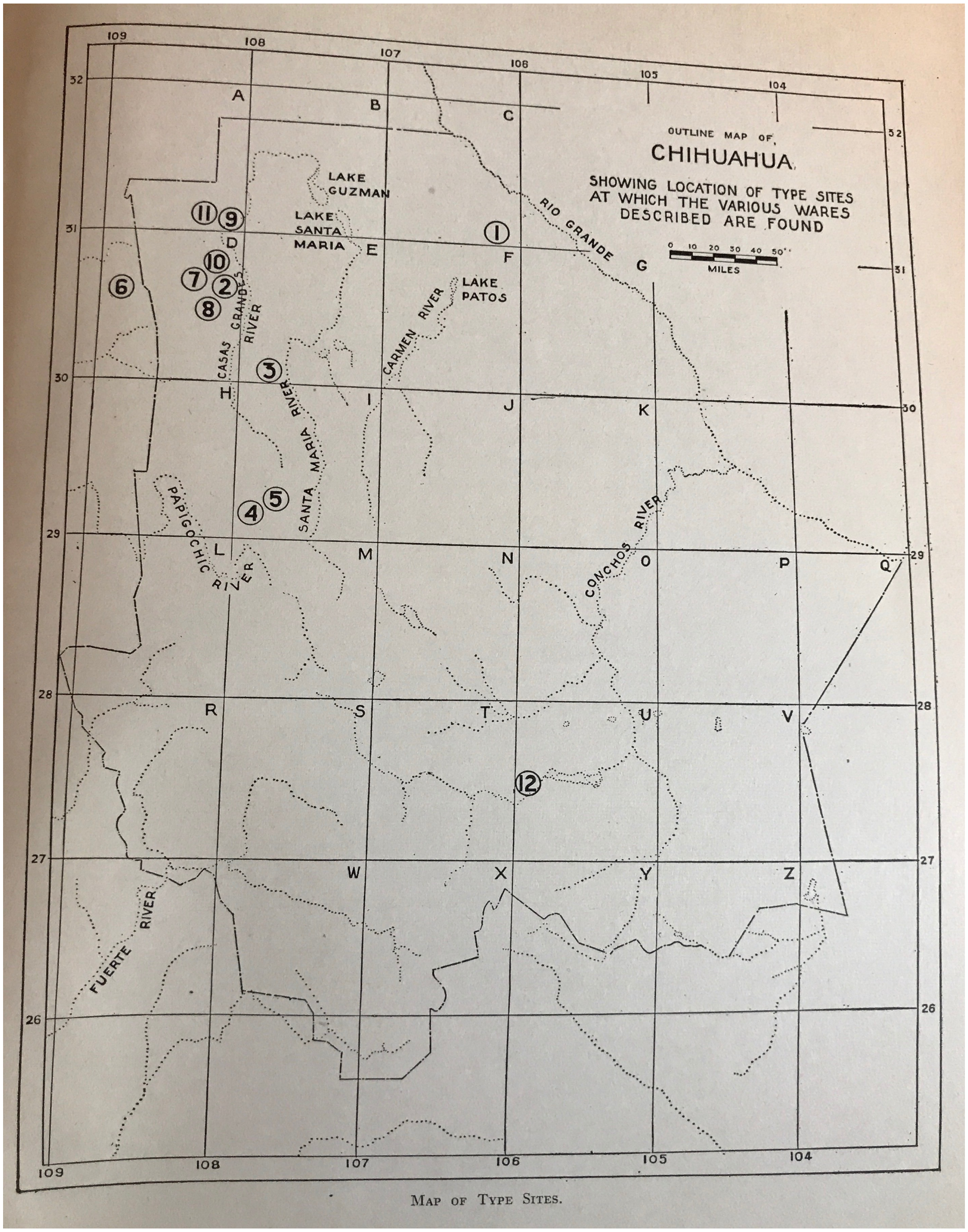


Figure 4.1: Map of "type sites," illustrating the grid system utilized by Sayles in the field (Sayles 1936b).

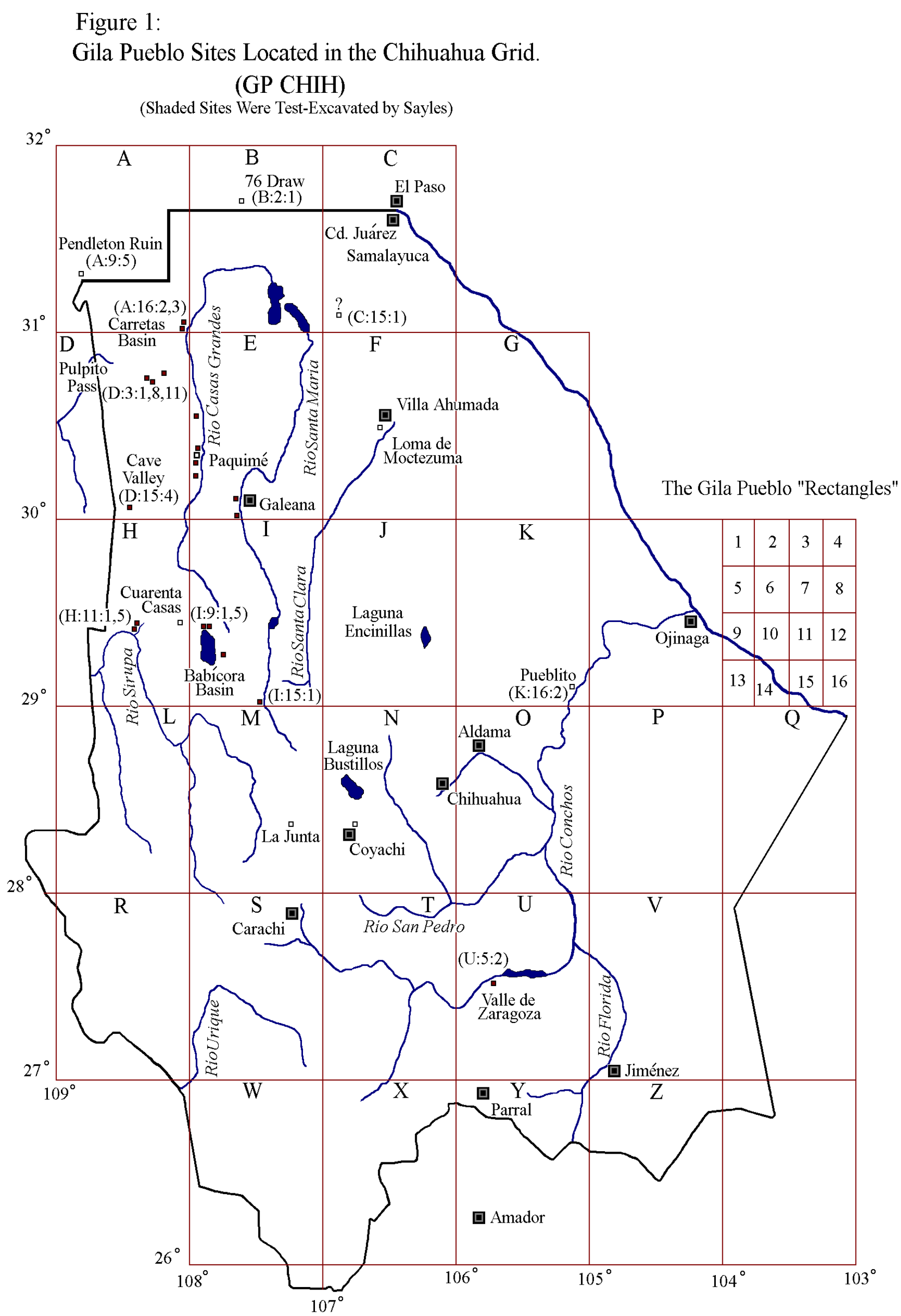


Figure 4.2: Map courtesy of A. MacWilliams.

Despite the incomplete nature of the final report, the collection's age, the corresponding archival materials, and the fact that the artifacts have been well-curated through time make it a rich resource for current and future research. Importantly, this and other historic collections may represent the only records of many sites that we will ever have, given that many have disappeared as a consequence of modern land use practices.

My intent is not to provide a comprehensive, finalized report of Sayles' survey. As the focus of my dissertation is to describe and begin to understand the variability of Casas Grandes polychromes, I ultimately do not discuss the majority of the collection in any great detail. It seems inappropriate, however, to ignore the rest of the collection entirely. As such, in the following paragraphs, I will describe some of the additional data I collected in hopes that they will both provide greater context to my own research as well as preliminary information useful to others' future research projects.

To start with, between the site forms and surface collections, Sayles' survey includes 293 individual sites, some with multiple collections of artifacts from the surface and test pits. Twenty-one of these sites, though, have no corresponding ceramic collections. These include Sites A:2:2, A:2:3, A:2:4, A:2:5, A:6:3, A:9:6, A:9:7, A:9:8, A:9:9, C:2:2, D:12:5, D:15:1, D:15:2, D:16:5, E:3:2, E:3:3, E:9:7, H:11:8, H:11:9, I:6:1, and U:14:1. Significantly, it is unclear whether or not all of these sites should have pottery. Some information can be gleaned from site forms that speak to these concerns. For example, Site E:9:7 should have corresponding ceramic material, whereas Site I:6:1's site form clearly notes that no surface collections were made at the time of Sayles' site visit. Site A:9:5's site record, though, indicates that no sherds were collected, yet there are sherds associated with this site in the Sayles' collection. Another site, represented by a surface collection of archaeological ceramics, Site D:16:3, has no corresponding site form. With these instances in mind, it is likely that there are multiple causes for discrepancy between site records and actual materials in Sayles' collection.

Clearly, at least some of these sites never had corresponding physical collections whereas some site forms contain inaccurate information. In addition to error, surface collections may not necessarily be ceramic in nature. Non-ceramic materials are housed differently at Arizona State Museum, one example being Site U:14:1, represented by only lithic artifacts. Additionally, at the time I worked with the collection, it was not entirely intact as some materials had been loaned out to other researchers. As such, missing sherds may not be missing at all, but rather housed elsewhere or destroyed as a consequence of destructive analysis. Alternatively, materials may have been lost through time. This is most likely and noticeable for sequences of ceramics for test pit excavations, wherein a section in the middle of the test pit is missing. In all likelihood, these materials have been lost. It is also plausible that the soil, in these layers was sterile, though there is no documentation that supports this speculation.

In addition to the sites that lack corresponding surface collections, others are not prehistoric. Historic sites, referred to as “presidios” in Sayles' notes, become noticeably more prevalent the further south he traveled through Chihuahua. It is unclear if this pattern is based in physical reality or had more to do with Sayles' growing attention to these historic sites. All told, he documented at least forty-three historic sites, many of which have corresponding ceramic surface collections. They are Sites C:13:2, C:16:2, E:9:10, M:2:1, M:6:1, M:6:2, N:10:1, N:9:1, N:9:2, N:9:4, O:5:1, O:7:1, O:7:3, O:7:5, O:7:6, O:8:2, O:11:1, U:5:2 A, U:5:2 B, U:5:2 C, U:5:2 D, U:5:2 E, U:5:2 F, U:5:2 G, U:5:2 H, U:5:2 I, U:5:2 J, U:5:2 K, U:5:2 L, U:5:2 M, U:5:2 N, U:5:2 O, U:5:2 P, U:5:2 Q, U:5:2 R, U:5:2 S, U:5:2 T, U:5:5, V:9:1, V:13:1, V:13:2, Y:3:1, and Y:10:1. My examination of the ceramic surface collections that correspond to these sites showed that at least some of them contain both historic and prehistoric components. These include Sites D:12:4, E:9:11, F:13:1, I:2:1, I:4:2, and I:16:1. I include these prehistoric sherds in my dissertation, though I disregarded all historic pottery types, the majority of which is generally utilitarian in nature.

Of the remaining prehistoric sites, not all surface collections contain painted ceramics, the focus of my dissertation. Sites without painted ceramics include the following sixty-nine sites: A:3:1, A:9:1, A:9:3, A:10:1, A:11:2, B:2:3, B:3:1, C:12:1, C:12:2, C:12:3, C:13:1, D:4:1, D:5:3, D:5:4, D:5:5, D:5:7, D:5:8, D:5:9, D:5:12, D:6:3, D:6:5, D:6:6, D:6:8, D:6:9, D:6:10, D:12:3, D:15:5, D:15:8, D:15:10, D:16:1, D:16:2, E:3:1, E:5:4, E:13:2, E:13:3, E:15:1, F:2:2, F:5:1, H:2:1, I:16:3, I:16:4, J:11:1, K:15:1, K:16:1, M:2:2, M:6:3, N:9:3, O:1:1, O:2:1, O:7:2, O:8:1, O:14:1, O:14:2, P:1:1, P:9:1, P:9:2, U:5:1, U:5:3, U:5:4, U:5:6, U:8:1, U:15:1, V:14:1, Y:2:1, Y:3:2, Y:4:5, Y:10:2, Y:10:3 Southwest, and Y:10:4 Northwest. While evaluating the collection, I noted that these sites had associated sherds housed at ASM but did not spend time counting these artifacts or making additional notes regarding the materials. I left these materials at the museum, and they were not part of my loan or additional analyses.

Ultimately, I obtained access to collections of painted ceramics from 160 sites with prehistoric components that span the southern portions of New Mexico and Arizona, eastern Sonora, and much of Chihuahua. I took out on loan all of the painted ceramics from each of these sites, leaving Ramos Black, Playas Red, and all other utilitarian ceramic types, including plain and textured wares. Initially, Sayles collected ceramic types in proportion to what existed on the site. There is no documented switch in Sayles' sampling strategy, but it is likely he switched his focus upon Gladwin's urging, collecting painted ceramics more heavily as they were proving useful as indicators of relative time in the American Southwest. Regardless of his motivation, it is useful to document the types of collection strategies that produced Sayles' collections, and this information is presented in Appendix B.

Site 204:

Site 204, also known as the Tinaja Site, is located approximately 17 km west of the site of Paquimé (Whalen and Minnis 2001a). It is likely that Sayles also visited the Site 204, but it is unclear given his site designations. The materials I used over the course of my dissertation, however, were excavated by Whalen and Minnis in 2000 and 2001 and their site reports are far more thorough than those completed by Sayles (see Whalen and Minnis 2001a, 2009).

Whalen and Minnis (2009) identified Site 204 as one of the largest near-neighbors to Paquimé, with three large mound complexes that are comprised of approximately 220 individual rooms of which 37 were ultimately excavated (see Figure 4.3 for site map). In addition to room-block mounds, there was a formal I-shaped ball court and two large ovens, similar to those excavated at Paquimé. Other prominent features include a nearby *atalaya* with a clear line of site to another *atalaya* situated on top of Cerro Moctezuma, a hilltop site commonly associated with Paquimé (see Pitezel 2003, 2007; Swanson 2003).

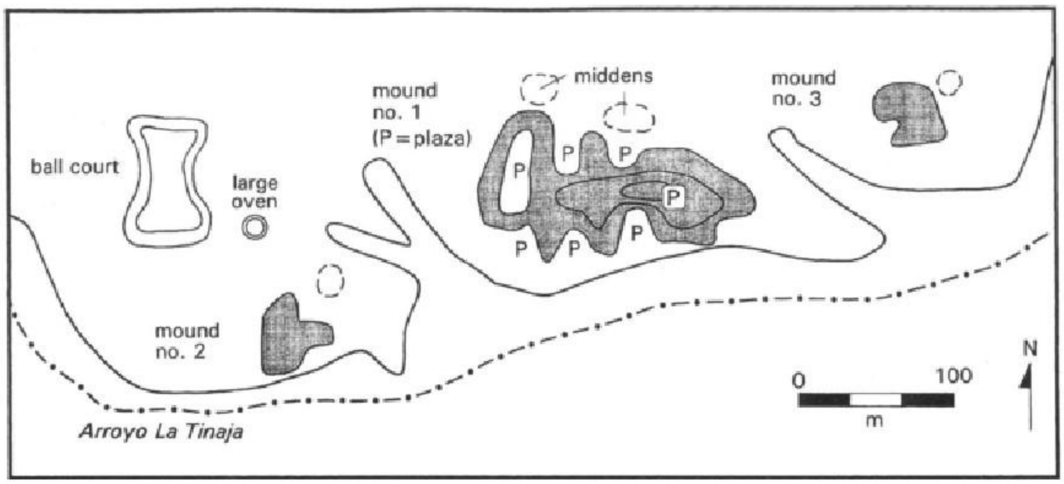


Figure 4.3: Site map of Site 204 (Whalen and Minnis 2009).

Most important for my own research is that Whalen and Minnis (2001a, 2009) also identified and excavated middens at Site 204. This is significant as previous researchers, as discussed previously, noted the dearth of middens, especially in comparison with the American Southwest (see Brand 1933 Carey 1931; Lister 1946). The middens at Site 204 are deep, ranging from 80 cm to 120 cm, and Whalen and Minnis ultimately completed nine 1 x 2 m test pits excavated in 5 cm increments. These excavated units represent some of the best diachronic evidence within the Casas Grandes region, leading to Whalen and Minnis' (2009; 2012) assertion that Ramos Polychrome occurs only after approximately AD 1300.

Sampling:

Sample selection for Sayles' collections and those from Site 204 differed significantly, primarily due to my own developing understanding of Casas Grandes polychromes. For both my regional and site-level datasets I focused on Ramos, Babícora, and White-Paste Babícora polychromes only, disregarding all other identifiable formal types. I decided to focus my analyses on these three formal types as they are the most prevalent throughout the Casas Grandes world and so are most likely to represent a more comprehensive documentation of human behaviors. They also are the most prominent in academic discussions of Casas Grandes polychromes.

I selected the analytic sample from Site 204 before that of Sayles' surface collections. As such, my experiences with sherd selection at Site 204 directly informed that of those from Sayles'. Using a Dino-Lite digital hand-held microscope I examined over a thousand polychromes from Site 204. I identified what I perceived to be paste groups using images captured with the microscope. Given my continued experiences with more Casas Grandes collections, I now consider reliance on such perceived paste groups as less than ideal proxies for paste diversity, as, after reflection, variations in texture and size of temper fragments frequently correlated with formal type identification. As such, I am concerned I selected sherds proportional to broad paste-temper categories within each formal type, rather than in regard to the overall paste diversity at the site. This stated, I sampled 107 Ramos, Babícora, and White-Paste Babícora polychromes from all levels from seven test units (see Appendix C for details). Forty-four (41%) sherds are Babícora polychromes, 27 (25%) are Ramos polychromes, and 36 (nearly 34%) are White-Paste Babícora polychromes.

In response to my learning experiences with sherds from Site 204, I used a more elaborate process for Sayles' regional collection. In contrast to my work with Site 204, Sayles' collection provided multiple site types of the 160 with prehistoric components. I reduced the number of sites by arbitrarily choosing 20 as what I considered to be a critical number of painted sherds. This critical number includes all painted sherds, not just those that are necessarily identifiable as Chihuahuan polychromes. My idea was that sites with small surface collections could be misleading due to the small number of sherds.

After disregarding sites represented by fewer than twenty painted sherds, I reviewed Sayles' site records to identify site type and make note of his observations regarding site size. I wanted to be sure that giving preference to larger surface collections would not necessarily bias my selection process towards large sites. Ultimately, both the chosen minimum number of painted sherds and selection for a diversity of site types resulted in a final list of sites that represent a regional cross-section of Casas Grandes communities. This list of sites includes A:16:2, A:16:3, B:2:1, B:4:1, C:2:1, C:2:4, D:3:1, D:3:9, D:3:11, D:5:6, D:8:1, D:9:1, E:7:2, E:9:1, E:9:12, E:14:1, E:14:4, E:14:5, F:6:1, F:13:2, H:11:1, H:11:5, I:9:1, I:9:5, I:9:9, I:9:11, and I:15:1. I mistakenly included Site D:8:1, which only has eight Chihuahuan polychromes associated with its surface collection. I do not believe that this inclusion significantly alters the nature of the final data set and it more completely defines Grid D sites.

While working through Sayles' surface collections, I also used a Dino-Lite digital, hand-held microscope to complete preliminary temper analysis. However, unlike my initial assessment of polychromes from Site 204, I also completed refire experiments of all sherds from Sayles' collection. This is a quick and cost-effective qualitative method of determining possible clay chemistry groups (Orton et al. 1993). I determined paste color before and after the refiring sherds to 1000°C using a Munsell Color Chart. I identified seven refire color groups throughout the region, which are defined in Appendix D. The assumption underlying this preliminary paste analysis is that sherds refiring different colors should also have correspondingly distinct chemistries. For example, sherds that refire red generally have different clay chemistries from those that refire white, as the first is iron-rich and the second is iron-poor.

Clearly paste color, as with temper, plays an important role in the identification of polychromes. Namely, Ramos and White-Paste Babícora polychromes are recognized by their light-firing pastes while Babícora polychromes typically exhibit brown pastes. However, what we perceive as paste colors are a result of a complex set of processes including firing conditions, use, and depositional environment, which no two sherds is likely to share. By refiring sherds in the same oxidizing atmosphere and at the same temperature, beyond that of the original firings, paste colors are more easily compared to one another. Diversity in these colors can approximate diversities in chemistry. Ramos and White-Paste Babícora polychromes, specifically, though sharing a light-firing paste, initially, refired to a wide range of colors, suggesting the use of multiple raw materials.

I determined final sherd selection from Sayles' collections through a combination of this perceived chemical diversity of sherds at a site, precision of formal type identification, and sherd size. After I concluded my preliminary analyses, I selected two Ramos, Babícora, and White-Paste Babícora Polychrome sherds per refire color group. If a color group was represented by only one sherd, I selected that sherd for destructive analysis. Also, I only selected sherds that unequivocally fit the stylistic type descriptions of Ramos and Babícora Polychrome. If a sherd were somehow ambiguous, I disregarded it in favor of another that clearly conform to our type definitions. Size was also a factor in sherd selection. If sherds were too small for both petrographic and the subsequent neutron activation analysis (NAA), both of which require a certain physical amount of material, they were disregarded. I also desired to retain at least some of each individual sherd after both types of destructive analysis.

The final sub-set selected for destructive analysis can be found in Appendix D. The final data set includes 185 Ramos, Babícora, and White-Paste Babícora polychrome sherds from 27 sites throughout the Casas Grandes area. Ultimately, 89

(48%) of my final sample set are Babícora Polychrome, 78 (42%) is Ramos Polychrome, and 18 (just over 9%) is White-Paste Babícora Polychrome.

Conclusions:

These two data sets provide the basis for one of the larger multi-method studies completed within Casas Grandes archaeology. By developing a better understanding of both regional and site-level polychrome diversity, I endeavor to describe previously unidentified modes that may aid in our understanding of patterned human behavior within the Casas Grandes region.

Chapter 5:

The Mineralogical and Chemical Diversity of Chihuahuan Polychromes

Few petrographic studies have been completed within the Casas Grandes world and most have not been of particularly large scale in either sample size or number of sites represented in the study. Anna O. Shepard completed petrographic analysis of a sample of sherds provided by Di Peso from excavations by the JCGP, but this work appears to have included a relatively small number of ceramics of unknown type. From the discussion presented by Di Peso and colleagues (1974: vol. 6), it appears that Shepard only examined Viejo period ceramics. Though provenience of the sherds is unverified, it is likely that this sample was derived from Paquimé. I have been unable to access Shepard's full analysis, which is possibly housed at either the Amerind Foundation or the Museum of Natural History at the University of Colorado at Boulder, along with the rest of Shepard's research materials. Di Peso (see 1974: vol. 6, 40) included a short excerpt of Shepard's letter addressed to him, dated 7/6/63: "All the sherds in your sample contain volcanic temper in which clear crystals (phenocrysts) and opaque particles of tuff are prominent. There are variations in texture and ratio of components and also in the firing color of the clays, but these differences do not correlate with type as far as I can judge from the samples."

Whereas these few sentences do not convey any sort of decisive interpretations on Shepard's part, her observations do suggest two possible scenarios for potters likely situated at and around Paquimé. For one, Shepard's observations regarding the large amount of textural diversity between sherds could suggest that Casas Grandes potters accessed many mineralogically similar clays. Alternatively, potters could have accessed relatively few raw clays sources that exhibit significant internal variation.

Carpenter (2002), as discussed previously, also reported petrographic analysis of ceramics from the Joyce Well Site. His analysis was made up of 21 sherds, only 14 of which were identified as Ramos Polychrome. The remaining sherds were Jornada Brown and El Paso Polychrome sherds. As with Shepard's analysis, Carpenter's study identified all non-plastic inclusions as being "crushed or decomposed igneous sources" (2002: 157). Whereas this agreement between these two petrographic reports is helpful, these petrographic distinctions remain somewhat vague as to anthropological implications. Carpenter (2002) reports that these inclusions are not at-odds with the geology surrounding the Joyce Well site. And whereas this observation is true, these igneous inclusions are also similar to much of the underlying geology within the Casas Grandes world (Cameron et al. 1980).

New Petrographic Work:

In addition to these formally published petrographic studies of Chihuahuan polychromes, I recently completed mineralogical analyses of polychrome and plainware pottery from Sites 291 (n=7) and 355 (n=18), excavated by Dr. Michael

Whalen, University of Tulsa, in 2013. However, only one sherd from Site 291 was a polychrome, identified as a Babícora Polychrome. Site 355's sample was only slightly more robust, producing six Babícora, five Ramos, two Villa Ahumada, and two White-Paste Babícora polychromes.

I manufactured the thin sections presented in this chapter using the rock lab facilities at the University of California, Santa Cruz. To complete the petrographic analysis, I used a Nikon Labophot T2-Pol optical mineralogy microscope. I initially worked with the samples blind, not referring to any additional information. After I completed this initial sorting, I used additional provenance and other information to further validate these groups. This is the largest petrographic sample from the greatest number of sites from the Casas Grandes world.

I also completed a 100 point counts of a sub-set of these samples, using an arbitrary absolute scale in millimeters and identifying the mineralogical components seen under the cross-hairs at every point along this scale. Point counts can be found in Appendix E. The focus of most petrographic analysis of sherds inevitably dwells on mineralogical inclusions rather than the clay itself, as clay minerals are not visible using optical mineralogy. Frequently, however, there are spaces during point counts where a single mineral inclusion does not fall under the cross-hairs of the field of view. In these instances, I typically make the notation "clay matrix" to signify the absence of any other identifiable inclusion. If there are no small inclusions, I note these spaces as simply "clay matrix." If there are small angular or rounded crystals in this clay matrix, I describe these spaces as “silty clay matrix.” The silt component of the clay matrix is often too small in physical size for significant mineralogical analysis.

Typically, there are two major categories of inclusions within archaeological ceramics: mono-crystals and lithic fragments. Other typical inclusions include crushed fragments of sherds, bone, and shell. However, the pottery from the Casas Grandes region generally does not include non-lithic inclusions.

Lithic fragments may pose a dilemma for ceramic petrographers in that we rarely have pieces large enough to make what many geologists would consider to be a clear or certain identification. However, with enough fragments in a single sherd, we can usually identify the parent material based on major and minor mineralogical inclusions and texture. Combining this information with an understanding of erosional processes and their effects on specific types of geologic units allows for identification with a fair degree of certainty. These identifications can then be compared with published descriptions of the local and regional surface geology to determine whether local production is a reasonable assumption, or if pottery was more likely produced elsewhere.

I use standard optical mineralogical methods in identifying each non-plastic inclusion by properties such as color, birefringence, fracture, cleavage, crystal habit, pleochroism, twinning, angle of extinction, and relief in thin section (see Nesse 2012). Interference figures are frequently used to further ascribe identity to individual crystals. This list of traits is not exhaustive. For rock fragments, I use comparative images of rocks in thin section, focusing on constituent grain shape, texture, and major and auxiliary mineral composition to make lithic identifications. These optical attributes and methods are common practice within ceramic petrography (see Peacock 1970, Shepard 1936, Stoltman 1991 among others).

Other traits observable during petrographic analysis include angularity and roundedness. This textural aspect of thin sections is often the result of natural erosional processes, both chemical and mechanical. However, these qualities may also be a result of human-action. “Crushed rock,” for example, is a phrase often used in the American Southwest to describe the mechanical reduction of rocks, by humans, to produce temper for pottery (see Shepard 1939). A marked decrease in the roundedness of some inclusions in comparison to the angularity of others could indicate the deliberate addition of crushed tempering materials by potters. Alternatively, this could be a result of the natural introduction of relatively recent sediments into a depositional system.

Size distributions of inclusions may be a result of either natural or cultural processes. Aeolian and alluvial processes may selectively winnow the smaller size fractions of a collection of sediments, producing a well-sorted collection of eroded material. Poorly sorted material may be indicative of an episodic high-energy event such as a flash flood through an arroyo. Humans can achieve similar results by adding tempering material from distinctly different natural environments and with different frequencies of particle angularity and roundedness. Well-sorted inclusions can equally be a result of natural or cultural processes. For example, winnowing of particles to a specific size classes can be a result of aeolian forces or human action.

Petrographic Group Definitions:

Over the course of my analysis of Chihuahuan polychromes from Sayles' surface collections, I developed a broad system described below for petrographically organizing Ramos, Babícora, and White-Paste Babícora polychromes. Note that the majority of sherds assigned to Groups 1 through 4 demonstrate clearly felsic igneous origins. Feldspars, quartz, and augite phenocrysts are all phenocrysts typically associated with rhyolitic and dacitic flows. Rhyolites and dacites are considered felsic igneous units, in contrast to basalts which are mafic. These designations, felsic and mafic, are determined by mineralogy. More felsic units contain larger quantities of quartz and feldspars whereas mafic units contain increasing amounts of iron and magnesium.

- Petrographic Group 1: This petrographic group is typified by a relatively even distribution of higher birefringence phenocrysts, usually augite (a pyroxene), and glassy, cryptocrystalline groundmass. Lower birefringence phenocrysts (feldspars and quartz) are typically absent or rare. This group is the most common among sherds from Sayles' surface collections, represented by 85 sherds (just over 45% of the collection) and present in all formal types.

- Petrographic Group 2: Like Petrographic Group 1, this group is typified by a relatively even distribution of cryptocrystalline groundmass and phenocrysts. In contrast, however, the phenocrysts within these sherds generally exhibit low birefringence (feldspars and quartz). I assigned 33 sherds (just over 18%) from Sayles' surface collection to this petrographic group.
- Petrographic Group 3: In contrast to Petrographic Groups 1 and 2, Petrographic Group 3 is typified by sherds dominated by cryptocrystalline, glassy groundmass fragments rather than an even distribution of the two inclusion types. Higher birefringence phenocrysts, augite, similar to Petrographic Group 1, are present but are significantly less frequent in their occurrence. Frequently, the groundmass fragments that dominate these slides are rounded and/or chemically altered. Thirty-eight sherds (just over 20% of the collection), of all formal types, form this petrographic group.
- Petrographic Group 4: This group, as with Petrographic Group 3, is dominated by cryptocrystalline groundmass fragments, but similar to Petrographic Group 2, the phenocrysts present exhibit lower birefringence (feldspars and quartz). Given the small number of sherds (n=20, just over 10% of the collection) assigned to this petrographic group and the low frequency of phenocrysts across the thin sections it is possible that higher birefringence phenocrysts may simply not be present through this single cross-section of the sherd.

However, the prevalence of augite crystals and the general absence of low birefringence phenocrysts in Petrographic Group 3, suggest that, whereas a possibility, is unlikely to be the case.

- Petrographic Group 5: This petrographic group is relatively minor (n=6, 3% of the collection) and is typified by the presence of mono-crystals, including feldspars, quartz, and higher birefringence crystals, like augite. These crystals tend to be moderately well-rounded. Crystalline groundmass, common in Petrographic Groups 1 through 4, is either entirely absent, or nearly absent.
- Petrographic Group 6: This group is the smallest of the groups I identified over the course of my analysis (n=3, just over 1% of the collection). It is set apart from the other petrographic groups by basalt-like inclusions that are not present in any other group. One of these thin sections (EBS1289) is clearly dominated by basalt-like fragments, with very few other types of inclusions. The second and third samples (EBS1102 and EBS294), however, contain fewer, more weathered basalt fragments which appear to be incidental.

While I have organized my sample according to this mineralogically-driven set of definitions, I want to be clear that all sherds organized together within any one broad petrographic group may not necessarily be directly related to one another. More specifically, simply because I assigned a collection of sherds to one of these categories does not necessarily imply that I think they were produced using raw materials from the same sources. Rather, the preceding petrographic groups and their corresponding definitions better represent types, or classes, of raw materials being selected and utilized by potters throughout the Casas Grandes world.

Whereas these broad petrographic group assignments should not be taken to imply direct production source relationships between sherds, the petrographic groups themselves are the basis of a significant interpretation on my part. Given my current analysis, I take the position that the majority of raw clays used in the Casas Grandes area were not significantly altered by potters through addition of tempering materials. This is especially true for Petrographic Group 1 through 4. None of the identified inclusions have overt cultural origins, such as crushed sherd (grog), crushed and/or burnt shell, or bone temper fragments, burned or otherwise. The inclusion types, mono-crystals and cryptocrystalline groundmass fragments, have conspicuous, direct associations with one another. For example, I have intentionally identified the free-floating mono-crystals as phenocrysts in my definitions, as some of them are surrounded by cryptocrystalline groundmass rinds similar to the rest of the groundmass fragments. Accordingly, there is no reason to suggest that these crystals have origins beyond that of a single, geologic parent material.

In addition to the clear physical relationships between inclusion types, other aspects of the various non-plastics indicate that Casas Grandes potter likely did not add significant amounts of foreign materials to raw clays. For example, phenocrysts and cryptocrystalline groundmass fragments exhibit consistent indications of chemical and physical weathering throughout each thin section. Mixing of raw clays or the addition of non-native tempering materials through natural aeolian or fluvial or cultural processes seems unlikely given how uniform attributes are, both in regard to mineralogy and indications of weathering. If materials had been added, inclusions would likely exhibit a variety of indications of chemical and/or physical weathering as well as other textural aspects such as angularity and roundedness.

While I cannot preclude the possibility entirely, there is also an absence of clear evidence that potters manipulated raw clays by removing material, either by hand, sieving, or levigation. I noted little to no clear evidence of uniformity in size distribution frequency that I could associate with any such behaviors. What is more, such uniformity in the size of inclusions may be as much related to natural fluvial or aeolian processes as to cultural behaviors.

Currently, my analysis supports the interpretations of Triadan and her colleagues (2017), who argue that Casas Grandes potters deliberately targeted primary (residual) clays, which are usually found close to geologic parent units. My petrographic analysis finds no clear evidence that Casas Grandes potters heavily modified the raw clays by adding tempering materials or mixing clays, or by removing native material. As such, my petrographic analysis of Ramos, Babícora, and White-Paste Babícora polychromes from Sayles' surface collections suggest that these polychromes should significantly reflect the original compositions of their clays and by association their geologic parent units.

This presumed close relationship between raw clays selected by Casas Grandes potters and their geologic parents would seem to facilitate archaeologists' attempts to assign provenance to pottery. However, the Casas Grandes region is geologically underlain by “mid-Tertiary ignimbrites of the Sierra Madre Occidental of western Mexico [which] constitute the largest continuous rhyolitic province in the world” (see Figure 5.1; Cameron et al. 1980). Statements like this appear at the beginning of nearly every article focusing on the geology of North and West Mexico. The Sierra Madre Occidental is geologically homogeneous in that it is dominated by ash-flow tuffs (also referred to as ignimbrites and pyroclastic flows) and other felsic lava flows, which are, not surprisingly, the same materials I have identified as being the likely foundational non-plastics among my Chihuahuan polychromes.

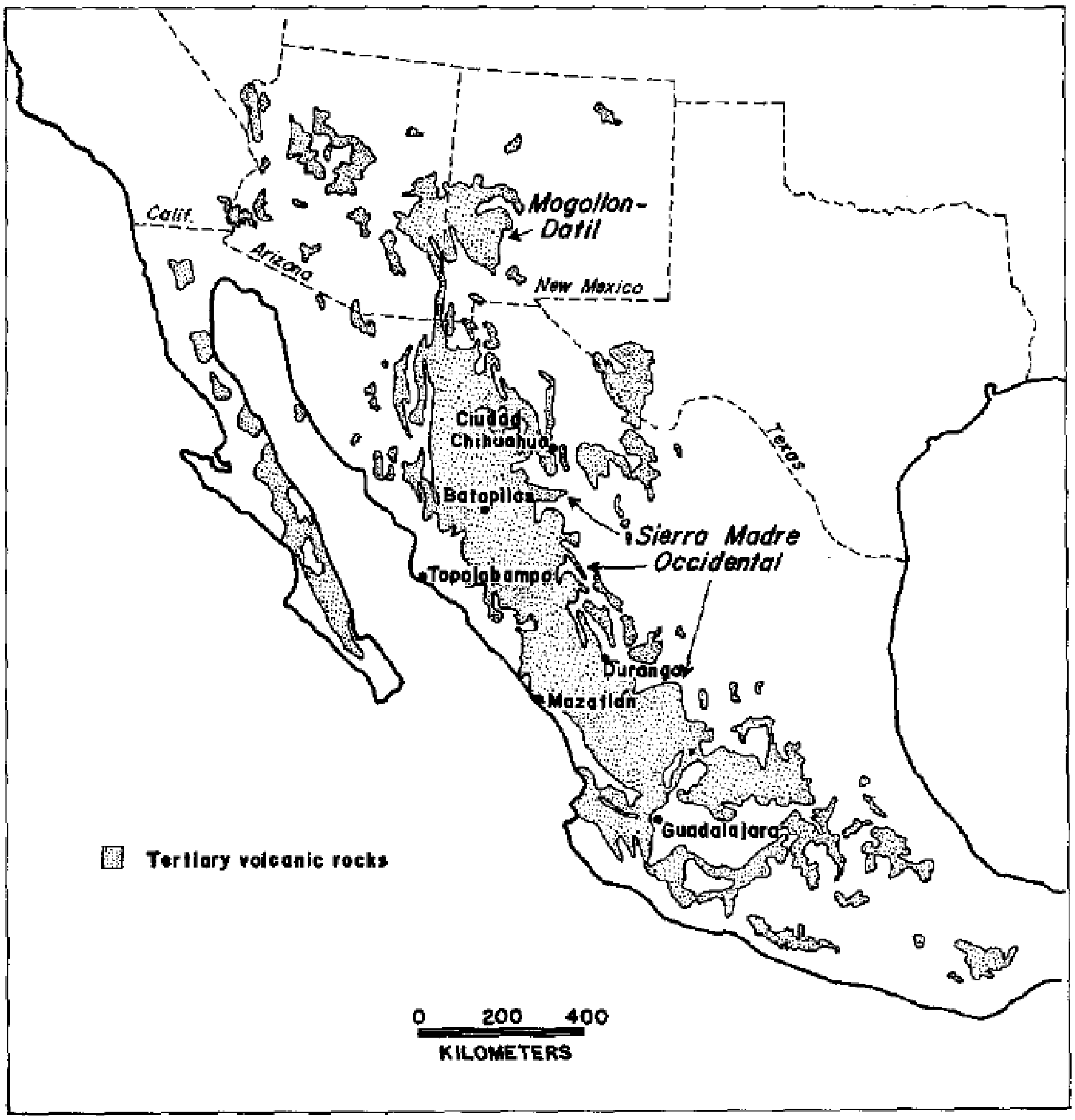


Figure 5.1: Map presenting the geographic distribution of Tertiary volcanic rocks in Mexico (Cameron et al. 1980).

However, while this geologic area is heavily dominated by felsic volcanic flows, this ignimbritic landscape is punctuated by other geologic units, including basalt plugs, from which manos and metates were likely manufactured (VanPool and Leonard 2002). Accordingly, although felsic geologic units are ubiquitous throughout the Sierra Madre Occidental, most clay deposits created by contributions from multiple, natural processes would inevitably be comprised of materials derived from multiple, distinct geologic units across the landscape and should reflect a more-mixed parentage. Despite this situation, petrographic slides of Ramos, Babícora, and White-Paste Babícora sherds from this study do not exhibit significant diversity. And, given the fact that the diversity of non-plastics is relatively low, largely comprised of cryptocrystalline groundmass fragments and phenocrysts, I support Triadan and her colleagues' (2017) positions that these clays are primary clays located near parent material that would have had similar texture and composition, even if collected at different locations throughout the Sierras.

In addition to this agreement, given the results of my petrographic analysis I offer additional interpretations. I suggest that the mineralogical distinctions between Petrographic Groups 1 and 2 and Petrographic Groups 3 and 4 likely represent geologically distinct sets of primary clay deposits. Specifically, I suggest that the raw materials used to produce sherds assigned to Petrographic Groups 1 and 2 are derived from lava flows, whereas sherds assigned to Petrographic Groups 3 and 4 may be manufactured from raw clays better associated with highly welded tuffs. These geological distinctions account for the significant differences in the amount of glassy, groundmass fragments as well as the prevalence or general absence of phenocrysts noted between these four major groups. Pyroclastic flows are naturally more glassy in nature and contain fewer phenocrysts. Erosion of lava flows, in contrast, will result in a more even distribution of these two inclusion types. The different mineralogical identities of the phenocrysts, feldspars, quartz, and augite can be tied to dacitic or rhyolitic mineralogical definitions. Petrographic groups with only feldspars and quartz are more likely to be rhyolitic in nature, while a combination of these two and the addition of augite are indicative of dacitic melts. The prevalence of only augite phenocrysts throughout many slides also supports that interpretation that many of these more dacitic melts are "dry" melts, as water is necessary for the formation of quartz and feldspar phenocrysts.

Given the likelihood that Petrographic Groups 1 through 4 are associated with distinct types of geologic units, the frequency of these petrographic groups may represent differences in the physical or cultural accessibility of raw clay deposits. Despite these clear preferences for a narrow range of raw materials, given the ubiquity of these geologic units throughout the Casas Grandes world, identifying and accessing these depositional units would not be difficult for knowledgeable local potters. It does, however, present a problematic situation for archaeologists seeking to identify raw sources and characterize pottery.

The results of my petrographic analysis of Ramos, Babícora, and White-Paste Babícora polychromes is presented in Table 5.1.

Formal Type/ Petrographic Group	Petrographic Group 1	Petrographic Group 2	Petrographic Group 3	Petrographic Group 4	Petrographic Group 5	Petrographic Group 6	Total
Ramos Polychrome	31	11	23	8	5	0	78
Babícora Polychrome	60	7	7	11	1	3	89
White-Paste Babícora Polychrome	6	1	10	1	0	0	18
Total	97	19	40	20	6	3	185

Table 5.1: Petrographic groups assignments across formal types (Sayles' collection)

Table 5.1 demonstrates that no single formal type is represented by any one petrographic group, with exception of Petrographic Group 6 to which only Babícora polychromes are assigned. Overall, however, Petrographic Groups 5 and 6 are relatively uncommon, with Petrographic Groups 1 through 4 representing over 95% of the thin sections analyzed from Sayles' regional surface collections. Petrographic Groups 1 and 2 represent nearly 63% of the sherds in this study and while 32% are assignable to Petrographic Groups 3 and 4. Given the disparity between Petrographic Groups 1 and 2 and 3 and 4, I suggest that clay deposits corresponding with the former pair are likely more widespread and were more commonly accessed by Casas Grandes potters.

There are some additional fine-scale observations I can make based on the data presented in Table 5.1. For example, the absence of White-Paste Babícora polychromes sherds assigned to Petrographic Groups 5 and 6 may be due to the rarity of this type in my sample set. Ramos Polychrome, however, is similarly not represented by Petrographic Group 6. Given the fact that both Ramos and White-Paste Babícora Polychrome are identified by white-firing pastes, this is not particularly surprising. Basalts and other more mafic geologic units are defined by the presence of iron and other heavy elements, which inevitably oxidize during the firing process, turning the vessels' paste red.

The frequency of petrographic groups within Ramos and Babícora polychromes from Sayles' surface collections are represented in Figures 5.2 and 5.3. I did not create a corresponding pie chart for White-Paste Babícora Polychrome as the small sample size may prove to be misleading. However, importantly, despite the small number of White-Paste Babícora polychromes assignable to Petrographic Groups 1, 2, 3, and 4, which, again, are the dominant petrographic groups, across all formal types examined in this study.

Figure 5.2: Distribution of petrographic groups

within Ramos Polychrome (Sayles' collection).

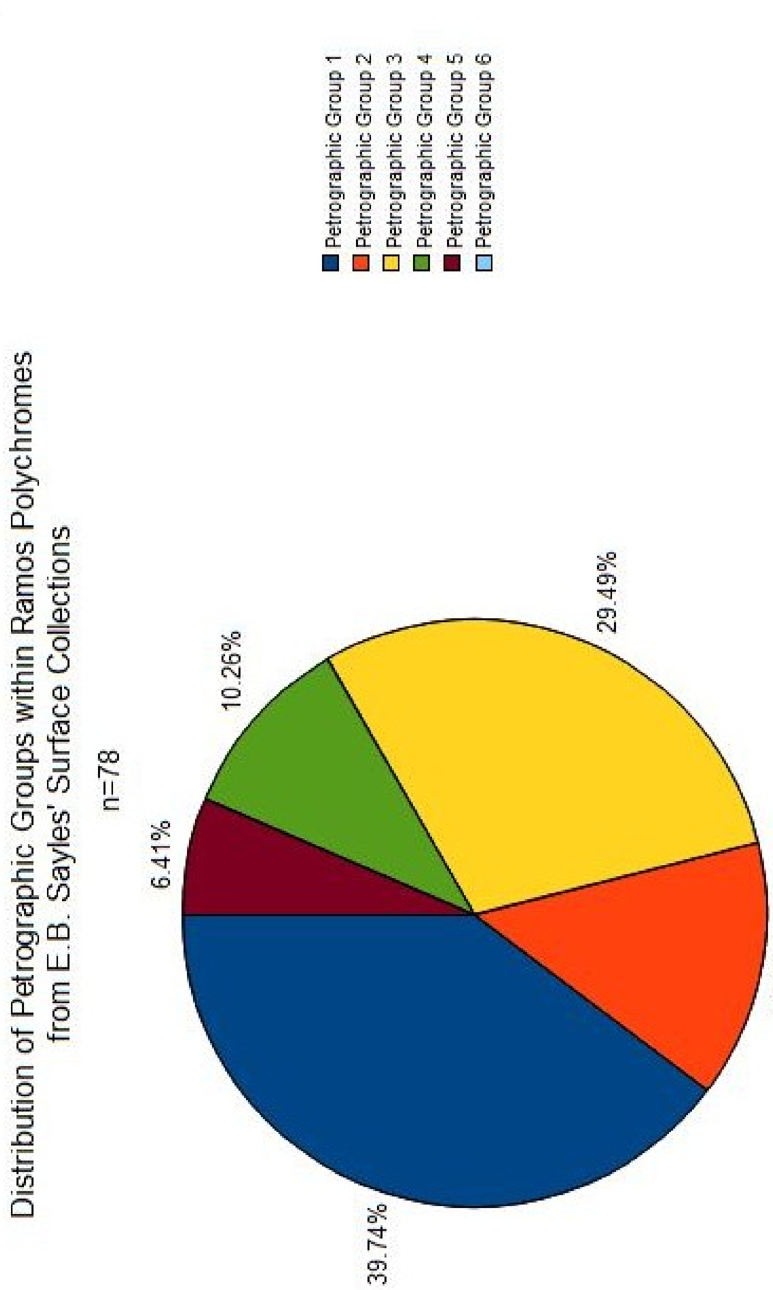
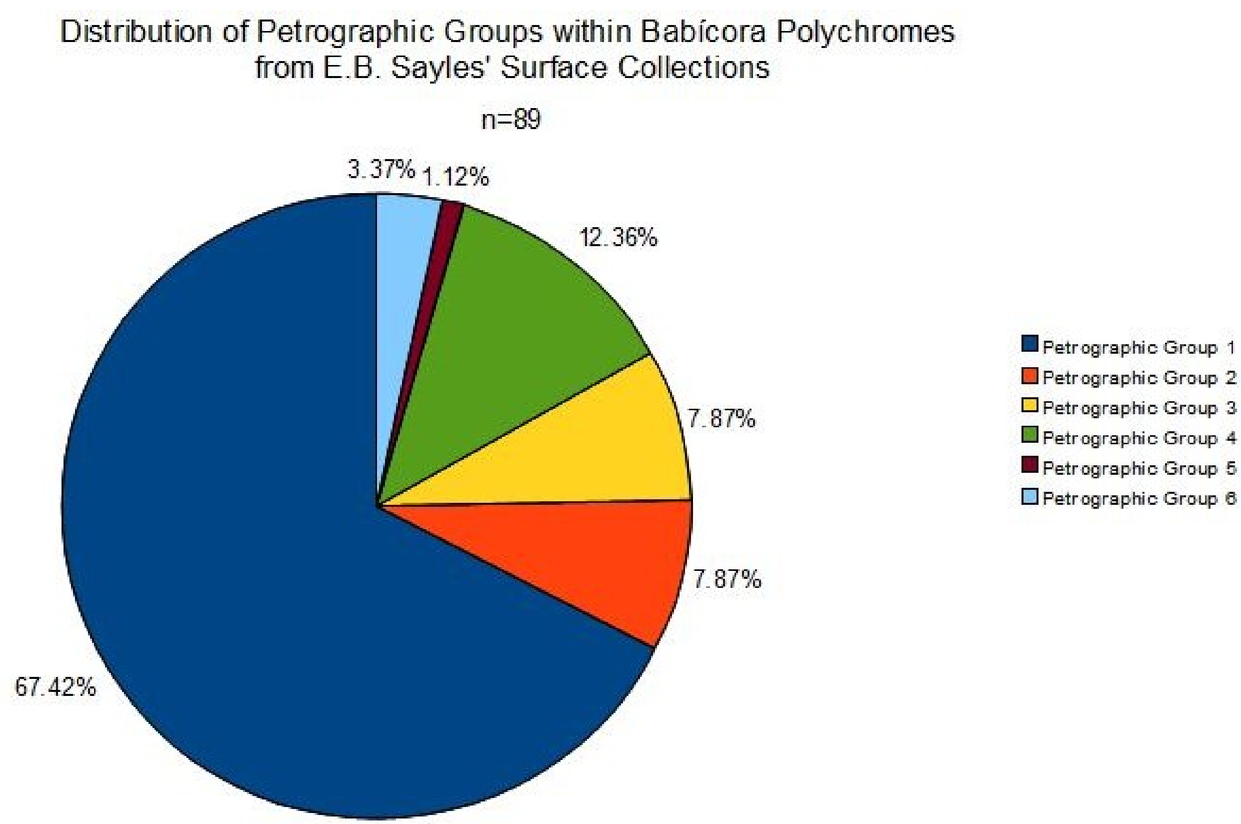

Distribution of Petrographic Groups within Ramos Polychromes
from E.B. Sayles' Surface Collections
n=78
39.74%
14.10%
29.49%
10.26%
6.41%
Petrographic Group 1
Petrographic Group 2
Petrographic Group 3
Petrographic Group 4
Petrographic Group 5
Petrographic Group 6

Figure 5.3: Distribution of petrographic groups

within Babícora Polychrome (Sayles' collection).


Distribution of Petrographic Groups within Babícora Polychromes
from E.B. Sayles' Surface Collections
n=89
3.37%
1.12%
12.36%
7.87%
7.87%
67.42%
Petrographic Group 1
Petrographic Group 2
Petrographic Group 3
Petrographic Group 4
Petrographic Group 5
Petrographic Group 6

Ramos polychromes exhibit a much more even distribution of frequencies of Petrographic Groups 1 through 3. In contrast, Babícora polychromes are predominantly represented by Petrographic Groups 1 and 2, with a much smaller number of sherds that are assignable to Petrographic Groups 3 and 4. What is more, Babícora Polychrome sherds assignable to Petrographic Groups 3 and 4 comprise just over 20% of the collection, whereas nearly 40% of Ramos polychromes are assignable to those same petrographic groups.

While both Ramos and Babícora polychromes share marked petrographic diversity, there are differences in the frequency of those petrographic groups. In regard to formal type, Ramos and Babícora polychromes both exhibit petrographic diversity, though there are differences in the frequency of those petrographic groups. Data related to these frequencies and statistical differences (chi-squared) are presented in Table 5.2. Sherd counts are represented by numbers in normal text, expected frequency in parentheses, and the component is in brackets. For the purposes of this regional analysis, I am disregarding White-Paste Babícora Polychrome given the small sample size. I am also disregarding Petrographic Groups 5 and 6 as only a small number of sherds are assignable to these groups.

Formal Type/ Petrographic Group	Petrographic Group 1	Petrographic Group 2	Petrographic Group 3	Petrographic Group 4	Total
Ramos Polychrome	31 (42.04) [2.90]	11 (8.32) [0.87]	23 (13.86) [6.03]	8 (8.78) [0.07]	73
Babícora Polychrome	60 (48.96) [2.49]	7 (9.68) [0.74]	7 (16.14) [5.18]	11 (10.22) [0.06]	85
Total	91	18	30	19	158

Table 5.2: Results of chi-squared.

In this sample, there is a significant difference in the frequencies of the four petrographic groups between Ramos and Babícora polychromes ($X^2 = 18.332$; df = 3; p = .0004). Both Ramos Polychrome (57.6%) and Babícora Polychrome (78.85%) are most commonly assignable to Petrographic Groups 1 and 2. Babícora Polychrome sherds assignable to Petrographic Groups 3 and 4 comprise just over 20% of the collection, while over 40% of Ramos polychromes, regionally, are assignable to those same petrographic groups. However, the number of Ramos polychromes assignable to

Petrographic Groups 1 and 2 are lower than what would be expected, while the number of sherds assignable to Petrographic Group 3 is much higher. In contrast, Babícora polychromes assignable to Petrographic Group 1 is much higher than should be expected, while those assignable to Petrographic Group 3 is somewhat lower than expected.

Overall, there are some broad generalizations that can be gathered from petrographic analysis of Ramos, Babícora, and White-Paste Babícora polychromes throughout the Casas Grandes world. First, Casas Grandes potters exhibit a strong preference for primary clays derived from distinctly felsic geologic units. Most pastes can be typified as (1) a relatively even distribution of phenocrysts and cryptocrystalline groundmass fragments or (2) pastes dominated by cryptocrystalline groundmass fragments accompanied by significantly fewer phenocrysts, which I associate with different types of geologic units: lava and pyroclastic flows, respectively. Given the wide geographic distribution of these paste types, with sherds being recovered from the boot heel of New Mexico all the way into the southern-most reaches of the Casas Grandes world in the Babícora Basin, it is difficult to argue, despite the mineralogical similarities between these individual thin sections, that these pots were produced by the same people in the same places.

The likelihood of the six previously defined petrographic groups represent similar but widely distributed raw material sources is supported by the number of sub-groups within each broad petrographic group. Texture, rather than mineralogy, ultimately served as a significant secondary aspect for determining petrographic group membership. I suggest that sherds assigned to any one sub-group are more suggestive of communities of potters using the same raw materials. If slides shared mineralogical *and* qualitative textural characteristics, I assigned these sherds to the same sub-group. Unlike the previously defined petrographic groups, these sub-groups are more qualitative in nature. Simply put, a sub-group comprises a series of sherds that are virtually identical to one another, especially in comparison to other sherds within the same petrographic group. However, what distinguishes one sub-group from another is a complex series of observations not easily quantified though they can be described. Sub-groups assignments can be found in Appendix D.

I identified twelve petrographic sub-groups, each comprised of two or more individual thin sections within Petrographic Group 1. However, whereas 71 samples can be assigned to one of these twelve sub-groups, 26 samples do not exhibit enough commonalities with one another to merit assignment to any sub-group. The remaining petrographic groups, with the exception of Petrographic Group 5, exhibit similar textural diversity.

This textural diversity across most petrographic groups supports the position that ceramics were manufactured throughout the Casas Grandes region using mineralogically similar, but distinct sources of raw material. However, it is also possible that some of these textural distinctions could represent internal variation within any single unconsolidated sediment source. Petrographic analysis without extensive field reconnaissance studies is unable to distinguish one possibility from the other. However, variations in geochemistry between otherwise mineralogically similar samples may provide more insight. To this end, I also included neutron activation analysis (NAA), alongside my petrography in an effort to better identify possible centers of production of Ramos, Babícora, and White-Paste Babícora polychromes.

The only significant study utilizing NAA, as a characterization technique, was executed in 1994 by Triadan and colleagues but has only been recently published (Triadan et al. 2017). They analyzed 655 polychromes from 31 of Sayles' sites. Two hundred and eighty-eight of these sherds were recovered from Paquimé. Ultimately, they identified three, prominent Core Groups to which all three formal types, Ramos, Babícora, and Villa Ahumada polychromes, can be assigned. However, while much of their study focused on these Core Groups, Triadan and colleagues identified a total of 13 compositional groups, many of which consisted of a relatively small number of samples, but were still distinct. Ultimately, they conclude that these various compositional groups likely indicate different sources and they find little evidence that any one formal type, including Ramos Polychrome, was made using any one specific raw material source (Triadan et al. 2017). Importantly, my dataset directly articulates with those data from Sayles' collection collected by Triadan and her colleagues. My samples are complementary, not redundant, to their project.

The raw NAA data for this component of my research were generated by the

University of Missouri Research Reactor (MURR), and was partially financially supported by a grant from the National Science Foundation to the MURR Archaeometry Laboratory (#BCS1621158, Jeffrey Ferguson, P.I.)(raw data can be found in Appendix F). Pottery specimens were prepared for NAA using procedures standard at the MURR. Fragments of about 1cm^2 were removed from each specimen and abraded using a silicon carbide burr in order to remove slip, paint, and adhering soil, thereby reducing the risk of contamination. The samples were washed in deionized water and allowed to dry in the laboratory. Once dry, the individual sherds were ground to powder in an agate mortar to homogenize the samples. Archival samples were retained from each sherd when possible for future research. Two analytical samples were prepared from each sherd specimen. Portions of approximately 50 mg of powder were weighed into clean high-density polyethylene vials used for short irradiations at MURR. At the same time, 200 mg samples were weighed into clean high-purity quartz vials used for long irradiations. Individual sample weights were recorded to the nearest 0.01 mg using an analytical balance. Both vials were sealed prior to irradiation. Standards made from National Institute of Standards and Technology (NIST) certified standard reference materials of SRM-1633a (coal fly ash) and SRM-688 (basalt rock) were similarly prepared, as were quality control samples (e.g., standards treated as unknowns) of SRM-278 (obsidian rock) and Ohio Red Clay (a standard developed for in-house applications).

Analysis of these specimens at the MURR, which consists of two irradiations and a total of three gamma counts, and is in accord with the procedures used at most other NAA laboratories (Glascock 1992; Neff 1992, 2000). As discussed in detail by Glascock (1992), a short irradiation is carried out through the pneumatic tube irradiation system. Samples in the polyethylene vials are sequentially irradiated two at a time for five seconds by a neutron flux of 8 x 10^{13} n cm^{-2} s^{-1}. The 720-second count yields gamma spectra containing peaks for nine short-lived elements aluminum (Al), barium (Ba), calcium (Ca), dysprosium (Dy), potassium (K), manganese (Mn), sodium (Na), titanium (Ti), and vanadium (V). The samples are encapsulated in quartz vials and are subjected to a 24–hour irradiation at a neutron flux of 5 x 10^{13} n cm^{-2} s^{-1}. This long irradiation is analogous to the single irradiation utilized at most other laboratories. After the long irradiation, samples decay for seven days, and then are counted for 1,800 seconds (the "middle count") on a high-resolution germanium detector coupled to an automatic sample changer. The middle count yields determinations of seven medium half-life elements, namely arsenic (As), lanthanum (La), lutetium (Lu), neodymium (Nd), samarium (Sm), uranium (U), and ytterbium (Yb). After an additional three- or four-week decay, a final count of 8,500 seconds is carried out on each sample. The latter measurements provide data on 17 long half-life elements: cerium (Ce), cobalt (Co), chromium (Cr), cesium (Cs), europium (Eu), iron (Fe), hafnium (Hf), nickel (Ni), rubidium (Rb), antimony (Sb), scandium (Sc), strontium (Sr), tantalum (Ta), terbium (Tb), thorium (Th), zinc (Zn), and zirconium (Zr). The element concentration data from the three measurements are tabulated in parts per million.

Further statistical analyses of these data were provided by Dr. Hector Neff from California State University, Long Beach. Dr. Neff's full report is provided in Appendix G. Over the course of his analyses, Dr. Neff identified eight chemical groups defined, below.

Chemical Group Definitions:

- Group 1: Typified by low tantalum and thorium relative to all other samples
- Group 2: Typified by low rare-earth element (REE) concentrations, especially lanthanum, lutetium, and terbium
- Group 3a: This group exhibits high concentrations of both rare-earth elements and transition metals. This is especially true for the REEs europium and lanthanum, and the transition metals iron, scandium, and titanium
- Group 3b: Typified by high cesium and high antimony in most
- Group 3c: Typified by low europium, cerium, chromium, iron, and aluminum
- Group 3c1: This chemical group is similar to Group 3c, but exhibits higher concentrations of rare earth element concentrations, especially europium

- Group 3d: This group exhibits high chromium concentrations relative to Group 3c (like Group 3a) but lower light REEs, especially lanthanum and neodymium, in comparison with Group 3a
- Group 3e: Similar to Group 3d, but with higher REEs, especially europium; Group 3e is intermediate in REEs between Group 3a and Group 3d.

NAA is a difficult technique with a dataset such as the Sayles' surface collections. Whereas the data set is robust for a largely qualitative petrographic study, NAA works best when there are relatively large samples that are representative across the entire range of diversity in the sample. However, regardless of the issue of sample size, the distribution of chemical groups across formal types is represented in Table 5.3.

Formal Type/ Chemical Group	Chemical Group 1	Chemical Group 2	Chemical Group 3a	Chemical Group 3b	Chemical Group 3c	Chemical Group 3c1	Chemical Group 3d	Chemical Group 3e	Total
Ramos Polychrome	2	5	2	4	9	7	28	13	70
Babícora Polychrome	19	10	19	2	1	2	6	21	80
White-Paste Babícora Polychrome	0	0	0	3	2	1	5	5	16
Total	21	15	21	9	12	10	39	39	166

Table 5.3: Distribution of chemical groups across formal types (Sayles' collection). Nineteen individual samples were excluded from this table as Dr. Neff was unable to statistically assign these sherds, with any degree of confidence, to a chemical group.

Predictably, given the fact that petrographic groups cross-cut formal types, chemical groups do the same. This further supports the fact that the production of Ramos, Babícora, and White-Paste Babícora polychromes was widespread throughout the Casas Grandes region by multiple groups of local potters, each manufacturing multiple formal types. As with petrographic groups, however, some chemical groups are more common than others, which suggests that raw material sources are shared by individual potters.

When chemical and petrographic groups are compared, see Table 5.4, we get a better understanding of whether or not the sub-groups I identified within each of the broad petrographic groups are indications of natural variation within an otherwise chemically indistinguishable source, or a result of potters utilizing many different sources.

Petrographic Group/ Chemical Group	Chemical Group 1	Chemical Group 2	Chemical Group 3a	Chemical Group 3b	Chemical Group 3c	Chemical Group 3c1	Chemical Group 3d	Chemical Group 3e	Total
Petrographic Group 1	17	11	11	0	2	4	14	27	86
Petrographic Group 2	2	3	2	1	0	0	2	5	15
Petrographic Group 3	0	1	0	6	6	6	17	1	37
Petrographic Group 4	2	0	8	2	4	0	1	3	20
Petrographic Group 5	0	0	0	0	0	0	5	1	6
Petrographic Group 6	0	0	0	0	0	0	0	2	2
Total	21	15	21	9	12	10	39	39	166

Table 5.4: Distribution of chemical groups across petrographic groups (Sayles' collection). Note that nineteen individual samples continue to be excluded from this table as Dr. Neff was unable to statistically assign these sherds to a chemical group.

The fact that samples from the most common petrographic groups, Petrographic Groups 1 through 4, are also assignable to six or seven geochemical groups validates the position that my broad petrographic system of organization is better indicative of multiple raw materials that share mineralogical commonalities rather than a single raw material source. Were petrographic groups indicative of single raw material sources, I would expect to exhibit fewer distinct chemical signatures. More generally, my chemical groups somewhat complicate my suspicion that Petrographic Groups 3 and 4, those I think may be associated with pyroclastic flows, represent a limited number of raw sources and could be tied to any one particular region within the Casas Grandes world.

Polychromes that exhibit glassier pastes are most commonly assigned to Chemical Groups 3a, 3b, 3c, 3c1, and 3d. Such sherds are also assigned to Chemical Groups 1, 2, and 3e, but I suggest that these sherds were inappropriately statistically assigned to these chemical groups as they are otherwise dominated by sherds that exhibit pastes more commonly assigned to Petrographic Groups 1 and 2. Clear relationships between many petrographic sub-groups and chemical group designation suggest that chemical diversity is not a misleading statistical artifact. For example, Petrographic Sub-Group 3a is comprised of eleven sherds typed as Ramos and White-Paste Babícora polychromes. All but two are also identified as pertaining to Chemical Group 3d. Similarly, Petrographic Sub-Group 4A is comprised of eleven sherds, primarily Babícora Polychrome, although one is identified as Ramos Polychrome. All but three also belong to Chemical Group 3a. Discrepancies between chemical and mineralogical data are to be expected, given the distinctly different sets of foundational principles underlying either characterization technique. However, the overlapping nature of petrographic sub-groups and chemical groups demonstrates that petrographic sub-groups may prove useful in further refining statistically-driven geochemical groups in future studies. And, more significantly, that both mineralogical and chemical variation supports my position that each broad petrographic group is indicative of many distinct, albeit mineralogically similar, sources being utilized throughout the Casas Grandes region, rather than internal variation within a more limited range of raw materials.

Summary of Results and Future Directions:

Multi-method studies combining petrography and NAA have been successfully applied to many archaeological contexts (see Day et al. 1999; Stoltman and Mainfort 2002; Heidke and Miksa 2000, among many others). However, currently supportable interpretations, given my own study, are somewhat more limited. What I can say is that potters used the same classes of raw materials to manufacture all three formal types. Samples in this study share strong mineralogical relationships with one another which I associate with either lava or pyroclastic flows. These overt preferences for one of two raw material types is indicative of a regionally cohesive behavior pattern. However, given the degree of textural and chemical diversity within broad petrographic groups, I suggest that while communities of potters closely ascribed to either raw materials derived from lava or pyroclastic flows, they accessed different sources throughout the Casas Grandes world. Potters are tracking classes of raw materials, but using what is locally available. The fact that Ramos, Babícora and White-Paste Babícora polychromes clearly share mineralogical relationships is not indicative of specialized production. Rather, the production of

Ramos Polychrome, the formal type at the center of discussions of specialized production, involved many people utilizing many raw clay sources, rather than production by a limited set of potters from a small number of sites within the Casas Grandes world.

My analyses also support the likelihood that potters throughout the area deliberately sought out distinct sets of primary clays, of igneous, felsic parentage. While such geologic deposits are ubiquitous throughout the Sierra Madre Occidental, basalt plugs and other sedimentary units do punctuate the landscape. Many secondary clay deposits would reflect this human-scale geologic diversity. However, the adherence to such a narrow range of types of materials indicates that potters participated in a cohesive knowledge network that required a relatively narrow range of raw materials, of which Ramos, Babícora, and White-Paste Babícora polychromes were to be manufactured. What is more, given the fact that Babícora Polychrome has been consistently identified as the likely oldest polychrome type (see Sayles 1936a; Whalen 2012), this overt pattern of behavior may be persistent over time. Significantly, this regional behavior likely precedes the florescence of Paquimé.

Whereas this widespread regional sample provides some critical insights into how Ramos, Babícora, and White-Paste Babícora polychromes were manufactured, it hardly represents a complete understanding of pottery production and consumption within the Casas Grandes world. Future Casas Grandes research focusing on the production and distribution of polychromes, would greatly benefit from geoarchaeological methods development. Petrography and NAA are designed to recognize mineralogical and chemical differences between samples. However, what I have demonstrated is that whereas differences between ceramics exist, they are subtle. The fact that Casas Grandes potters rejected other more heterogeneous clays in favor of a narrow set of classes raw materials, in conjunction with the natural availability of such deposits within the Sierra Madre Occidental, creates a situation wherein characterizing the nature of locally manufactured ceramics is distinctly cryptic. I posit that more effective geoarchaeological characterization techniques should capitalize on possible differences not directly tied to mineralogy or geochemistry, as these clearly have been only useful to the point of broad-brush patterns of behavior, rather than decisively characterizing sites of production. Significantly, such methods development would have impacts beyond the Casas Grandes region. The Sierra Madre Occidental is not confined to this one, single culture area, but rather extends south and through much of western Mexico.

Given the difficult of distinguishing such closely related pastes from one another, I conducted a pilot study of 18 Ramos Polychrome sherds utilizing a relatively new characterization technique based on the age frequency distributions of zircon crystals. This technique characterizes sherds using zircon crystals. The age of zircon crystals within a geologic deposit is established at the point of rock formation and is not influenced by either its parent magma or erosional processes once the rock is exposed to surface conditions. Researchers from the Earth Sciences Department at the University of Arizona adapted a method widely used in sedimentary petrology for inferring the source rocks from which sandstones formed (Gehrels 2014). This technique is originally designed for pottery tempered with detrital quartz sand which is not reliably attributable to particular sources by optical petrography. It operates by matching zircon age distributions of zircon crystals recovered from a pulverized pottery sherd to those from potential source sands by visual comparison of plots and by statistical methods.

I selected six sherds were from sites north of Paquimé, seven central to Paquimé, and five south of Paquimé. The results of this pilot study can be found in Appendix H. In short, the majority of the sherds did not produce enough zircon crystals for analysis and those few that did were unable to support a cohesive discussion, due to their small number. Whereas this pilot study was a worthwhile endeavor, ultimately I doubt this technique will be specifically useful in characterizing Casas Grandes ceramics given the pilot study's lack of success. The method necessitates the destruction of large sherds in order to recover enough zircon crystals in order to achieve statistical significance and unfortunately, a large number of my samples did not produce a sufficient number of crystals. This, coupled with the high cost of the analysis, precludes what I consider to be any fruitful future studies in the Casas Grandes region.

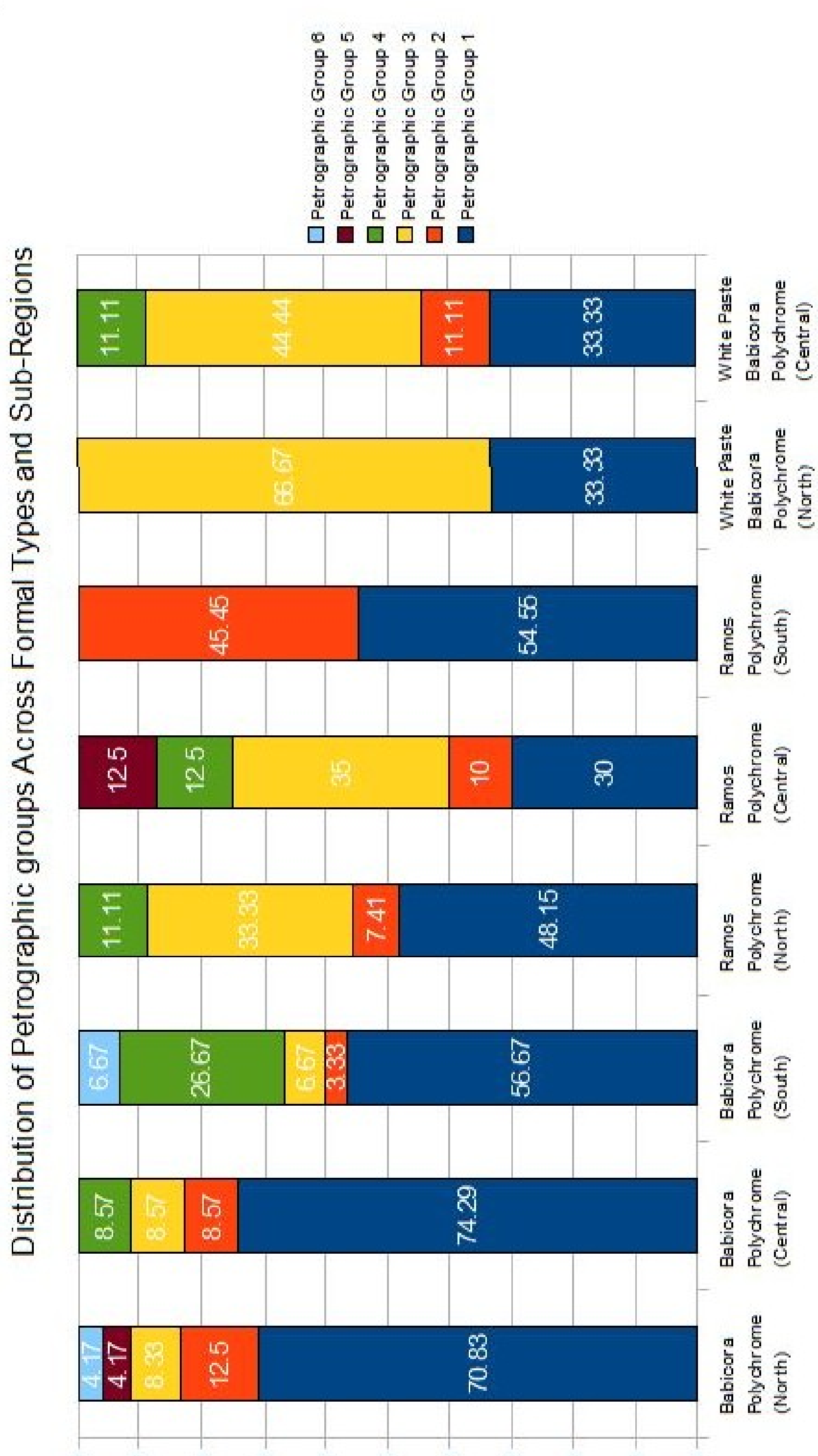
I am convinced that productive future studies of the production and consumption of Ramos, Babícora, White-Paste Babícora, and other polychromes, in the Casas Grandes world alone, necessitates geoarchaeological innovation. I hold that our standard techniques are insufficient, although my current multi-method study does offer some more practical insights for guiding future field programs.

Polychrome Diversity and Geographic Trends:

Specifically, data I collected from Sayles' collection is useful for guiding research agendas situated in distinct areas within the Casas Grandes world. I used Sayles' arbitrary grid system to code sites and their corresponding sherds, assigning them to arbitrary, geographic sub-divisions. Grids A, B, and C are coded as north of Paquimé, Grids D, E, and F are sites central to Paquimé, while Grids H and I are considered sites south of Paquimé. I want to emphasize that these divisions are entirely arbitrary. The distribution of petrographic groups across formal types and sub-region is presented in Figure 5.4.

Figure 5.4: Petrographic groups

across formal types and sub-regions.



Distribution of Petrographic groups Across Formal Types and Sub-Regions
Petrographic Group 6
Petrographic Group 5
Petrographic Group 4
Petrographic Group 3
Petrographic Group 2
Petrographic Group 1
Babicora Polychrome (North)
Babicora Polychrome (Central)
Babicora Polychrome (South)
Ramos Polychrome (North)
Ramos Polychrome (Central)
Ramos Polychrome (South)
White Paste Babicora Polychrome (North)
White Paste Babicora Polychrome (Central)
70.83
12.5
8.33
4.17
4.17
74.29
8.57
8.57
8.57
56.67
3.33
6.67
26.67
6.67
48.15
7.41
33.33
11.11
30
10
35
12.5
12.5
54.55
45.45
33.33
66.67
33.33
11.11
44.44
11.11
0
10
20
30
40
50
60
70
80
90
100

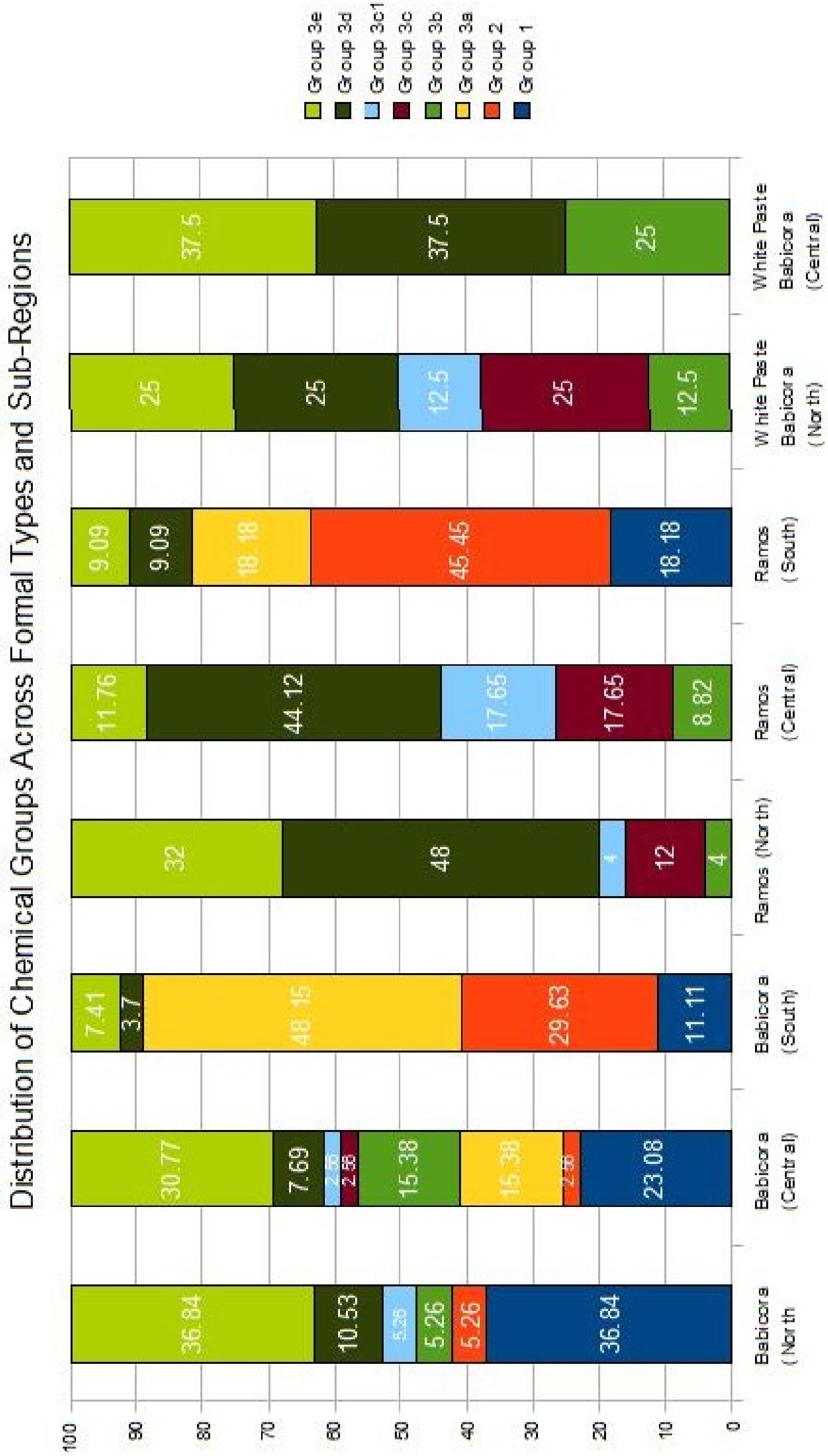
Petrographic Groups 1 and 2 are strikingly prevalent across many formal types and sub-regions. However, in comparison to Babícora Polychrome, Ramos and White-Paste Babícora polychromes recovered from sites central to and north of Paquimé are less likely to be assigned to these petrographic groups. This is in striking contrast to southern sites where Ramos polychrome sherds are only assigned to Petrographic Groups 1 and 2. Babícora polychromes from the same area are assigned to these petrographic groups at a lower frequency (60%). This suggests that procurement patterns for potters living south of Paquimé are distinct from their northern neighbors.

Sherds assigned to Petrographic Groups 3 and 4 are more commonly associated with sites pertaining to sub-regions central to and north of Paquimé. Ramos and White-Paste Babícora polychromes, specifically, recovered from sites north of and central to Paquimé are much more likely to be assigned to Petrographic Groups 3 and 4 than their Babícora counterparts. Nearly 44% of Ramos Polychromes in the north and 47% of those central to Paquimé are assigned to Petrographic Groups 3 and 4. Approximately 67% of White-Paste Babícora polychromes in the north and 55% central to Paquimé are assigned to Petrographic Groups 3 and 4. However, only 8% and 17% of Babícora polychromes from areas north of or central to Paquimé are assigned to Petrographic Groups 3 and 4, respectively. As with Petrographic Groups 1 and 2, though, this overall trend in areas north of and central to Paquimé manifests differently at sites in the south. The percentage of Babícora polychromes in the south assignable to Petrographic Groups 3 and 4 jump to about 33%. In contrast, no Ramos polychromes are assignable to these petrographic groups.

Similar to my petrographic analyses, chemical groups exhibit markedly different frequencies across sub-regions within the Casas Grandes world, see Figure 5.5.

Figure 5.5: Chemical groups

across formal types and sub-regions.


Distribution of Chemical Groups Across Fomal Types and Sub-Regions
Group 3e
Group 3d
Group 3c1
Group 3c
Group 3b
Group 3a
Group 2
Group 1
0
10
20
30
40
50
60
70
80
90
100
Babicora (North
Babicora (Central)
Babicora (South)
Ramos (North)
Ramos (Central)
Ramos (South)
White Paste Babicora (North)
White Paste Babicora (Central)
36.84
10.53
5.26
5.26
5.26
36.84
30.77
7.69
15.38
15.38
23.08
7.41
3.7
48.15
29.63
11.11
32
48
4
12
4
11.76
44.12
17.65
17.65
8.82
9.09
9.09
18.18
45.45
18.18
25
25
12.5
25
12.5
37.5
37.5
25

Chemical groups exhibit a relatively wide geographic distribution that generally agrees with conclusions drawn from my petrographic analyses. For example, Chemical Group 2 is more clearly associated with southern sites than those north of or central to Paquimé. Thirteen of the fifteen sherds assigned to Chemical Group 2 were recovered at southern sites. Group 3a appears to be absent at northern sites and is unevenly split between the central (n=5) and southern sub-regions (n=16). Chemical Group 3b and 3c is best associated with sites north of and central to Paquimé. Chemical Group 3c is primarily composed of Ramos and White-Paste Babícora polychrome sherds (9 and 2, respectively), with one Babícora polychrome outlier. Similarly, Chemical Group 3c1 is comprised of primarily Ramos and White-Paste Babícora Polychrome sherds (n=8) recovered from sites north of and central to Paquimé. Two Babícora Polychrome sherds, one from Site A:16:2 and one from Site E:14:5, were also assigned to Chemical Group 3c1.

Chemical Groups 3d and 3e are the most prominent groups, in regard to number of sherds assignable to each, and they are the most geographically widespread of this analysis. However, two sherds from Chemical Group 3d were recovered in the south, and I suggest that these sherds may be erroneously assigned to this group. Similarly, three southern sherds are assigned to Chemical Group 3e and, again, I suggest that these sherds might actually be from another chemical group. I justify these removals based on additional data and petrographic scrutiny of the samples. By removing these five sherds, chemical groups become associated with sherds recovered, respectively, only at sites north of Paquimé and central to it. However, even if these five sherds are ultimately validated as pertaining to their currently respective chemical groups, Chemical Groups 3d and 3e would remain much less prevalent at southern sites.

These chemical and petrographic data support the position that polychrome production and exchange patterns at sites south of Paquimé differ from those of their northern counterparts. In contrast, sherds sharing petrographic sub-group and chemical group assignments, but recovered at different sites, supports the likelihood of polychrome exchange between sites central to and north of Paquimé. This indicates that the directionality of inter-community relationships has a much stronger focus towards northern sites, perhaps in ways and to a degree that have not been clearly evident in previous studies. This north-facing focus of exchange is unsurprising given the fact that ceramic exchange of non-Chihuahuan ceramics, such as Salado polychromes and Chupadero Black-on-White, inevitably have northern origins (Di Peso 1974; Douglas 1992).

These observations present the possibility that neither the northern-most nor the southern-most sites are passive peripheries of the Casas Grandes world. However, distinctions between the production and exchange of finished polychrome vessels recovered from southern sites in comparison to their northern neighbors may ultimately support the interpretation that southern sites were not as tightly integrated into the rest of what we think of as the Casas Grandes world. The fact that Casas

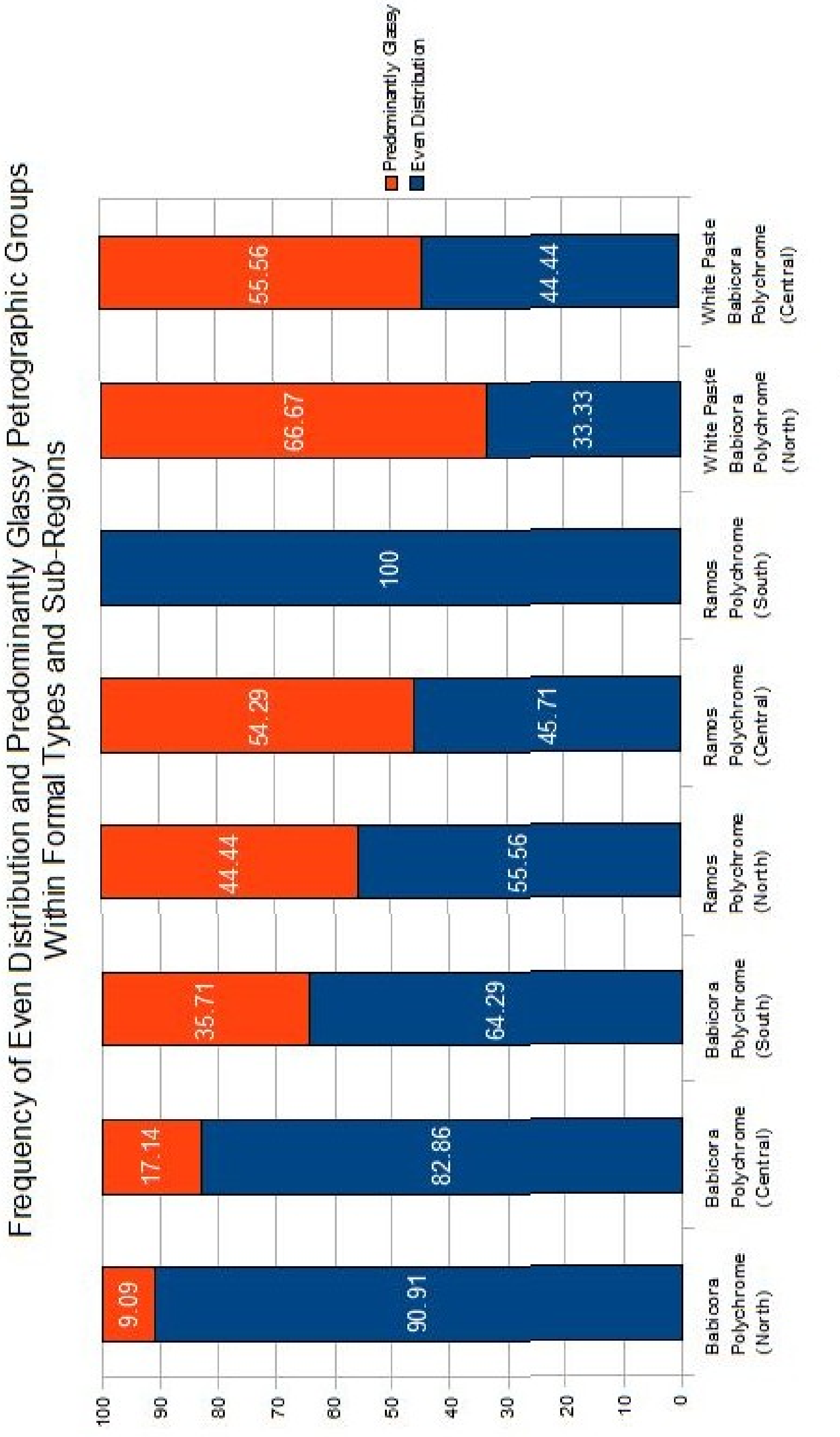
Grandes potters produce stylistically similar vessels using materials similar to those found throughout the Casas Grandes region may support an interpretation wherein southern sites are less involved with the rest of the system and engaging in their own interaction networks. In contrast, sherds assigned to mineralogical and chemical groups occur more evenly at sites north of and central to Paquimé which suggests stronger social relationships between these sites. Northern sites thus appear as active and critical participants in how the Casas Grandes world developed, rather than passive recipients.

I can make further generalized observations by focusing on formal type and a reorganization of mineralogical groups. In contrast to my previous regional subdivisions, my reorganization of mineralogical group assignments is less arbitrary. I reorganized my petrographic groups so that they best-reflected their major defining features: an even distribution of phenocrysts and glassy groundmass ("Even Distribution") or a predominantly glassy groundmass with a relatively minor number of phenocrysts ("Predominantly Glassy"). Given my assumption that Petrographic Groups 1 and 2 and 3 and 4 likely represent primary clays derived from distinct geologic units (lava or pyroclastic flows), this reorganization of data could indicate a combination of regional availability of such materials and potters who have been taught to seek out and utilize these clays.

For this section, I ignored Petrographic Groups 5 and 6, entirely, as the way in which they are defined is not well-suited to this method of reorganization. Sub-regions remained defined as they have been, previously. The distribution of sherds that exhibit an Even Distribution and Predominantly Glassy pastes is presented in Figure 5.6.

Figure 5.6: Raw material classes

across formal types and sub-regions.


Frequency of Even Distribution and Predominantly Glassy Petrographic Groups
Within Formal Types and Sub-Regions
Predominantly Glassy
Even Distribution
100
90
80
70
60
50
40
30
20
10
0
9.09
90.91
17.14
82.86
35.71
64.29
44.44
55.56
54.29
45.71
100
66.67
33.33
55.56
44.44
Babicora Polychrome (North)
Babicora Polychrome (Central)
Babicora Polychrome (South)
Ramos Polychrome (North)
Ramos Polychrome (Central)
Ramos Polychrome (South)
White Paste Babicora Polychrome (North)
White Paste Babicora Polychrome (Central)

By shifting this mineralogically-driven data set and how it is portrayed, the prevalence of Predominantly Glassy pastes associated with Ramos and White-Paste Babícora Polychrome, in comparison to Babícora Polychrome, is clear. However, notably, Ramos polychromes recovered south of Paquimé do not exhibit Predominantly Glassy pastes, at all. In contrast, just over 35% of Babícora polychromes in regions south of Paquimé exhibit such Predominantly Glassy pastes whereas their Ramos Polychrome counterparts do not. This situation further supports the interpretation that sites in regions south of Paquimé may have had manufacture and distribution networks entirely independent of those sites more central to and north of Paquimé. Also, given the fact that Ramos Polychrome is one of few polychrome types that exhibits any sort of temporal sensitivity, this distinction in how stylistically identifiable pottery is manufactured may imply a moment in time at which southern sites' independence is either maintained or exerted. Alternatively, these sites could be marginal and more simply removed from those sites more heavily involved with one another in areas central to and north of Paquimé.

However, this regional representation of different paste types problematizes my position that Ramos Polychrome is unlikely to be a product of specialized production from any one specific place within the Casas Grandes world. By far and away, Babícora polychromes recovered from sites north of and central to Paquimé exhibit pastes with a more even distribution of glassy groundmass fragments and phenocrysts (90.91% and 82.86%, respectively). In contrast, Ramos polychromes from these same sub-regions exhibit a marked difference in frequency. In the north, 44.44% of Ramos polychromes exhibit Predominantly Glassy pastes, whereas 55.56% exhibit an even distribution. Ramos polychromes recovered at sites central to Paquimé exhibit 54.29% Predominantly Glassy pastes whereas 45.71% exhibit an even distribution of phenocrysts and groundmass fragments. While potters who accessed primary clays derived from pyroclastic flows did not exclusively manufacture Ramos Polychrome, this prevalence of Predominantly Glassy pastes does appear to be more closely tied to the formal types' manufacture.

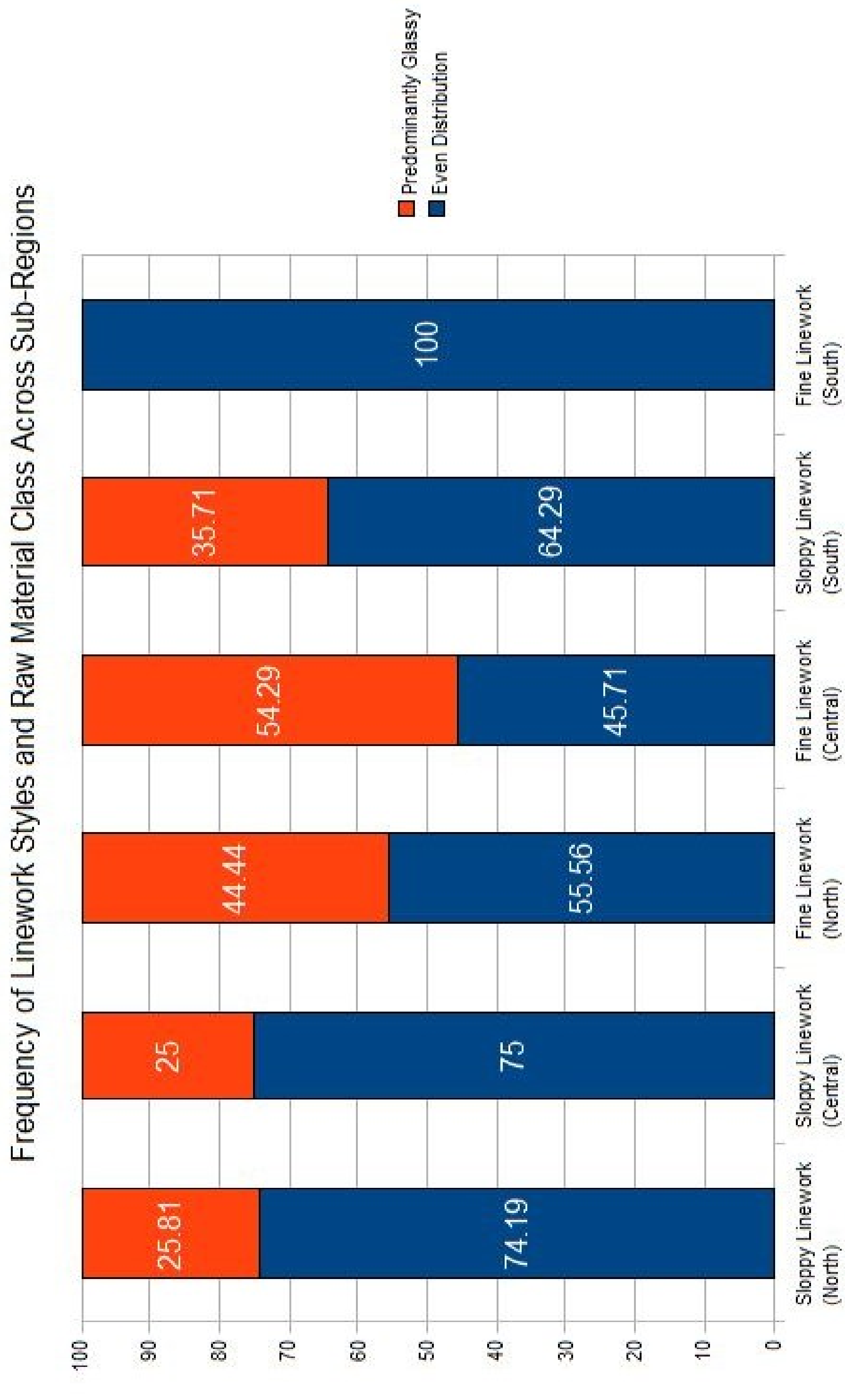
These observations reinvigorate the possibility that Ramos Polychrome production is limited to a distinct set of potters who access a limited number of raw materials located near a limited number of production sites. Following this logic, finished Ramos Polychrome vessels then enjoy a wide distribution throughout sites central to and north of that production center (perhaps Paquimé).

This interpretation, however, neglects those sherds that exhibit sloppy-lined Babícora-style painting and the diagnostically white pastes of Ramos polychromes: White-Paste Babícora Polychrome. The majority of White-Paste Babícora sherds at sites north of and central to Paquimé exhibit Predominantly Glassy pastes, 66.67% and 55.56%, respectively. Whereas the sample size of White-Paste Babícora polychromes is smaller than either Ramos or Babícora polychrome sherds, these do present the possibility of a second scenario. Also, some standard Babícora polychromes in this sample may have been misidentified due to the absence of a light-firing paste. This diagnostic feature is easily obscured during initial typing due to mis-firing during the manufacturing process, burning either during the vessel's use-life or post-deposition, and/or natural diagenesis.

This possibility of improper identification invokes the issue of formal types being modern constructs. Distinctions made between these three styles are entirely our own, not necessarily distinctions of any great importance to Casas Grandes potters themselves. With this in mind, I combined the two sloppy-line formal types (White-Paste Babícora and standard Babícora Polychrome). Ramos Polychrome is defined as exhibiting fine linework. I re-present these data in Figure 5.7.

Figure 5.7: Linework style and

raw material classes and sub-regions.



Frequency of Linework Styles and Raw Material Class Across Sub-Regions
100
90
80
70
60
50
40
30
20
10
0
25.81
74.19
25
75
44.44
55.56
54.29
45.71
35.71
64.29
100
Sloppy Linework (North)
Sloppy Linework (Central)
Fine Linework (North)
Fine Linework (Central)
Sloppy Linework (South)
Fine Linework (South)
Predominantly Glassy
Even Distribution

With the two sloppy-lined variants combined, the southern-most sites remain distinct from their northern neighbors. Babícora-style vessels, as defined by sloppy linework, recovered from sites north of and central to Paquimé remain dominated by pastes that exhibit an even distribution of glassy groundmass fragments and phenocrysts. Nearly 25%, however, exhibit Predominantly Glassy pastes. In contrast, Ramos Polychrome, and its diagnostically fine linework is split between pastes defined as Even Distribution or Predominantly Glassy.

The frequency of these paste types ascribed to sherds recovered at sites north of and central to Paquimé are fairly uniform, which suggests these paste differences are not simply attributable to environmental availability. If this were true, I would expect greater differences in frequencies between sub-regions. Whereas it is possible that primary clays derived from pyroclastic flows are just as available around sites central to Paquimé as they are north of Paquimé, I suggest another likely scenario. I suggest that there are two sets of potters throughout Casas Grandes communities: one set utilize raw clays that are derived from lava flows whereas a second deliberately seek clays with pyroclastic flow parentage. This indicates two distinct learning networks with which competent potters at Casas Grandes communities can be assigned. Significantly, people involved in these learning networks do not, ultimately, produce mutually exclusive styles of polychrome, whether we assign these styles formal type names or identify them by type of linework. However, potters who are dedicated to Predominantly Glassy clay sources do preferentially produce pottery identifiable as Ramos Polychrome rather than sloppy-lined Babícora-style vessels.

Problems with Regional Data Sets and Site Level Analysis:

Whereas these general observations are compelling and provide trajectories for future productive research programs, there are some distinct concerns regarding my analysis. Most specifically, my data are representative of a wide-ranging, regional survey comprised of surface collections, rather than site-focused, stratigraphic excavations. Any temporal trends, for example, are entirely obscured and/or conflated over the course of my analyses. Sites with recognizable Ramos polychromes undoubtedly have Late Medio components. But as there are no clear and indisputable indicators for Early Medio components, sites can only be identified as having Late Medio components, with no ability to ascertain whether or not a site's construction was only Late Medio or exhibits indications of both Early and Late Medio construction. What is more, sites where Ramos polychromes are absent may simply be a product of incomplete sampling. These concerns make it nearly impossible to ascribe any sort of meaningful chronological information to Sayles' regional site survey.

The preceding analyses are based on substantive datasets, but simply do not carry the same significance enjoyed by site-level projects. In response to this concern, I petrographically examined 107 thin sections manufactured from Ramos, Babícora, and White-Paste Babícora sherds recovered from middens at Site 204. During my analysis of these polychromes, I found that the same petrographic group definitions I developed for the samples from Sayles' surface collections were applicable to those from Site 204. The only deviation from my original organization scheme is that the basalt-like fragments that make Petrographic Group 6 distinct from the others appear to be entirely incidental and do not comprise a significant percentage of the inclusions I identified. There are no sherds sampled from Site 204 that are dominated by basalt-like fragments. Individual data on each sherd from Site 204 can be found in Appendix C. The distribution of petrographic groups across formal types is represented in Table 5.5.

Formal Type/ Petrographic Group	Petrographic Group 1	Petrographic Group 2	Petrographic Group 3	Petrographic Group 4	Petrographic Group 5	Petrographic Group 6	Total
Ramos Polychrome	16	1	4	5	1	1	28
Babícora Polychrome	28	4	8	1	0	2	43
White-Paste Babícora Polychrome	26	1	7	0	1	1	36
Total	70	6	19	6	2	4	107

Table 5.5: Distribution of petrographic groups across formal type (Site 204).

As with data collected from Sayles' ceramic collections, the petrographic group assignments cross-cut formal types. At Site 204, no single style of pottery is exclusively associated with any one petrographic group. Similar to my regional analysis, Petrographic Groups 5 and 6 are uncommon across all formal types included in this study. As with the analysis of Sayles' regional surface collections, 95% of the sherds recovered from Site 204 are represented by Petrographic Groups 1 through 4. What is more, similar to the petrographic analysis of Sayles' materials, 71% of the sherds recovered from Site 204 are assignable to Petrographic Groups 1 and 2, whereas only 23% are this sample set are assignable to Petrographic Groups 3 and 4. This sharp difference in frequency between the Petrographic Groups 1 and 2 and Petrographic Groups 3 and 4 supports the suggestion that clay deposits that mineralogically correspond to these groups may have different geographic distributions and/or that there are two sets of potters deliberate accessing distinct clay sources at different frequencies.

Petrographic distinctions within Sayles' regional materials are supported by additional site-level analyses of Ramos and Babícora polychromes at Site 204, see Figures 5.8 and 5.9.

Figure 5.8: Distribution of petrographic groups

across Ramos Polychrome (Site 204).

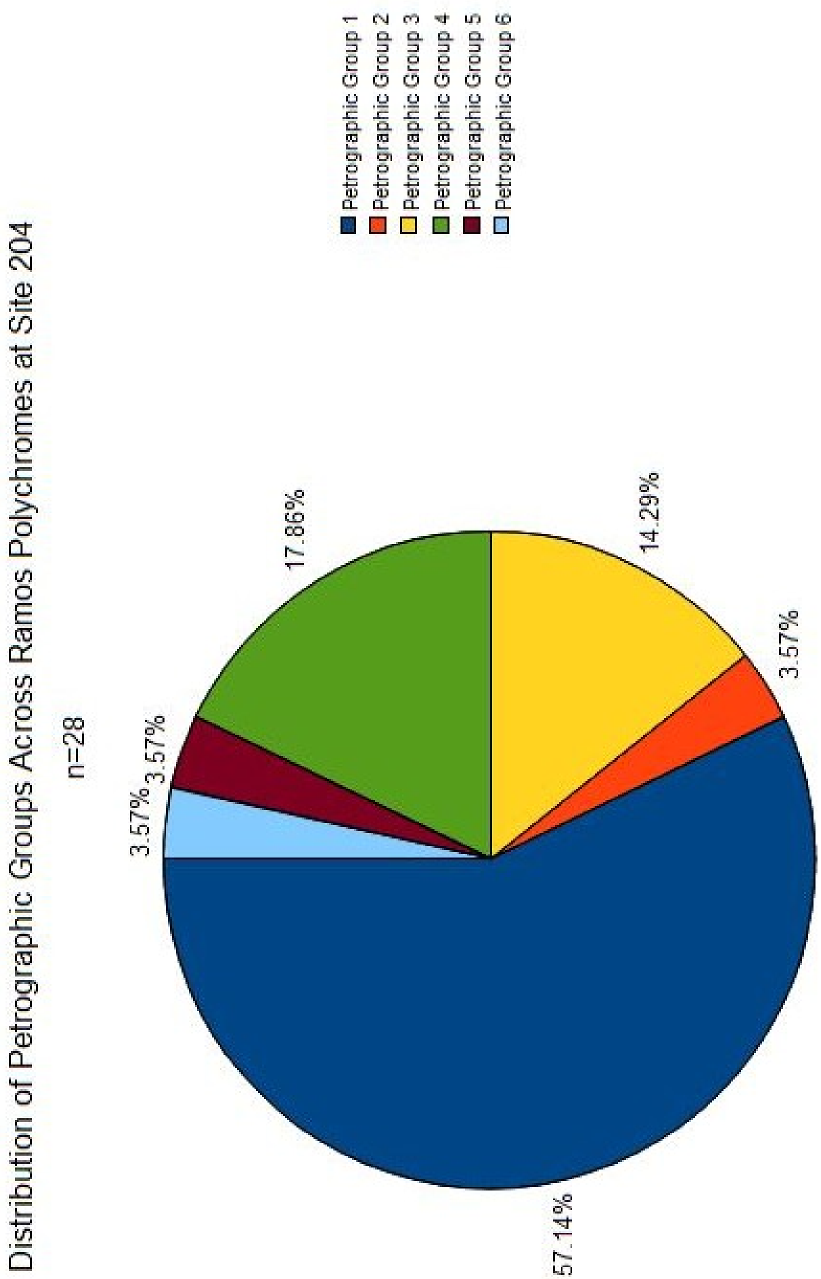
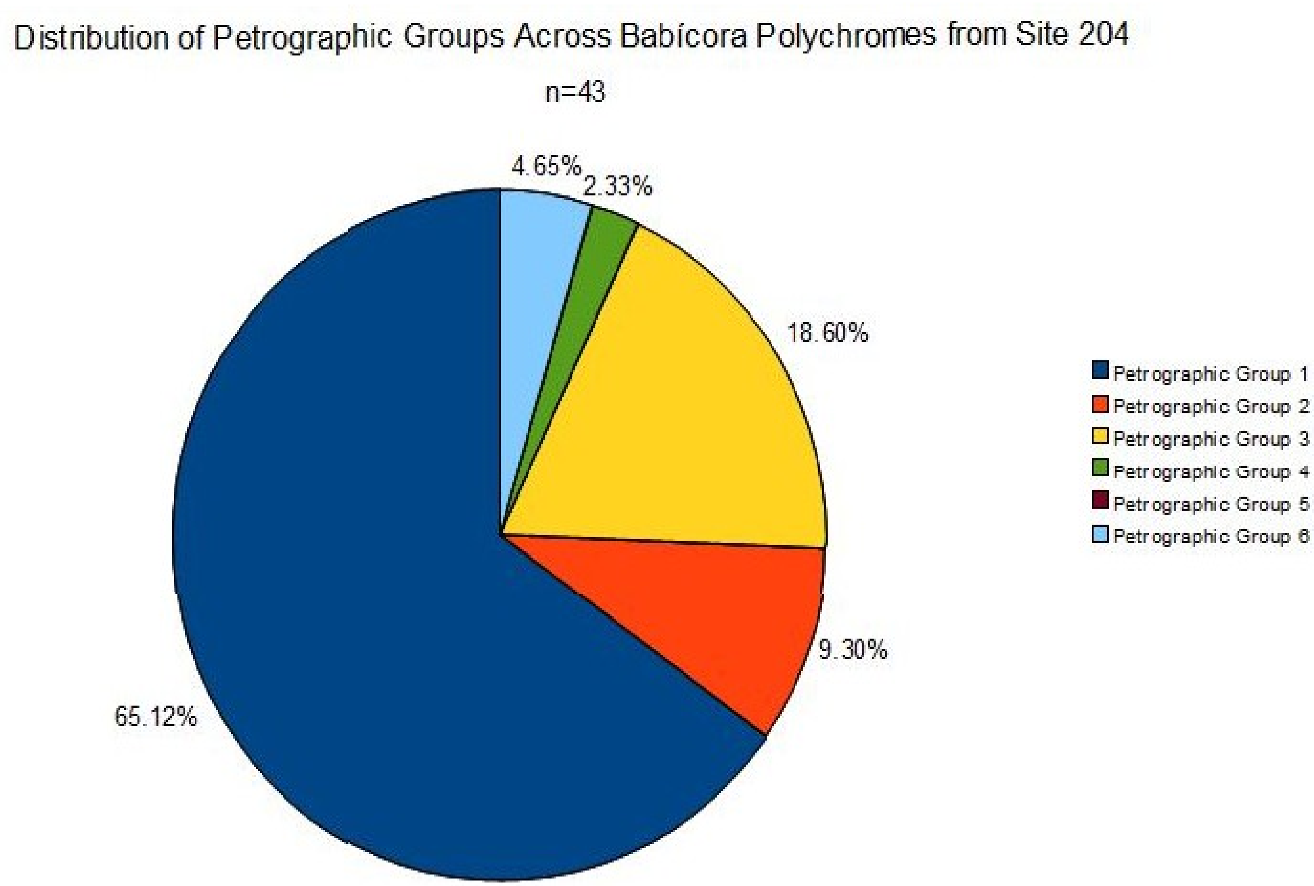

Distribution of Petrographic Groups Across Ramos Polychromes at Site 204
n=28
Petrographic Group 1
Petrographic Group 2
Petrographic Group 3
Petrographic Group 4
Petrographic Group 5
Petrographic Group 6
57.14%
3.57%
14.29%
17.86%
3.57%
3.57%

Figure 5.9: Distribution of petrographic groups

across Babícora Polychrome (Site 204).



Distribution of Petrographic Groups Across Babícora Polychromes from Site 204
n=43
4.65%
2.33%
18.60%
9.30%
65.12%
Petrographic Group 1
Petrographic Group 2
Petrographic Group 3
Petrographic Group 4
Petrographic Group 5
Petrographic Group 6

Site level analysis of individual formal types and petrographic group assignment predictably differs from those frequencies derived from Sayles' regional data. However, there are some consistent observations I can make given these regional- and site-level frequencies. As stated previously, Petrographic Groups 1 and 2 are clearly most common both regionally as well as at Site 204. In keeping with analysis of Sayles' surface collections, just over 32% of the Ramos polychromes from Site 204 are assigned to Petrographic Groups 3 and 4. Approximately 21% of Babícora polychromes from Site 204 are assignable to Petrographic Groups 3 and 4, which is not at odds with frequencies of this same formal type in Sayles' regional collections.

In regard to formal type, Ramos, Babícora, and White-Paste Babícora polychromes exhibit petrographic diversity, though there are differences in the frequency of those petrographic groups. As exhibited previously in regard to Sayles' regional sample, data related to these frequencies and statistical differences (chi-squared) at Site 204 are presented in Table 5.6. Sherd counts are represented by numbers in normal text, percentages of each petrographic group within each formal type in italics, expected frequency in parentheses, and the component is in brackets. In contrast to my regional data set, I included White-Paste Babícora Polychrome given its more robust sample size. I do, however, continue to disregard Petrographic Groups 5 and 6 as only a small number of sherds are assignable to these groups.

Formal Type/ Petrographic Group	Petrographic Group 1	Petrographic Group 2	Petrographic Group 3	Petrographic Group 4	Total
Ramos Polychrome	16 (18) [0.22]	1 (1.5) [0.17]	4 (4.9) [0.17]	5 (1.5) [8.17]	26
Babícora Polychrome	28 (28.4) [0.01]	4 (2.4) [1.07]	8 (7.7) [0.01]	1 (2.4) [0.82]	41
White-Paste Babícora Polychrome	26 (23.5) [0.27]	1 (2) [0.5]	7 (6.4) [0.06]	0 (0) [0]	34
Total	70	6	19	6	

Table 5.6: Chi-squared results.

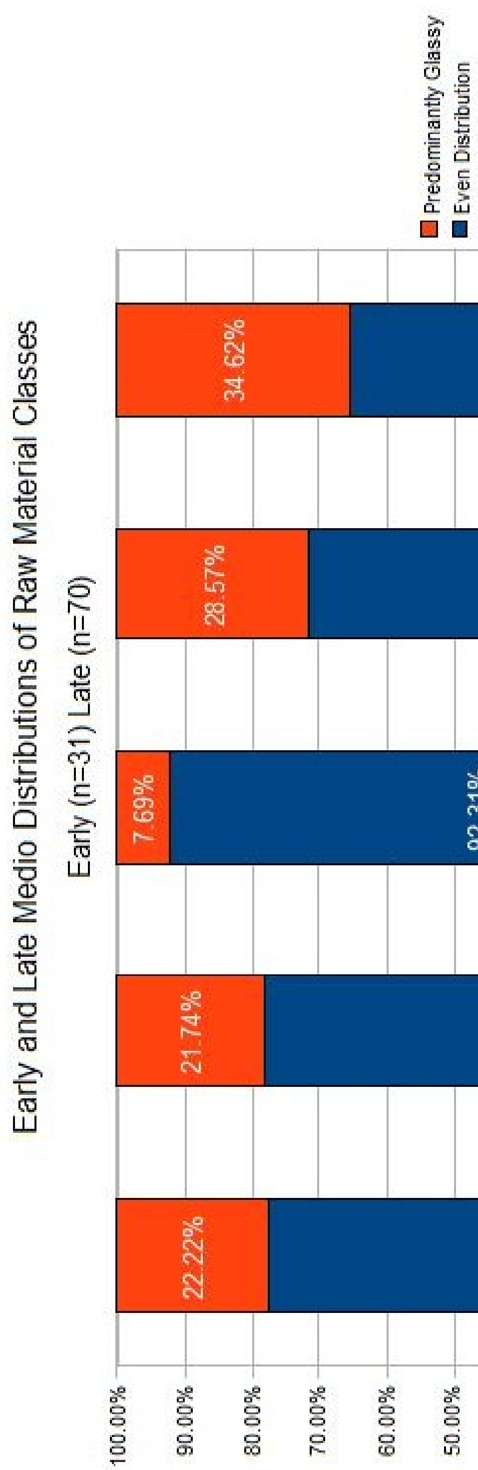
In this sample, there is difference in the frequencies of the four petrographic groups between Ramos, Babícora, and White-Paste Babícora polychromes (X^2 = 11.47; df = 3; p = 0.01), but in contrast to my regional data set, polychromes assignable to the four major petrographic groups appear to nearly match what should be expected. Ramos (65.3%), Babícora (78.1%), and White-Paste Babícora (79.4%) polychromes, as with data from Sayles' survey, are most commonly assignable to Petrographic Groups 1 and 2. A much smaller proportion of the each of the three are assignable to Petrographic Groups 3 and 4. Site-level petrographic analyses appear to shed little light as to potter's preferences for one type of raw clay in contrast to another. The prevalence of what I perceive as clays derived from lava flows is much more prevalent in comparison with those that likely have more pyroclastic origins at Site 204 is striking, but given that my counts more or less match what should be expected, it is difficult to say whether or not this pattern of behavior is caused by environmental availability, learning networks, or trade from other sites.

That being said, it is possible that pastes that are predominantly glassy in nature, Petrographic Groups 3 and 4, could represent a discrete, more geographically scarce set of clays is complicated by data from sherds at Site 204. This perceived difference in Predominantly Glassy and pastes that exhibit an Even Distribution could be entirely dictated by environmental availability. Sayles' regional data are unable to entirely speak to this issue. Site 204, though, is unique in that the sherds were recovered from a stratified midden. Importantly, Whalen and Minnis (2009) were able to identify Early Medio and Late Medio components of these middens based on the presence of Ramos Polychrome, which, as previously discussed, appears after approximately AD 1300. As such, I was able to identify individual sherds as being from either Early or Late Medio contexts. Excavated middens, as mentioned previously, are somewhat rare within Casas Grandes archaeology, so this analysis provides potentially unique insights.

I used the same definitions of Even Distribution and Predominantly Glassy pastes in this analysis. Notably, whereas White-Paste Babícora polychromes in my sub-sample of Sayles' regional collection are less robust in number in comparison with the other polychrome types selected in my study, the number of White-Paste Babícora polychromes sampled from Site 204 is much more robust (n=34), in comparison with the other formal types in this site-based sub-sample. The results of this analysis are presented in Figure 5.10.

Figure 5.10: Raw material classes

used through time (Site 204).



Early and Late Medio Distributions of Raw Material Classes
Early (n=31) Late (n=70)
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
22.22%
77.78%
21.74%
78.26%
7.69%
92.31%
28.57%
71.43%
34.62%
65.38%
Babicora Polychrome (Early)
Babicora Polychrome (Late)
White Paste Babicora Polychrome (Early)
White Paste Babicora Polychrome (Late)
Ramos Polychrome (Late)
Predominantly Glassy
Even Distribution

Admittedly, these data are somewhat problematic. Namely, Late Medio sherds are twice as common, in my sample, as pottery fragments from Early Medio components of the midden. However, the fact that the frequency of Even Distribution and Predominantly Glassy petrographic assignments for both Early and Late Medio Babícora polychromes remains consistent through time, suggests that different sample sizes of sherds from Early and Late Medio contexts may not be a significant problem. Additionally, the frequency of Ramos polychromes assignable to Predominantly Glassy petrographic groups at Site 204 (nearly 35%), does not significantly disagree with either regional or site-level analysis of the dominant petrographic groups. If the dataset was somehow skewed, I expect that the frequencies of petrographic groups to be at odds with my preceding regional analyses.

What is most striking about Figure 5.10 is the increase in the frequency of White-Paste Babícora polychromes ascribed to Predominantly Glassy petrographic groups during the Late Medio. Through time, White-Paste Babícora polychromes that exhibit predominantly glassy pastes jumps from just over 7% during the Early Medio to nearly 29% during the Late Medio. The marked increase in finished vessels assignable to Petrographic Groups 3 and 4 does not refute the possibility of a geographically restricted set of raw materials, it is unlikely that such deposits suddenly appeared near Site 204. If pyroclastic flows are geographically restricted, the increase in the frequency of pastes corresponding to such raw materials, supports the interpretation that this shift in frequency is a result of the increased production of such vessels by a community of potters who have learned to access such raw materials. In this scenario, there is a corresponding increase of consumption of these finished vessels on the part of sites not situated near pyroclastic geology. Alternatively, if pyroclastic materials are evenly distributed throughout the Casas Grandes world, the increase of frequency of finished vessels that exhibit Predominantly Glassy pastes could correspond to an expansion of the learning network and the number of potters who understand how to utilize such raw materials.

In an effort to identify which of these two scenarios is more likely, I examined the number of petrographically identifiable sub-groups within my sample of thin sections assignable Petrographic Groups 3 and 4 at Site 204, see Appendix C for a complete account of these sub-groups. Whereas I do not have corresponding chemical analyses for sherds from Site 204, I have demonstrated with my sub-sample of Sayles' surface collections that petrographic sub-groups frequently correspond to specific chemical groups, which supports the position that textural diversity is indicative of a diversity of raw materials accessed by potters.

At Site 204, the number of sub-groups within Petrographic Groups 3 and 4 are predictably fewer than those sub-groups corresponding to my regional analyses. For example, I identified three sub-groups (combined total n=18) within Petrographic Group 3. Only one sherd assigned to Petrographic Group 3 is not assignable to a sub-group. Within Petrographic Group 4, I identified only one sub-group (n=5), and only one sherd is unassignable to this subgroup. Ultimately, however, these petrographic sub-groups are unable to speak to which scenario is more plausible, as only five of the sherds assignable to any sub-group, of the total sample of 23 sherds assignable to sub-groups, are from Early Medio contexts. A more robust sample of sherds that exhibit Predominantly Glassy pastes more evenly distributed through time is necessary for such speculation.

Regardless of issues of sample size, what we do know is that the increase in production and consumption of finished polychromes that exhibit Predominantly Glassy pastes corresponds to a specific interval of time. This indicates the possibility of an increased degree of community-based specialization of polychromes within the Casas Grandes world. Unexpectedly, my regional sample suggests that these communities of potters may not be limited to a single site, or even a limited number of sites. This indicates that the presence of Predominantly Glassy pastes could be entirely determined by human behavior, not dictated by environmental availability. What is more, communities of potters who producing polychromes with Predominantly Glassy pastes do not monopolize or replace locally-produced vessels. Rather, there is simply a possible influx of some types of finished vessels.

Predominantly Glassy pastes are, however, at least partially related to the production of Ramos Polychrome. This correlation is significant for future studies focusing on the increase of production and consumption of such vessels. However, the fact that the use of raw materials derived from pyroclastic deposits precedes Paquimé's prominence suggests enhancement, rather than invention, of an already established set of practices.

Chapter 6:

Black Pigments in the Casas Grandes World

At this point, I suggest that future studies designed to characterize Chihuahuan polychromes using either petrographic or neutron activation analysis may be regarded as useful, but I am concerned that even larger site-focused projects relying on such standard techniques will not be entirely productive, knowing what we do from my current research as well as those completed prior to mine (see Carpenter 2002; Triadan et al. 2017; Woosley and Olinger 1993). However, on-going pursuits that endeavor to understand Casas Grandes polychrome production and subsequent exchange of finished vessels within the Casas Grandes world are tenable. For example, in this chapter I present data collected regarding pigment recipes within the Casas Grandes world.

Whereas the preceding chapter focuses exclusively on ceramic pastes, this chapter examines the black paint with which Sayles' sherds were decorated. Painting is an integral aspect of polychrome production and could act as a proxy for possible production sites, as our ability to understand ceramic pastes is seemingly currently confounded by a combination of geology and culture. Black pigments used to paint Casas Grandes polychrome demonstrate a wide degree of textural diversity, including matte, sub-glaze, and true-glaze. Though true glaze-paints are diagnostic of some formal types (see Appendix A), they are not significant in distinguishing Ramos, Babícora, or White-Paste Babícora sherds. Rather, these formal types are distinguished by how the linework is executed. Regardless of this fact, black paints are necessary for the identification of all three polychromes types and other research programs that have focused on the composition of such paints have been successful in on-going studies of ceramic production and provenance throughout the Southwest (see Duwe and Neff 2007; Habicht-Mauche et al. 2000; Van der Weerd et al. 2004; Van Keuran et al. 2013).

The data from this chapter directly builds from preliminary analysis of Casas Grandes paint recipes using non-destructive portable X-ray fluorescence (p-XRF) on black pigments on polychromes of all formal types recovered from Site 204 (Britton 2013). This study suggested that black pigments were a result of various combinations of manganese (Mn), lead (Pb), copper (Cu), and iron (Fe). The technique detected other elements, but these four were the most common and occurred at the highest relative frequencies. They are also the least likely to a result of direct contributions from the underlying paste during chemical interactions between paste and paint occurring throughout the firing process. What is more, it is unlikely that the x-rays are able to penetrate through the pigment to the area of interface between pigment and ceramic body (Potts and West 2008).

However, p-XRF is unable to satisfactorily quantify the amounts of these individual elements. Rather, the technique was limited to noting the relative presence and absence of various elements. As part of my dissertation, I endeavored to begin describing, quantitatively, black pigment recipes and how these recipes can be related by to various aspects of finished vessels with the idea that certain recipe groups will be indicative of centers of production of polychromes throughout the Casas Grandes world.

Laser Ablation Inductively Coupled Mass Spectroscopy (LA-ICP-MS) and Paint Group Definitions:

Laser ablation inductive coupled mass spectroscopy (LA-ICP-MS) is a characterization technique well suited for paints and slips in that researchers can target specific areas of interest. I completed the analysis working with Mr. Rob Franks, Manager of the Marine Analytical Laboratory at the University of California, Santa Cruz. I ablated a 5 µm line, twice, using a Photon Machines Analyte 193H laser attached to a Thermo X-Series2 quadrupole inductively coupled plasma mass spectrometer. The first pass is designed to ablate the surface-most layer of the pigment, which may exhibit contamination due to diagenesis. The second pass is recognized as being more indicative of the real chemical composition of the pigment. The depth of the laser is strictly controlled so as to not cut through the pigment layer down into the paste body. The pigment sample is ionized and passes through a mass spectrometer, which reports the frequency of elements with atomic mass ranges of 7 to 250 (Li to U), at the scale of parts per million (ppm). I recorded 54 elements and raw data can be found in Appendix I.

The sample set I selected for my LA-ICP-MS study was smaller than that presented for petrography or NAA, though it uses many of the same sherds from Sayles' collection. The reason for this reduction in number is primarily related to two factors: the general availability of black pigment and whether or not a sample of black pigment was easily accessible for analysis. Some sherds selected for paste characterization analyses did not exhibit significant amounts of black pigment. In other cases, the available black paint was flaky and heavily abraded. These samples were disregarded during sample selection. Lastly, some sherds in my preceding paste characterization sample contained appropriate areas of black pigment that were located in their centers. This is significant because the chamber and loading tray associated with the LA-ICP-MS machine are small. Dissecting sherds with painted central areas in order to remove a small section precluded other destructive analyses, most specifically petrography. As such, I disregarded these sherds as unsuitable for LA-ICP-MS.

After I completed the selection process, my final sample was comprised of a total of 86 polychrome sherds. Approximately 40% of this sample are Babícora Polychrome, nearly 49% are Ramos Polychrome, and just over 10% are White-Paste Babícora Polychrome. And, ultimately, the results of my pigment analysis of Sayles' sherds confirmed previous preliminary analysis of sherds from Site 204 (see Britton 2013). The majority of the paints from Sayles' collection across the three formal types are dominated by a combination of manganese (Mn), lead (Pb), copper (Cu), and iron

(Fe) (see raw data in Appendix I). As with my preliminary p-XRF study, I identified these four as the most significant foundational elements for black pigment groups given that manganese, lead, and copper are unlikely to be related to the finished vessel's paste body, can be tied to known mineral pigments (see Duff et al. 2017), and exhibit the most quantifiable variation. Iron, the fourth foundational element, is notably a prominent component of clays. However, approximately 59% of these polychromes exhibit light-firing pastes which indicates iron-poor clays. These iron-poor pastes do not appear to exhibit significantly different concentrations of the element in comparison to Babícora polychromes, which should contain significantly more iron. More specifically, Babícora polychromes do not form their own paint groups, apart from the others. This, coupled with the fact that we still do not understand how ceramic pastes chemically interact with paints and slips in a quantifiable way, necessitates that I acknowledge this potentiality but must assume that contributions of iron by the ceramic pastes is negligible.

Importantly, this combination of elements is intriguing given the fact that some of these elements, copper and lead for example, co-occur naturally within geologic units, but all four elements co-occurring within a single ore or rock is geologically improbable. This unlikely combination of elements leads me to suspect that potters within the Casas Grandes were mixing multiple raw materials in order to manufacture black pigments (also see Britton 2013). A natural conclusion deduced from this cultural combination of multiple naturally-occurring pigment sources is that recipes have some sort of functional purpose. One logical purpose is that, by combining several raw materials, Casas Grandes potters greatly enhanced a desirable quality associated with these paints, such as the crispness of a finished line after firing or depth of final color. Alternatively, this combination of elements may indicate an endeavor to manufacture vessels decorated with glaze-paints. Preliminary observations suggest that this may not be the case, as pigments do not become more glaze-like through time (Britton 2013). What is more, there appears to be no correlation between composition and glassiness of paints, despite the fact that high concentrations of fluxes, such as lead and copper, do result in glaze-paints in the Greater Southwest. However, conclusive results demand both a larger data set and tailored research design. This study was designed to identify compositional groups and investigate whether or not these cultural practices have clear relationships with pottery style or paste recipes. It is also possible that these recipes are more environmentally-determined, which would be supported by evidence that paint groups being geographically circumscribed.

Regardless of what final effects Casas Grandes potters may have been attempting to achieve, the mixing of raw materials generated identifiable paint recipes within the Casas Grandes world. Paint group definitions are presented in Table 6.1. Cross-plots on a logarithmic scale of the results of this analysis are presented in Figures 6.1, 6.2, and 6.3. Concentrations of the foundational elements increase along the x and y-axes and the further any single sample is from another along these axes indicates increasing difference. I ultimately identified three recipes, one of which is dominant but exhibits wide chemical variability (Appendix D contains paint group designations of individual sherds).

Paint Group Designation/ Element	Manganese (Mn)	Copper (Cu)	Lead (Pb)	Iron (Fe)
Paint Group I (n=5; All Babícora polychromes)	Low	High	Very High	High
Paint Group II (n=80)	Relatively High	Variable	Variable	High
Paint Group III (n=1; Ramos Polychrome)	Low	Low	Moderate	High

Table 6.1: Paint group definitions.

Figure 6.1: Cross-plot, Mn vs. Fe (recipes).

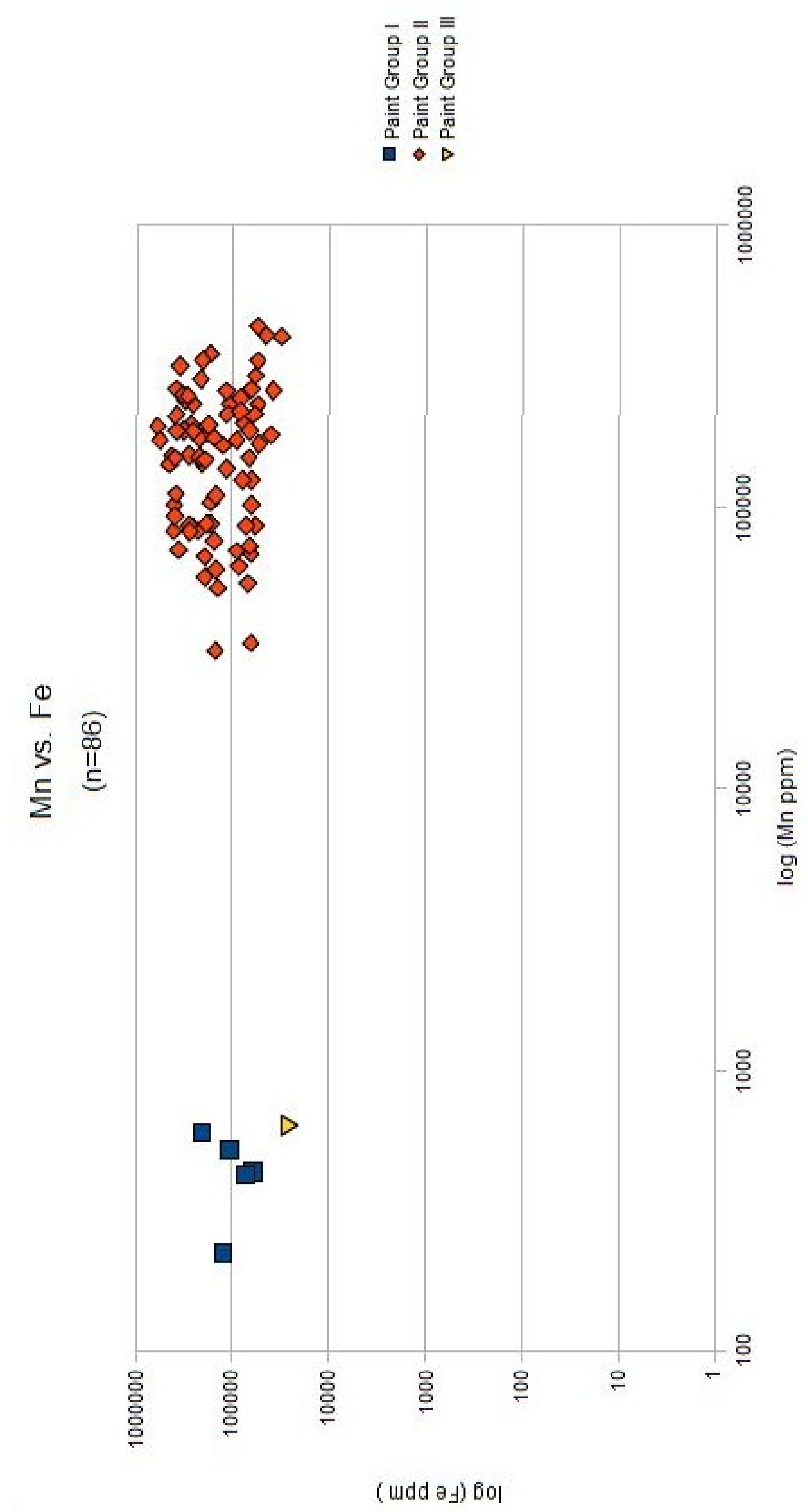

Mn vs. Fe
(n=86)
Paint Group I
Paint Group II
Paint Group III
log (Fe ppm)
1000000
100000
10000
1000
100
10
1
log (Mn ppm)
100
1000
10000
100000
1000000

Figure 6.2: Cross-plot, Mn vs. Cu (recipes).

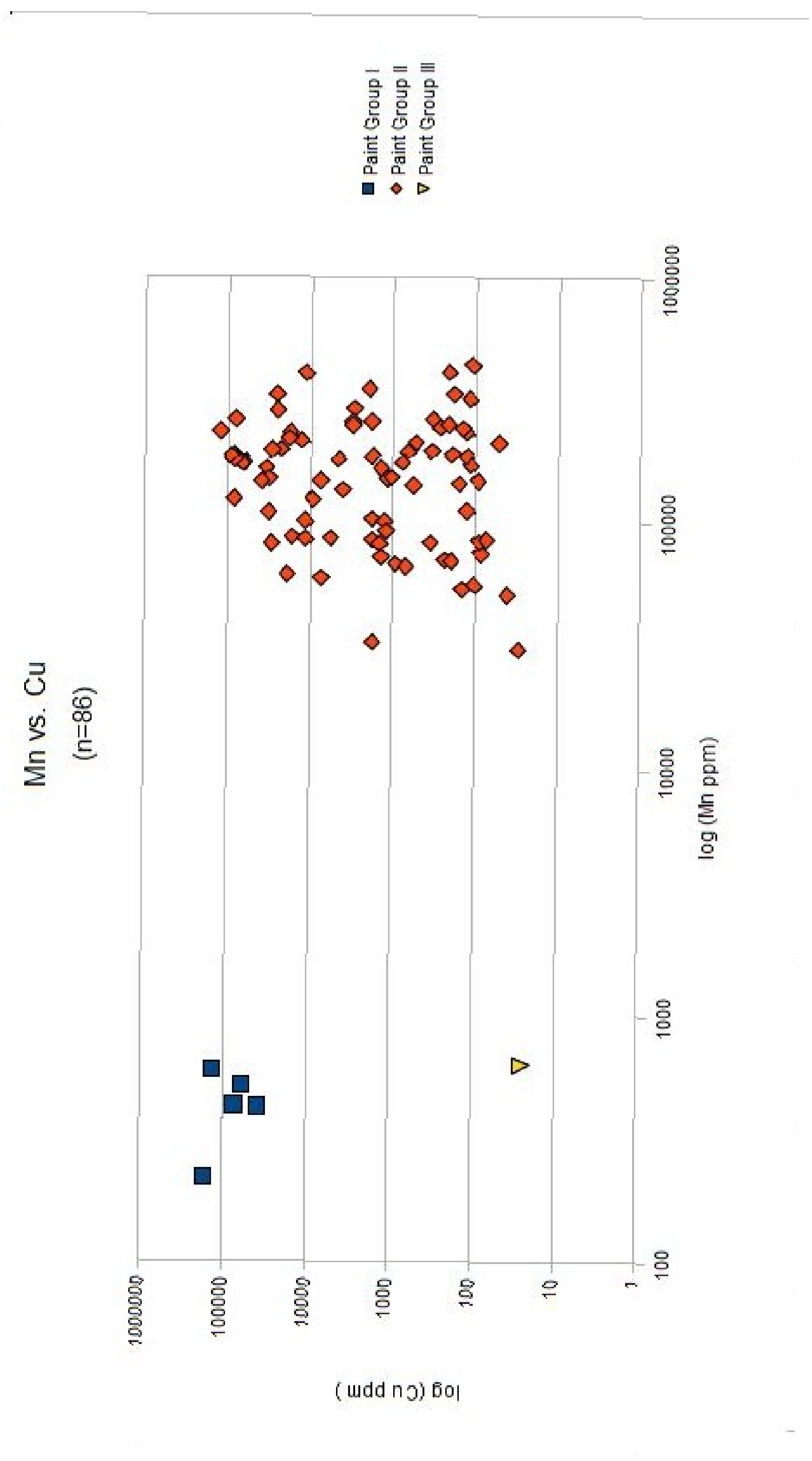
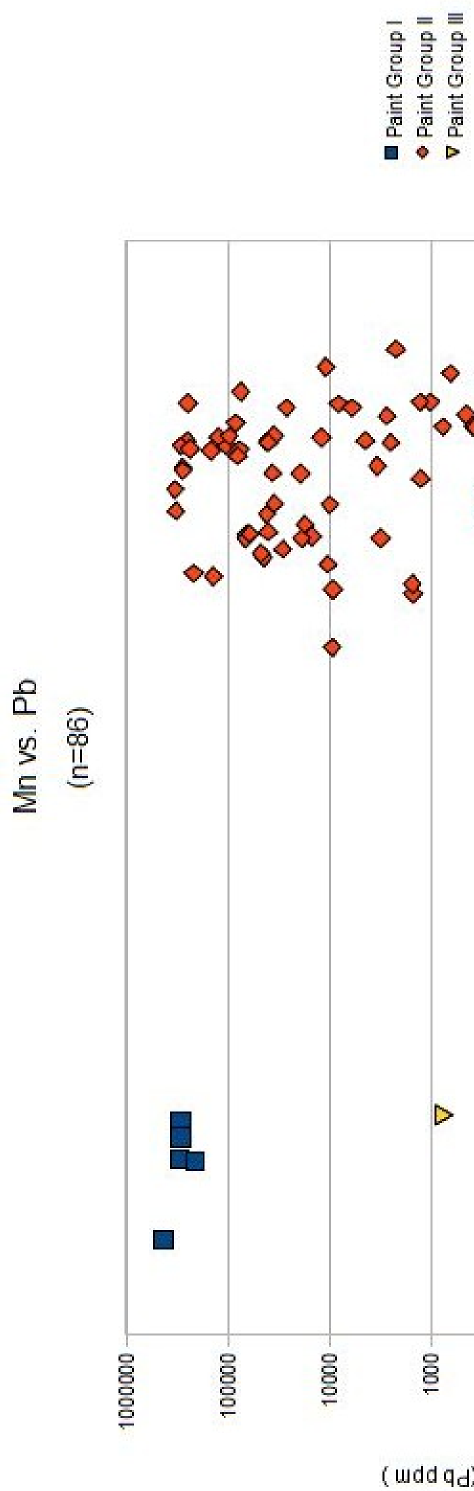

Mn vs. Cu
(n=86)
log (Mn ppm)
log (Cu ppm)
100
1000
10000
100000
1000000
1
10
100
1000
10000
100000
1000000
Paint Group I
Paint Group II
Paint Group III

Figure 6.3: Cross-plot, Mn vs. Pb (recipes).


Mn vs. Pb
(n=86)
log (Pb ppm)
log (Mn ppm)
1000000
100000
10000
1000
100
10
1
100
1000
10000
100000
1000000
Paint Group I
Paint Group II
Paint Group III

Paint Group II warrants further discussion outside of Table 6.1. This paint group clearly exhibits extreme members, in regard to copper, lead, and iron. Please note that this variability does not directly correspond to paints that are more or less glaze-like in appearance despite the fact that copper and lead, specifically, are common fluxes. I suggest that this variation is a result of various circumstances, including environmental availability and variability of raw materials as well as the fact that Casas Grandes potters are unlikely to have used any sort of standard metric during the manufacturing process. Also, Casas Grandes peoples would be making cultural determinations of what makes a raw materials serviceable which likely had little to do with what we detect as the amount (parts per million) of any one element. Batching, or making a reserve of black pigment all at once is another source of variability.

Questions as to the availability of such raw materials is unclear at this time. Modern maps of such likely raw materials are a useful start at identifying possible procurement sites, but necessarily focus on materials that are economically viable by today's standards. However, this modern focus may be misleading for identification of pre-industrial craft production and reconnaissance for smaller-scale deposits would be necessary to understand availability around sites.

Paint Groups and Relationships to Other Identifiable Casas Grandes Traditions:

Paint group assignments in relation to formal types are presented in Table 6.2. These relationships between composition paint groups and formal type are also presented in Figures 6.4, 6.5, and 6.6. Please note that Sherd EBS1197, identified as a Ramos Polychrome, is not the same unique sherd (Sherd EBS1289) assigned to Petrographic Group 6. Anomalous sherds, in regard to petrographic groups, it seems, do not directly correspond to anomalous paint recipes.

Formal Type/ Paint Group	Paint Group I	Paint Group II	Paint Group III	Total
Ramos Polychrome	0	41	1	42
Babícora Polychrome	5	30	0	35
White-Paste Babícora Polychrome	0	9	0	9
Total	5	80	1	86

Table 6.2: Distribution of paint groups across formal types (Sayles' collection).

Figure 6.4: Cross-plot, Mn vs. Fe (formal types).

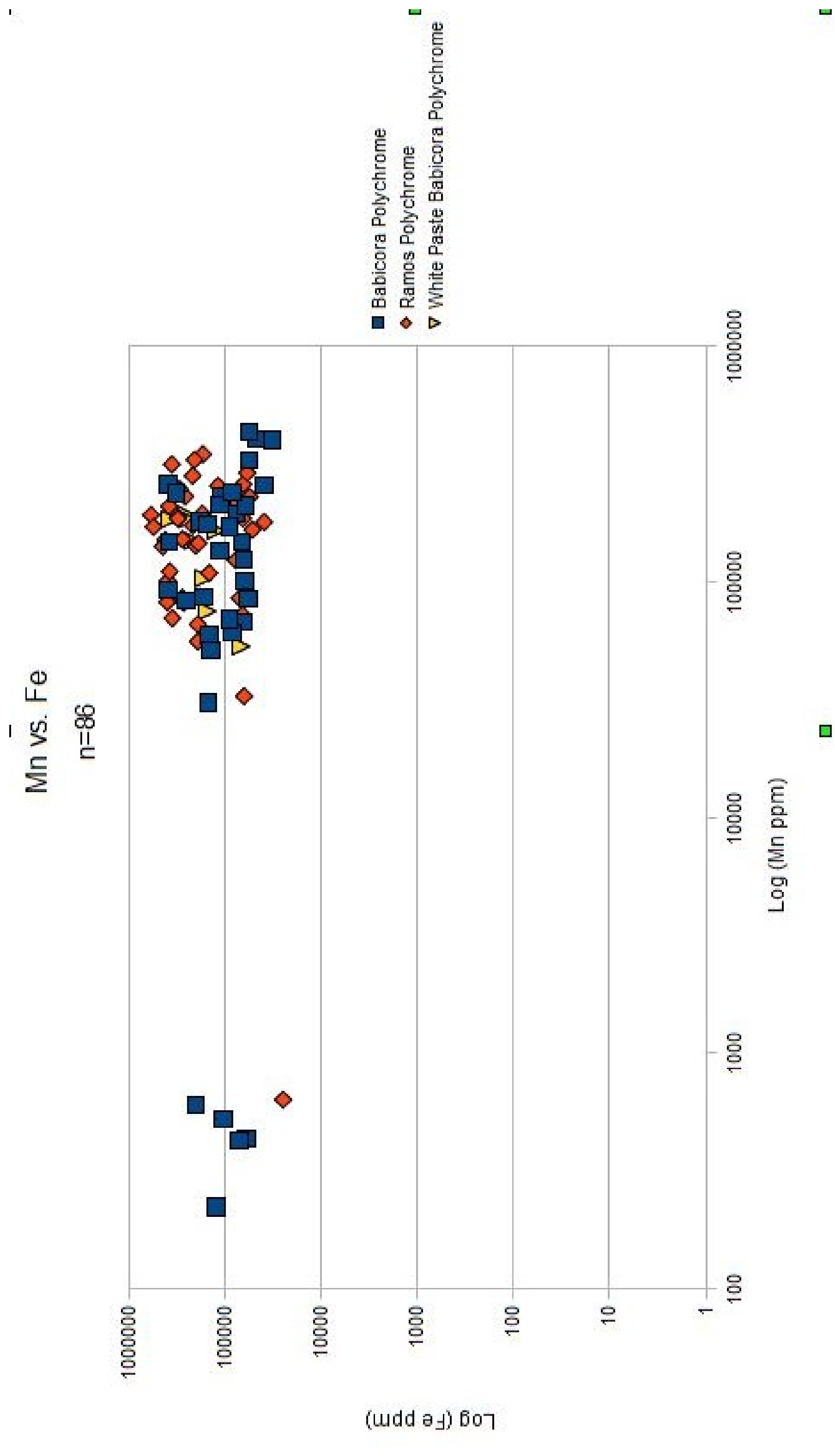

Mn vs. Fe
n=86
Log (Fe ppm)
Log (Mn ppm)
1000000
100000
10000
1000
100
10
1
Babicora Polychrome
Ramos Polychrome
White Paste Babicora Polychrome

Figure 6.5: Cross-plot, Mn vs. Cu (formal types).

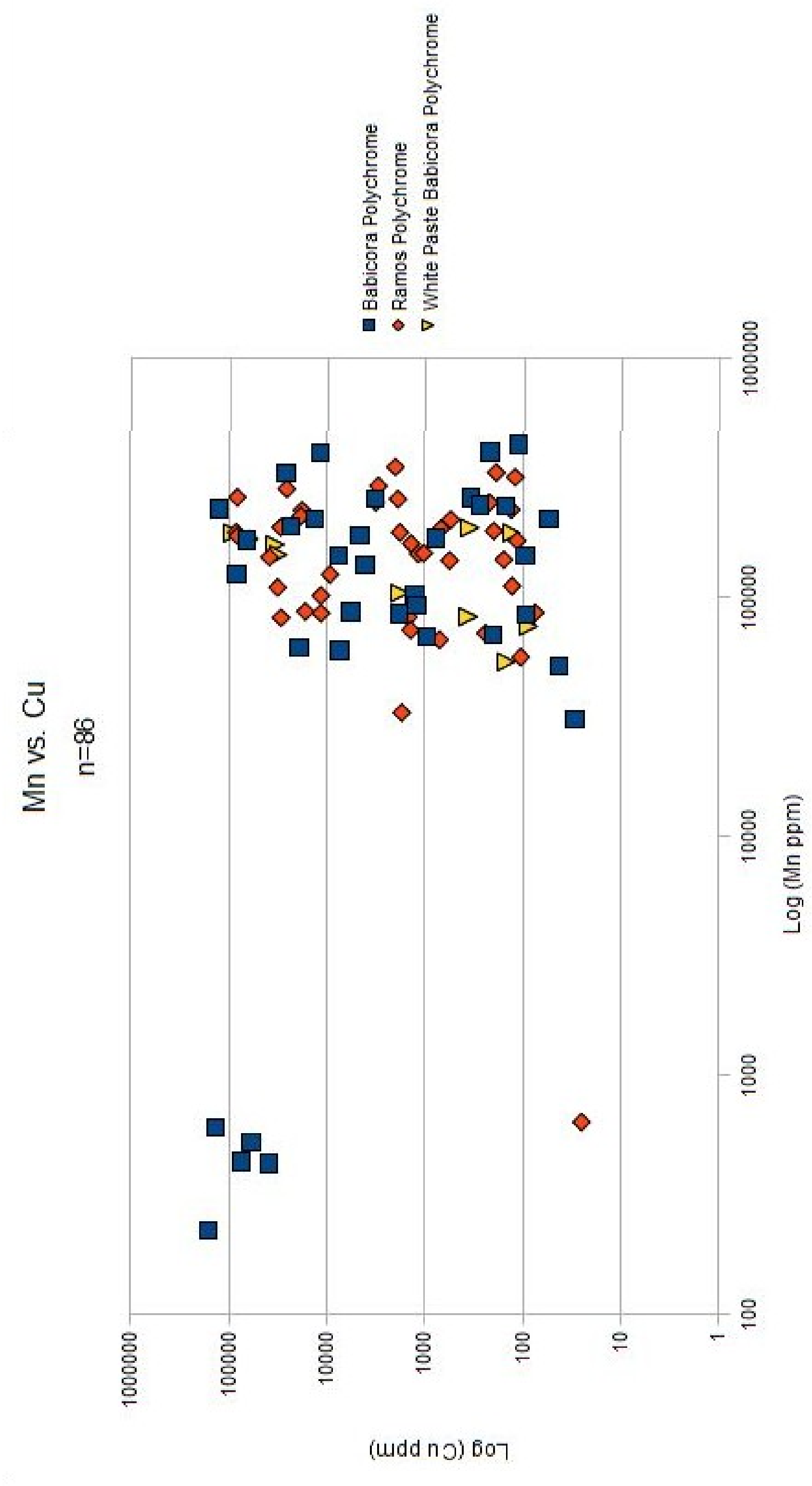
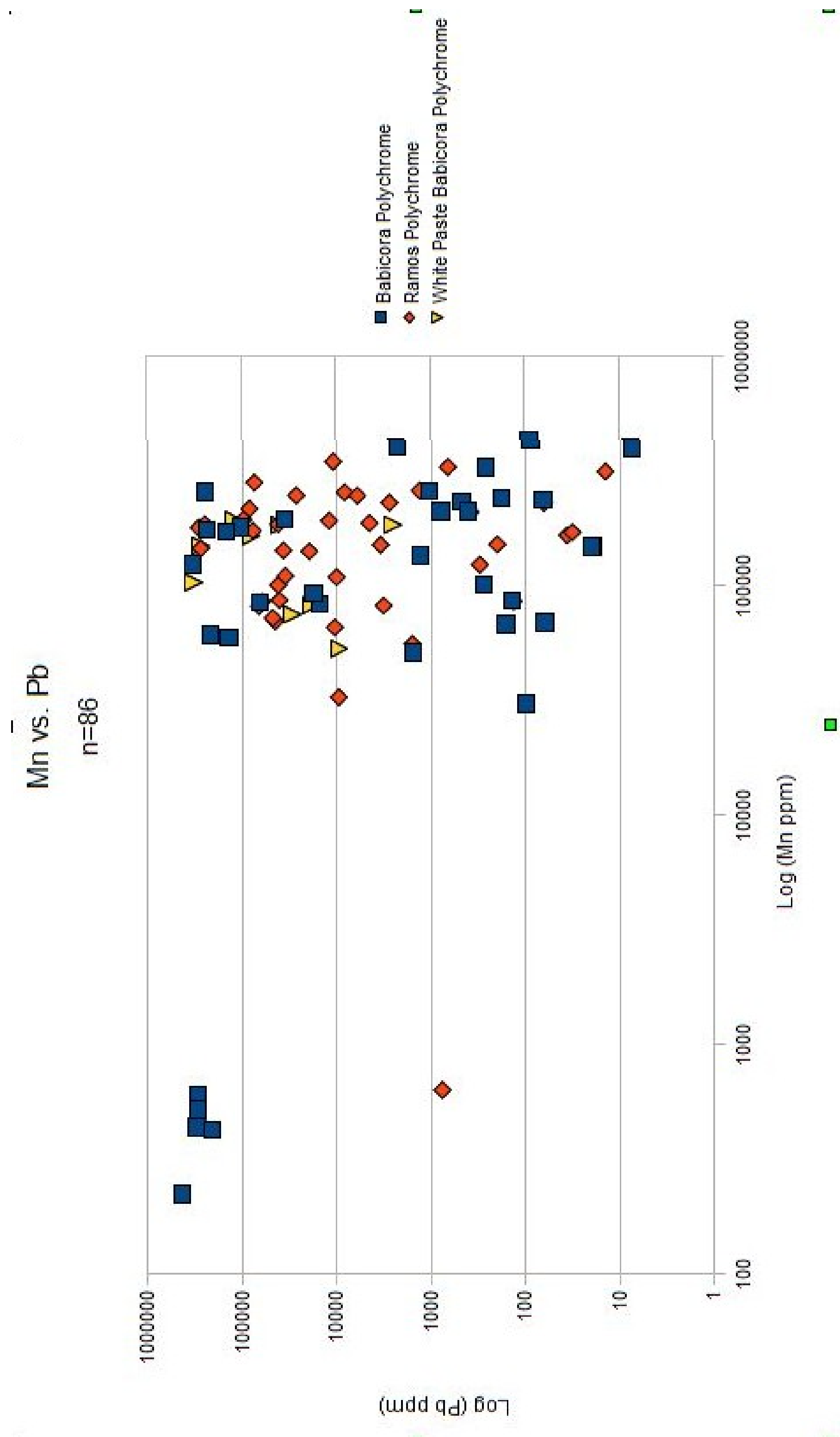

Mn vs. Cu
n=86
Babicora Polychrome
Ramos Polychrome
White Paste Babicora Polychrome
Log (Mn ppm)
Log (Cu ppm)
100
1000
10000
100000
1000000
1
10
100
1000
10000
100000
1000000

Figure 6.6: Cross-plot, Mn vs. Pb (formal types).


Mn vs. Pb
n=86
Log (Pb ppm)
Log (Mn ppm)
1000000
100000
10000
1000
100
10
1
Babicora Polychrome
Ramos Polychrome
White Paste Babicora Polychrome

As with mineralogical and chemical data regarding pastes presented in Chapter 5, paint recipe groups largely cross-cut formal types with some exceptions. For example, Paint Group I is only represented by Babícora Polychrome. Paint Groups I and III are also clearly less common than Paint Group II. It is possible that they may become more prevalent in future analyses, though Paint Group III does appear quite anomalous. However, this speculation on the part of Paint Group I is supported by a senior thesis completed by Emily Case (2015) who demonstrated that Carretas and Huerigos Polychrome sherds frequently exhibited paints that fall into my Paint Group I. Paint Group I may be unusual for Ramos and White-Paste Babícora polychromes, but Case has demonstrated that this is likely not the situation for all polychrome types. Note that Carretas and Huerigos Polychrome are both partially recognized by their diagnostic glaze-paints. However, the Babícora polychromes in my study exhibited a sub-glaze texture, not a true glaze-paint.

There are some formal types that appear to be more closely associated with some aspects of compositional variation within Paint Group II. For example, White-Paste Babícora polychromes appear to exhibit higher concentrations of lead and iron and lower concentrations of copper. I do consider the small sample set of White-Paste Babícora polychromes (n=9) to be somewhat problematic. Ramos Polychrome exhibits widely variable concentrations of copper and iron, but does appear to exhibit paints with slightly higher concentrations of lead than others in Paint Group II. Babícora polychromes that are painted with pigments corresponding to Paint Group

II, however, exhibit the greatest amount of variation with little indications of compositional trends.

While there are some compositional trends in regard to formal types, the fact that pigment groups are not directly tied to any one style of pottery is not surprising, given my observations that ceramic design style cross-cut broad petrographic groups in Chapter 5. However, it follows that people who share knowledge of how to form a vessel's clay body should also share a similar understanding of how to mix pigments. Following this logic, I investigated the possibility that paint groups and petrographic groups are more likely to correspond to formal types than are paint groups alone. Paint group assignments in relation to petrographic groups are presented in Table 6.3.

Paint Group/ Petrographic Group	Petrographic Group 1	Petrographic Group 2	Petrographic Group 3	Petrographic Group 4	Petrographic Group 5	Petrographic Group 6	Total
Paint Group I	4	1	0	0	0	0	5
Paint Group II	37	8	23	6	4	2	80
Paint Group III	0	0	0	0	1	0	1
Total	41	9	23	6	5	2	86

Table 6.3: Distribution of paint groups across petrographic groups (Sayles' collection).

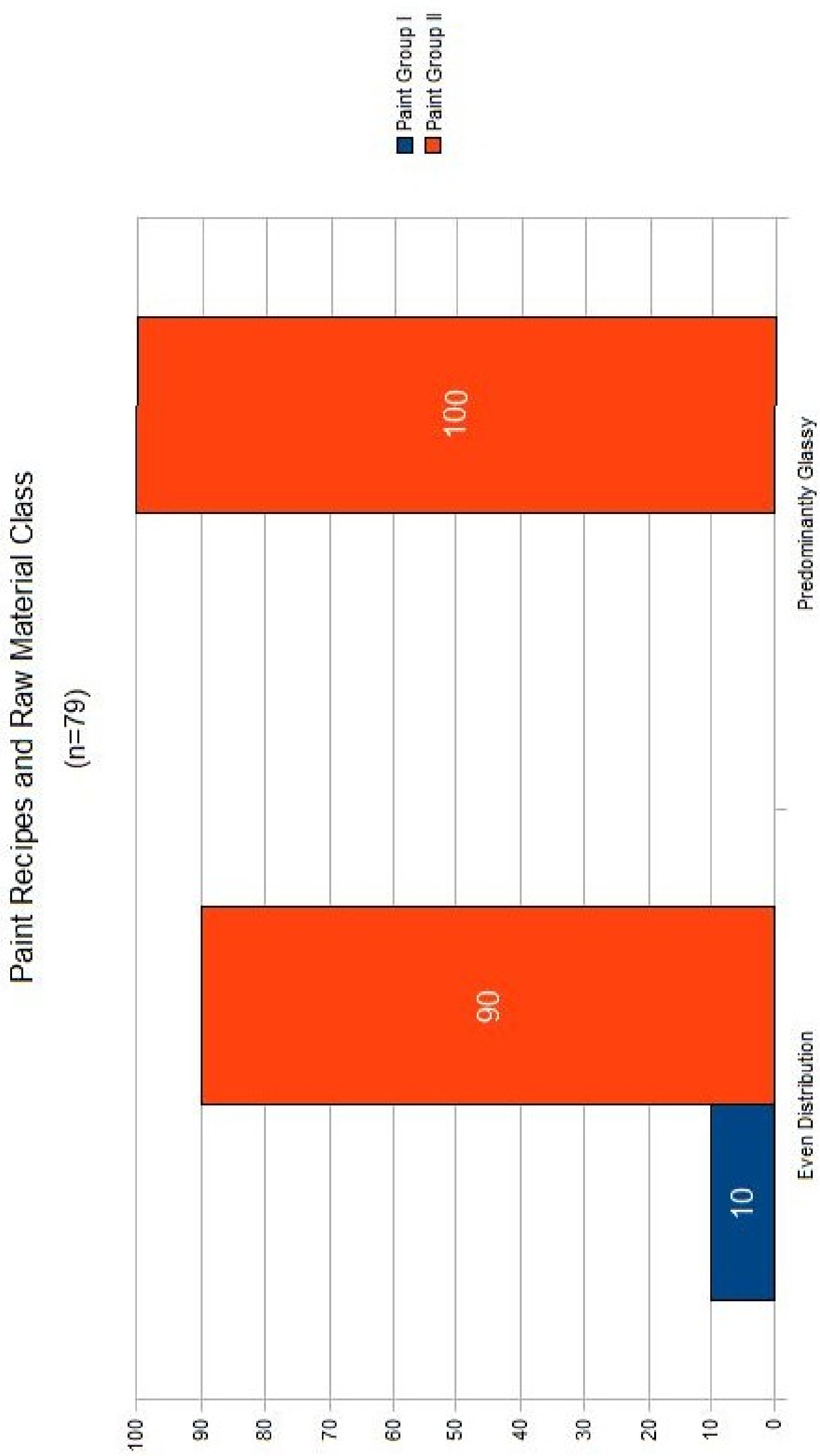
Contrary to my logic, however, paint groups cross-cut petrographic group designations. Some of these groups, though, exhibit less variation than others. For example, Paint Group I corresponds only with Petrographic Groups 1 and 2. This is in contrast to Paint Group II, which is represented by all six petrographic groups. What is more, petrographic sub-groups seemingly exhibit little correlation to with paint groups, with a few exceptions (see Appendix D for petrographic group and sub-group assignments). For example, Petrographic Group 5 (n=5, all are assigned to the same sub-group), which has received little attention in prior discussions of ceramic pastes, appears to co-occur with Paint Group II, with one exception. Given this evidence, Petrographic Group 5 could be interpreted as a discrete set of potters, or an individual, manufacturing polychromes. Similarly, Petrographic Sub-Group 4B (n=4) similarly co-occurs with Paint Group II. However, whereas these two petrographic groups and sub-groups appear to have correspond with Paint Group II, the vast majority of sherds have no overt relationships with paint groups. While chemical groups validate petrographically distinct sherds, these groups are not further supported by pigment recipes.

To further investigate how paint groups possibly articulate with aspects of polychrome production, I used my previously discussed reclassification of raw materials used (Even Distribution and Predominantly Glassy). Given the fact that this reorganization of information disregards some petrographic groups, the resulting number of samples is 79 individual sherds. The single sherd assigned to Paint Group

III is disregarded in this analysis. Results are presented in Figure 6.7.

Figure 6.7: Paint recipes across

raw material classes (Sayles' collection).


Paint Recipes and Raw Material Class
(n=79)
Paint Group I
Paint Group II
100
90
80
70
60
50
40
30
20
10
0
10
90
100
Even Distribution
Predominantly Glassy

Paint Group I appears to only correspond to Babícora polychromes that exhibit pastes with an even distribution of phenocrysts and cryptocrystalline groundmass fragments, clays likely derived from lava flows. In contrast, sherds that exhibit pigments corresponding to Paint Group II can be tied to raw materials types derived from either lava or pyroclastic flows. In this dataset, Paint Group I would appear to be indicative of a suite of cultural practices. However, without understanding the pastes of the Carretas and Huerigos polychromes from Case's senior thesis, this suggestion remains highly speculative.

Discussion:

Further investigation of these various traditions of pigment recipes using my previously defined sub-regions and this dataset is unlikely to be productive. Nearly 50% of the sherds in this dataset correspond to sites central to Paquimé. Southern sites, specifically, are underrepresented and sub-regional investigations are likely to be misleading. However, I do submit that it is possible that future studies may support the position that paint groups have some regional sensitivity. This is certainly the case for Paint Group I, which is identified on sherds recovered from northern sites and apparently corresponds to pigments used on Carretas polychromes (Case 2015), a formal type also associated with the Carretas Basin (Carpenter 1992). Paint groups may also be chronologically sensitive and future analyses of multiple site-based collections with profound stratigraphic information are necessary to test this hypothesis.

However, regardless of the limitations of this dataset and whether or not the distribution of paint groups is regionally or temporally sensitive, the identification of pigment groups and their relationships to other aspects of polychrome production does present an additional line of evidence not previously explored by archaeologists working within the Casas Grandes region. Importantly, this study has established that lead is a prominent component of many identifiable pigment groups. Other researchers (see Habicht-Mauche et al. 2000) have established that we are able to isotopically characterize such paints, given the presence of lead, and to link paints to likely raw materials that exhibit that same isotopic signature. At this time, results from Cases' thesis suggest that these glaze-paints can be attributed to multiple sources, but further defining localized resource acquisition practices are subject to future study.

Chapter 7:

Final Thoughts

The data presented in the previous two chapters reveal new identifiable patterns of human behavior, in the production of Ramos, Babícora, and White-Paste Babícora polychromes throughout the Casas Grandes world. In addition to long-identified decorative styles defining fine-lined and sloppy-lined painting styles (Di Peso et al. 1974: vol. 6; Hendrickson 2003), petrographic analysis of ceramic pastes, supported by neutron activation analysis (NAA)(Chapter 5) now similarly identifies two major traditions related to the procurement of raw clay materials for these polychromes. These two procurement patterns do not necessarily exclude others but are certainly prevalent regionally. I relate them back to primary clays derived from two distinct geologic unit types: lava and pyroclastic flows.

However, despite the fact that Casas Grandes potters appear to have deliberately targeted two classes of raw clays, further petrographic identification of many qualitative but recognizable sub-groups, coupled with evidence from chemical groups, support the interpretation that these clays represent types of materials, rather than single sources. Petrographic and chemical diversity support the interpretation that many individual clay sources were accessed by potters throughout the region. Even pastes that I determined to be Predominantly Glassy and derived from pyroclastic material exhibit many petrographic sub-groups and chemical groups.

Examination of stratified midden samples from Site 204, though, indicate that raw materials likely derived from pyroclastic deposits may exhibit an increase in frequency of use through time. This possibly suggests that potters who were dedicated to the use of such pyroclastic materials began to produce more finished vessels during the Late Medio in response to an increase in demand. Alternatively, the increase of such Predominantly Glassy pastes may indicate an increase in the number of potters at Site 204 who ascribe to that particular potting tradition, a possibility that could be generational in nature or a result of migration.

The preceding chapter also established a minimum of three pigment recipes used to paint these vessels with what appears to be the same black paints. Regardless of paint group designation, these pigments share the same combination of fundamental elements: manganese, lead, copper, and iron. Whereas some of these elements can co-occur, the combination of all four is geologically improbable, indicating that these recipes are a result of intentional mixing by Casas Grandes peoples rather than simply products of environmental availability.

Paint Group I is entirely distinct from the other two and is likely related to the production of polychrome types not included in this study, including Carretas and Huerigos Polychrome (see Case 2015). Given the fact that Carretas Polychrome is frequently associated with the Carretas Basin, Paint Group I may represent a distinct paint recipe that could be regionally-tied. However, the distinctions between the second and third pigment recipes remains unclear at this time. While these two recipes exhibit the same combination of elements, and end members of each group appear distinct from one another, concentrations of copper and iron exist throughout either group more in a spectrum. Larger, site-based sample sets combined with isotopic studies may provide better clarity for both paint recipes and their possible regional associations.

Significantly, identifiable traditions regarding the manufacture of pigments and ceramic bodies do not have direct relationships to one another but rather cross-cut formal types. What is more, compositional paint groups and paste types do not directly correspond to one another. Rather, the black paint recipes used to complete designs are somewhat independent of decorative style which is in turn somewhat independent of the procurement patterns utilized by potters in the formation of vessel bodies. This disconnect between paint and paint recipes and finished design is unexpected. Rather than corroborating already-identified modes involving raw clay procurement, by including additional aspects of diversity related to polychrome production (black paint recipes), I identified another seemingly independent mode. I speculate that future studies regarding paint recipes may provide evidence for regional and/or temporal patterns of use, though either possibility is unclear given my current regional sample. Alternatively, pigment recipes may represent an entirely distinct and separate area of knowledge that is not mutually inclusive of either people who make pots or people who decorate them.

Perhaps most significant, though, is clear evidence that these modes of procurement regarding raw clay types, specifically, appear to be a long-situated pattern of behavior. Babícora Polychrome, the oldest polychrome type, exhibits pastes that I relate to clays derived from both lava and pyroclastic flows. These patterns of behavior appear to be regionally and temporally pervasive. Importantly, Babícora polychromes recovered from the lower-most components of middens at Site 204 exhibit the same frequency of paste types during the Early Medio (AD 1150-1275) as the Late Medio (AD 1275-1450). The importance of the fact that such early ceramics so strongly correlate with what appears to be a firmly established potting tradition using one of two classes of materials is profound. I can only speculate as to whether or not these procurement patterns have antecedents prior to AD 1150 when the Medio begins, though it seems most certain that they would. Most importantly, regardless of possible antecedents, this pattern long precedes the florescence of Paquimé.

Implications and Final Thoughts:

In identifying the depth of traditions related to polychrome production within the Casas Grandes world, I suggest that archaeologists working in the region may benefit by thinking alongside archaeologists working within Pueblo III (AD 1150-1275) contexts, as well as those focused on Pueblo IV (AD 1275-1600)(Adler 2016). Overall, Pueblo III is a period of Southwest history recognized as socially turbulent with various environmental and cultural factors contributing to notable breaks in existing well-developed regional systems and lifeways. Several areas exhibit clear evidence for depopulation. These large-scale migrations and subsequent resettlement into new communities characterize the beginnings of the Pueblo IV period (Cordell and McBrinn 2012; Gumerman 1994; Kantner 2004). As social relationships are renegotiated within communities, new widespread styles of painted pottery were introduced, like those discussed in Chapter 1. Such polychromes have frequently been associated with migrants' attempts to integrate themselves into already-existing communities by introducing new ritualistic ideologies.

And while much academic focus has been placed on Paquimé and its sudden prominence after about AD 1300, marking the Casas Grandes region as a prominent Pueblo IV participant, identifiable behaviors associated with the production of Casas Grandes polychromes have much deeper cultural roots. These roots place Casas Grandes peoples, chronologically, as contemporary with the beginning of Classic Hohokam (AD 1150-1300), Postclassic Mimbres (early AD 1100s), and the end of Chaco in the AD 1100s. Paquimé itself and the introduction of Ramos Polychrome may have been products of or responses to Pueblo IV happenings, but the foundational basis of polychrome production is situated contextually within an earlier era of the Greater Southwest, especially along its southern frontier. The production and distribution of Ramos Polychrome is an elaboration upon already-existing regionally pervasive behaviors. And while, possibly somewhat more limited and specialized in its production especially in areas central to and north of Paquimé, it appears to have had little effect on the broader outlines of these cultural preferences and long-situated practices (also see Whalen and Minnis 2009, 2012 for similar arguments regarding Ramos Polychrome).

Shifting our chronological perspective on the emergence of the Casas Grandes world, especially in terms of the development and spread of the Chihuahuan polychrome tradition, has important implications. Most importantly, foundational and enduring Chihuahuan potting practices appear to have their roots in a time period that is otherwise interpreted as chaotic and disruptive. Hegmon and colleagues (2008) have reexamined dramatic and stressful social transformations in Pueblo III communities in American Southwest using resiliency theory, originally developed within the field of ecology and applied to complex adaptive systems.

Specifically, Hegmon and her colleagues (2008) examine the end of Hohokam and Mimbres Classic societies identifying rigidity traps, or a systems' inability to absorb disturbances. Such inability ultimately results in social transformation. In their study, they present various measures of rigidity, including integration, hierarchy, and conformity. Conformity, specifically, refers to “the squeezing out of diversity and the suppression of innovation” and is a concept discussed by others including Kohler and colleagues (2004) who argue that conformity, which includes various social practices, is something that characterizes many early population aggregates in an effort to foster integration and cooperation. However, conformity, as we perceive it, in potting traditions may be misleading in the Casas Grandes area. In places such as the Hohokam or Mimbres areas, such restrictive paste recipes could be interpreted as evidence for social rigidity, but due to the fact that the Sierra Madre Occidental presents such an ample array of suitable raw materials, Casas Grandes potters seem unlikely to experience that pressure.

Hegmon and colleagues' (2008) argument is compelling and clearly presages the introduction of such far-reaching and integrating ideological forces like those associated with Salado polychromes and White Mountain Red Wares during the Pueblo IV period and it is a narrative that fits much of the social changes in the Southwest. I suggest an alternative conversation may be more productive for the Casas Grandes area as well as some aspects of the Greater Southwest. Not all cultural practices may be evidence for the introduction of new socially-binding ideas, but rather may indicate a reinvigoration of older more deeply-held beliefs as to how people should articulate with their environment.

Sites associated with the Pueblo III period and perhaps most famously those associated with Chaco Canyon are not perceived by modern Pueblos in the most positive light. Many oral narratives refer to places that people lived in the past, but whose residents succumbed to various forms of moral depravity resulting in their inevitable destruction (Courlander 1971; Cushing 1890; Parsons 1939; see Kantner 2004 for discussion). Much of poor conduct that occurred at such places is described as people inflicting harm upon their fellows, but certainly extreme environmental changes resulting in prolonged droughts would also seem to indicate that these inhabitants were also out of step with their environments as well.

Though responses to this social deviance in regard to human relationships is something that has received significant disciplinary attention by archaeologists working with Pueblo IV materials (Crown 1994, 1996; Clark 2001; Clark et al. 2013; Triadan 1997; VanPool and Savage 2010; VanPool and VanPool 2006), those cultural shifts that may be directed at peoples' physical surroundings are less well-explored.

An exception to the overall pattern within our discipline is an exploration of Pueblo III towers within the northern San Juan by Van Dyke and King (2010). These towers exhibit an array of physical forms and have been identified in many distinct locations. Through time, towers have been interpreted as defensive features, lookouts, signaling stations, astronomical observatories, storehouses, and ceremonial structures. Van Dyke and King (2010) break with these typically functional explanations for these towers and instead investigate what they may mean within the communities in which they were erected. Van Dyke and King (2010: 352) argue:

> “Towers were not simply spaces to contain behaviors...All architecture embodies ideas about the social world. Unusual, highly visible architecture often intentionally conveys symbolic concepts...Towers also are strongly associated with features that, in Pueblo oral traditions, are places of emergence. In Pueblo cosmology, contemporary people inhabit the latest in a series of layered worlds. Kivas, water, subterranean cavities, and earlier sites—features strongly associated with towers—can all be considered symbolic conduits to the world below. In the storied Pueblo past, when corrupt social practices or ritual neglect led to environmental and social chaos, virtuous ancestors escaped the turmoil by climbing upwards to a new and better world. We suggest that ancient tower builders may have been attempting to escape chaotic Pueblo III circumstances by ascending—symbolically—to the next world.”

I make a similar argument for the behaviors enacted to make Casas Grandes polychromes. In the act of making a pot many Puebloan potters maintain an understanding that they are not only communicating with other people through the vessels form and decorative motifs, but are also interacting with the pot itself is a living being (VanPool and Newsome 2012). By extending this modern cultural perception the threat of ethnographic tyranny is credible, but VanPool and Newsome (2012) have constructed a convincing argument that this is likely the case for Casas Grandes potters as well. The remainder of their discussion, however, explores insights regarding decoration and where and in what form these vessels are subsequently recovered by archaeologists. I would like to extend this conversation to include insights regarding the cultural practices involved in manufacturing pots.

Native potters, and all precontact craftspeople, are overtly competent materials scientists. However, Native scientists operate under a distinct set of guiding principles, in comparison with modern Western scientists. Specifically, Cajete (2004: 46) writes:

> "Native American philosophy of science has always been a broad-based ecological philosophy, based not on rational thought alone, but also incorporating to the highest degree all aspects of interactions of 'man in and of nature,' i.e. the knowledge and truth gained from interaction of body, mind, soul, and spirit with all aspects of Nature."

In contrast to Western science, Native scientists recognize that:

> "[The] world of nature is in constant flux; therefore, Native science does not attempt to categorize firmly within the domains of ideas, concepts, or laws form only through an analysis bent on specific discovery, as is the case in Western scientific analysis. Rather, Native science attempts to understand the nature or essence of things. This does not mean the exclusion of rational thought, but rather the inclusion of heart and being with rational perception to move beyond the surface understanding of a thing to a relationship which includes all aspects of one's self" (Cajete 2004: 52).

Rather than prediction and control, goals of Western science, Native science prioritizes meaning and understanding (Cajete 2004: page: 46), emphasizing that

Native people are “people of place, and the nature of place is embedded,” providing “a kind of 'map' they carry in their heads and transfer from generation to generation. This map is multidimensional and reflect the spiritual as well as mythic geography of a people.”

Ultimately, the results of my dissertation have lead me to question my understanding of place, physical landscape, and raw materials and how this understanding stands in marked difference to that of Native peoples. Ultimately, I identified two clear sets of raw materials used throughout the Casas Grandes region, to manufacture the clay bodies of vessels. I also determined that potters painted Chihuahuan polychromes using a minimum of three distinct recipes comprised of manganese, lead, copper, and iron. This unexpected combination of elements has lead me to consider the likelihood that multiple raw resources were used to create the same black paint. This mixing, given the fact that three recipes are recognizable, is not haphazard.

By examining multiple aspects of pottery using several distinct techniques, I have determined that Casas Grandes potters are articulating themselves with their environment in clear, consistent and geographically persistent ways. Given the absence of any overt functional or environmentally-determined underlying causes, I suggest that the combination of elements resulting in black pigments, for example, could be tied to cosmological concerns with raw pigment rocks exhibiting colors often associated with directionality and world-making (Britton 2013). Similarly, without clear functional motivations for targeting such specific raw clays, I suspect that Casas Grandes potters' strong preferences are driven by non-Western conceptions of what is usable and proper. What is more, I mobilize VanPool and Newsome's (2010) argument that pots are “made beings,” and argue that Casas Grandes potters' adherence to specific modes of manufacture is possibly tied to understandings of how people are related, properly, to their physical world.

Explaining these patterns as being “ritualistic” in nature, though, is dismissive of Indigenous potters as it presumes that potters privilege superstition and ritual over being successful technologists and scientists in their own right. As Cajete (2004: 52) writes: “Native science is about creating the inner sensibilities of humans, or the inner ear, which hears the subtle voice of nature.” By regarding ritualistic behavior as superficial or rationally groundless, a large aspect of Native life is summarily dismissed and avoided by tone deaf archaeologists. Given the fact that the foundations Casas Grandes potting traditions appear to be situated within a time period otherwise typified by discord, it seems appropriate to consider such profound and patterned behaviors as an attempt to mediate the relationship between people and the natural world and not just that between human individuals or groups.

Appendix A:

Descriptions of Formal Types

Definitions and Discussions of Casas Grandes Polychromes:

Ramos Polychrome:

Prior to the development of the Joint Casas Grandes Project's (JCGP) ceramic typology, Ramos Polychrome is referred to as Chihuahua Painted Ware (see Kidder 1916), Fine Polychrome (see Carey 1931), and Casas Grandes Polychrome (see Brand 1935; note: Brand referred to Ramos and Babícora Polychrome, collectively, as Casas Grandes Polychrome) in early 20th Century archaeological literature. These terms, however, are largely unused in current literature. Whereas Di Peso, Rinaldo, and Fenner's (1974: vol. 6) description of Ramos Polychrome does not necessarily contradict these other, early descriptions, it most specifically relies on Sayles' (1936a, 1936b) work with Chihuahuan ceramics.

The three diagnostic characteristics that define Ramos Polychrome are as follow: 1) a light-colored, finely-textured paste, 2) the presence of red painted elements outlined in black, and 3) the vessel, overall, exhibiting fine-lined brushwork. Photographs of examples of Ramos polychrome sherds from Sayles' collection are presented, below (see Photographs A.1 and A.2).

Photograph A.1: Photograph, taken with Dino-Lite digital, hand-held microscope, of exterior of Ramos polychrome sherd, inventory number EBS00050. The red element is clearly outlined in black, lines are thin and regular, and the ceramic body is light-colored.

Photograph A.2: Photograph, taken with Dino-Lite digital, hand-held microscope, of a cross-section of Ramos polychrome sherd, inventory number EBS00050. The paste is fine-textured and light-colored.

Additionally, Di Peso, Rinaldo, and Fenner (1974: vol. 6) identified three variants of Ramos Polycrome, referred to as Standard, Black-on-White, and Capulín, but these terms will not be utilized in the course of my dissertation. The Black-on-White variety of Ramos Polychrome is defined by an absence of red paint and is not distinguishable in sherd-form as a whole vessel is required to verify the absence of all red paint (Di Peso et al. 1974: vol. 6). The Capulín variant is a finely painted vessel where red elements are not outlined in black (Di Peso et al. 1974: vol. 6). I would argue that this variant is probably better described, given more recent observations, as White-Paste Babícora Polychrome, to be discussed later, especially as red elements outlined in black ought to be firm diagnostic for Ramos Polychrome identification. Another possible variant, utilized by Whalen and Minnis during the course of their field work, includes Coarse Ramos Polychrome, which I will discuss, below, under the sub-heading "additional types."

As a rule, Ramos Polychrome vessels are significantly more likely to appear as jars, rather than bowls, a trend that is common throughout the Casas Grandes polychrome suite (Di Peso et al. 1974: vol. 6; Whalen and Minnnis 2009, 2012). For example, approximately 86% of Ramos polychromes recovered at Paquimé by the JCGP were identified as jars, whereas only 14% are bowls (Di Peso et al: vol. 6, 251). Importantly, though not a diagnostic set of characteristics, in comparison with other Chihuahuan polychromes, Ramos Polychrome exhibits the greatest variety of layout patterns, decorative motifs, and elements (Di Peso et al. 1974: vol. 6; Whalen and Minnnis 2009, 2012). Black paint is generally mineral, which is typical of all Casas Grandes polychromes, and glaze-painted vessels are permitted within the type, though this characteristic is not diagnostic. Major, structural line work is usually executed in black paint and figures are usually filled with black rather than red paint (Di Peso et al. 1974: vol. 6). Though uncommon, I have observed a distinctive variation on this tendency, however, where elements are filled with red paint and the black-outlining-red rule is inverted, with black elements being outlined in red paint. This decorative style is rare, but distinctive and visually striking. Significantly, Ramos Polychrome is currently the only polychrome within the Casas Grandes world that demonstrates any temporal sensitivity, appearing after approximately AD 1300 (Whalen and Minnis 2009, 2012).

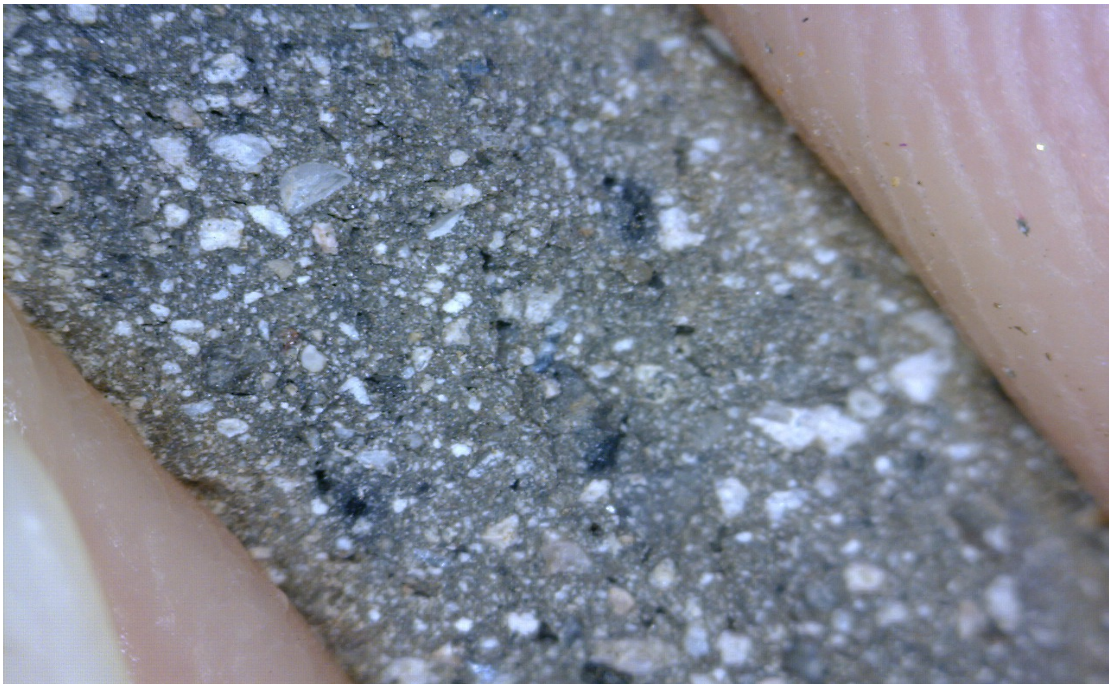
Babícora Polychrome:

As with the description of Ramos Polychrome, Di Peso, Rinaldo, and Fenner (1974: vol. 6) rely heavily on Sayles' (1936b) descriptions of Babícora Polychrome, though the authors further elaborate upon Sayles' observations. In earlier literature, Babícora Polychrome is sometimes referred to as Inferior Casas Grandes Polychrome (see Brand 1943), a designation that references the fact that Babícora Polychrome is generally perceived as less well executed in comparison with other Casas Grandes polychromes, most especially Ramos Polychrome.

It is not entirely inaccurate to describe Babícora Polychrome as a catch-all ceramic identification for Casas Grandes polychromes that do not fall into other type designations. Babícora Polychrome itself does not maintain its own diagnostic attributes, but is rather defined by those distinctive attributes that other polychromes have, and Babícora Polychrome lacks. Whalen and Minnis (2012) make a similar observation, stating that Babícora polychromes share the most characteristics with other polychromes within the Casas Grandes polychrome suite, than any other single formal type.

As briefly mentioned previously, Babícora Polychrome is recognized for having poorly executed line work, often referred to as “sloppy,” in comparison with other ceramic types, such as Ramos Polychrome (Di Peso et al. 1974: vol. 6; Whalen and Minnis 2009, 2012). Additionally, Babícora Polychromes exhibit free red elements, not outlined in black, as is diagnostic for Ramos Polychrome, do not have a slip, and typically lack glaze paint. Examples of a Babícora polychrome sherd are presented, below (Photographs A.3 and A.4). However, glaze or sub-glaze paints are not prohibited by the type description. In contrast to Ramos Polychrome, design layout and motifs are more repetitive, exhibiting less variety, and the paste ranges in color from light brown to gray (Di Peso et al. 1974: vol. 6).

Photograph A.3: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Babícora polychrome sherd, inventory number EBS00047. Linework is sloppy, red elements are not outlined in black paint, and the ceramic body has a tendency to be more buff or brown in color.



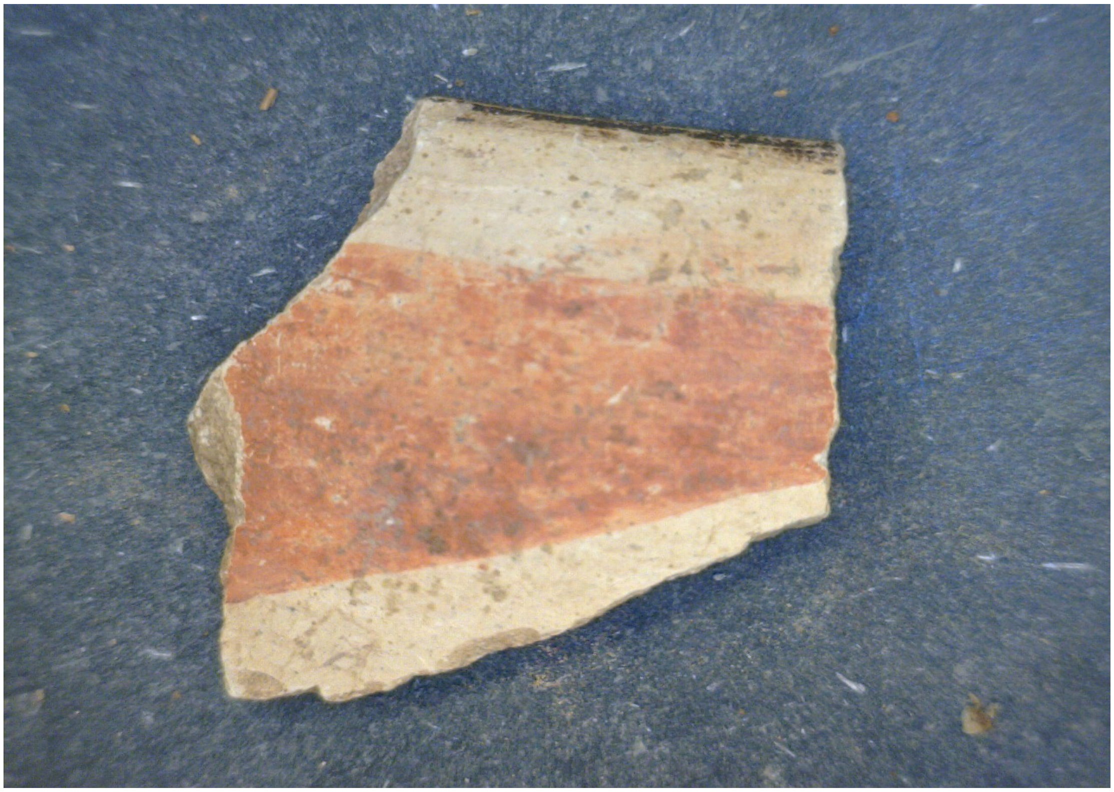
Photograph A.4: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Babícora polychrome sherd, inventory number EBS00047. Clearly, the paste color is somewhat altered by the deposition of dark, organic material, like during the firing process, but overall, the color is much darker than that of Ramos polychromes and the inclusions are significantly coarser.

Di Peso, Rinaldo, and Fenner (1974: vol. 6) identified two variants of Babícora Polychrome: Standard and Paquimé, the second of which is distinctive in that it is finer-lined than its Standard counterpart. It is distinct from the Capulín variant of Ramos Polychrome in that the Paquimé variant of Babícora Polychrome shares the Standard variant's paste color rather than that of Ramos Polychrome. More recently, Jane Kelley and her colleagues have identified a possible Babícora Polychrome relative, through their work during the Proyecto Arqueológico Chihuahua (PAC) located in more southern portions of the Casas Grandes world, which they refer to as Santa Ana Polychrome (Larkin et al. 2004). Santa Ana Polychrome is frequently described as a potentially early version of Babícora Polychrome, that is distinct from the more-widely recognized type in that motifs are limited to lines and chevrons, in contrast to Babícora Polychrome vessels that exhibit a more diverse assemblage of motifs including triangles and interlocking scrolls (Larkin et al. 2004). Additionally, in contrast with Santa Ana Polychrome, Babícora Polychrome is much more widely distributed than Santa Ana Polychrome, though this difference in geographic distribution may be due, in part, to how archaeologists are trained to recognize ceramic types. In addition to Santa Ana Polychrome, Whalen and Minnis use a type variant they refer to as Babícora Ramos-Style, discussed more extensively under the sub-heading "additional types."

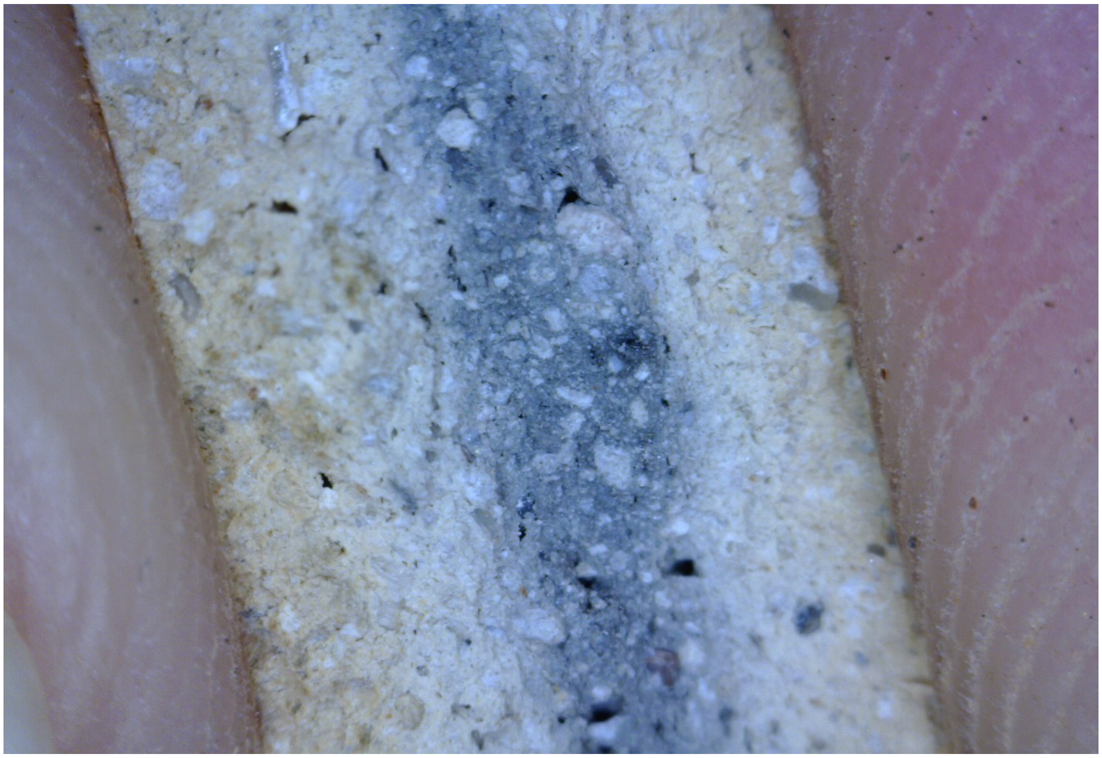
These variants, and potentially distinct ceramic types, exist in the literature, but I will not make common use of these terms in the course of my dissertation. They exist in the literature, as it stands, but making these finer distinctions doe not seem to be an overly productive undertaking for my own dissertation. From this point, I will use a Babícora Polychrome variant, identified by Whalen, and Minnis, and Todd Pitezel: White-Paste Babícora Polychrome.

White-Paste Babícora Polychrome (Babícora Polychrome variant):

The phrase, White-Paste Babícora Polychrome, is a descriptive term that Whalen and Minnis (2009, 2012) use to identify this variant based on its light-colored, finely-textured paste, a diagnostic attribute of Ramos Polychrome, with design elements that are more typical of standard Babícora including sloppy line-work and red elements free of black outlining. Originally identified through their work at Site 204 (the Tinaja Site), the variant has also been identified at other sites, including Paquimé, which verifies the type is not exclusive to Site 204. Whalen and Minnis (2009, 2012) suggest that this amalgamation of characteristics may be indicative that White-Paste Babícora Polychrome represents an intermediate between standard Ramos and Babícora Polychrome. I have adopted the use of this variant as the distinction is useful to me in the combination of attributes suggests an interesting interplay between geologic fact (the availability of white-firing clays) and cultural choice (both the use of white-firing clays in addition to choice in decorative style). Photographs of an example of a White-Paste Babícora polychrome are presented, below (Photographs A.5 and A.6).



Photograph A.5: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a White-Paste Babícora polychrome sherd, inventory number EBS00035. Red elements are not outlined in black, but this variant shares a light-firing paste with Ramos polychromes.

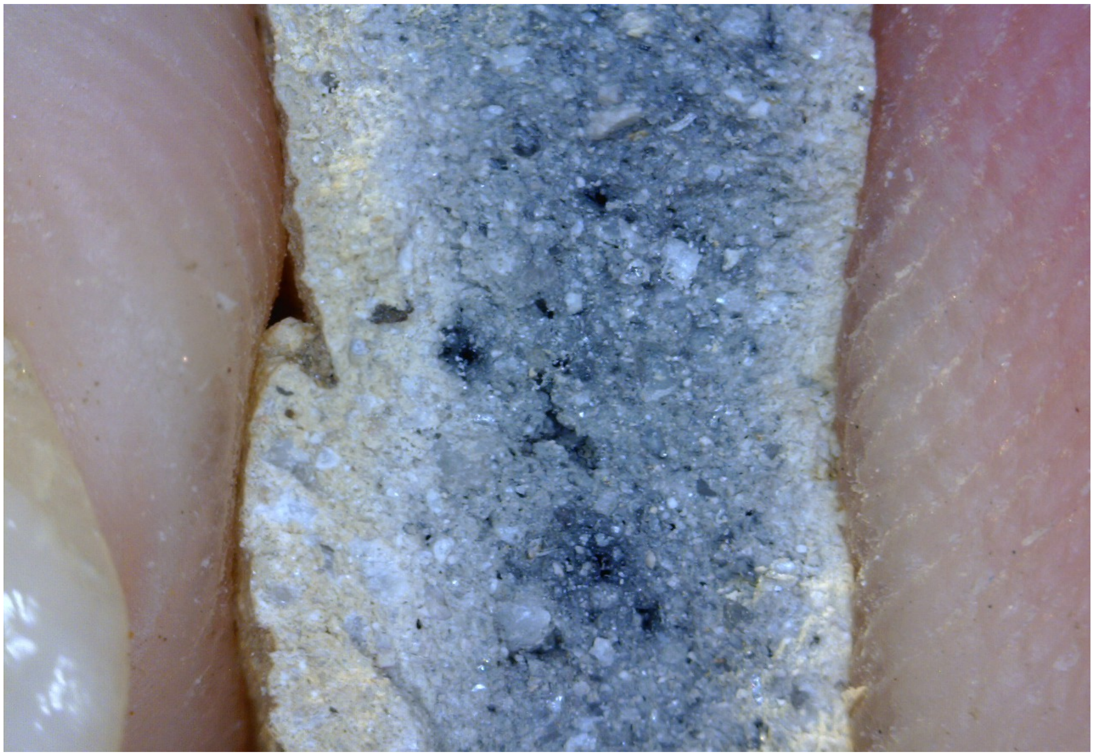


Photograph A.6: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a White-Paste Babícora polychrome sherd, inventory number EBS00035. Paste color is similar to that of Ramos polychromes.

Dublán Polychrome:

Dublán Polychrome is a relatively uncommon Casas Grandes polychrome type. The number of sherds and vessels recovered by the JCGP and its associated excavations was so low that Di Peso and his colleagues (1974: vol. 6) consulted with existing museum collections in order to form a type description. These pots typically exhibit a light tan paste and are identified by simple black and red lines painted over a finely corrugated neck. This corrugation normally stops long before the shoulder of the vessel, leaving most of the pot undecorated. As the paint-and-corrugation combination is necessary for positive identification, assigning sherds to this formal type is difficult. Photographs of Dublán polychromes sherds are presented, below (see Photographs A.7 and A.8). For a clearer understanding of the stylistic layout typically associated with Dublán polychromes, see Photograph A.9.

Photograph A.7: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Dublán polychrome sherd, inventory number EBS00027. Painted lines drawn down across corrugated bands are the most striking, diagnostic feature of this polychrome type.



Photography A.8: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Dublán polychrome sherd, inventory number EBS00027. Paste color is light-colored.

Photograph A.9: Image used courtesy of the Maxwell Museum. This example of Dublán Polychrome may be somewhat more stylistically complex than is generally suggested by sherds recovered at sites. As with Photograph X, above, sherds tend to exhibit corrugation with black and red lines painted diagonally across the corrugations. However, the whole pot pictured above does provide an overall visual description of corrugated neck followed by a plain, often-burnished rounded base.

Corralitos Polychrome:

Di Peso, Rinaldo, and Fenner (1974: vol. 6) identified three variants of Corralitos Polycrome, including Textured, Punched, and Non-Punched, expanding on Sayles' (1936b) descriptions. I am skeptical that these variants should be subsumed under the type description of Corralitos Polychrome. Specifically, Textured and Punched vessels seem to lack black paint and also appear to exhibit different design layouts and elements than what I would consider as true Corralitos Polychrome. These shifts in style may mark them as distinct. These observations remain only as a potential differentiation marker however, as I have admittedly seen little of either the type or its variants and will refrain from making a final judgment, at this time. Earlier literature refers to Corralitos Polychromes as Chihuahuan Red Ware (Kidder 1916) and Corralitos Polychrome Incised (Sayles 1936b). Typically, Corralitos Polychrome is distinguished by a yellow-red paste and, most importantly, by painted elements bounded by incised lines (see Photographs A.10 and A.11). Design layouts tend to be simplistic, band forms and design elements are geometric and repetitive.

Photograph A.10: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Corralitos polychrome sherd, inventory number EBS00437. Incised lines separate the painted elements.

Photograph A.11: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Corralitos polychrome sherd, inventory number EBS00437. Paste is somewhat more yellow in tone in comparison with other Casas Grandes polychromes.

This formal type can be difficult to identify as most of the decoration appears above the shoulder of the vessel, leaving large amounts of the pot undecorated. Undecorated portions of a Corralitos vessel, in sherd-form, would be impossible to attribute to the formal type-description. Overall, Corralitos Polychrome is a relatively uncommon ceramic type. Di Peso and colleagues (1974: vol. 6) note that Corralitos Polychrome is much more likely, in comparison with other ceramic types, to occur as double vessels connected by a tube (see Photograph A.12). This observation may be skewed due to the small sample size and its reliance on recovering whole vessels. However, it does suggest the possibility that this formal type may have had a distinct function not shared with other ceramic vessels. I have identified few Corralitos polychrome sherds during my work with Casas Grandes collections and have little to add to this description, as a result.

Photograph A.12: Image of Corralitos polychrome vessel, courtesy of the Maxwell Museum.

Carretas Polychrome:

Di Peso, Rinaldo, and Fenner's (1974: vol. 6) description of Carretas Polychrome is an elaboration upon Amsden (1928), Sayles (1936b), and Brand's (1935) descriptions from their own work with Casas Grandes ceramics. Brand (1935), specifically, described Carretas Polychrome as being included of his description of Huerigos Polychrome. The distinction between the two was later made by Di Peso and his colleagues. In other earlier literature, Amsden (1928) referred to Carretas Polychrome, as Peripheral Casas Grandes, whereas Gladwin and Gladwin (1934) named the ceramic type Nacozari Polychrome.

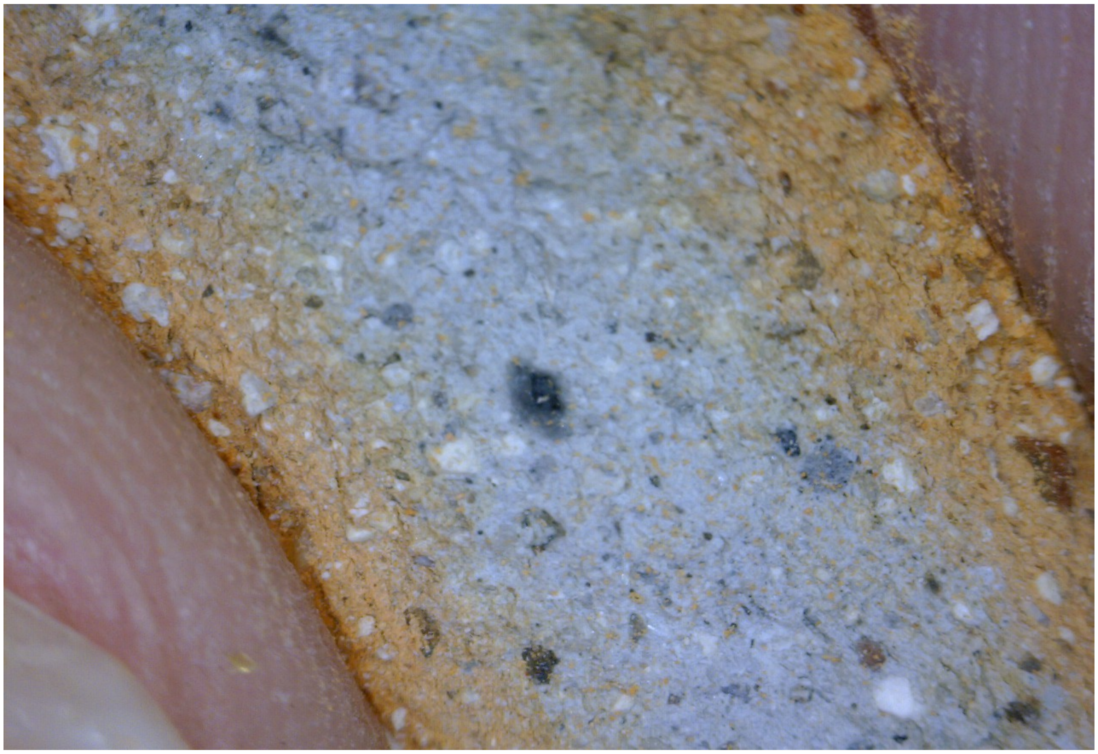
According to Di Peso, Rinaldo, and Fenner (1974: vol. 6) Carretas Polychrome is identified by its thick glaze or sub-glaze paint and a typically red-yellow paste. Carretas Polychrome is distinguished from Huerígos Polychrome in that it lacks a white slip. Significantly, from my own observations of Casas Grandes decorated wares, I have made a distinction from Di Peso and his colleagues' work. After the excavations and laboratory analysis for the JCGP was concluded, the final description of Carretas Polychrome included two variants: Standard and Black-on-Orange. Standard Carretas Polychrome exhibits black glaze, or sub-glaze, and red paints on a surface that significantly ranges in color, from buff to orange, whereas the Black-on-Orange variant presents black glaze or sub-glaze paint on an orange body, without red elements. In my own experience with Casas Grandes polychromes, I have failed to see any striking difference between many of Di Peso's Standard Carretas

Polychromes and Standard Babícora Polychrome, especially as glaze and sub-glaze paint is not expressly prohibited by the description of Babícora Polychrome. For this reason, I identify the combination of glaze or sub-glaze paint with the orange-colored ceramic body as being a distinctive combination of attributes that define Carretas Polychrome. It is impossible to further distinguish the Black-on-Orange variant as I am working with sherds rather than whole vessels.

I find the inclusion of non-orange colored vessels within Di Peso and colleagues' (1974: vol. 6) definition of Carretas Polychrome problematic as buff-colored vessels could be effectively lost, indistinguishable, if placed among a collection of Babícora-identified ceramics, especially in sherd-form. The JCGP's inclusion of these more buff-colored ceramics within the designation of Carretas Polychrome may, in part, be related to the prevalence of bowls within the type. Though not diagnostic, by the JCGP or my own estimations, Carretas Polychrome vessels are significantly more likely to appear in the form of bowls, rather than jars, which is unusual for Casas Grandes polychromes. According to the JCGP's counts, 58.4% of identified Carretas polychromes were bowls, and 41.6% were jars (Di Peso et al. 1974: vol. 6, pg. 199). This is in contrast to Ramos Polychrome (bowls: 14.3% jars: 85.7%) or Babícora Polychrome (bowls: 10.9% jars: 89.1%). Ultimately, I am concerned that buff-colored, glaze-painted bowls, have been identified as Carretas polychromes, more based on their bowl-form, rather than any other characteristic.

As form is not diagnostic among any of the Casas Grandes polychromes, I have restricted my own determination of sherds as belonging to the Carretas type-description by the presence of an orange-colored body and glaze or sub-glaze paints (see Photographs A.13 and A.14). Again, this serves the purposes of my own dissertation in that paste color, as with White-Paste Babícora Polychrome, is suggestive of geologic origin in addition to cultural choice. By organizing overtly orange-colored pastes within the category of Carretas Polychrome, I have reorganized, roughly and in a solely preliminary capacity, which sherds may be derived from similar geologic sources. Admittedly, this practice does increase the overall diversity and "catch-all" nature of Babícora polychromes themselves.

Photograph A.13: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Carretas polychrome sherd, inventory number EBS00043. An orange-firing ceramic body and black glaze-paint is evident in this photograph.



Photograph A.14: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Carretas polychrome sherd, inventory number EBS00043. Though the core is grey, the fully-oxidized edges of this cross-section are distinctly orange in color.

Huerigos Polychrome:

Huerigos Polychrome was separated from Carretas Polychrome by both Sayles (1936b) and, later, Di Peso and his colleagues during the JCGP (1974: vol. 6). However, Huerigos Polychrome has been previously subsumed under the Carretas Polychrome type-description (Brand 1935), and Peripheral Casas Grandes (Amsden

1928). Regardless of how early 20th Century archaeologists organized the decorative style, it is distinct from Carretas Polychrome in that is differentiated by the presence of a white slip, which is entirely absent from Carretas Polychrome, and relatively unusual among Casas Grandes ceramics (Di Peso et al. 1974: vol. 6).

In addition to the white slip, Huerigos Polychrome, typically, has a light red-brown paste and is known for a glaze or sub-glaze black paint (see Photographs A.15, A.16, and A.17). This characteristic is also common to Carretas Polychrome. However, the glaze-like paint marks it as different from Villa Ahumada Polychrome, the only other Casas Grandes polychrome identified by the presence of a white slip. The white slip on Huerigos Polychrome vessels tends to be harder, thicker, and more resilient to post-depositional processes than Villa Ahumada Polychrome, which has a diagnostic white slip that has a tendency to be chalky, thin, and prone to flaking. Huerigos Polychrome can be identified through the combination of these two, otherwise shared characteristics.

Photograph A.15: Photograph, taken with Dino-Lite digital, hand-held microscope, of the interior of a Huerigos polychrome bowl, inventory number EBS00051. A hard white slip and glaze-paint are evident.

Photography A.16: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Huerigos polychrome bowl, inventory number EBS00051. The white slip is absent on the exterior, but the black glaze paint is still clearly present.

Photograph A.17: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Huerigos polychrome bowl, inventory number EBS00051. The paste is brown in color, which stands in contrast to the hard, white slip on the interior.

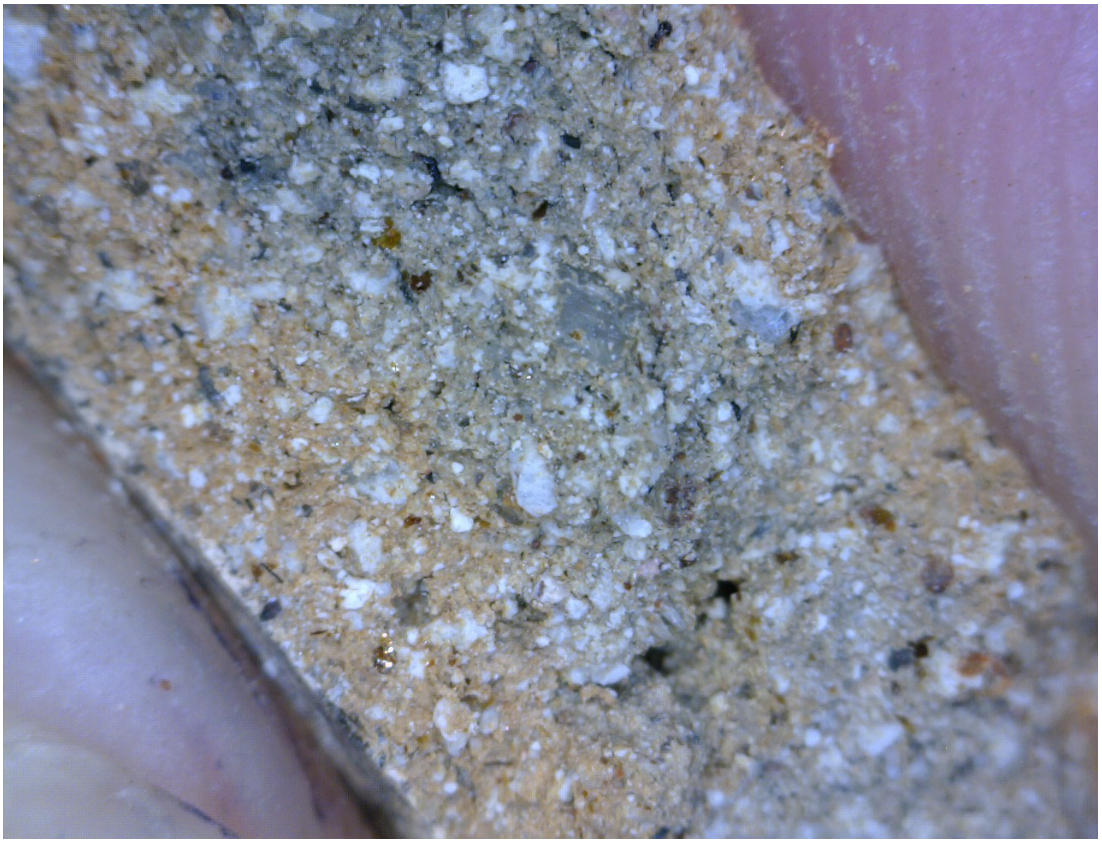
Villa Ahumada Polychrome:

Di Peso, Rinaldo, and Fenner (1974: vol. 6), as with other ceramic descriptions, relied heavily on Sayles' (1936b) observations in the construction of their characterization of Villa Ahuamda Polychrome, though they derived some attributes from others, including Brand (1935), Hawley (1950), and Lister (1958).

Prior to the creation and use of the Villa Ahumada type-designation, this collection of ceramics was described and Red and Black on White Slip (Carey 1931), and Galeana Polychrome (Gladwin and Gladwin 1934).

Villa Ahumada Polychrome is recognized by a light gray to brown paste and is most immediately distinguished by its frequently chalky, white slip (Di Peso et al. 1974: vol. 6)(see Photographs A.18 and A.19). It is not uncommon that the slip on many Villa Ahumada sherds to be almost entirely abraded off the surface of the ceramic, due to post-depositional actions. Black matte paint is the standard for all Villa Ahumada polychromes whereas glaze paint would mark the sherd or vessel as Huerigos Polychrome. Villa Ahumada vessels tend to exhibit a band layout, rather than a quadripartite arrangement, and motifs tend to be geometric and repetitive, demonstrating less variety than other polychromes, such as Ramos Polychrome (though this tendency is not diagnostic) with some vessels demonstrating intricate designs. Di Peso and his colleagues (1974: vol. 6) identify multiple Villa Ahumada Polychrome variants, including Standard, Ramos, Capulín, and Memmott, but I will not discuss, nor use, these distinctions over the course of my dissertation.

Photograph A.18: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Villa Ahumada polychrome jar, inventory number EBS00105. The white slip is soft and flaky, especially in contrast to Huerigos Polychrome. The black paint is matte.



Photograph A.19: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Villa Ahumada polychrome jar, inventory number EBS00105. The paste is coarse and brown-colored.

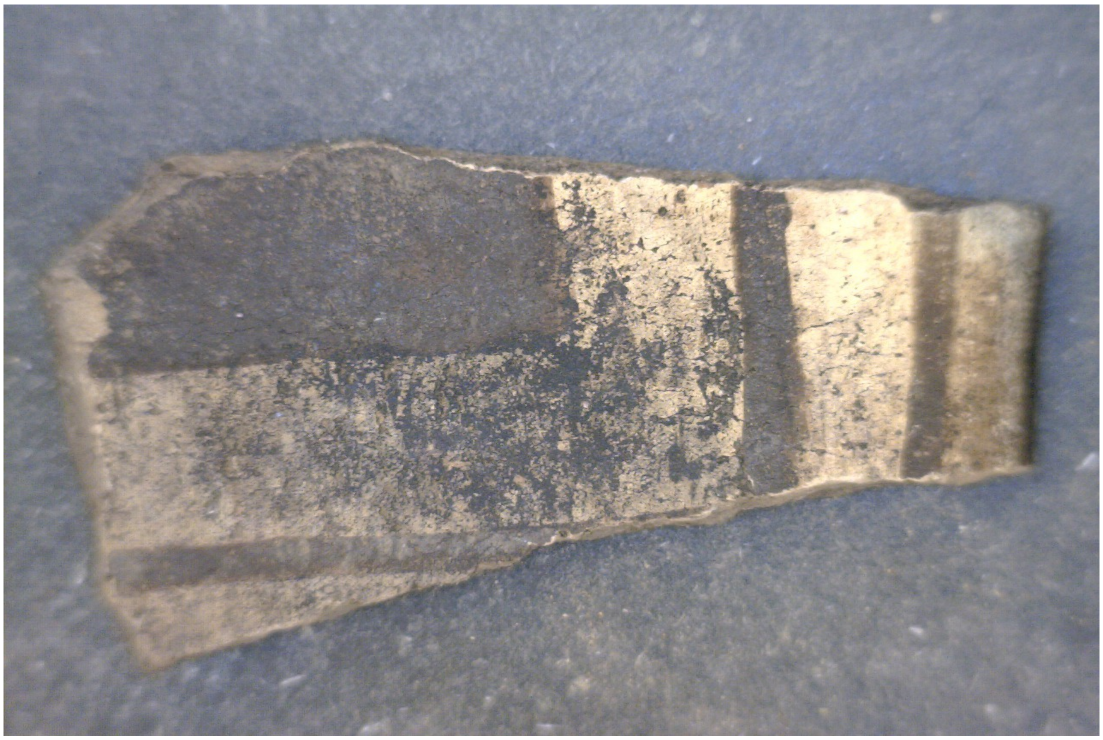
Escondida Polychrome:

Escondida Polychrome is an interesting Casas Grandes polychrome in that it has a long history of being compared to Salado polychromes, in the American Southwest, a strong allusion to the Casas Grandes region's northern neighbors which is practically absent in discussion of other polychrome types in the suite (Brand 1943;

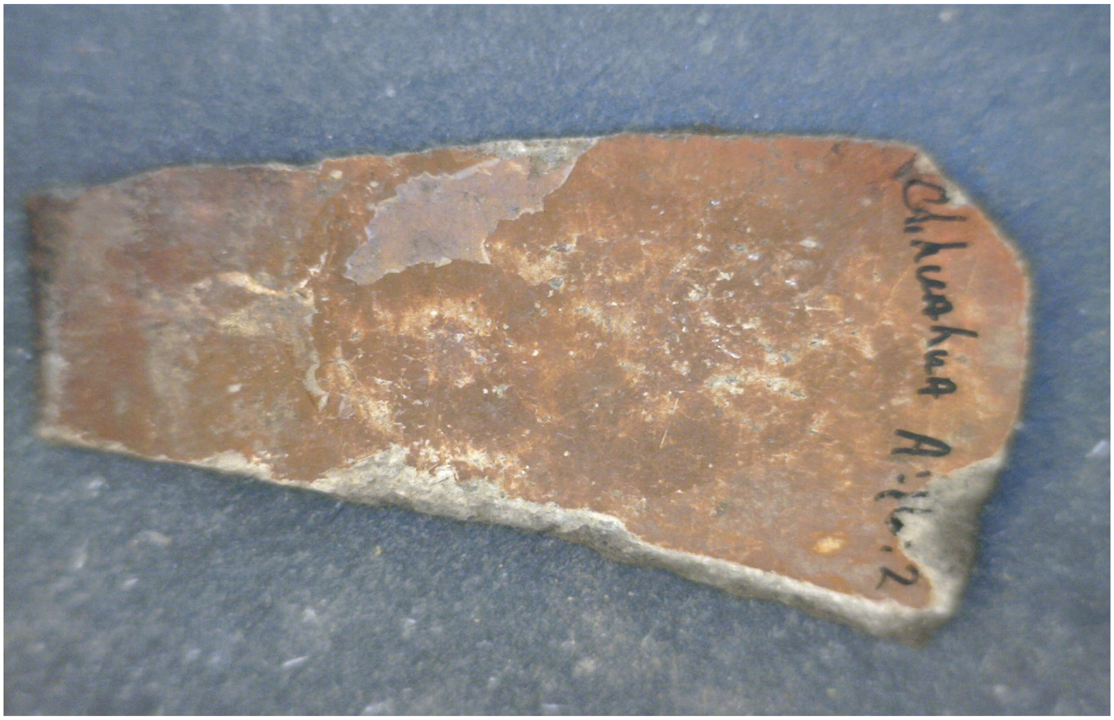
Di Peso et al. 1974: vol. 6; Gladwin 1957; Kidder 1916; Sayles 1936b). The similarity between the two regional types is reflected in how archaeologists have referred to this type, through time, which includes terms like Imitation Gila Polychrome (Kidder 1916), Gila-like Polychrome (Brand 1943), Ramos Polychrome with Salado influence (Sayles 1936b), Local Gila Polychrome (Gladwin 1957), and, finally, by Di Peso and his colleagues (1974: vol. 6) when they distinguish Escondida Polychrome as having two variants, Gila and Tonto. Importantly, whereas many archaeologists have recognized a passing resemblance between Escondida and Salado polychromes, no studies, of any variety, have confirmed or denied a possible relationship between the two. However, results on how stylistically similar, or not, these two types are, in actuality are pending.

Escondida Polychrome is defined by white-colored, finely-textured paste, similar to that of Ramos Polychrome and White-Paste Babícora Polychrome (Di Peso et al. 1974: vol. 6; Whalen and Minnis 2012)(see Photographs A.20, A.21, and A.22). It is unlike Salado polychromes, as well as Huerigos and Villa Ahumada polychromes within the Casas Grandes world, in that it lacks a white slip. However, Escondida's naturally white exterior creates the appearance that the red and black painted elements appear against a light-colored backdrop, as with other slipped ceramic types. There is, however, use of red slips, especially on the exteriors of bowls. Black paints may be matte, glaze, or sub-glaze. Glaze-painted Escondida polychromes, specifically, are rare, but paint is not diagnostic of the ceramic type as a whole (Di Peso et al. 1974:

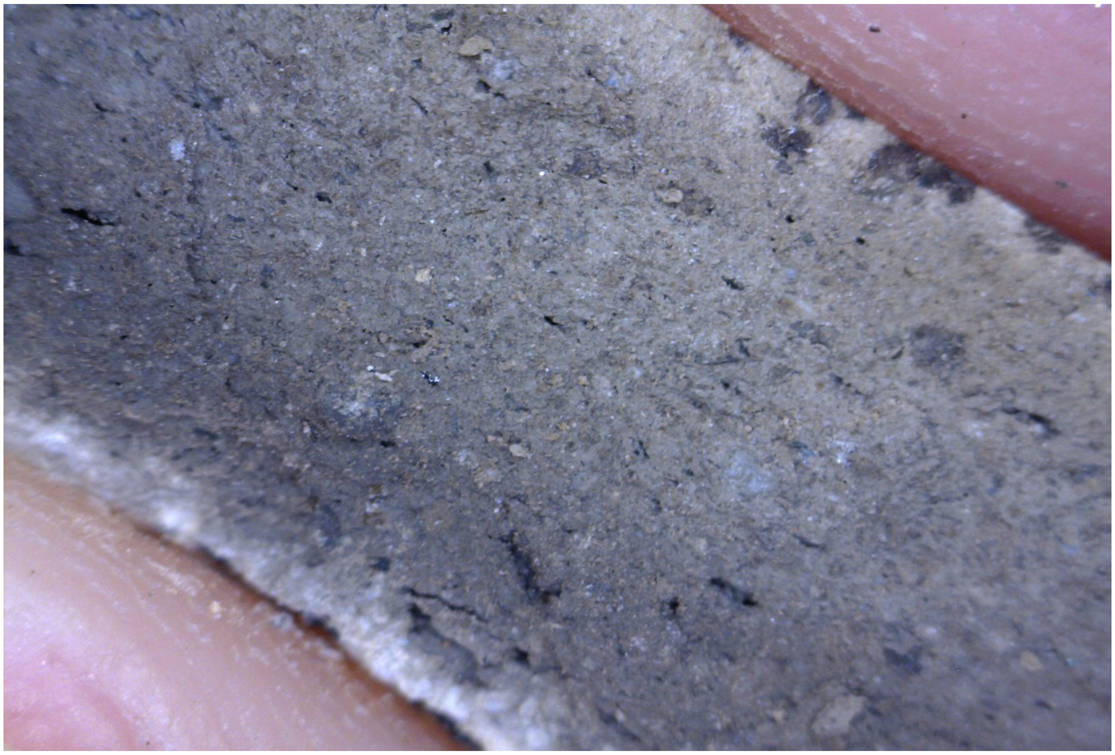
vol. 6).



Photograph A.20: Photograph, taken with Dino-Lite digital, hand-held microscope, of the interior of a Escondida polychrome bowl, inventory number EBS00110. The interior of this vessel is characterized by a white-firing ceramic body and a sub-glaze black paint.



Photograph A.21: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Escondida polychrome bowl, inventory number EBS00110. A red slip is evident.



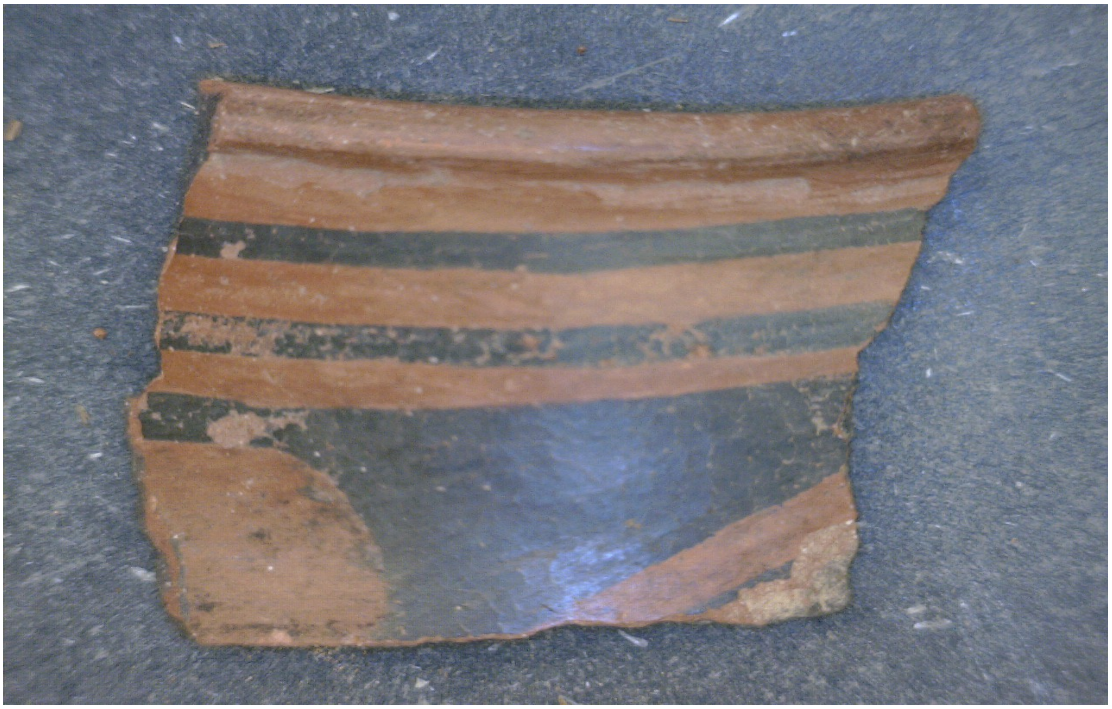
Photograph A.22: Photograph, taken with Dino-Lite digital, hand-held microscope, of the cross-section of a Escondida polychrome bowl, inventory number EBS00110. Organic deposition obscures the true color, but the paste is clearly lighter-colored and finer-textured than some Casas Grandes polychromes.

In addition to the use of a white backdrop for painted elements, Escondida's resemblance to Salado polychromes is largely due to the prevalence of “ribbon-like design” layouts (Sayles 1936b), which are similar to layouts executed on Salado polychromes and differs from the standard band and quadripartite layouts typical of other Casas Grandes polychromes. Other qualitative observations tying Escondida and Salado polychromes together include the presence of "bird-wing" motifs, though Escondida polychromes also exhibit a high number of macaw motifs, which links the ceramic type, stylistically, closely to Ramos Polychrome (Di Peso et al. 1974: vol. 6). This question of stylistic relationship to Escondida's immediate ceramic counterparts within the Casas Grandes region and with those to the north remains unanswered.

Additional Types:

In addition to the most common and widely recognized polychrome types, I also categorized ceramics uses the terms Madera Black-on-Red, Coarse Ramos Polychrome, Babícora Ramos-Style Polychrome, Red-on-Buff, and Indeterminate.

Technically not a polychrome, Madera Black-on-Red ceramic vessels are red-firing, self-slipping vessels that are usually highly burnished and painted with a black, matte mineral paint (see Di Peso et al. 1976: vol. 6)(see Photograph A.23). Through time, others, including Kidder (1916), Carey (1931), Brand (1935), and Sayles (1936b) have recognized this ceramic type in some form. Overall, Madera Black-on-Red vessels are somewhat uncommon, if not easily recognized. Di Peso noted that Madera Black-on-Red represented 1.1% of those sherds recovered during his excavations through the JCGP (Di Peso et al. 1976: vol. 6). I identified no Madera Black-on-Red sherds while working with materials from Site 204 and the Joyce Well Site.



Photograph A.23: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Madera Black-on-Red jar rim, inventory number EBS00034.

Coarse Ramos Polychrome and Babícora Ramos-style Polychrome vessels, alternatively, are true polychromes and terms used by Whalen and Minnis during their field activities. These types could be described as either Ramos Polychrome or Babícora Polychrome variants. Both of these variants describe a mix of decorative styles in combination with paste, providing for combinations unpredicted by standard type definitions. Photograph A.24, below, is an example of a Babícora Ramos-Style sherd, exhibiting the red-outlined-by-black rule combined with a more brown-colored ceramic body. These sherds are somewhat rare and whereas I assigned sherds to these type designations, I did not pursue additional data collection, through destructive techniques for example, due to their rarity. I determined that it was better to determine patterns among standard types, first, before introducing ceramics that combine stylistic characteristics.

Photograph A.24: Photograph, taken with Dino-Lite digital, hand-held microscope, of the exterior of a Babícora Ramos-style sherd, inventory number EBS00031.

Red-on-buff sherds, again not polychromes, are other examples of painted ceramics in Sayles' collections. Red, washy paint, usually simple lines, are inscribed upon unburnished, brown-firing ceramic bodies. It is possible that these ceramics represent sites with Viejo Period components. Red-on-buff sherds were recovered from Sites D:3:11, D:5:13, D:15:12, E:9:9, E:14:5, F:6:1, F:13:2, I:9:1, and I:9:11. Given that we know little about the Viejo Period, as previously discussed, it may be important to re-identify these sites for future research agendas.

A final category, "indeterminate," represents a variety of painted, punctated, incised, tool-punched, and otherwise decorated ceramics that do not fit into our largest and most common ceramic type descriptions. These sherds are not recognizable within other Southwest ceramic typologies, and, as such, I have assumed that these ceramics are most likely to be manufactured by Casas Grandes peoples within the Casas Grandes world rather than imports from areas outside the Casas Grandes world. Many of these ceramics could be from the Viejo Period, as well, but I do not currently have the expertise to determine this association. More simplistic ceramic styles are not necessarily a product of earlier time periods, but this possibility does exist.

Appendix B:

Background Information

Regarding E.B. Sayles' Surface

Collections

The nature of Sayles' collection is presented in Table B.1, below. These sites are represented by surface collections and minor excavations. Sites marked with an asterisk do not have accurate sherd counts for utilitarian wares. Not all sites contain painted ceramics and the utilitarian counts represent those that also contain painted wares. Painted wares have been split into two groups: Medio Period Casas Grandes polychromes ("CG") and Other painted wares ("Other"). These "other" painted wares are non-Chihuahuan and include recognizable Southwestern types, such as Mimbres Black-on-White and St. John's Polychrome, as well as El Paso Polychrome, which may be most common. I counted only clearly identifiable Southwest types in this category. Sherds that were ambiguous were assumed to be local Chihuahuan pottery and included in my analysis of Chihuahuan polychromes.

Site Designation	**Site Type**	**Ramos Black (Counts)**	**Playas Red (Counts)**	**Painted Wares (Counts)**
A:1:1	Rock Shelter	0	0	CG: 1 Other: 4
A:1:2	Village	0	0	CG: 0 Other: 1
A:1:3	No info	0	0	CG: 0 Other: 19

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
A:2:1	Rock Shelter	0	1	CG: 1 Other: 0
A:5:1	House Ruins	0	4	CG: 3 Other: 18
A:5:2	House	0	0	CG: 6 Other: 4
A:5:3	Small Village	0	1	CG: 3 Other: 6
A:5:4	Large Village	0	1	CG: 2 Other: 5
A:6:1	Camp Site	0	0	CG: 1 Other: 5
A:6:2	Camp Site	0	3	CG: 2 Other: 12
A:6:4	Camp Site	0	0	CG: 0 Other: 3
A:6:5	Camp Site	0	1	CG: 1 Other: 4
A:9:2	Camp Site	0	0	CG: 0 Other: 2

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
A:9:4	House	0	1	CG: 1 Other: 3
A:9:5	No info	1	0	CG: 7 Other: 10
A:10:2	House	0	2	CG: 4 Other: 11
A:11:1	House	0	1	CG: 5 Other: 11
A:16:1	Camp Site	0	0	CG: 5 Other: 1
A:16:2	House, Camp	7	8	CG: 84 Other: 39
A:16:3*	House	7	15	CG: 106 Other: 28
B:1:1	Small Village	0	4	CG: 0 Other: 6
B:1:2	Small Village	0	0	CG: 0 Other: 6
B:1:3	Camp Site	0	2	CG: 0 Other: 14

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
B:1:4	House?	1	0	CG: 1 Other: 16
B:2:1	Village	2	0	CG: 55 Other: 19
B:2:2	Camp Site	0	0	CG: 0 Other: 14
B:3:2	Camp, House	0	0	CG: 0 Other: 8
B:4:1	No info	0	0	CG: 15 Other: 23
B:4:2	House, Camp	0	0	CG: 3 Other: 46
B:4:3	Camp Site	0	0	CG: 0 Other: 14
B:4:4	Camp Site	0	0	CG: 0 Other: 9
B:13:1	House	2	3	CG: 8 Other: 5
B:15:1	Camp Site	No data	No data	All El Paso Polychrome, collection left at ASM

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
B:15:2	Camp with Stone Foundations	0	0	CG: 0 Other: 9
C:2:1	Camp Site	0	0	CG: 3 Other: 22
C:2:3	Camp Site	0	0	CG: 0 Other: 16
C:2:4	Camp Site	0	0	CG: 3 Other: 38
C:2:5	Camp Site	0	0	CG: 0 Other: 18
C:15:1	Camp Site	0	0	CG: 13 Other: 0
C:16:1	Camp Site	0	0	CG: 0 Other: 2
D:3:1*	House	0	7	CG: 81 Other: 9
D:3:2	House	0	1	CG: 1 Other: 0
D:3:3	House	0	1	CG: 1 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
D:3:4	House	0	0	CG: 12 Other: 3
D:3:5	Fortified Ruin	0	0	CG: 15 Other: 0
D:3:6	No info	0	2	CG: 1 Other: 0
D:3:7	No info	0	0	CG: 10 Other: 0
D:3:8*	No info	0	2	CG: 15 Other: 1
D:3:9	No info	0	3	CG: 20 Other: 0
D:3:10	House	0	1	CG: 1 Other: 0
D:3:11*	House	2	0	CG: 93 Other: 3
D:3:12	House	0	0	CG: 17 Other: 2
D:4:2	House	0	0	CG: 0 Other: 3

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
D:4:3	House	2	0	CG: 12 Other: 3
D:5:1	Pueblo	0	0	CG: 10 Other: 0
D:5:2	Pueblo	0	0	CG: 2 Other: 0
D:5:6	Boulder Foundations	0	0	CG: 21 Other: 4
D:5:10	Pueblo	0	0	CG: 8 Other: 0
D:5:11	Rock Shelter	0	0	CG: 7 Other: 0
D:5:13	Trincheras?	0	0	CG: 3 Other: 0
D:6:1	Pueblo	0	0	CG: 18 Other: 0
D:6:2	Pueblo	0	0	CG: 1 Other: 1
D:6:4	Pueblo	0	0	CG: 1 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
D:6:7	Pueblo	0	0	CG: 1 Other: 0
D:6:11	No info	0	2	CG: 10 Other: 2
D:7:1	House	0	0	CG: 5 Other: 0
D:7:2	House	0	0	CG: 5 Other: 0
D:7:3	House	0	1	CG: 4 Other: 0
D:7:4	House	0	0	CG: 10 Other: 2
D:8:1	House	0	2	CG: 8 Other: 0
D:8:2	House	0	0	CG: 4 Other: 0
D:8:3	House	0	1	CG: 5 Other: 0
D:8:4	House	0	0	CG: 5 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
D:9:1	Pueblo	0	0	CG: 18 Other: 2
D:9:2	Pueblo	0	0	CG: 11 Other: 0
D:12:1	House	0	0	CG: 8 Other: 0
D:12:2	House	1	0	CG: 10 Other: 0
D:12:4	No info	2	1	CG: 2 Other: 0
D:12:6	House	0	5	CG: 11 Other: 2
D:15:3	Houses in Shelter	0	0	CG: 3 Other: 0
D:15:4	Houses in Caves	0	0	CG: 2 Other: 0
D:15:6	Houses in Caves	0	0	CG: 0 Other: 2
D:15:7	House	0	3	CG: 2 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
D:15:9	Houses in Caves	0	0	CG: 3 Other: 0
D:15:11	Cliff Dwelling	1	0	CG: 5 Other: 0
D:15:12	Mound	2	1	CG: 9 Other: 5
D:16:3	No info	0	0	CG: 3 Other: 0
D:16:4	House	0	5	CG: 0 Other: 4
E:5:5	House	0	0	CG: 14 Other: 0
E:5:6	House	0	0	CG:6 Other: 0
E:5:7	House	1	0	CG: 12 Other: 0
E:5:8	House	0	0	CG: 4 Other: 2
E:7:1	House, Camp	0	7	CG: 7 Other: 18

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
E:7:2	House	0	4	CG: 5 Other: 29
E:9:1	House	2	7	CG: 16 Other: 11
E:9:2*	House	0	0	CG: 2 Other: 0
E:9:3	House	0	2	CG: 4 Other: 0
E:9:4	House	1	2	CG: 2 Other: 5
E:9:5*	House	0	4	CG: 5 Other: 0
E:9:6	House	0	5	CG: 6 Other: 0
E:9:8	House	0	0	CG: 4 Other: 0
E:9:9*	House	0	0	CG: 5 Other: 0
E:9:11	Presidio	0	0	CG: 2 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
E:9:12*	House	23	42	CG: 83 Other: 9
E:9:13	House	0	3	CG: 6 Other: 2
E:9:14	House	0	0	CG: 0 Other: 1
E:13:1	House	0	4	CG: 12 Other: 0
E:13:4	House in Cave	1	0	CG: 5 Other: 0
E:14:1*	Unknown	5	20	CG: 43 Other: 57
E:14:2	House	0	1	CG: 11 Other: 2
E:14:3	House	1	3	CG: 2 Other: 2
E:14:4	House	1	3	CG: 18 Other: 2
E:14:5*	House	21	27	CG: 92 Other: 21

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
E:14:6	House	0	1	CG: 4 Other: 0
E:14:7	House	1	8	CG: 8 Other: 0
E:14:8	House	0	3	CG: 3 Other: 0
F:2:1	Camp Site	0	0	CG: 0 Other: 8
F:5:2	Camp Site	0	0	CG: 10 Other: 0
F:6:1	House	0	1	CG: 14 Other: 41
F:9:1	Camp Site	0	0	CG: 0 Other: 6
F:13:1	Presidio	0	0	CG: 1 Other: 0
F:13:2	House, Camp	1	5	CG:22 Other: 7
H:8:1	House Mound	0	0	CG: 1 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
H:8:2	House Mound	0	0	CG: 7 Other: 0
H:8:3	Cliff Dwelling	0	0	CG: 2 Other: 0
H:11:1*	Cliff Dwelling	0	0	CG: 22 Other: 0
H:11:2	Cliff Dwelling	0	0	CG: 1 Other: 0
H:11:3	Cliff Dwelling	0	0	CG: 3 Other: 0
H:11:4	Cliff Dwelling	0	0	CG: 3 Other: 0
H:11:5*	Cliff Dwelling	0	0	CG: 20 Other: 0
H:11:7	Cliff Dwelling	0	0	CG: 5 Other: 0
I:2:1	Presidio	0	0	CG: 0 Other: 1
I:2:2	House	1	2	CG: 7 Other: 1

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
I:2:3	House	0	0	CG: 9 Other: 1
I:2:4	House	0	8	CG: 17 Other: 1
I:2:5	House	0	0	CG: 1 Other: 0
I:4:1	House	0	0	CG: 18 Other: 0
I:4:2	House	0	0	CG: 1 Other: 0
I:4:3	House	0	12	CG: 7 Other: 0
I:9:1*	No info	2	4	CG: 34 Other: 0
I:9:2	No info	1	0	CG: 11 Other: 0
I:9:3	No info	0	1	CG: 3 Other: 0
I:9:5*	No info	12	10	CG: 83 Other: 0

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
I:9:6	No info	1	0	CG: 14 Other: 0
I:9:7	No info	0	0	CG: 8 Other: 0
I:9:8	No info	0	0	CG: 7 Other: 2
I:9:9	No info	0	1	CG: 25 Other: 3
I:9:10	No info	1	2	CG: 11 Other: 0
I:9:11*	No info	2	7	CG: 137 Other: 0
I:15:1*	No info	2	5	CG: 40 Other: 0
I:15:2	No info	0	0	CG: 8 Other: 0
I:15:3	No info	0	0	CG: 8 Other: 0
I:16:1	No info	0	2	CG: 7 Other: 1

Site Designation	Site Type	Ramos Black (Counts)	Playas Red (Counts)	Painted Wares (Counts)
I:16:2	No info	0	2	CG: 12 Other: 0
J:1:1	No info	2	3	CG: 13 Other: 1
K:16:2	No info	0	0	CG: 0 Other: 7
K:16:3	No info	0	0	CG: 12 Other: 0
M:11:1	No info	0	2	CG: 2 Other: 0
N:6:1	No info	0	0	CG: 2 Other: 0
O:7:4	No info	0	0	CG: 1 Other: 0

Table B.1: Sherd tabulations for Sayles' sites.

Appendix C:

Data for Polychromes Recovered

from Site 204

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
16	1	2	Late	Babícora Polychrome	1F
30	1	3	Late	Ramos Polychrome	4Z
38	1	4	Late	Babícora Polychrome	3B
61	1	5	Late	White-Paste Babícora Polychrome	1Z
63	1	6	Late	Ramos Polychrome	1Z
136	1	13	Late	White-Paste Babícora Polychrome	1A
149	1	16	Early	White-Paste Babícora Polychrome	1A
176	2	2	Late	Ramos Polychrome	6
181	2	2	Late	White-Paste Babícora Polychrome	3A
190	2	4	Late	White-Paste Babícora Polychrome	5Z
205	2	6	Early	Babícora Polychrome	3C
207	2	6	Early	White-Paste Babícora Polychrome	1B

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
217	2	7	Early	White-Paste Babícora Polychrome	1C
222	2	8	Early	Babícora Polychrome	1Z
232	2	10	Early	White-Paste Babícora Polychrome	1Z
239	2	11	Early	Babícora Polychrome	1Z
241	2	11	Early	Babícora Polychrome	1Z
248	2	13	Early	Babícora Polychrome	3C
251	2	14	Early	Babícora Polychrome	1E
270	3	3	Late	Babícora Polychrome	3C
274	3	3	Late	Ramos Polychrome	4A
277	3	3	Late	Ramos Polychrome	4A
278	3	3	Late	Ramos Polychrome	1A
282	3	3	Late	White-Paste Babícora Polychrome	1J
312	3	7	Late	White-Paste Babícora Polychrome	1H
323	3	8	Late	Babícora Polychrome	3B

Inventory Number	**Test Pit**	**Level**	**Early/Late**	**Formal Type**	**Petrographic Group**
347	3	10	Late	White-Paste Babícora Polychrome	3B
358	3	11	Late	Ramos Polychrome	4A
387	3	19	Early	Babícora Polychrome	1G
415	4	4	Late	Ramos Polychrome	1C
430	4	5	Late	Babícora Polychrome	3B
454	4	7	Late	Ramos Polychrome	1Z
455	4	7	Late	Ramos Polychrome	2Z
456	4	7	Late	White-Paste Babícora Polychrome	1B
472	4	8	Late	Ramos Polychrome	1C
474	4	8	Late	Ramos Polychrome	3B
481	4	9	Late	Babícora Polychrome	1A
490	4	10	Late	Babícora Polychrome	6
522	4	14	Early	White-Paste Babícora Polychrome	1K
524	4	15	Early	Babícora Polychrome	1Z
529	4	16	Early	Babícora Polychrome	1Z

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
531	4	16	Early	White-Paste Babícora Polychrome	6
532	4	16	Early	White-Paste Babícora Polychrome	1Z
537	4	17	Early	White-Paste Babícora Polychrome	1C
541	4	18	Early	White-Paste Babícora Polychrome	1J
586	5	6	Late	Babícora Polychrome	2Z
590	5	6	Late	Babícora Polychrome	1Z
594	5	6	Late	Ramos Polychrome	1D
598	5	7	Late	Babícora Polychrome	1Z
614	6	8	Late	Ramos Polychrome	1A
621	6	8	Late	Babícora Polychrome	1Z
641	5	10	Late	White-Paste Babícora Polychrome	1Z
649	5	11	Late	Babícora Polychrome	1Z
651	5	11	Late	Babícora Polychrome	5Z
652	5	11	Late	Ramos Polychrome	1B

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
672	5	13	Late	White-Paste Babícora Polychrome	1A
681	5	13	Late	Babícora Polychrome	3B
686	5	13	Late	Ramos Polychrome	1B
709	5	13	Late	Ramos Polychrome	1B
711	5	13	Late	Babícora Polychrome	1K
716	5	13	Late	White-Paste Babícora Polychrome	1A
723	5	16	Late	Ramos Polychrome	1B
726	5	16	Late	Babícora Polychrome	1Z
738	5	17	Early	Babícora Polychrome	4A
749	5	18	Early	Babícora Polychrome	1G
752	5	18	Early	Babícora Polychrome	3Z
780	6	4	Late	White-Paste Babícora Polychrome	2Z
782	6	4	Late	Ramos Polychrome	1A
794	6	7	Late	White-Paste Babícora Polychrome	1A

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
798	6	7	Late	Babícora Polychrome	2Z
799	6	7	Late	Ramos Polychrome	3C
827	6	9	Late	Babícora Polychrome	1Z
828	6	9	Late	White-Paste Babícora Polychrome	3A
833	6	9	Late	White-Paste Babícora Polychrome	1E
844	6	10	Late	Ramos Polychrome	1D
852	6	11	Late	Babícora Polychrome	2Z
857	6	11	Late	Ramos Polychrome	1B
860	6	12	Late	Ramos Polychrome	4A
861	6	12	Late	Ramos Polychrome	3A
868	6	13	Late	Ramos Polychrome	1B
875	6	13	Late	Babícora Polychrome	1F
876	6	13	Late	Babícora Polychrome	1B
877	6	13	Late	Babícora Polychrome	1E
878	6	13	Late	Babícora Polychrome	1B

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
881	6	13	Late	Babícora Polychrome	1Z
883	6	13	Late	White-Paste Babícora Polychrome	3A
886	6	13	Late	White-Paste Babícora Polychrome	3A
889	6	14	Late	Ramos Polychrome	1Z
894	6	14	Late	White-Paste Babícora Polychrome	3A
897	6	14	Late	White-Paste Babícora Polychrome	1A
898	6	14	Late	White-Paste Babícora Polychrome	1I
903	6	14	Late	White-Paste Babícora Polychrome	1E
904	6	14	Late	Babícora Polychrome	1D
928	6	15	Late	White-Paste Babícora Polychrome	1I
935	6	16	Late	Babícora Polychrome	6
942	6	17	Late	Ramos Polychrome	3A
951	9	18	Early	White-Paste Babícora Polychrome	1H

Inventory Number	Test Pit	Level	Early/Late	Formal Type	Petrographic Group
954	8	18	Early	Babícora Polychrome	2Z
966	9	19	Early	White-Paste Babícora Polychrome	1K
979	9	21	Early	White-Paste Babícora Polychrome	1D
985	9	22	Early	Babícora Polychrome	1A
989	9	22	Early	Babícora Polychrome	1A
991	9	23	Early	Babícora Polychrome	1A
996	9	24	Early	White-Paste Babícora Polychrome	1H
997	9	24	Early	Babícora Polychrome	1Z
1007	9	26	Early	Babícora Polychrome	1Z
1013	9	27	Early	White-Paste Babícora Polychrome	3B

Table C.1: Raw data for sherds from Site 204.

Appendix D:

Data for Sherds

from

Sayles' Regional Collection

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0013	A:16:3	Test Pit 2, 0-6 inches	House; No additional information	Babícora Polychrome	Light Orange	3d	3B	NA
EBS0014	A:16:3	Test Pit 2, 0-6 inches	House; No additional information	Babícora Polychrome	Yellow	3b	2B	2
EBS0016	A:16:3	Test Pit 2, 0-6 inches	House; No additional information	Babícora Polychrome	Orange	Unassigned	2Z	1
EBS0030	A:16:3	NA	House; No additional information	Babícora Polychrome	Light Orange	2	1B	2
EBS0033	A:16:3	NA	House; No additional information	Ramos Polychrome	Unknown	3e	1D	NA
EBS0035	A:16:3	NA	House; No additional information	White-Paste Babícora Polychrome	Yellow	3c	3Z	NA
EBS0067	A:16:3	Test Pit 2, 24-36 inches	House; No additional information	White-Paste Babícora Polychrome	Light Orange	3c	3B	2
EBS0068	A:16:3	Test Pit 2, 24-36 inches	House; No additional information	Babícora Polychrome	Orange	1	1Z	2
EBS0076	A:16:3	Test Pit 1, 36-42 inches	House; No additional information	Babícora Polychrome	Orange	3e	1C	2
EBS0088	E:9:1	NA	House; Paquimé	Babícora Polychrome	White	3a	1G	NA
EBS0091	E:9:1	NA	House; Paquimé	White-Paste Babícora Polychrome	Pink	3d	3C	2
EBS0096	E:9:1	NA	House; Paquimé	Ramos Polychrome	Pink	Unassigned	3B	NA
EBS0122	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Yellow	3d	1D	2
EBS0124	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Yellow	3e	1D	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0129	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Light Orange	3d	1I	NA
EBS0137	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Light Orange	3e	1Z	2
EBS0140	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	White	3d	3A	2
EBS0144	A:16:2	N A	House, camp; No additional information	Ramos Polychrome	White	Unassigned	3B	NA
EBS0147	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Pink	3e	3B	NA
EBS0148	A:16:2	NA	House, camp; No additional information	Ramos Polychrome	Pink	3d	3A	NA
EBS0152	A:16:2	NA	House, camp; No additional information	White-Paste Babícora Polychrome	Light Orange	3e	1D	2
EBS0153	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Light Orange	Unassigned	1Z	2
EBS0161	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Yellow	3c1	3B	2
EBS0163	A:16:2	NA	House, camp; No additional information	White-Paste Babícora Polychrome	White	3b	3A	NA
EBS0170	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Yellow	3d	1Z	2
EBS0181	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Light Orange	3e	1Z	NA
EBS0183	A:16:2	NA	House, camp; No additional information	White-Paste Babícora Polychrome	Yellow	3d	3D	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0184	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Orange	1	1B	1
EBS0187	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Light Orange	1	1H	NA
EBS0188	A:16:2	NA	House, camp; No additional information	Babícora Polychrome	Orange	3e	1B	2
EBS0200	E:7:2	NA	House; Four Rooms	Ramos Polychrome	Yellow	3d	3D	2
EBS0209	B:2:1	NA	Village; No additional information	Ramos Polychrome	White	3d	3A	2
EBS0210	B:2:1	NA	Village; No additional information	Ramos Polychrome	Pink	3c	4B	2
EBS0211	B:2:1	NA	Village; No additional information	Ramos Polychrome	Light Orange	3c	1C	2
EBS0212	B:2:1	NA	Village; No additional information	Ramos Polychrome	Yellow	3c1	3D	2
EBS0216	B:2:1	NA	Village; No additional information	Ramos Polychrome	Light Orange	3d	1I	2
EBS0219	B:2:1	NA	Village; No additional information	Ramos Polychrome	White	3b	4C	NA
EBS0220	B:2:1	NA	Village; No additional information	Ramos Polychrome	Yellow	3d	1C	2
EBS0221	B:2:1	NA	Village; No additional information	Ramos Polychrome	White	3d	3A	2
EBS0222	B:2:1	NA	Village; No additional information	Ramos Polychrome	Pink	3d	1E	NA
EBS0223	B:2:1	NA	Village; No additional information	Ramos Polychrome	Yellow	3d	1D	NA
EBS0231	B:2:1	NA	Village; No additional information	Babícora Polychrome	Orange	1	1K	1
EBS0232	B:2:1	NA	Village; No additional information	Babícora Polychrome	Light Orange	3e	2Z	2

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0235	B:2:1	NA	Village; No additional information	White-Paste Babícora Polychrome	White	3d	3A	2
EBS0247	B:2:1	NA	Village; No additional information	Babícora Polychrome	Orange	1	1A	1
EBS0248	B:2:1	NA	Village; No additional information	Babícora Polychrome	Orange	1	1A	NA
EBS0250	B:2:1	NA	Village; No additional information	Babícora Polychrome	Light Orange	Unassigned	1A	2
EBS0251	B:2:1	NA	Village; No additional information	Babícora Polychrome	Orange	1	1Z	NA
EBS0254	B:2:1	NA	Village; No additional information	White-Paste Babícora Polychrome	White	3c1	3Z	NA
EBS0268	I:9:5	NA	No information provided	Babícora Polychrome	Orange	3a	1A	NA
EBS0273	I:9:5	NA	No information provided	Ramos Polychrome	Light Orange	2	1F	2
EBS0281	I:9:5	NA	No information provided	Babícora Polychrome	NA	3a	4A	2
EBS0294	H:11:1	NA	Cliff Dwelling; No additional information	Babícora Polychrome	Orange	3e	6	2
EBS0299	H:11:1	NA	Cliff Dwelling; No additional information	Ramos Polychrome	Light Orange	3d	2Z	NA
EBS0302	H:11:1	NA	Cliff Dwelling; No additional information	Babícora Polychrome	Dark Red	Unassigned	1B	NA
EBS0303	H:11:1	NA	Cliff Dwelling; No additional information	Ramos Polychrome	Dark Red	2	2Z	2
EBS0359	E:14:1	Test 2	No information provided	Babícora Polychrome	Orange	3e	1A	2

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0376	E:14:5	NA	House; no additional information	Babícora Polychrome	White	Unassigned	1J	NA
EBS0379	E:14:5	NA	House; no additional information	Babícora Polychrome	Light Orange	3a	4A	NA
EBS0415	E:14:1	Test 1	No information provided	Babícora Polychrome	Light Orange	2	1A	NA
EBS0429	I:15:1	1. Below Floor	No information provided	Babícora Polychrome	Orange	3a	1Z	2
EBS0709	E:9:12	Test 3 6-12”	House; 60 rooms total	Babícora Polychrome	Orange	3e	2Z	NA
EBS0728	H:11:5	18-24”	Cliff dwelling; No additional information	Babícora Polychrome	Light Orange	3a	4A	NA
EBS0730	H:11:5	18-24”	Cliff dwelling; No additional information	Babícora Polychrome	Orange	3a	4A	NA
EBS0731	C:2:4	NA	Camp site; No additional information	Ramos Polychrome	Light Orange	3e	1C	NA
EBS0737	D:5:6	NA	Boulder foundation; No additional information	Ramos Polychrome	Light Orange	3d	4C	NA
EBS0739	D:5:6	NA	Boulder foundation; No additional information	Ramos Polychrome	Orange	3e	1I	NA
EBS0744	D:5:6	NA	Boulder foundation; No additional information	Babícora Polychrome	Orange	1	1G	2
EBS0754	D:5:6	NA	Boulder foundation; No additional information	Babícora Polychrome	Orange	1	1A	NA
EBS0786	I:9:11	Test 1 0-6”, General Surface	No information provided	Ramos Polychrome	Light Orange	2	1B	2

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0787	I:9:11	Test 1 0-6”, General Surface	No information provided	Ramos Polychrome	Orange	2	1B	NA
EBS0800				Babícora Polychrome	Orange	2	3Z	2
EBS0809	I:9:11	Test 1 0-6”, General Surface	No information provided	Babícora Polychrome	Light Orange	2	1Z	NA
EBS0810	I:9:11	Test 1 0-6”, General Surface	No information provided	Babícora Polychrome	Orange	1	1Z	2
EBS0815	I:9:1	Test 1, 0-6”	No information provided	Babícora Polychrome	Orange	1	1A	2
EBS0888	A:16:3	Test 1, 42-52”	House; No additional information	White-Paste Babícora Polychrome	Light Orange	3e	1E	NA
EBS0890	A:16:3	Test 1, 42-52”	House; No additional information	White-Paste Babícora Polychrome	Yellow	Unassigned	1E	2
EBS0894	A:16:3	Test 1, 42-52”	House; No additional information	Ramos Polychrome	Yellow	3d	1E	NA
EBS0896	A:16:3	Test 1, 42-52”	House; No additional information	Ramos Polychrome	Light Orange	3e	1Z	NA
EBS0897	A:16:3	Test 1, 42-52”	House; No additional information	Ramos Polychrome	Light Orange	3e	2A	NA
EBS0898	A:16:3	Test 1, 42-52”	House; No additional information	Ramos Polychrome	White	Unassigned	2Z	2
EBS0906	I:15:1	1. Above	No information provided	Babícora Polychrome	Orange	2	1Z	NA
EBS0911	I:9:5	0-6”	No information provided	Babícora Polychrome	Dark Red	1	4A	NA
EBS0914	I:9:5	0-6”	No information provided	Babícora Polychrome	Dark Red	2	2D	NA
EBS0916	I:9:5	0-6”	No information provided	Babícora Polychrome	Light Orange	3a	1B	NA
EBS0918	I:9:5	0-6”	No information provided	Babícora Polychrome	Light Orange	3a	1Z	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS0924	A:16:3	Test 2, 18-24”	House; No additional information	Ramos Polychrome	Yellow	3c	3Z	NA
EBS0933	E:9:12	Test 3, 24-30”	House; 60 rooms	White-Paste Babícora Polychrome	Light Orange	Unassigned	1D	NA
EBS0934	E:9:12	Test 3, 24-30”	House; 60 rooms	White-Paste Babícora Polychrome	Light Orange	3b	3Z	NA
EBS0935	E:9:12	Test 3, 24-30”	House; 60 rooms	Babícora Polychrome	Light Orange	3e	1Z	NA
EBS0944	D:8:1	NA	House; No additional information	Babícora Polychrome	Orange	1	1Z	NA
EBS0945	D:8:1	NA	House; No additional information	Babícora Polychrome	Orange	3e	4A	NA
EBS0947	D:8:1	NA	House; No additional information	Ramos Polychrome	White	3c1	3B	2
EBS0948	D:8:1	NA	House; No additional information	Ramos Polychrome	Light Orange	3e	2Z	2
EBS0951	A:16:3	Test 1, 0-12”	House; No additional information	Ramos Polychrome	Pink	3d	3A	NA
EBS0956	A:16:3	Test 1, 0-12”	House; No additional information	Babícora Polychrome	Yellow	3e	5A	2
EBS0972	E:14:5	Test 2, Mid-level	House; No additional information	Babícora Polychrome	Light Orange	3c1	1F	NA
EBS0975	H:11:5	NA	Cliff dwelling; No additional information	Ramos Polychrome	Light Orange	3a	1J	2
EBS0979	H:11:5	NA	Cliff dwelling; No additional information	Babícora Polychrome	Yellow	3a	1Z	2
EBS0982	I:9:1	Test 3, 18-24”	No additional information	Ramos Polychrome	Light Orange	1	1A	NA
EBS0994	I:15:1	NA	No additional information	Babícora Polychrome	Light Orange	2	1H	NA
EBS0997	I:9:1	12-18”	No additional information	Babícora Polychrome	Light Orange	3a	4A	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS1013	D:9:1	NA	Pueblo; No additional information	Babícora Polychrome	Light Orange	1	1A	NA
EBS1021	D:9:1	NA	Pueblo; No additional information	Babícora Polychrome	Light Orange	1	1A	NA
EBS1030	D:3:11	NA	House; 100 rooms	White-Paste Babícora Polychrome	Yellow	3e	1L	2
EBS1031	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Light Orange	1	1K	2
EBS1037	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Light Orange	3e	1A	2
EBS1039	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Yellow	3d	3C	2
EBS1045	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Light Orange	3e	1Z	NA
EBS1046	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Yellow	3e	1Z	NA
EBS1047	D:3:11	NA	House; 100 rooms	Babícora Polychrome	Light Orange	3d	1C	NA
EBS1056	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Pink	Unassigned	2A	2
EBS1057	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Yellow	3d	2A	NA
EBS1059	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Pink	3d	3A	NA
EBS1061	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Pink	Unassigned	3B	2
EBS1063	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Light Orange	3c1	1C	NA
EBS1064	D:3:11	NA	House; 100 rooms	Ramos Polychrome	Pink	3c	4A	2
EBS1066	D:3:11	NA	House; 100 rooms	Ramos Polychrome	White	3d	1E	NA
EBS1072	D:3:11	NA	House; 100 rooms	Ramos Polychrome	White	3d	5A	2
EBS1086	A:16:3	Test 1, 12-24”	House; No additional information	Ramos Polychrome	Pink	3e	4B	NA
EBS1102	C:2:1	NA	Camp site; No additional information	Babícora Polychrome	Yellow	3e	6	NA
EBS1122	E:9:12	Test 2, 18-24”	House; 60 rooms	Babícora Polychrome	Yellow	3e	1E	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS1127	E:14:1	Test B, Above Floor	No additional information	Babícora Polychrome	Light Orange	3a	1H	2
EBS1128	I:9:1	24-30”	No additional information	Babícora Polychrome	Yellow	3a	4A	NA
EBS1138	I:9:1	18-24”	No additional information	Babícora Polychrome	Light Orange	3a	4A	NA
EBS1145	E:9:12	Test 2, 12-18”	House; 60 rooms	Ramos Polychrome	Yellow	3b	4B	2
EBS1166	H:11:1	36-42”	Cliff dwelling; no additional information	Ramos Polychrome	Orange	3a	2C	NA
EBS1172	H:11:1	Surface	Cliff dwelling; no additional information	Ramos Polychrome	Light Orange	1	2Z	NA
EBS1173	H:11:1	Surface	Cliff dwelling; no additional information	Babícora Polychrome	Light Orange	3d	3C	2
EBS1197	D:3:1	6-12”	House; 10-15 rooms	Ramos Polychrome	Pink	3d	5A	3
EBS1206	D:3:1	6-12”	House; 10-15 rooms	Babícora Polychrome	Light Orange	3e	1Z	2
EBS1208	D:3:1	6-12”	House; 10-15 rooms	Ramos Polychrome	Yellow	3c1	3B	2
EBS1213	F:13:2	NA	Camp, House; no additional information	Ramos Polychrome	Yellow	3c	4B	NA
EBS1231	F:13:2	NA	Camp, House; no additional information	Babícora Polychrome	Orange	3a	2C	NA
EBS1236	E:14:4	NA	House; no additional information	Ramos Polychrome	Light Orange	Unassigned	1D	2
EBS1237	E:14:4	NA	House; no additional information	Babícora Polychrome	Orange	3a	1A	NA
EBS1240	E:14:4	NA	House; no additional information	Babícora Polychrome	Light Orange	3b	3B	2
EBS1247	E:14:4	NA	House; no additional information	White-Paste Babícora Polychrome	White	3b	3B	

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS1256	D:3:9	NA	House; 10-15 rooms	Ramos Polychrome	White	3b	3B	2
EBS1257	D:3:9	NA	House; 10-15 rooms	Ramos Polychrome	White	3d	3A	2
EBS1258	D:3:9	NA	House; 10-15 rooms	Ramos Polychrome	Yellow	Unassigned	2B	NA
EBS1262	D:3:9	NA	House; 10-15 rooms	Babícora Polychrome	Orange	1	1Z	1
EBS1266	D:3:9	NA	House; 10-15 rooms	Babícora Polychrome	Orange	1	4C	NA
EBS1269	D:3:9	NA	House; 10-15 rooms	Ramos Polychrome	Yellow	3e	1E	2
EBS1278	I:9:9	NA	No additional information	Ramos Polychrome	Light Orange	3e	1B	NA
EBS1281	I:9:9	NA	No additional information	Babícora Polychrome	Light Orange	3a	1A	NA
EBS1283	I:9:9	NA	No additional information	Babícora Polychrome	Orange	3e	1B	NA
EBS1285	I:9:9	NA	No additional information	Babícora Polychrome	Orange	3a	1A	NA
EBS1287	I:9:9	NA	No additional information	Babícora Polychrome	Light Orange	3a	4A	NA
EBS1289	I:9:9	NA	No additional information	Babícora Polychrome	Dark Brown	Unassigned	6	NA
EBS1320	I:9:11	Test 2, 6-12”	No additional information	Coarse Ramos Polychrome	Light Orange	2	2D	2
EBS1339	D:3:11	12-18”	House; 100 rooms	Ramos Polychrome	Light Orange	3c1	1G	2
EBS1343	D:3:11	12-18”	House; 100 rooms	Ramos Polychrome	White	3b	3B	2
EBS1345	D:3:11	12-18”	House; 100 rooms	Ramos Polychrome	Orange	3d	1C	2
EBS1346	D:3:11	12-18”	House; 100 rooms	Ramos Polychrome	Yellow	3d	3C	2
EBS1351	I:15:1	NA	No additional information	Babícora Polychrome	Orange	2	1Z	NA
EBS1352	I:15:1	NA	No additional information	Babícora Polychrome	Light Orange	2	1B	NA

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS1392	D:3:11	24-30”	House; 100 rooms	Ramos Polychrome	Light Orange	3d	1D	2
EBS1409	I:9:11	Test 1, 12-18”	No additional information	Babícora Polychrome	Light Orange	2	1B	NA
EBS1421	E:9:12	Test 3, 30-36”	House; 60 rooms	Ramos Polychrome	White	3d	5A	NA
EBS1423	E:9:12	Test 3, 18-24”	House; 60 rooms	Babícora Polychrome	Light Orange	3e	1C	2
EBS1429	E:9:12	Test 3, 18-24”	House; 60 rooms	Ramos Polychrome	Light Orange	3c	4B	2
EBS1432	E:9:12	Test 3, 18-24”	House; 60 rooms	Ramos Polychrome	Pink	3d	5A	2
EBS1446	E:9:12	Test 3, 0-6”	House; 60 rooms	Babícora Polychrome	Orange	3e	1Z	NA
EBS1453	E:9:12	Test 3, 0-6”	House; 60 rooms	Ramos Polychrome	Light Orange	Unas	1Z	NA
EBS1454	E:9:12	Test 3, 0-6”	House; 60 rooms	Ramos Polychrome	White	3d	5A	2
EBS1455	E:9:12	Test 3, 0-6”	House; 60 rooms	Ramos Polychrome	Pink	3c	3Z	2
EBS1522	F:6:1	NA	House; no additional information	Babícora Polychrome	Light Orange	3c	3Z	2
EBS1523	F:6:1	NA	House; no additional information	White-Paste Babícora Polychrome	Pink	3d	3A	NA
EBS1526	F:6:1	NA	House; no additional information	Babícora Polychrome	White	Unassigned	1Z	NA
EBS1531	D:3:1	NA	House; 10-15 rooms	Babícora Polychrome	Orange	1	2Z	NA
EBS1545	D:3:1	Na	House; 10-15 rooms	Babícora Polychrome	Orange	3e	1A	NA
EBS1549	D:3:1	0-6”	House; 10-15 rooms	Babícora Polychrome	Light Orange	3d	1A	NA
EBS1561	D:3:1	0-6”	House; 10-15 rooms	White-Paste Babícora Polychrome	Light Orange	3e	2Z	2
EBS1563	D:3:1	0-6”	House; 10-15 rooms	White-Paste Babícora Polychrome	Yellow	3e	4B	2

Inventory Number	Site Designation	Test Pit	Sayles' Site Type	Formal Type	Refire Color Group	Chemical Group	Petrographic Group	Paint Group
EBS1570	D:3:1	0-6”	House; 10-15 rooms	White-Paste Babícora Polychrome	Yellow	3d	1L	2
EBS1577	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	White	3c	3A	2
EBS1581	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	Light Orange	3e	1Z	NA
EBS1582	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	Pink	3c1	1Z	2
EBS1583	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	Yellow	3c1	3B	NA
EBS1587	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	Light Orange	3c	1C	2
EBS1588	D:3:1	0-6”	House; 10-15 rooms	Ramos Polychrome	White	3d	3B	NA
EBS1591	B:4:1	NA	No additional information	Babícora Polychrome	Light Orange	3e	1C	NA
EBS1596	B:4:1	NA	No additional information	Babícora Polychrome	Orange	Unassigned	1C	NA
EBS1600	B:4:1	NA	No additional information	Babícora Polychrome	Orange	Unassigned	1Z	NA

Table D.1: Data for sherds from Sayles' regional collection.

Refire Color Group Definitions:

Yellow: 7.5YR 8/6 reddish yellow

White: White (No Munsell color)

Pink: 7.5YR 8/4 pink

Light Orange: 5YR 6/6 reddish yellow, 5YR 7/6 reddish yellow, 5YR 7/8 reddish yellow

Orange: 5YR 5/8 yellowish red, 5YR 6/8 reddish yellow

Appendix E:

Petrographic Point Counts

Collection: E.B. Sayles' Surface Collections **Sherd Designation:** EBS 124

1) Glassy groundmass	26) Glassy groundmass	51) Augite	76) Feldspar
2) Feldspar	27) Glassy groundmass	52) Feldspar	77) Glassy groundmass
3) Feldspar	28) Feldspar	53) Feldspar	78) Glassy groundmass
4) Glassy groundmass	29) Quartz	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Feldspar	55) Glassy groundmass	80) Glassy groundmass
6) Feldspar	31) Feldspar	56) Feldspar	81) Feldspar
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Quartz
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Feldspar	85) Glassy groundmass
11) Augite	36) Feldspar	61) Augite (weathered)	86) Feldspar
12) Glassy Groundmass	37) Quartz	62) Feldspar	87) Glassy groundmass
13) Feldspar	38) Augite	63) Feldspar	88) Glassy groundmass
14) Augite	39) Glassy groundmass	64) Glassy groundmass	89) Feldspar
15) Augite	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy groundmass	41) Glassy groundmass	66) Glassy groundmass	91) Glassy groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Augite

18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Feldspar	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Feldspar	70) Glassy groundmass	95) Feldspar
21) Quartz	46) Glassy groundmass	71) Feldspar	96) Feldspar
22) Feldspar	47) Glassy groundmass	72) Augite	97) Glassy groundmass
23) Feldspar	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Feldspar	49) Augite	74) Glassy groundmass	99) Glassy groundmass
25) Augite	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: E.B. Sayles' Surface Collections **Sherd Designation:** EBS 140

1) Silty	26) Silty	51) Augite	76) Feldspar
2) Silty	27) Augite	52) Augite	77) Silty
3) Glassy Groundmass	28) Feldspar	53) Feldspar	78) Silty
4) Silty	29) Quartz	54) Quartz	79) Silty
5) Silty	30) Feldspar	55) Feldspar	80) Feldspar
6) Silty	31) Quartz	56) Silty	81) Quartz
7) Augite	32) Silty	57) Silty	82) Glassy Groundmass
8) Silty	33) Silty	58) Feldspar	83) Silty
9) Augite	34) Silty	59) Quartz	84) Silty
10) Feldspar	35) Augite	60) Silty	85) Silty
11) Feldspar	36) Augite	61) Augite	86) Feldspar
12) Feldspar	37) Feldspar	62) Augite	87) Feldspar
13) Augite	38) Feldspar	63) Feldspar	88) Silty
14) Silty	39) Augite	64) Feldspar	89) Silty
15) Feldspar	40) Silty	65) Silty	90) Glassy Groundmass
16) Augite	41) Silty	66) Silty	91) Feldspar
17) Silty	42) Silty	67) Silty	92) Augite
18) Silty	43) Feldspar	68) Feldspar	93) Feldspar
19) Glassy Groundmass	44) Feldspar	69) Glassy Groundmass	94) Augite
20) Augite	45) Augite	70) Feldspar	95) Feldspar
21) Feldspar	46) Feldspar	71) Glassy Groundmass	96) Silty
22) Silty	47) Silty	72) Silty	97) Silty
23) Silty	48) Silty	73) Silty	98) Silty

24) Feldpsar	49) Silty	74) Feldspar	99) Silty
25) Silty	50) Silty	75) Feldspar	100) Silty

Collection: E.B. Sayles' Surface Collections **Sherd Designation:** EBS 210

1) Glassy groundmass (altered)	26) Feldspar	51) Glassy groundmass (altered)	76) Glassy groundmass (altered)
2) Feldspar	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Feldspar
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Feldspar	56) Feldspar	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Hole	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Feldspar	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Feldspar	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Silty
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Feldspar	85) Feldspar
11) Glassy groundmass (altered)	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Quartz

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Glassy groundmass (altered)
13) Glassy groundmass (altered)	38) Silty	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Feldspar	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Feldpsar	40) Glassy groundmass (altered)	65) Feldspar	90) Glassy groundmass (altered)
16) Feldspar	41) Hole	66) Glassy groundmass (altered)	91) Silty
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Quartz with glassy groundmass	68) Glassy groundmass (altered)	93) Glassy groundmass (altered)
19) Glassy groundmass (altered)	44) Feldpsar	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Augite??	46) Silty	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Feldspar
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy	49) Glassy	74) Glassy	99) Glassy

groundmass (altered)	groundmass (altered)	groundmass (altered)	groundmass (altered)
25) Feldspar	50) Feldspar	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1213

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Feldspar	78) Feldspar
4) Glassy groundmass	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Feldspar	30) Feldspar	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar	33) Glassy groundmass	58) Feldspar	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Augite??
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Feldspar	91) Glassy

groundmass	groundmass		groundmass
17) Glassy groundmass	42) Feldspar	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Feldspar	70) Glassy groundmass	95) Glassy groundmass
21) Augite?	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Feldspar	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Feldspar
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1429

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Hole	81) Glassy groundmass
7) Feldspar with glassy groundmass	32) Feldspar	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Feldspar
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Feldspar
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Feldspar	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Feldspar	95) Glassy groundmass
21) Feldspar	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Feldspar
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1086

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Feldspar with glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Feldspar with glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Feldspar with glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Feldspar	61) Feldspar	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Hole	71) Feldspar	96) Glassy groundmass
22) Feldspar	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Hornblende	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1257

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Quartz
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Augite	30) Augite	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Feldspar
8) Glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Glassy groundmass
9) Augite	34) Glassy groundmass	59) Augite	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Feldspar	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Feldspar

groundmass	groundmass	groundmass	
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Augite
18) Feldspar	43) Glassy groundmass	68) Feldspar	93) Glassy groundmass
19) Augite	44) Glassy groundmass	69) Feldspar	94) Feldspar
20) Glassy groundmass	45) Feldspar	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Feldspar	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Feldspar	50) Feldspar	75)Feldspar	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 148

1) Glassy groundmass	26) Augite	51) Augite	76) Augite
2) Glassy groundmass	27) Glassy groundmass	52) Feldspar	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Augite	32) Augite	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Augite	58) Glassy groundmass	83) Augite
9) Augite	34) Feldspar	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Glassy groundmass	61) Feldspar	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Augite
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Quartz	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Augite
18) Glassy groundmass	43) Glassy groundmass	68) Silty	93) Feldspar
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Augite	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1523

1) Glassy groundmass	26) Augite	51) Augite	76) Augite
2) Glassy groundmass	27) Glassy groundmass	52) Feldspar	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Feldspar	31) Glassy groundmass	56) Glassy groundmass	81) Feldspar
7) Glassy groundmass	32) Feldspar	57) Feldspar	82) Feldspar
8) Glassy groundmass	33) Augite	58) Glassy groundmass	83) Augite
9) Augite	34) Feldspar	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Augite	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Glassy groundmass	87) Augite
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Quartz	64) Feldspar	89) Glassy groundmass
15) Glassy groundmass	40) Augite	65) Quartz	90) Glassy groundmass
16) Glassy	41) Feldspar	66) Glassy	91) Glassy

groundmass		groundmass	groundmass
17) Feldspar	42) Glassy groundmass	67) Feldspar	92) Glassy groundmass
18) Feldspar	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Augite	44) Feldspar	69) Augite	94) Augite
20) Feldspar	45) Augite	70) Augite	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Feldspar	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Feldspar
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Feldspar
24) Glassy groundmass	49) Glassy groundmass	74) Feldspar	99) Augite
25) Feldspar	50) Glassy groundmass	75) Feldspar	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1059

1) Glassy groundmass	26) Feldspar	51) Augite	76) Feldspar
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Feldspar
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Augite	30) Feldspar	55) Glassy groundmass	80) Glassy groundmass
6) Feldspar	31) Feldspar	56) Glassy groundmass	81) Feldspar
7) Glassy groundmass	32) Glassy groundmass	57) Feldspar	82) Augite
8) Glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Augite
9) Glassy groundmass	34) Quartz	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Augite	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Hole	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Feldspar
15) Feldspar	40) Feldspar	65) Glassy groundmass	90) Glassy groundmass
16) Quartz	41) Feldspar	66) Glassy	91) Glassy

		groundmass	groundmass
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Feldspar	94) Augite
20) Glassy groundmass	45) Glassy groundmass	70) Feldspar	95) Feldspar
21) Glassy groundmass	46) Glassy groundmass	71)	96) Glassy groundmass
22) Quartz	47) Augite	72)	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73)	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74)	99) Feldspar
25) Glassy groundmass	50) Glassy groundmass	75)	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 235

1) Glassy groundmass	26) Glassy groundmass	51) Feldspar	76) Glassy groundmass
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass (altered)	77) Feldspar
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Quartz
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Quartz	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass
6) Glassy groundmass	31) Augite	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Feldspar	57) Glassy groundmass	82) Feldspar
8) Glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Augite
9) Glassy groundmass	34) Glassy groundmass	59) Feldspar	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Quartz	85) Glassy groundmass
11) Augite	36) Feldspar with glassy groundmass	61) Augite	86) Glassy groundmass
12) Glassy groundmass	37) Augite	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Hole	63) Glassy groundmass	88) Glassy groundmass
14) Augite	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass

16) Glassy groundmass	41) Glassy groundmass	66) Glassy groundmass	91) Glassy groundmass
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Augite
18) Augite	43) Glassy groundmass	68) Feldspar	93) Glassy groundmass
19) Augite	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Feldspars	71) Glassy groundmass	96) Quartz
22) Augite	47) Feldspars	72) Feldspar	97) Feldspar
23) Feldspar	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 209

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Augite	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass (altered)
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55)Glassy groundmass (altered)	80) Feldspar
6) Glassy groundmass	31) Glassy groundmass	56) Augite	81) Feldspar
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Augite
8) Augite	33) Glassy groundmass (altered)	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Augite	59) Feldspar	84) Glassy groundmass
10) Glassy groundmass	35) Feldspar	60) Feldspar	85) Glassy groundmass
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Augite	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass (altered)
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Augite
14) Glassy groundmass	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass

15) Augite	40) Augite	65) Glassy groundmass	90) Feldspar
16) Glassy groundmass	41) Feldspar	66) Glassy groundmass	91) Glassy groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Augite	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass (altered)	70) Glassy groundmass	95) Glassy groundmass
21) Feldspar	46) Glassy groundmass	71) Glassy groundmass	96) Feldspar
22) Glassy groundmass	47) Glassy groundmass	72) Augite	97) Glassy groundmass
23) Glassy groundmass	48) Augite	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar	74) Feldspar	99) Glassy groundmass
25) Glassy groundmass	50) Augite	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 268

1) Silty	26) Augite	51) Glassy groundmass	76) Glassy groundmass (altered)
2) Silty	27) Augite	52) Feldspar	77) Glassy groundmass (altered)
3) Feldspar	28) Feldspar	53) Feldspar	78) Feldspar
4) Silty	29) Glassy groundmass	54) Hole	79) Feldspar
5) Glassy groundmass	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass
6) Augite	31) Glassy groundmass	56) Augite	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar	33) Feldspar	58) Glassy groundmass	83) Feldspar with glassy groundmass
9) Feldspar	34) Glassy groundmass	59) Glassy groundmass	84) Feldspar
10) Augite	35) Glassy groundmass	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Augite
12) Feldspar	37) Glassy groundmass	62) Augite	87) Feldspar
13) Glassy groundmass (altered)	38) Feldspar	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass (altered)	39) Glassy groundmass	64) Glassy groundmass	89) Augite
15) Feldspar in	40) Glassy	65) Glassy	90) Hole

glassy groundmass (altered)	groundmass	groundmass	
16) Augite	41) Glassy groundmass	66) Glassy groundmass	91) Augite
17) Augite	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Feldspar	43) Feldspar	68) Feldspar	93) Augite
19) Glassy groundmass	44) Augite	69) Glassy groundmass	94) Feldspar
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Glassy groundmass (altered)	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass (altered)	47) Glassy groundmass	72) Glassy groundmass	97) Feldspar
23) Augite	48) Glassy groundmass	73) Augite	98) Feldspar
24) Feldspar	49) Augite	74) Glassy groundmass	99) Glassy groundmass (altered)
25) Feldspar	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 815

1) Feldspar with glassy groundmass	26) Glassy groundmass (altered)	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass (altered)	77) Hole
3) Feldspar	28) Hole	53) Feldspar	78) Feldspar
4) Augite	29) Glassy groundmass	54) Hole	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass (altered)
6) Augite	31) Hole	56) Feldspar	81) Feldspar
7) Hole	32) Feldspar	57) Hole	82) Feldspar
8) Augite	33) Augite	58) Glassy groundmass	83) Glassy groundmass
9) Hole	34) Feldspar	59) Glassy groundmass (altered)	84) Glassy groundmass (altered)
10) Feldspar	35) Augite	60) Feldspar	85) Augite
11) Glassy groundmass	36) Glassy groundmass	61) Augite	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Quartz	87) Feldspar
13) Glassy groundmass	38) Glassy groundmass (altered)	63) Hole	88) Feldspar
14) Augite	39) Augite	64) Feldspar	89) Augite
15) Glassy groundmass	40) Feldspar	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Feldspar	66) Glassy	91) Glassy

groundmass (altered)		groundmass (altered)	groundmass
17) Glassy groundmass (altered)	42) Hole	67) Feldspar	92) Feldspar
18) Augite	43) Augite	68) Feldspar	93) Glassy groundmass (altered)
19) Hole	44) Feldspar	69) Hole	94) Feldspar
20) Augite	45) Feldspar	70) Feldspar	95) Feldspar
21) Hole	46) Glassy groundmass (altered)	71) Hole	96) Augite
22) Feldspar	47) Glassy groundmass	72) Glassy groundmass	97) Feldspar
23) Augite	48) Feldspar	73) Glassy groundmass	98) Augite
24) Hole	49) Augite	74) Augite	99) Feldspar
25) Augite	50) Feldspar	75) Glassy groundmass	100) Augite

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 415

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Feldspar	27) Feldspar	52) Feldspar	77) Glassy groundmass
3) Quartz	28) Feldspar	53) Augite	78) Feldspar
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Feldspar
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Augite
6) Glassy groundmass	31) Feldspar	56) Augite	81) Feldspar
7) Quartz	32) Quartz	57) Glassy groundmass	82) Feldspar
8) Quartz	33) Feldspar	58) Augite	83) Hole
9) Feldspar	34) Feldspar	59) Feldspar	84) Feldspar
10) Feldspar	35) Augite	60) Feldspar	85) Feldspar
11) Silty	36) Augite	61) Feldspar	86) Glassy groundmass
12) Glassy groundmass	37) Feldspar	62) Glassy groundmass	87) Augite
13) Glassy groundmass	38) Silty	63) Feldspar	88) Feldspar
14) Feldspar	39) Feldspar	64) Feldspar	89) Feldspar
15) Feldspar	40) Feldspar	65) Feldspar	90) Glassy groundmass
16) Feldspar	41) Feldspar	66) Augite	91) Augite
17) Quartz	42) Augite	67) Augite	92) Augite
18) Hole	43) Feldspar	68) Feldspar	93) Feldspar
19) Silty	44) Augite	69) Feldspar	94) Feldspar
20) Glassy	45) Feldspar	70) Augite	95) Feldspar

groundmass			
21) Quartz	46) Glassy groundmass	71) Augite	96) Glassy groundmass
22) Feldspar	47) Feldspar	72) Feldspar	97) Augite
23) Feldspar	48) Feldspar	73) Feldspar	98) Glassy groundmass
24) Feldspar	49) Glassy groundmass	74) Augite	99) Augite
25) Feldspar	50) Feldspar	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1281

1) Glassy groundmass	26) Feldspar	51) Augite	76) Glassy groundmass (altered)
2) Feldspar with glassy groundmass	27) Quartz	52) Glassy groundmass	77) Feldspar
3) Feldspar	28) Quartz	53) Glassy groundmass	78) Feldspar
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Quartz	30) Hole	55) Feldspar	80) Hole
6) Feldspar	31) Glassy groundmass	56) Augite	81) Glassy groundmass (altered)
7) Glassy groundmass	32) Feldspar	57) Feldspar	82) Feldspar
8) Feldspar	33) Feldspar	58) Feldspar	83) Glassy groundmass
9) Glassy groundmass	34) Feldspar	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Glassy groundmass (altered)	60) Feldspar	85) Feldspar
11) Feldspar	36) Glassy groundmass	61) Feldspar	86) Augite
12) Augite	37) Feldspar	62) Feldspar	87) Glassy groundmass (altered)
13) Feldspar	38) Feldspar	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Feldspar	64) Feldspar	89) Feldspar
15) Feldspar	40) Hole	65) Silty	90) Feldspar

16) Feldspar	41) Feldspar	66) Feldspar	91) Hole
17) Glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Quartz
18) Glassy groundmass	43) Feldspar	68) Feldspar	93) Glassy groundmass
19) Feldspar	44) Feldspar	69) Glassy groundmass	94) Quartz
20) Hole	45) Augite	70) Feldspar	95) Feldspar
21) Feldspar	46) Glassy groundmass	71) Glassy groundmass	96) Feldspar
22) Glassy groundmass	47) Feldspar	72) Feldspar	97) Glassy groundmass
23) Feldspar	48) Feldspar	73) Feldspar	98) Feldspar
24) Glassy groundmass (altered)	49) Feldspar	74) Felspar	99) Glassy groundmass
25) Glassy groundmass	50) Augite	75) Glassy groundmass	100) Feldspar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 359

1) Glassy groundmass	26) Augite	51) Hole	76) Glassy groundmass
2) Feldspar	27) Glassy groundmass	52) Quartz	77) Feldspar
3) Feldspar	28) Feldspar	53) Feldspar	78) Feldspar
4) Glassy groundmass	29) Feldspar	54) Feldspar	79) Glassy groundmass
5) Feldspar with glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Feldspar
6) Glassy groundmass	31) Hole	56) Glassy groundmass	81) Quartz
7) Augite	32) Feldspar with glassy groundmass	57) Feldspar	82) Glassy groundmass
8) Glassy groundmass	33) Feldspar	58) Glassy groundmass	83) Feldspar
9) Feldspar	34) Glassy groundmass	59) Feldspar	84) Glassy groundmass
10) Hole	35) Glassy groundmass	60) Feldspar	85) Feldspar
11) Feldspar	36) Feldspar	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Hole	87) Feldspar
13) Glassy groundmass	38) Feldspar	63) Glassy groundmass	88) Augite
14) Hole	39) Augite	64) Feldspar	89) Feldspar
15) Glassy groundmass (altered)	40) Glassy groundmass	65) Glassy groundmass	90) Feldspar
16) Feldspar	41) Feldspar	66) Feldspar	91) Glassy groundmass

17) Feldspar	42) Hole	67) Quartz	92) Glassy groundmass
18) Feldspar	43) Feldspar	68) Feldspar	93) Feldspar
19) Glassy groundmass	44) Feldspar	69) Glassy groundmass	94) Feldspar
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Feldspar
22) Feldspar	47) Feldspar	72) Feldspar	97) Glassy groundmass
23) Glassy groundmass	48) Feldspar	73) Feldspar	98) Feldspar
24) Glassy groundmass	49) Glassy groundmass	74) Feldspar	99) Glassy groundmass
25) Feldspar	50) Augite	75) Glassy groundmass	100) Feldspar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1237

1) Glassy groundmass	26) Feldspar	51) Feldspar	76) Quartz
2) Feldspar	27) Quartz	52) Feldspar	77) Glassy groundmass
3) Feldspar	28) Feldspar	53) Glassy groundmass	78) Feldspar
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Felspar
5) Augite	30) Feldspar	55) Glassy groundmass	80) Hole
6) Glassy groundmass	31) Glassy groundmass	56) Feldspar	81) Feldspar
7) Feldspar	32) Hole	57) Glassy groundmass	82) Feldspar
8) Glassy groundmass	33) Glassy groundmass	58) Augite	83) Glassy groundmass
9) Feldspar	34) Quartz	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Augite
11) Glassy groundmass	36) Feldspar	61) Feldspar	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Hole	87) Feldspar
13) Feldspar	38) Feldspar	63) Glassy groundmass	88) Feldspar
14) Feldspar	39) Feldspar	64) Feldspar	89) Feldspar
15) Glassy groundmass	40) Glassy groundmass	65) Feldspar	90) Glassy groundmass
16) Quartz	41) Glassy groundmass	66) Felspar	91) Feldspar

17) Altered crystal	42) Feldspar	67) Glassy groundmass	92) Felspar
18) Quartz	43) Hole	68) Feldspar	93) Glassy groundmass
19) Feldspar	44) Feldspar	69) Feldspar	94) Feldspar
20) Glassy groundmass	45) Feldspar	70) Glassy groundmass	95) Quartz
21) Glassy groundmass (altered)	46) Glassy groundmass	71) Felspar	96) Feldspar
22) Glassy groundmass	47) Glassy groundmass	72) Quartz	97) Glassy groundmass
23) Feldspar	48) Feldspar	73) Feldspar	98) Glassy groundmass (altered)
24) Feldspar	49) Feldspar	74) Felspar	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Feldspar	100) Feldpsar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1037

1) Glassy groundmass	26) Hole	51) Feldspar	76) Glassy groundmass
2) Feldspar	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Feldspar	28) Glassy groundmass	53) Glassy groundmass	78) Quartz
4) Glassy groundmass	29) Feldspar	54) Glassy groundmass	79) Feldspar
5) Feldspar	30) Feldspar	55) Feldspar	80) Feldspar
6) Augite	31) Glassy groundmass	56) Feldspar	81) Quartz
7) Feldspar	32) Hole	57) Augite	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Feldspar	60) Glassy groundmass	85) Feldspar
11) Feldspar in glassy groundmas	36) Feldspar	61) Feldspar	86) Augite
12) Hole	37) Quartz	62) Feldspar	87) Feldspar
13) Glassy groundmass	38) Feldspar	63) Glassy groundmass	88) Glassy groundmass
14) Feldspar	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Feldspar	40) Glassy groundmass	65) Feldspar	90) Feldspar
16) Quartz	41) Glassy groundmass	66) Glassy groundmass	91) Glassy groundmass
17) Feldspar in	42) Feldspar	67) Glassy	92) Feldspar

glassy groundmass		groundmass	
18) Glassy groundmass	43) Glassy groundmass	68) Feldspar	93) Glassy groundmass
19) Feldspar	44) Feldspar	69) Feldspar	94) Feldspar in glassy groundmass
20) Quartz	45) Quartz	70) Feldspar	95) Glassy groundmass
21) Feldspar	46) Glassy groundmass	71) Hole	96) Feldspar
22) Glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Feldspar
23) Feldspar	48) Feldspar	73) Glassy groundmass	98) Quartz
24) Glassy groundmass	49) Augite	74) Feldspar	99) Feldspar
25) Feldspar	50) Feldspar in glassy groundmass	75) Feldspar in glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1013

1) Glassy groundmass	26) Feldspar	51) Augite	76) Glassy groundmass
2) Feldspar	27) Augite	52) Glassy groundmass	77) Glassy groundmass
3) Feldspar	28) Glassy groundmass	53) Glassy groundmass	78) Feldspar in glassy groundmass
4) Glassy groundmass	29) Hole	54) Feldspar	79) Glassy groundmass
5) Augite	30) Glassy groundmass	55) Feldspar in glassy groundmass	80) Augite
6) Glassy groundmass	31) Feldspar	56) Glassy groundmass	81) Hole
7) Augite	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar	33) Feldspar	58) Glassy groundmass	83) Augite
9) Feldspar in glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Feldpsar
10) Glassy groundmass	35) Augite	60) Feldspar	85) Feldspar
11) Augite	36) Glassy groundmass	61) Augite	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Augite	63) Augite	88) Feldspar
14) Feldspar	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Feldspar
16) Glassy	41) Augite	66) Feldspar	91) Augite

groundmass			
17) Feldspar	42) Augite	67) Feldspar	92) Glassy groundmass
18) Feldspar	43) Glassy groundmass	68) Feldspar	93) Glassy groundmass
19) Glassy groundmass	44) Augite	69) Augite	94) Feldspar
20) Feldspar	45) Feldspar	70) Glassy groundmass	95) Feldspar
21) Feldspar	46) Feldspar in glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Feldspar	97) Feldspar
23) Glassy groundmass	48) Feldspar	73) Feldspar	98) Augite
24) Feldspar	49) Feldspar	74) Augite	99) Glassy groundmass
25) Glassy groundmass	50) Augite	75) Feldspar	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1285

1) Feldspar	26) Feldspar	51) Feldspar	76) Feldspar
2) Feldspar	27) Hole	52) Feldspar	77) Quartz
3) Glassy groundmass	28) Glassy groundmass	53) Augite	78) Feldspar
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Feldspar
5) Feldspar	30) Feldspar	55) Hole	80) Glassy groundmass
6) Glassy groundmass	31) Feldspar	56) Glassy groundmass	81) Feldspar
7) Feldspar	32) Glassy groundmass	57) Feldspar	82) Glassy groundmass
8) Augite	33) Glassy groundmass	58) Feldspar	83) Feldspar
9) Feldspar	34) Feldspar	59) Glassy groundmass	84) Quartz
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Feldspar	61) Feldspar	86) Feldspar
12) Feldspar	37) Feldspar	62) Feldspar	87) Feldspar
13) Feldspar	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Feldspar
15) Augite	40) Feldspar	65) Glassy groundmass	90) Glassy groundmass
16) Glassy groundmass	41) Hole	66) Feldspar	91) Glassy groundmass
17) Glassy groundmass	42) Feldspar	67) Quartz	92) Feldspar

18) Feldspar	43) Feldspar	68) Feldspar	93) Feldspar
19) Feldspar	44) Glassy groundmass	69) Feldspar	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Felspar	46) Feldspar	71) Feldspar	96) Glassy groundmass
22) Feldspar	47) Feldspar	72) Glassy groundmass	97) Feldspar
23) Glassy groundmass	48) Altered crystal	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Augite	50) Glassy groundmass	75) Glassy groundmass	100) Feldspar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1549

1) Glassy groundmass	26) Augite	51) Augite	76) Feldspar
2) Feldspar	27) Augite	52) Augite	77) Augite
3) Feldspars in glassy groundmass	28) Feldspar	53) Feldspar	78) Feldspar
4) Glassy groundmass	29) Glassy groundmass	54) Augite	79) Glassy groundmass
5) Glassy groundmass	30) Augite	55) Feldspar	80) Feldspar in glassy groundmass
6) Feldspar	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Augite	32) Augite	57) Glassy groundmass	82) Augite
8) Augite	33) Glassy groundmass	58) Feldspar	83) Glassy groundmass
9) Feldspar	34) Augite	59) Feldspar	84) Augite
10) Augite	35) Feldspar	60) Silty	85) Feldspar
11) Augite	36) Augite	61) Feldspar	86) Feldspar
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar in glassy groundmass
14) Augite	39) Feldspar in glassy groundmass	64) Feldspar	89) Augite
15) Glassy groundmass	40) Augite	65) Augite	90) Feldspar
16) Feldspar in glassy groundmass	41) Feldspar	66) Feldspar	91) Glassy groundmass
17) Quartz in glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Glassy groundmass
18) Feldspar	43) Feldspar in	68) Augite	93) Glassy

	Glassy groundmass		groundmass
19) Glassy groundmass	44) Feldspar	69) Augite	94) Feldspar
20) Glassy groundmass	45) Feldspar in glassy groundmass	70) Feldspar	95) Feldspar in glassy groundmass
21) Feldspar	46) Feldspar	71) Glassy groundmass	96) Feldspar
22) Feldspar in glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Augite
23) Glassy groundmass	48) Glassy groundmass	73) Feldspar in glassy groundmass	98) Glassy groundmass
24) Feldspar	49) Feldspar in glassy groundmass	74) Augite	99) Feldspar
25) Feldspar	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 728

1) Glassy groundmass (altered)	26) Hematite	51) Glassy groundmass (altered)	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Feldspar	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Feldspar	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Quartz	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Opaque
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Glassy groundmass (altered)	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Feldspar	84) Silty
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Glassy groundmass (altered)	85) Opaque
11) Glassy groundmass (altered)	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Glassy groundmass (altered)
13) Glassy groundmass (altered)	38) Quartz	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Quartz	39) Glassy groundmass (altered)	64) Augite??	89) Glassy groundmass (altered)
15) Glassy groundmass (altered)	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Feldspar
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Feldspar
17) Feldspar	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Glassy groundmass (altered)	68) Glassy groundmass (altered)	93) Glassy groundmass (altered)
19) Glassy groundmass (altered)	44) Glassy groundmass (altered)	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Augite??	45) Feldspar	70) Glassy groundmass (altered)	95) Feldspar
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy	49) Glassy	74) Glassy	99) Glassy

groundmass (altered)	groundmass (altered)	groundmass (altered)	groundmass (altered)
25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 281

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Feldspar	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Feldspar
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Augite	33) Glassy groundmass	58) Feldspar	83) Glassy groundmass
9) Glassy groundmass	34) Feldspar	59) Augite??	84) Glassy groundmass
10) Glassy groundmass	35) Augite?	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Feldspar
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Feldspar	88) Glassy groundmass
14) Glassy groundmass	39) Feldspar	64) Feldspar	89) Feldspar
15) Feldspar	40) Glassy groundmass	65) Glassy groundmass	90) Feldspar
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Feldspar	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Feldspar	69) Feldspar	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Glassy groundmass	46) Feldspar	71)	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72)	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73)	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar	74)	99) Feldspar
25) Feldspar	50) Glassy groundmass	75)	100) Feldspar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1287

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Glassy groundmass (altered)	76) Feldspar
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Feldspar
3) Glassy groundmass (altered)	28) Feldspar	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Feldspar	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Feldspar	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Glassy groundmass (altered)	57) Hole	82) Glassy groundmass (altered)
8) Feldspar	33) Feldspar	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Feldspar	34) Augite??	59) Glassy groundmass (altered)	84) Glassy groundmass (altered)
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Glassy groundmass (altered)	85) Feldspar
11) Glassy groundmass (altered)	36) Quartz	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Augite??	87) Quartz
13) Glassy groundmass (altered)	38) Hole	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Augite??	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Glassy groundmass (altered)
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Feldspar
17) Glassy groundmass (altered)	42) Feldspar	67) Quartz	92) Feldspar
18) Feldspar	43) Feldspar	68) Feldspar	93) Glassy groundmass (altered)
19) Feldspar	44) Glassy groundmass (altered)	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Feldspar
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Feldspar
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Feldspar	49) Feldspar	74) Feldspar	99) Glassy

			groundmass (altered)
25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 945

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Feldspar	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Feldspar
6) Glassy groundmass	31) Glassy groundmass	56) Hole	81) Glassy groundmass
7) Glassy groundmass	32) Feldspar	57) Glassy groundmass	82) Feldspar
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Silty	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Feldspar	64) Glassy groundmass	89) Feldspar
15) Glassy groundmass	40) Feldspar	65) Feldspar	90) Glassy groundmass
16) Feldspar	41) Hole	66) Feldspar	91) Glassy

			groundmass
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Feldspar	70) Feldspar	95) Glassy groundmass
21) Feldspar	46) Glassy groundmass	71) Feldspar	96) Glassy groundmass
22) Augite??	47) Glassy groundmass	72) Glassy groundmass	97) Feldspar
23) Feldspar	48) Glassy groundmass	73) Glassy groundmass	98) Feldspar
24) Glassy groundmass	49) Feldspar	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Feldspar	75) Feldspar	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 379

1) Glassy groundmass (altered)	26) Hole	51) Feldspar	76) Feldspar
2) Glassy groundmass (altered)	27) Glassy groundmass	52) Glassy groundmass	77) Augite??
3) Glassy groundmass (altered)	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Feldspar	54) Feldspar	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass (altered)	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass (altered)
7) Glassy groundmass	32) Glassy groundmass	57) Feldspar	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass (altered)	58) Glassy groundmass	83) Feldspar
9) Feldspar	34) Glassy groundmass	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Glassy groundmass	60) Feldspar	85) Feldspar
11) Glassy groundmass	36) Feldspar	61) Feldspar	86) Hole
12) Glassy groundmass	37) Feldspar	62) Glassy groundmass	87) Feldspar
13) Glassy groundmass	38) Augite??	63) Glassy groundmass	88) Hole
14) Feldspar	39) Glassy	64) Glassy	89) Feldspar

	groundmass	groundmass	
15) Glassy groundmass	40) Glassy groundmass	65) Feldspar	90) Glassy groundmass
16) Glassy groundmass	41) Glassy groundmass	66) Glassy groundmass	91) Glassy groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Glassy groundmass
18) Feldspar	43) Feldspar	68) Glassy groundmass	93) Feldspar
19) Feldspar	44) Glassy groundmass	69) Glassy groundmass	94) Feldspar
20) Glassy groundmass	45) Glassy groundmass	70) Feldspar	95) Feldspar
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Feldspar	73) Feldspar	98) Feldspar
24) Feldspar	49) Glassy groundmass	74) Glassy groundmass	99) Feldspar
25) Augite??	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1128

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Glassy groundmass (altered)	76) Feldspar
2) Glassy groundmass (altered)	27) Augite	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Feldspar	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Feldspar	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Feldspar	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Feldspar
10) Feldspar	35) Glassy groundmass (altered)	60) Glassy groundmass (altered)	85) Glassy groundmass (altered)
11) Feldspar	36) Augite	61) Glassy groundmass (altered)	86) Feldspar

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Glassy groundmass (altered)
13) Glassy groundmass (altered)	38) Glassy groundmass (altered)	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Glassy groundmass (altered)	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Glassy groundmass (altered)
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Glassy groundmass (altered)
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Glassy groundmass (altered)	68) Glassy groundmass (altered)	93) Glassy groundmass (altered)
19) Glassy groundmass (altered)	44) Glassy groundmass (altered)	69) Feldspar	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Feldspar	95) Glassy groundmass (altered)
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Feldspar
22) Feldspar	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Glassy groundmass (altered)	48) Feldspar	73) Glassy groundmass (altered)	98) Feldspar
24) Glassy	49) Feldspar	74) Glassy	99) Glassy

groundmass (altered)		groundmass (altered)	groundmass (altered)
25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 730

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Glassy groundmass (altered)	76) Feldspar
2) Glassy groundmass (altered)	27) Feldspar	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Feldspar	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Glassy groundmass (altered)	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Feldspar	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Feldspar
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Feldspar	85) Feldspar
11) Glassy groundmass (altered)	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Glassy groundmass (altered)
13) Glassy groundmass (altered)	38) Glassy groundmass (altered)	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Augite	39) Feldspar	64) Feldspar	89) Feldspar
15) Glassy groundmass (altered)	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Feldspar
16) Glassy groundmass (altered)	41) Feldspar	66) Glassy groundmass (altered)	91) Glassy groundmass (altered)
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Augite	43) Glassy groundmass (altered)	68) Feldspar	93) Feldspar
19) Glassy groundmass (altered)	44) Glassy groundmass (altered)	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Feldspar	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Glassy groundmass (altered)	48) Feldspar	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy groundmass (altered)	49) Glassy groundmass (altered)	74) Glassy groundmass (altered)	99) Glassy groundmass (altered)

25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1561

1) Silty	26) Silty	51) Silty	76) Silty
2) Silty	27) Silty	52) Feldspar	77) Feldspar
3) Glassy groundmass	28) Quartz in glassy groundmass	53) Silty	78) Silty
4) Silty	29) Silty	54) Silty	79) Silty
5) Silty	30) Silty	55) Silty	80) Glassy groundmass
6) Spherule	31) Silty	56) Glassy groundmass	81) Glassy groundmass
7) Silty	32) Feldspar	57) Glassy groundmass	82) Glassy groundmass
8) Silty	33) Silty	58) Silty	83) Silty
9) Silty	34) Feldspar	59) Silty	84) Silty
10) Feldspar	35) Silty	60) Silty	85) Glassy groundmass
11) Feldspar	36) Feldspar	61) Silty	86) Glassy groundmass
12) Feldspar	37) Silty	62) Silty	87) Silty
13) Silty	38) Glassy groundmass	63) Feldspar	88) Silty
14) Silty	39) Feldspar	64) Feldspar	89) Feldspar
15) Silty	40) Feldspar	65) Silty	90) Silty
16) Feldspar in glassy groundmass	41) Feldspar	66) Silty	91) Feldspar
17) Silty	42) Silty	67) Silty	92) Silty
18) Silty	43) Silty	68) Glassy groundmass	93) Glassy groundmass
19) Silty	44) Silty	69) Feldspar	94) Glassy groundmass
20) Silty	45) Silty	70) Silty	95) Feldspar

21) Glassy groundmass	46) Silty	71) Silty	96) Silty
22) Feldspar	47) Feldspar	72) Silty	97) Silty
23) Feldspar	48) Silty	73) Silty	98) Silty
24) Silty	49) Silty	74) Silty	99) Feldspar
25) Silty	50) Silty	75) Feldspar	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 709

1) Feldspar	26) Feldspar	51)	76)
2) Feldspar	27) Hole	52)	77)
3) Glassy groundmass	28) Feldspar	53)	78)
4) Feldspar	29) Altered material?	54)	79)
5) Feldspar	30) Feldspar	55)	80)
6) Quartz	31) Feldspar	56)	81)
7) Rhyolite fragment	32) Glassy groundmass	57)	82)
8) Feldspar	33) Hole	58)	83)
9) Hole	34) Feldspar	59)	84)
10) Feldspar	35) Feldspar	60)	85)
11) Rhyolite fragment	36) Quartz with glassy groundmass (rhyolite fragment)	61)	86)
12) Feldspar	37) Glassy groundmass	62)	87)
13) Glassy groundmass	38) Glassy groundmass	63)	88)
14) Feldspar	39) Glassy groundmass	64)	89)
15) Quartz	40) Quartz	65)	90)
16) Feldspar	41) Feldspar	66)	91)
17) Quartz	42) Feldspar	67)	92)
18) Hole	43) Feldspar in glassy groundmass	68)	93)
19) Quartz	44) Hole	69)	94)
20) Feldspar	45) Quartz	70)	95)

21) Altered crystal	46) Glassy groundmass	71)	96)
22) Feldspar	47) Glassy groundmass	72)	97)
23) Glassy groundmass	48) Glassy groundmass	73)	98)
24) Quartz	49) Quartz	74)	99)
25) Feldspar	50) Glassy groundmass	75)	100)

NOTE: Small sherd, only 50 points.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 232

1) Heavily altered rock fragment	26) Glassy groundmass	51) Heavily altered rock fragment	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Feldspar	28) Glassy groundmass	53) Feldspar	78) Feldspar
4) Feldspar	29) Feldspar	54) Feldspar	79) Glassy groundmass
5) Quartz	30) Feldspar	55) Feldspar	80) Glassy groundmass
6) Hole	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Feldspar	59) Feldspar	84) Glassy groundmass
10) Feldspar	35) Feldspar	60) Feldspar	85) Feldspar
11) Feldspar	36) Feldspar	61) Feldspar	86) Feldspar
12) Hematite	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Feldspar	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Glassy groundmass
15) Feldspar	40) Feldspar	65) Feldspar	90) Feldspar
16) Quartz	41) Feldspar	66) Glassy groundmass	91) Quartz
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Quartz

18) Feldspar	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Glassy groundmass	44) Glassy groundmass	69) Feldspar	94) Glassy groundmass
20) Feldspar	45) Quartz	70) Feldspar	95) Glassy groundmass
21) Glassy groundmass	46) Feldspar	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Feldspar
23) Feldspar	48) Quartz	73) Feldspar	98) Glassy groundmass
24) Feldspar	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Feldspar	50) Quartz	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 898

1) Clay	26) Clay	51)	76)
2) Clay	27) Clay	52)	77)
3) Clay	28) Feldspar	53)	78)
4) Clay	29) Clay	54)	79)
5) Clay	30) Clay	55)	80)
6) Quartz	31) Tephra????	56)	81)
7) Silty	32) Clay	57)	82)
8) Clay	33) Clay	58)	83)
9) Clay	34) Feldspar	59)	84)
10) Clay	35) Feldspar	60)	85)
11) Clay	36) Clay	61)	86)
12) Silty	37) Clay	62)	87)
13) Quartz	38) Clay	63)	88)
14) Silty	39) Clay	64)	89)
15) Clay	40) Clay	65)	90)
16) Clay	41) Glassy groundmass	66)	91)
17) Glassy groundmass	42) Heavily altered rock fragment	67)	92)
18) Clay	43) Clay	68)	93)
19) Clay	44) Clay	69)	94)
20) Clay	45) Clay	70)	95)
21) Clay	46) Clay	71)	96)
22) Glassy groundmass	47) Clay	72)	97)
23) Quartz	48) Clay	73)	98)
24) Clay	49) Clay	74)	99)
25) Clay	50) Glassy	75)	100)

	groundmass		

NOTE: Few non-plastics, 50 point count.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 211

1) Hole	26) Feldspar	51) Augite	76) Glassy groundmass
2) Quartz in glassy groundmass	27) Feldspar	52) Feldspar	77) Feldspar
3) Glassy groundmass	28) Glassy groundmass	53) Feldspar	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Feldspar	55) Glassy groundmass	80) Hole
6) Feldspar	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Quartz	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Altered crystal	58) Hole	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass (altered)	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Feldspar	85) Quartz
11) Quartz in glassy groundmass	36) Glassy groundmass	61) Altered crystal in glassy groundmass	86) Feldspar
12) Glassy groundmass	37) Quartz	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Quartz in glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Feldspar	90) Feldspar

16) Glassy groundmass	41) Glassy groundmass	66) Opaque	91) Glassy groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Opaque	92) Feldspar
18) Feldspar	43) Quartz	68) Quartz	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Hole	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Feldspar
22) Feldspar in glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Quartz
23) Hole	48) Feldspar	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Quartz	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Feldspar	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 220

1) Quartz	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Feldspar	27) Feldspar	52) Glassy groundmass	77) Feldspar
3) Glassy groundmass	28) Feldspar	53) Glassy groundmass	78) Augite
4) Glassy groundmass	29) Quartz	54) Feldspar	79) Augite
5) Glassy groundmass	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass
6) Quartz	31) Glassy groundmass	56) Feldspar	81) Glassy groundmass
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Feldspar
8) Feldspar in glassy groundmass	33) Feldspar	58) Glassy groundmass	83) Feldspar
9) Feldspar	34) Hornblende?	59) Augite	84) Feldspar
10) Quartz	35) Feldspar	60) Feldspar	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Augite	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Feldspar	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Augite	39) Glassy groundmass	64) Glassy groundmass	89) Feldspar
15) Glassy groundmass	40) Augite	65) Glassy groundmass	90) Glassy groundmass
16) Glassy groundmass	41) Feldspar	66) Feldspar	91) Glassy groundmass
17) Glassy	42) Feldspar	67) Feldspar	92) Feldspar

groundmass			
18) Feldspar	43) Feldspar	68) Glassy groundmass	93) Augite
19) Feldspar	44) Quartz	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Feldspar	95) Feldspar
21) Glassy groundmass	46) Glassy groundmass	71) Feldspar	96) Glassy groundmass
22) Glassy groundmass	47) Quartz	72) Augite	97) Feldspar
23) Glassy groundmass	48) Feldspar	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Opaque	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Hole	75) Glassy groundmass	100) Quartz

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 76

1) Glassy groundmass	26) Glassy groundmass	51) Augite	76) Feldspar in glassy groundmass
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Feldspar	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Glassy groundmass	80) Feldspar
6) Glassy groundmass	31) Quartz	56) Feldspar	81) Glassy groundmass
7) Glassy groundmass	32) Feldspar	57) Feldspar	82) Glassy groundmass
8) Glassy groundmass	33) Feldspar	58) Feldspar	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Feldspar	84) Feldspar
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar in glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Feldspar
13) Feldspar	38) Augite	63) Feldspar	88) Feldspar in glassy groundmass
14) Feldspar	39) Glassy groundmass	64) Feldspar	89) Glassy groundmass
15) Feldspar	40) Glassy groundmass	65) Feldspar	90) Glassy groundmass
16) Glassy	41) Quartz	66) Glassy	91) Glassy

groundmass		groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Glassy groundmass	68) Feldspar	93) Feldspar
19) Feldspar	44) Feldspar	69) Glassy groundmass	94) Glassy groundmass
20) Quartz	45) Feldspar	70) Glassy groundmass	95) Glassy groundmass
21) Feldspar	46) Feldspar	71) Feldspar	96) Glassy groundmass
22) Feldspar	47) Glassy groundmass	72) Feldspar in glassy groundmass	97) Feldspar
23) Glassy groundmass	48) Glassy groundmass	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar in glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 731

1) Quartz	26) Glassy groundmass	51)	76)
2) Glassy groundmass	27) Glassy groundmass	52)	77)
3) Glassy groundmass	28) Feldspar	53)	78)
4) Glassy groundmass	29) Feldspar	54)	79)
5) Feldspar	30) Glassy groundmass	55)	80)
6) Feldspar	31) Glassy groundmass	56)	81)
7) Altered crystal	32) Glassy groundmass	57)	82)
8) Glassy groundmass	33) Feldspar in glassy groundmass	58)	83)
9) Glassy groundmass	34) Glassy groundmass	59)	84)
10) Opaque	35) Glassy groundmass	60)	85)
11) Glassy groundmass	36) Feldspar	61)	86)
12) Glassy groundmass	37) Feldspar	62)	87)
13) Feldspar	38) Glassy groundmass	63)	88)
14) Quartz	39) Feldspar	64)	89)
15) Clay	40) Feldspar	65)	90)
16) Quartz	41) Quartz	66)	91)
17) Feldspar	42) Quartz	67)	92)
18) Clay	43) Feldspar	68)	93)

19) Glassy groundmass	44) Glassy groundmass	69)	94)
20) Glassy groundmass	45) Glassy groundmass	70)	95)
21) Glassy groundmass	46) Clay	71)	96)
22) Quartz in glassy groundmass	47) Feldspar	72)	97)
23) Augite??	48) Feldspar	73)	98)
24) Quartz	49) Quartz	74)	99)
25) Feldspar	50) Glassy groundmass	75)	100)

NOTE: Half of slide is over-ground, 50 point count.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1063

1) Glassy groundmass	26) Feldspar	51) Feldspar	76) Glassy groundmass
2) Glassy groundmass	27) Feldspar	52) Feldspar	77) Feldspar
3) Glassy groundmass	28) Feldspar	53) Feldspar	78) Feldspar
4) Hole	29) Quartz	54) Feldspar	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Quartz	80) Glassy groundmass
6) Feldspar	31) Glassy groundmass	56) Feldspar	81) Hole
7) Feldspar	32) Feldspar	57) Feldspar	82) Glassy groundmass
8) Quartz	33) Feldspar	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Silty	59) Glassy groundmass	84) Augite
10) Glassy groundmass	35) Silty	60) Feldspar	85) Feldspar
11) Glassy groundmass	36) Feldspar	61) Feldspar	86) Feldspar
12) Feldspar	37) Feldspar	62) Feldspar	87) Glassy groundmass
13) Feldspar	38) Silty	63) Glassy groundmass	88) Feldspar
14) Quartz	39) Quartz	64) Glassy groundmass	89) Feldspar
15) Glassy groundmass	40) Silty	65) Augite	90) Hole
16) Glassy	41) Silty	66) Glassy	91) Glassy

groundmass		groundmass	groundmass
17) Opaque	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Opaque	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Opaque	44) Glassy groundmass	69) Feldspar	94) Feldspar
20) Feldspar	45) Augite??	70) Glassy groundmass	95) Feldspar
21) Feldspar	46) Quartz in glassy groundmass	71) Feldspar	96) Hole
22) Glassy groundmass	47) Glassy groundmass	72) Feldspar	97) Feldspar
23) Glassy groundmass	48) Feldspar	73) Feldspar	98) Feldspar in glassy groundmass
24) Opauq	49) Feldspar	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 122

1) Quartz	26) Glassy groundmass	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Feldspar	53) Feldspar	78) Glassy groundmass
4) Glassy groundmass	29) Feldspar	54) Feldspar	79) Feldspar
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Feldspar
6) Feldspar	31) Glassy groundmass	56) Feldspar	81) Feldspar
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Augite
8) Feldspar	33) Glassy groundmass	58) Glassy groundmass	83) Feldspar
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Augite
10) Glassy groundmass	35) Glassy groundmass	60) Feldspar	85) Glassy groundmass
11) Quartz	36) Feldspar	61) Feldspar	86) Glassy groundmass
12) Augite	37) Feldspar	62) Glassy groundmass	87) Glassy groundmass
13) Augite	38) Feldspar	63) Glassy groundmass	88) Feldspar
14) Feldspar	39) Glassy groundmass	64)Augite	89) Glassy groundmass
15) Feldspar	40) Glassy groundmass	65) Augite	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Feldspar	68) Feldspar	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Glassy groundmass	46) Feldspar	71) Feldspar	96) Glassy groundmass
22) Augite	47) Glassy groundmass	72) Feldspar	97) Glassy groundmass
23) Augite	48) Augite	73) Feldspar	98) Feldspar
24) Augite	49) Augite	74) Glassy groundmass	99) Augite
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

NOTE: This slide is a bit high still.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 152

1) Feldspar	26) Feldspar	51) Feldspar	76) Augite
2) Glassy groundmass	27) Glassy groundmass	52) Feldspar	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Feldspar	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Feldspar
6) Glassy groundmass	31) Glassy groundmass	56) Feldspar	81) Feldspar
7) Glassy groundmass	32) Glassy groundmass	57) Augite	82) Feldspar
8) Glassy groundmass	33) Feldspar	58) Feldspar	83) Glassy groundmass
9) Feldspar	34) Glassy groundmass	59) Augite	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Feldspar	85) Quartz
11) Feldspar	36) Feldspar	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Spherule	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Feldspar	63) Quartz	88) Quartz
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Feldspar
15) Feldspar	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Quartz	41) Feldspar	66) Quartz	91) Glassy groundmass

17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Feldspar	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar
19) Glassy groundmass	44) Feldspar	69 Quartz	94) Glassy groundmass
20) Glassy groundmass	45) Feldspar	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass (altered)	46) Glassy groundmass	71) Glassy groundmass	96) Augite
22) Quartz	47) Glassy groundmass	72) Feldspar	97) Feldspar
23) Glassy groundmass	48) Glassy groundmass	73) Feldspar	98) Augite
24) Glassy groundmass	49) Feldspar	74) Glassy groundmass	99) Glassy groundmass
25) Augite	50) Feldspar	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1454

1) Clay	26) Clay	51)	76)
2) Clay	27) Augite	52)	77)
3) Clay	28) Feldspar	53)	78)
4) Augite	29) Feldspar	54)	79)
5) Clay	30) Augite	55)	80)
6) Clay	31) Augite	56)	81)
7) Clay	32) Clay	57)	82)
8) Feldspar	33) Clay	58)	83)
9) Feldspar	34) Clay	59)	84)
10) Clay	35) Clay	60)	85)
11) Clay	36) Augite	61)	86)
12) Clay	37) Augite	62)	87)
13) Feldspar	38) Augite	63)	88)
14) Feldspar	39) Clay	64)	89)
15) Clay	40) Clay	65)	90)
16) Clay	41) Clay	66)	91)
17) Clay	42) Feldspar	67)	92)
18) Clay	43) Clay	68)	93)
19) Feldspar	44) Clay	69)	94)
20) Feldspar	45) Clay	70)	95)
21) Augite	46) Clay	71)	96)
22) Augite	47) Clay	72)	97)
23) Feldspar	48) Feldspar	73)	98)
24) Clay	49) Feldspar	74)	99)
25) Clay	50) Augite	75)	100)

NOTE: 50 points count due to few inclusions.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 956

1) Glassy groundmass (altered)	26) Augite	51)	76)
2) Glassy groundmass (altered)	27) Clay	52)	77)
3) Augite	28) Clay	53)	78)
4) Augite	29) Augite	54)	79)
5) Clay	30) Opaque	55)	80)
6) Clay	31) Augite	56)	81)
7) Clay	32) Augite	57)	82)
8) Feldspar	33) Clay	58)	83)
9) Feldspar	34) Clay	59)	84)
10) Augite	35) Augite	60)	85)
11) Augite	36) Augite	61)	86)
12) Feldspar	37) Feldspar	62)	87)
13) Clay	38) Feldspar	63)	88)
14) Glassy grounmass	39) Augite	64)	89)
15) Glassy groundmass	40) Feldspar	65)	90)
16) Augite	41) Augite	66)	91)
17) Clay	42) Augite	67)	92)
18) Augite	43) Augite	68)	93)
19) Glassy groundmass	44) Feldspar	69)	94)
20) Glassy groundmass	45) Feldspar	70)	95)
21) Augite	46) Felspar	71)	96)

22) Augite	47) Feldspar	72)	97)
23) Augite	48) Augite	73)	98)
24) Feldspar	49) Feldspar	74)	99)
25) Feldspar	50) Glassy groundmass	75)	100)

NOTE: 50 point count.

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1343

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Glassy groundmass (altered)	76) Augite
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Hole	31) Augite	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Hornblende	32) Glassy groundmass (altered)	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Glassy groundmass (altered)
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Quartz	85) Glassy groundmass (altered)
11) Glassy groundmass (altered)	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Augite
13) Feldspar	38) Glassy groundmass (altered)	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Feldspar	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Glassy groundmass (altered)	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Glassy groundmass (altered)
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Feldspar	91) Glassy groundmass (altered)
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Glassy groundmass (altered)	68) Glassy groundmass (altered)	93) Augite
19) Glassy groundmass (altered)	44) Feldspar	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Feldspar	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Glassy groundmass (altered)	46) Augite	71) Feldspar	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Augite	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy	49) Glassy	74) Glassy	99) Glassy

groundmass (altered)	groundmass (altered)	groundmass (altered)	groundmass (altered)
25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1583

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Augite
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Augite	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Hole	32) Glassy groundmass	57)Augite	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Feldspar	40) Glassy groundmass	65) Glassy groundmass	90) Feldspar
16) Opaque	41) Glassy	66) Augite	91) Glassy

	groundmass		groundmass
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Feldspar	95) Feldspar
21) Feldspar	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Feldspar

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 1208

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Hematite
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Feldspar	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Augite??
7) Feldspar	32) Glassy groundmass	57) Feldspar	82) Glassy groundmass
8) Feldspar	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Hole	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Augite	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Quartz	41) Feldspar	66) Glassy	91) Glassy

		groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Glassy groundmass	68) Augite	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Feldspar
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Augite??
23) Glassy groundmass	48) Feldspar	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 947

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Glassy groundmass	28) Augite	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Augite	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar (plag)	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Hole
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Quart z	41) Glassy	66) Glassy	91) Glassy

	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Augite??
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Feldspar	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Feldspar	97) Glassy groundmass
23) Glassy groundmass	48) Augite	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Augite

Collection: Sayles' Surface Collections **Sherd Designation:** EBS 13

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Hole	79) Glassy groundmass
5) Glassy groundmass	30) Quartz	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Feldpsar	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Hole
9) Glassy groundmass	34) Glassy groundmass	59)Augite	84) Glassy groundmass
10) Feldspar	35) Augite??	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Glassy groundmass
15) Quartz	40) Feldspar with glassy groundmass	65) Feldspar	90) Glassy groundmass
16) Glassy	41) Feldspar with	66) Glassy	91) Glassy

groundmass	glassy groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Glassy groundmass	92) Glassy groundmass
18) Quartz	43) Glassy groundmass	68) Glassy groundmass	93) Feldspar in glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23)Hole	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Opaque	49) Quartz	74) Glassy groundmass	99) Feldspar
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 716

1) Feldspar	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Feldspar	52) Augite	77) Feldspar
3) Feldspar	28) Feldspar	53) Glassy groundmass	78) Feldspar
4) Quartz	29) Glassy groundmass	54) Feldspar	79) Augite
5) Feldspar	30) Feldspar	55) Feldspar	80) Feldspar
6) Feldspar	31) Feldspar	56) Feldspar	81) Feldspar
7) Glassy groundmass	32) Quartz	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar with glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Feldspar
9) Feldspar	34) Pyroxene	59) Feldspar	84) Feldspar
10) Feldspar	35) Feldspar	60) Feldspar	85) Feldspar
11) Quartz	36) Feldspar	61) Glassy groundmass	86) Feldspar
12) Glassy groundmass	37) Feldspar	62) Feldspar	87) Feldspar with glassy groundmass
13) Augite	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Quartz	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Feldspar	40) Feldspar	65) Feldspar	90) Glassy groundmass
16) Feldspar	41) Feldspar	66) Feldspar	91) Feldspar
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Feldspar with glassy groundmass	68) Felspar	93) Heavily altered rock fragment

19) Feldspar	44) Feldspar	69) Feldspar	94) Glassy groundmass
20) Glassy groundmass	45) Feldspar	70) Augite	95) Feldspar
21) Feldspar	46) Glassy groundmass	71) Feldspar	96) Feldspar
22) Feldspar	47) Feldspar	72) Feldspar	97) Quartz
23) Feldspar	48) Feldspar	73) Feldspar	98) Feldspar
24) Glassy groundma	49) Feldspar	74) Feldspar	99) Feldspar
25) Augite	50) Feldspar	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 278

1) Feldspar	26) Feldspar	51) Opaque	76) Quartz
2) Feldspar	27) Feldspar	52) Feldspar	77) Feldspar
3) Feldspar	28) Feldspar	53) Glassy groundmass	78) Feldspar
4) Augite	29) Feldspar	54) Glassy groundmass	79) Feldspar
5) Feldspar	30) Augite	55) Feldspar	80) Glassy groundmass
6) Feldspar	31) Feldspar	56) Feldspar	81) Feldspar
7) Augite	32) Feldspar	57) Augite	82) Feldspar
8) Glassy groundmass	33) Feldspar	58) Quartz	83) Feldspar
9) Augite	34) Feldspar with glassy groundmass	59) Feldspar	84) Feldspar
10) Feldspar	35) Feldspar	60) Feldspar	85) Glassy groundmass
11) Quartz	36) Augite	61) Feldspar	86) Feldspar
12) Feldspar	37) Feldspar	62) Feldspar	87) Feldspar
13) Feldspar	38) Augite	63) Quartz	88) Feldspar
14) Feldspar	39) Feldspar	64) Feldspar	89) Augite
15) Augite	40) Quartz	65) Feldspar	90) Feldspar
16) Feldspar	41) Feldspar	66) Augite	91) Feldspar
17) Feldspar	42) Quartz with glassy groundmass	67) Feldspar	92) Feldspar
18) Glassy groundmass	43) Feldspar	68) Feldspar	93) Feldspar
19) Feldspar	44) Feldspar	69) Feldspar	94) Augite
20) Quartz	45) Glassy groundmass	70) Feldspar	95) Feldspar

21) Feldspar	46) Feldspar	71) Feldspar	96) Feldspar
22) Feldspar	47) Feldspar	72) Glassy groundmass	97) Glassy groundmass
23) Augite	48) Opaque	73) Augite	98) Augite
24) Feldspar	49) Feldspar	74) Feldspar	99) Feldspar
25) Feldspar	50) Feldspar	75) Feldspar	100) Feldspar

Collection: Site 204 **Sherd Designation:** Inv. 897

1) Augite	26) Augite	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Feldspar	28) Feldspar	53) Augite	78) Glassy groundmass
4) Feldspar	29) Feldspar	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Augite	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Feldspar
7) Feldspar	32) Glassy groundmass	57) Feldspar	82) Augite
8) Glassy groundmass	33) Augite	58) Feldspar	83) Feldspar
9) Feldspar with glassy groundmass	34) Augite	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass (altered)
11) Feldspar	36) Feldspar	61) Feldspar	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Feldspar	87) Feldspar
13) Glassy groundmass	38) Glassy groundmass	63) Augite	88) Void
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Feldspar
15) Augite	40) Augite	65) Feldspar	90) Feldspar
16) Feldspar	41) Glassy	66) Quartz	91) Glassy

	groundmass		groundmass
17) Feldspar	42) Augite	67) Feldspar	92) Glassy groundmass
18) Feldspar	43) Feldspar	68) Feldspar	93) Glassy groundmass
19) Feldspar	44) Feldspar	69) Glassy groundmass	94) Feldspar
20) Glassy groundmass	45) Feldspar	70) Feldspar	95) Glassy groundmass
21) Augite	46) Feldspar	71) Feldspar	96) Glassy groundmass
22) Glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Feldspar
23) Glassy groundmass	48) Quartz	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar	74) Glassy groundmass	99) Feldspar
25) Feldspar	50) Glassy groundmass	75) Feldspar with glassy groundmass	100) Feldspar

Collection: Site 204 **Sherd Designation:** Inv. 149

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass (altered)	52) Feldspar	77) Feldspar
3) Feldspar	28) Glassy groundmass	53) Feldspar	78) Feldspar
4) Feldspar	29) Feldspar	54) Feldspar	79) Feldspar
5) Feldspar	30) Feldspar	55) Glassy groundmass	80) Feldspar
6) Feldspar	31) Augite	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Feldspar	57) Augite in altered lithic fragment	82) Feldspar
8) Opaque	33) Feldspar	58) Feldspar	83) Feldspar
9) Feldspar	34) Glassy groundmass	59) Feldspar	84) Glassy groundmass
10) Opaque	35) Glassy groundmass	60) Feldspar	85) Feldspar
11) Feldspar	36) Glassy groundmass	61) Augite	86) Feldspar
12) Feldspar	37) Feldspar	62) Augite	87) Glassy groundmass
13) Feldspar in glassy groundmass	38) Feldspar	63) Feldspar	88) Feldspar
14) Glassy groundmass	39) Feldspar	64) Feldspar	89) Feldspar
15) Glassy groundmass	40) Glassy groundmass	65) Feldspar	90) Feldspar
16) Feldspar	41) Glassy	66) Glassy	91) Glassy

	groundmass	groundmass	groundmass
17) Feldspar	42) Opaque altered lithic fragment	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass	43) Augite with altered lithic fragment	68) Feldspar	93) Feldspar
19) Glassy groundmass	44) Feldspar	69) Feldspar	94) Feldspar
20) Quartz	45) Feldspar	70) Glassy groundmass	95) Augite
21) Glassy groundmass	46) Augite	71) Feldspar	96) Feldspar
22) Feldspar	47) Feldspar	72) Feldspar	97) Glassy groundmass
23) Feldspar	48) Void	73) Feldspar	98) Glassy groundmass
24) Feldspar	49) Augite with altered lithic fragment	74) Feldspar	99) Feldspar
25) Augite	50) Augite	75) Feldspar	100) Feldspar

Collection: Site 204 **Sherd Designation:** Inv. 817

1) Feldspar	26) Glassy groundmass	51) Glassy groundmass	76) Feldspar
2) Feldspar	27) Glassy groundmass	52) Glassy groundmass	77) Feldspar
3) Feldspar	28) Augite	53) Glassy groundmass	78) Glassy groundmass (altered)
4) Feldspar in glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass (altered)
5) Glassy groundmass	30) Glassy groundmass	55) Feldspar	80) Feldspar
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Augite
7) Glassy groundmass	32) Feldspar	57) Glassy groundmass	82) Feldspar
8) Feldspar	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Feldspar	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Feldspar	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar in glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Feldspar	87) Glassy groundmass
13) Glassy groundmass	38) Feldspar	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Feldspar	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Augite	65) Glassy groundmass	90) Glassy groundmass

16) Feldspar	41) Glassy groundmass	66) Glassy groundmass	91) Feldspar
17) Feldspar	42) Glassy groundmass	67) Glassy groundmass	92) Feldspar
18) Glassy groundmass (altered)	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass (altered)	44) Glassy groundmass	69) Opaque	94) Glassy groundmass
20) Glassy groundmass (altered)	45) Feldspar	70) Glassy groundmass	95) Feldspar
21) Feldspar	46) Feldspar	71) Glassy groundmass	96) Feldspar
22) Feldspar	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass (altered)
23) Feldspar	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass (altered)
24) Glassy groundmass	49) Glassy groundmass	74) Feldspar	99) Feldspar
25) Glassy groundmass	50) Feldspar	75) Feldspar	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 794

1) Feldspar	26) Glassy groundmass	51) Void	76) Feldspar
2) Feldspar	27) Glassy groundmass	52) Feldspar	77) Feldspar
3) Augite	28) Glassy groundmass	53) Augite	78) Glassy groundmass
4) Void	29) Feldspar	54) Feldspar	79) Augite
5) Augite	30) Feldspar	55) Feldspar	80) Glassy groundmass
6) Feldspar	31) Glassy groundmass	56) Glassy groundmass	81) Feldspar
7) Glassy groundmass	32) Quartz	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Feldspar	58) Glassy groundmass	83) Glassy groundmass
9) Feldspar	34) Feldspar	59) Glassy groundmass	84) Feldspar
10) Feldspar	35) Feldspar	60) Feldspar	85) Feldspar
11) Feldspar	36) Augite	61) Augite	86) Augite
12) Feldspar	37) Feldspar	62) Feldspar	87) Feldspar
13) Glassy groundmass	38) Augite	63) Glassy groundmass	88) Augite
14) Feldspar	39) Feldspar in glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Feldspar	40) Feldspar	65) Glassy groundmass	90) Glassy groundmass
16) Glassy groundmass	41) Augite	66) Feldspar	91) Augite
17) Augite	42) Feldspar	67) Feldspar	92) Feldspar
18) Feldspar	43) Augite	68) Glassy groundmass	93) Feldspar

19) Feldspar	44) Feldspar	69) Glassy groundmass	94) Feldspar
20) Feldspar	45) Feldspar	70) Glassy groundmass	95) Glassy groundmass
21) Augite	46) Augite	71) Feldspar	96) Feldspar
22) Feldspar	47) Feldspar	72) Feldspar	97) Glassy groundmass
23) Augite	48) Augite	73) Augite	98) Feldspar
24) Feldspar	49) Glassy groundmass	74) Feldspar	99) Glassy groundmass
25) Augite	50) Augite	75) Feldspar	100) Augite

Collection: Site 204 **Sherd Designation:** Inv. 903

1) Clay body	26) Opaque	51) Feldspar	76) Glassy groundmass
2) Feldspar	27) Feldspar	52) Feldspar	77) Glassy groundmass
3) Clay body	28) Clay body	53) Feldspar	78) Glassy groundmass
4) Opaque	29) Clay body	54) Augite	79) Clay body
5) Clay body	30) Clay body	55) Feldspar	80) Clay body
6) Clay body	31) Augite	56) Clay body	81) Clay body
7) Augite	32) Feldspar	57) Clay body	82) Augite
8) Clay body	33) Feldspar	58) Clay body	83) Clay body
9) Glassy groundmass	34) Glassy groundmass	59) Augite	84) Feldspar
10) Clay body	35) Clay body	60) Clay body	85) Feldspar
11) Glassy groundmass	36) Clay body	61) Clay body	86) Feldspar
12) Augite	37) Clay body	62) Clay body	87) Glassy groundmass
13) Clay body	38) Glassy groundmass	63) Augite	88) Clay body
14) Clay body	39) Clay body	64) Glassy groundmass	89) Feldspar
15) Glassy groundmass (altered)	40) Clay body	65) Glassy groundmass	90) Feldspar
16) Feldspar	41) Clay body	66) Clay body	91) Feldspar
17) Feldspar	42) Glassy groundmass	67) Clay body	92) Clay body
18) Glassy groundmass (altered)	43) Glassy groundmass	68) Clay body	93) Clay body

19) Feldspar	44) Clay body	69) Feldspar	94) Feldspar
20) Glassy groundmass	45) Clay body	70) Clay body	95) Clay body
21) Glassy groundmass	46) Feldspar	71) Feldspar	96) Clay body
22) Clay body	47) Feldspar	72) Feldspar	97) Feldspar
23) Clay body	48) Feldspar	73) Clay body	98) Augite
24) Clay body	49) Clay body	74) Clay body	99) Feldspar
25) Feldspar	50) Clay body	75) Clay body	100) Clay body

Collection: Site 204 **Sherd Designation:** Inv. 877

1) Clay body	26) Opaque	51) Clay body	76) Feldspar
2) Opaque	27) Clay body	52) Glassy groundmass	77) Feldspar
3) Clay body	28) Glassy groundmass	53) Clay body	78) Clay body
4) Opaque	29) Glassy groundmass (altered)	54) Glassy groundmass	79) Clay body
5) Feldspar	30) Glassy groundmass (altered)	55) Clay body	80) Glassy groundmass
6) Feldspar	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Clay body	32) Feldspar	57) Glassy groundmass	82) Glassy groundmass (altered)
8) Clay body	33) Clay body	58) Clay body	83) Augite
9) Feldspar	34) Clay body	59) Glassy groundmass (altered)	84) Clay body
10) Clay body	35) Clay body	60) Glassy groundmass (altered)	85) Clay body
11) Glassy groundmass	36) Glassy groundmass	61) Clay body	86) Glassy groundmass
12) Clay body	37) Clay body	62) Clay body	87) Glassy groundmass
13) Glassy groundmass	38) Clay body	63) Feldspar	88) Clay body
14) Augite	39) Clay body	64) Feldspar	89) Augite
15) Glassy groundmass	40) Augite	65) Glassy groundmass	90) Clay body

16) Clay body	41) Clay body	66) Glassy groundmass	91) Clay body
17) Feldspar	42) Clay body	67) Glassy groundmass	92) Glassy groundmass
18) Clay body	43) Clay body	68) Clay body	93) Glassy groundmass
19) Glassy groundmass	44) Feldspar	69) Glassy groundmass	94) Clay body
20) Clay body	45) Feldspar	70) Clay body	95) Glassy groundmass
21) Glassy groundmass	46) Feldspar	71) Opaque	96) Glassy groundmass
22) Clay body	47) Clay body	72) Glassy groundmass (altered)	97) Augite
23) Glassy groundmass	48) Feldspar	73) Clay body	98) Glassy groundmass
24) Glassy groundmass	49) Clay body	74) Clay body	99) Clay body
25) Glassy groundmass	50) Feldspar	75) Clay body	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 977

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Feldspar	53) Glassy groundmass	78) Feldspar
4) Augite	29) Glassy groundmass	54) Augite	79) Augite
5) Glassy groundmass	30) Glassy groundmass	55) Augite	80) Feldspar
6) Feldspar	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Augite	57) Glassy groundmass	82) Glassy groundmass
8) Feldspar	33) Feldspar	58) Glassy groundmass	83) Feldspar
9) Glassy groundmass	34) Augite	59) Glassy groundmass	84) Feldspar
10) Glassy groundmass	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass (altered)	86) Glassy groundmass
12) Augite	37) Augite	62) Augite	87) Feldspar
13) Augite	38) Feldspar	63) Feldspar	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Augite	40) Feldspar	65) Glassy groundmass	90) Feldspar
16) Feldspar	41) Feldspar	66) Glassy	91) Feldspar

		groundmass (altered)	
17) Glassy groundmass	42) Glassy groundmass	67) Augite	92) Feldspar
18) Glassy groundmass	43) Opaque	68) Feldspar	93) Glassy groundmass
19) Feldspar	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Glassy groundmass	46) Feldspar	71) Feldspar in glassy groundmass	96) Feldspar
22) Glassy groundmass	47) Augite	72) Glassy groundmass	97) Glassy groundmass
23) Augite	48) Feldspar	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Feldspar	74) Feldspar	99) Feldspar
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Feldspar

Collection: Site 204 **Sherd Designation:** Inv. 875

1) Glassy groundmass	26) Clay body	51) Glassy groundmass	76) Augite
2) Glassy groundmass	27) Clay body	52) Feldspar	77) Clay body
3) Feldspar	28) Augite	53) Feldspar	78) Clay body
4) Feldspar in glassy groundmass	29) Augite	54) Augite	79) Clay body
5) Feldspar	30) Feldspar	55) Clay body	80) Opaque
6) Augite	31) Glassy groundmass	56) Clay body	81) Feldspar
7) Feldspar	32) Glassy groundmass	57) Feldspar in glassy groundmass	82) Augite
8) Augite	33) Clay body	58) Glassy groundmass	83) Feldspar
9) Augite	34) Clay body	59) Feldspar	84) Quartz
10) Glassy groundmass	35) Clay body	60) Feldspar	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass (altered)	61) Void	86) Clay body
12) Feldspar in glassy groundmass	37) Glassy groundmass (altered)	62) Feldspar	87) Clay body
13) Augite	38) Augite	63) Feldspar	88) Glassy groundmass
14) Augite	39) Augite	64) Clay body	89) Glassy groundmass
15) Augite	40) Feldspar	65) Glassy groundmass	90) Opaque
16) Glassy groundmass	41) Clay body	66) Glassy groundmass	91) Feldspar

17) Glassy groundmass	42) Feldspar	67) Glassy groundmass	92) Clay body
18) Clay body	43) Feldspar	68) Clay body	93) Clay body
19) Clay body	44) Clay body	69) Clay body	94) Feldspar
20) Feldspar	45) Feldspar	70) Clay body	95) Augite
21) Opaque	46) Clay body	71) Feldspar	96) Glassy groundmass
22) Clay body	47) Opaque	72) Opaque	97) Glassy groundmass
23) Clay body	48) Glassy groundmass	73) Feldspar	98) Feldspar
24) Augite	49) Glassy groundmass	74) Quartz	99) Glassy groundmass
25) Clay body	50) Augite	75) Augite	100) Augite

Collection: Site 204 **Sherd Designation:** Inv. 852

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Feldspar	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Feldspar	77) Glassy groundmass (altered)
3) Opaque	28) Feldspar	53) Feldspar	78) Opaque
4) Feldspar	29) Opaque	54) Opaque	79) Opaque
5) Feldspar	30) Feldspar	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Feldspar	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Feldspar	57) Feldspar	82) Opaque
8) Opaque	33) Feldspar	58) Glassy groundmass (altered)	83) Feldspar
9) Hematite	34) Opaque	59) Glassy groundmass (altered)	84) Feldspar
10) Glassy groundmass (altered)	35) Feldspar	60) Feldspar	85) Opaque
11) Glassy groundmass (altered)	36) Glassy groundmass (altered)	61) Feldspar	86) Feldspar
12) Feldspar	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Opaque
13) Feldspar	38) Feldspar	63) Glassy	88) Opaque

		groundmass (altered)	
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Feldspar	89) Feldspar
15) Glassy groundmass (altered)	40) Opaque	65) Opaque	90) Feldspar
16) Feldspar	41) Opaque	66) Glassy groundmass (altered)	91) Glassy groundmass (altered)
17) Feldspar	42) Opaque	67) Feldspar	92) Glassy groundmass (altered)
18) Feldspar	43) Glassy groundmass (altered)	68) Opaque	93) Feldspar
19) Augite	44) Feldspar	69) Feldspar	94) Feldspar
20) Feldspar	45) Feldspar	70) Feldspar	95) Feldspar
21) Feldspar	46) Feldspar	71) Opaque	96) Opaque
22) Glassy groundmass (altered)	47) Feldspar	72) Feldspar	97) Augite
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Opaque	98) Feldspar
24) Feldspar	49) Glassy groundmass (altered)	74) Feldspar	99) Augite
25) Feldspar	50) Feldspar	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Site 204 **Sherd Designation:**

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Glassy groundmass (altered)	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Feldspar	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32)Augite	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Feldspar
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Glassy groundmass (altered)
10) Feldspar	35) Glassy groundmass (altered)	60) Glassy groundmass (altered)	85) Glassy groundmass (altered)
11) Feldspar	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Feldspar	37) Feldspar	62) Glassy groundmass (altered)	87) Feldspar
13) Glassy groundmass (altered)	38) Glassy groundmass (altered)	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Feldspar	40) Glassy groundmass (altered)	65) Quartz in glassy groundmass	90) Glassy groundmass (altered)
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Glassy groundmass (altered)
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Feldspar in glassy groundmass	68) Glassy groundmass (altered)	93) Glassy groundmass (altered)
19) Glassy groundmass (altered)	44) Glassy groundmass (altered)	69) Glassy groundmass (altered)	94) Feldspar
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Feldspar	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Feldspar	98) Feldspar
24) Glassy	49) Glassy	74) Glassy	99) Glassy

groundmass (altered)	groundmass (altered)	groundmass (altered)	groundmass (altered)
25) Glassy groundmass (altered)	50) Feldspar	75) Glassy groundmass (altered)	100) Glassy groundmass (altered)

Collection: Site 204 **Sherd Designation:** Inv. 883

1) Glassy groundmass (altered)	26) Opaque	51) Augite	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Glassy groundmass (altered)
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Glassy groundmass (altered)	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Augite	80) Glassy groundmass (altered)
6) Feldspar	31) Feldspar	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Glassy groundmass (altered)	57) Augite	82) Feldspar
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Opaque	84) Glassy groundmass (altered)
10) Glassy groundmass (altered)	35) Augite	60) Glassy groundmass (altered)	85) Glassy groundmass (altered)
11) Feldspar	36) Feldspar	61) Void	86) Opaque
12) Glassy groundmass	37) Feldspar	62) Glassy groundmass	87) Glassy groundmass

(altered)		(altered)	(altered)
13) Glassy groundmass (altered)	38) Feldspar in glassy groundmass	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Augite	40) Glassy groundmass (altered)	65) Augite	90) Glassy groundmass (altered)
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Augite
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Glassy groundmass (altered)	68) Glassy groundmass (altered)	93) Augite
19) Feldspar	44) Glassy groundmass (altered)	69) Glassy groundmass (altered)	94) Glassy groundmass (altered)
20) Feldspar	45) Void	70) Augite	95) Glassy groundmass (altered)
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Feldspar
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy groundmass (altered)	49) Glassy groundmass (altered)	74) Glassy groundmass (altered)	99) Glassy groundmass (altered)

25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Glassy groundmass (altered)	100) Feldspar

Collection: Site 204 **Sherd Designation:** Inv. 828

1) Glassy groundmass (altered)	26) Glassy groundmass (altered)	51) Augite	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Augite	52) Glassy groundmass (altered)	77) Feldspar
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Augite	78) Glassy groundmass (altered)
4) Feldspar	29) Glassy groundmass (altered)	54) Glassy groundmass (altered)	79) Glassy groundmass (altered)
5) Feldspar	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Augite	56) Feldspar	81) Glassy groundmass (altered)
7) Glassy groundmass (altered)	32) Feldspar	57) Feldspar	82) Glassy groundmass (altered)
8) Feldspar	33) Feldspar in glassy groundmass	58) Glassy groundmass (altered)	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Glassy groundmass (altered)
10) Glassy groundmass (altered)	35) Glassy groundmass (altered)	60) Glassy groundmass (altered)	85) Opaque
11) Augite	36) Glassy groundmass (altered)	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Glassy groundmass (altered)	87) Glassy groundmass (altered)
13) Glassy groundmass (altered)	38) Feldspar	63) Feldspar	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Feldspar	89) Glassy groundmass (altered)
15) Glassy groundmass (altered)	40) Glassy groundmass (altered)	65) Glassy groundmass (altered)	90) Augite
16) Void	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Feldspar
17) Glassy groundmass (altered)	42) Augite	67) Glassy groundmass (altered)	92) Glassy groundmass (altered)
18) Glassy groundmass (altered)	43) Glassy groundmass (altered)	68) Feldspar	93) Glassy groundmass (altered)
19) Augite	44) Glassy groundmass (altered)	69) Feldspar	94) Glassy groundmass (altered)
20) Glassy groundmass (altered)	45) Glassy groundmass (altered)	70) Feldspar	95) Feldspar
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Quartz	47) Glassy groundmass (altered)	72) Glassy groundmass (altered)	97) Glassy groundmass (altered)
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Glassy groundmass (altered)
24) Glassy	49) Augite	74) Glassy	99) Feldspar

groundmass (altered)		groundmass (altered)	
25) Glassy groundmass (altered)	50) Glassy groundmass (altered)	75) Feldspar in glassy groundmass	100) Augite

Collection: Site 204 **Sherd Designation:** Inv. 883

1) Glassy groundmass (altered)	26) Feldspar	51) Glassy groundmass (altered)	76) Glassy groundmass (altered)
2) Glassy groundmass (altered)	27) Glassy groundmass (altered)	52) Glassy groundmass (altered)	77) Augite
3) Glassy groundmass (altered)	28) Glassy groundmass (altered)	53) Glassy groundmass (altered)	78) Glassy groundmass (altered)
4) Feldspar	29) Augite	54) Augite	79) Glassy groundmass (altered)
5) Glassy groundmass (altered)	30) Glassy groundmass (altered)	55) Glassy groundmass (altered)	80) Glassy groundmass (altered)
6) Glassy groundmass (altered)	31) Glassy groundmass (altered)	56) Glassy groundmass (altered)	81) Glassy groundmass (altered)
7) Augite	32) Augite	57) Glassy groundmass (altered)	82) Glassy groundmass (altered)
8) Glassy groundmass (altered)	33) Glassy groundmass (altered)	58) Augite	83) Glassy groundmass (altered)
9) Glassy groundmass (altered)	34) Glassy groundmass (altered)	59) Glassy groundmass (altered)	84) Augite
10) Augite	35) Feldspar	60) Glassy groundmass (altered)	85) Glassy groundmass (altered)
11) Glassy groundmass (altered)	36) Augite	61) Glassy groundmass (altered)	86) Glassy groundmass (altered)

12) Glassy groundmass (altered)	37) Glassy groundmass (altered)	62) Augite	87) Feldspar
13) Opaque	38)Glassy groundmass (altered)	63) Glassy groundmass (altered)	88) Glassy groundmass (altered)
14) Glassy groundmass (altered)	39) Glassy groundmass (altered)	64) Glassy groundmass (altered)	89) Glassy groundmass (altered)
15) Opaque	40) Glassy groundmass (altered)	65) Feldspar	90) Feldspar
16) Glassy groundmass (altered)	41) Glassy groundmass (altered)	66) Glassy groundmass (altered)	91) Glassy groundmass (altered)
17) Glassy groundmass (altered)	42) Glassy groundmass (altered)	67) Glassy groundmass (altered)	92) Augite
18) Glassy groundmass (altered)	43) Opaque	68) Glassy groundmass (altered)	93) Feldspar in glassy groundmass
19) Opaque	44) Glassy groundmass (altered)	69) Feldspar	94) Glassy groundmass (altered)
20) Augite	45) Glassy groundmass (altered)	70) Glassy groundmass (altered)	95) Glassy groundmass (altered)
21) Glassy groundmass (altered)	46) Glassy groundmass (altered)	71) Glassy groundmass (altered)	96) Glassy groundmass (altered)
22) Glassy groundmass (altered)	47) Feldspar	72) Glassy groundmass (altered)	97) Augite
23) Glassy groundmass (altered)	48) Glassy groundmass (altered)	73) Glassy groundmass (altered)	98) Opaque
24) Glassy	49) Glassy	74) Glassy	99) Glassy

groundmass (altered)	groundmass (altered)	groundmass (altered)	groundmass (altered)
25) Glassy groundmass (altered)	50) Augite	75) Opaque	100) Glassy groundmass (altered)

Collection: Site 204 **Sherd Designation:** Inv. 323

1) Glassy groundmass	26) Glassy groundmass	51) Glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Augite	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Feldspar
6) Glassy groundmass	31) Feldspar	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Augite	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Feldspar
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Augite

groundmass	groundmass	groundmass	
17) Glassy groundmass	42) Feldspar	67) Glassy groundmass	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Feldspar	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Glassy groundmass	46) Glassy groundmass	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Quartz
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 860

1) Glassy groundmass	26) Glassy groundmass	51) Feldspar in glassy groundmass	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Feldspar	30) Glassy groundmass	55) Feldspar	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Glassy groundmass	32) Glassy groundmass	57) Glassy groundmass	82) Feldspar
8) Feldspar in glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Feldspar	84) Glassy groundmass
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Quartz in glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Feldspar in glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Feldspar	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Feldspar in glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Feldspar	71) Glassy groundmass	96) Feldspar
22) Glassy groundmass	47) Feldspar	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Feldspar	49) Glassy groundmass	74) Feldspar	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 430

1) Glassy groundmass	26) Feldspar	51) Glassy groundmass	76) Feldspar
2) Glassy groundmass	27) Feldspar	52) Glassy groundmass	77) Glassy groundmass
3) Augite	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Feldspar	29) Glassy groundmass	54) Feldspar	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Quartz	32) Feldspar	57) Augite	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Augite
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Glassy groundmass	36) Void	61) Glassy groundmass	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Feldspar	87) Augite
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Augite	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Feldspar

groundmass	groundmass	groundmass	
17) Glassy groundmass	42) Glassy groundmass	67) Augite	92) Glassy groundmass
18) Feldspar	43) Feldspar	68) Glassy groundmass	93) Glassy groundmass
19) Feldspar	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Feldspar	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Augite	48) Glassy groundmass	73) Feldspar	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 274

1) Glassy groundmass	26) Glassy groundmass	51) Feldspar	76) Feldspar
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Glassy groundmass	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Void	29) Glassy groundmass	54) Glassy groundmass	79) Glassy groundmass
5) Glassy groundmass	30) Glassy groundmass	55) Glassy groundmass	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Spherule
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Feldspar	83) Glassy groundmass
9) Glassy groundmass	34) Quartz	59) Glassy groundmass	84) Glassy groundmass
10) Glassy groundmass	35) Glassy groundmass	60) Glassy groundmass	85) Feldspar
11) Glassy groundmass	36) Glassy groundmass	61) Glassy groundmass	86) Glassy groundmass
12) Glassy groundmass	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Feldspar	38) Feldspar	63) Glassy groundmass	88) Glassy groundmass
14) Feldspar	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Glassy groundmass	65) Glassy groundmass	90) Glassy groundmass
16) Glassy	41) Glassy	66) Glassy	91) Glassy

groundmass	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Feldspar
18) Glassy groundmass	43) Glassy groundmass	68) Glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Glassy groundmass	45) Glassy groundmass	70) Glassy groundmass	95) Glassy groundmass
21) Glassy groundmass	46) Feldspar	71) Glassy groundmass	96) Feldspar
22) Feldspar	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Feldspar	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Collection: Site 204 **Sherd Designation:** Inv. 358

1) Glassy groundmass	26) Feldspar	51) Feldspar	76) Glassy groundmass
2) Glassy groundmass	27) Glassy groundmass	52) Glassy groundmass	77) Glassy groundmass
3) Feldspar	28) Glassy groundmass	53) Glassy groundmass	78) Glassy groundmass
4) Glassy groundmass	29) Glassy groundmass	54) Glassy groundmass	79) Feldspar
5) Glassy groundmass	30) Opaque	55) Feldspar	80) Glassy groundmass
6) Glassy groundmass	31) Glassy groundmass	56) Glassy groundmass	81) Glassy groundmass
7) Feldspar	32) Glassy groundmass	57) Glassy groundmass	82) Glassy groundmass
8) Glassy groundmass	33) Glassy groundmass	58) Glassy groundmass	83) Glassy groundmass
9) Glassy groundmass	34) Glassy groundmass	59) Glassy groundmass	84) Feldspar
10) Glassy groundmass	35) Feldspar	60) Glassy groundmass	85) Glassy groundmass
11) Feldspar	36) Glassy groundmass	61) Feldspar	86) Glassy groundmass
12) Feldspar	37) Glassy groundmass	62) Glassy groundmass	87) Glassy groundmass
13) Glassy groundmass	38) Glassy groundmass	63) Glassy groundmass	88) Glassy groundmass
14) Glassy groundmass	39) Glassy groundmass	64) Glassy groundmass	89) Glassy groundmass
15) Glassy groundmass	40) Feldspar	65) Glassy groundmass	90) Feldspar
16) Feldspar	41) Glassy	66) Glassy	91) Glassy

	groundmass	groundmass	groundmass
17) Glassy groundmass	42) Glassy groundmass	67) Feldspar	92) Glassy groundmass
18) Glassy groundmass	43) Glassy groundmass	68) Feldspar in glassy groundmass	93) Glassy groundmass
19) Glassy groundmass	44) Glassy groundmass	69) Glassy groundmass	94) Glassy groundmass
20) Feldspar	45) Glassy groundmass	70) Glassy groundmass	95) Feldspar
21) Feldspar	46) Feldspar	71) Glassy groundmass	96) Glassy groundmass
22) Glassy groundmass	47) Glassy groundmass	72) Glassy groundmass	97) Glassy groundmass
23) Glassy groundmass	48) Glassy groundmass	73) Glassy groundmass	98) Glassy groundmass
24) Glassy groundmass	49) Glassy groundmass	74) Glassy groundmass	99) Glassy groundmass
25) Glassy groundmass	50) Glassy groundmass	75) Glassy groundmass	100) Glassy groundmass

Appendix F:

Raw Neutron Activation Analysis

(NAA)

Data

ID	Site Number	Provenience	Ceramic Type
EBS0013	A:16:3	Test 2, 0-6"	Babicora Polychrome
EBS0014	A:16:3	Test 2, 0-6"	Babicora Polychrome
EBS0016	A:16:3	Test 2. 0-6"	Babicora Polychrome
EBS0030	A:16:3	Surface Collection	Babicora Polychrome
EBS0033	A:16:3	Surface Collection	Ramos Polychrome
EBS0035	A:16:3	Surface Collection	White Paste Babicora Polychrome
EBS0067	A:16:3	Test 2. 24-36"	White Paste Babicora Polychrome
EBS0068	A:16:3	Test 2, 24-36"	Babicora Polychrome
EBS0076	A:16:3	Test 1, 36-42"	Babicora Polychrome
EBS0088	E:9:1	Surface Collection	Babicora Polychrome
EBS0091	E:9:1	Surface Collection	White Paste Babicora Polychrome
EBS0096	E:9:1	Surface Collection	Ramos Polychrome
EBS0122	A:16:2	Surface Collection	Ramos Polychrome
EBS0124	A:16:2	Surface Collection	Ramos Polychrome
EBS0129	A:16:2	Surface Collection	Ramos Polychrome
EBS0137	A:16:2	Surface Collection	Ramos Polychrome
EBS0140	A:16:2	Surface Collection	Ramos Polychrome
EBS0144	A:16:2	Surface Collection	Ramos Polychrome
EBS0147	A:16:2	Surface Collection	Ramos Polychrome
EBS0148	A:16:2	Surface Collection	Ramos Polychrome
EBS0152	A:16:2	Surface Collection	White Paste Babicora Polychrome
EBS0153	A:16:2	Surface Collection	Babicora Polychrome
EBS0161	A:16:2	Surface Collection	Babicora Polychrome
EBS0163	A:16:2	Surface Collection	White Paste Babicora Polychrome
EBS0170	A:16:2	Surface Collection	Babicora Polychrome
EBS0181	A:16:2	Surface Collection	Babicora Polychrome
EBS0183	A:16:2	Surface Collection	White Paste Babicora Polychrome
EBS0184	A:16:2	Surface Collection	Babicora Polychrome
EBS0187	A:16:2	Surface Collection	Babicora Polychrome
EBS0188	A:16:2	Surface Collection	Babicora Polychrome
EBS0200	E:7:2	Surface Collection	Ramos Polychrome
EBS0209	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0210	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0211	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0212	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0216	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0219	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0220	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0221	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0222	B:2:1/LA156980	Surface Collection	Ramos Polychrome
EBS0223	B:2:1/LA156980	Surface Collection	Ramos Polychrome

ID	Site Number	Provenience	Ceramic Type
EBS0231	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0232	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0235	B:2:1/LA156980	Surface Collection	White Paste Babicora Polychrome
EBS0247	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0248	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0250	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0251	B:2:1/LA156980	Surface Collection	Babicora Polychrome
EBS0254	B:2:1/LA156980	Surface Collection	White Paste Babicora Polychrome
EBS0268	I:9:5	Surface Collection	Babicora Polychrome
EBS0273	I:9:5	Surface Collection	Ramos Polychrome
EBS0281	I:9:5	Surface Collection	Babicora Polychrome
EBS0294	H:11:1	Surface Collection	Babicora Polychrome
EBS0299	H:11:1	Surface Collection	Ramos Polychrome
EBS0302	H:11:1	Surface Collection	Babicora Polychrome
EBS0303	H:11:1	Surface Collection	Ramos Polychrome
EBS0359	E:14:1	Test 2	Babicora Polychrome
EBS0376	E:14:5	Surface Collection	Babicora Polychrome
EBS0379	E:14:5	Surface Collection	Babicora Polychrome
EBS0415	E:14:1	Test 1	Babicora Polychrome
EBS0429	I:15:1	1. Below Floor	Babicora Polychrome
EBS0709	E:9:12	Test 3, 6-12"	Babicora Polychrome
EBS0728	H:11:5	18-24"	Babicora Polychrome
EBS0730	H:11:5	18-24"	Babicora Polychrome
EBS0731	C:2:4	Surface Collection	Ramos Polychrome
EBS0737	D:5:6	Surface Collection	Ramos Polychrome
EBS0739	D:5:6	Surface Collection	Ramos Polychrome
EBS0744	D:5:6	Surface Collection	Babicora Polychrome
EBS0754	D:5:6	Surface Collection	Babicora Polychrome
EBS0786	I:9:11	Test 1, 0-6" General Surface	Ramos Polychrome
EBS0787	I:9:11	Test 1, 0-6" General Surface	Ramos Polychrome
EBS0800	I:9:11	Test 1, 0-6" General Surface	Babicora Polychrome
EBS0809	I:9:11	Test 1, 0-6" General Surface	Babicora Polychrome
EBS0810	I:9:11	Test 1, 0-6" General Surface	Babicora Polychrome
EBS0815	I:9:1	Test 1, 0-6" General Surface	Babicora Polychrome
EBS0888	A:16:3	Test 1, 42-52"	White Paste Babicora Polychrome
EBS0890	A:16:3	Test 1, 42-52"	White Paste Babicora Polychrome
EBS0894	A:16:3	Test 1, 42-52"	Ramos Polychrome
EBS0896	A:16:3	Test 1, 42-52"	Ramos Polychrome
EBS0897	A:16:3	Test 1, 42-52"	Ramos Polychrome
EBS0898	A:16:3	Test 1, 42-52"	Ramos Polychrome
EBS0906	I:15:1	1. Above	Babicora Polychrome

ID	Site Number	Provenience	Ceramic Type
EBS0911	I:9:5	0-6"	Babicora Polychrome
EBS0914	I:9:5	0-6"	Babicora Polychrome
EBS0916	I:9:5	0-6"	Babicora Polychrome
EBS0918	I:9:5	0-6"	Babicora Polychrome
EBS0924	A:16:3	Test 2, 18-24"	Ramos Polychrome
EBS0933	E:9:12	Test 3, 24-30"	White Paste Babicora Polychrome
EBS0934	E:9:12	Test 3, 24-30"	White Paste Babicora Polychrome
EBS0935	E:9:12	Test 3, 24-30"	Babicora Polychrome
EBS0944	D:8:1	Surface Collection	Babicora Polychrome
EBS0945	D:8:1	Surface Collection	Babicora Polychrome
EBS0947	D:8:1	Surface Collection	Ramos Polychrome
EBS0948	D:8:1	Surface Collection	Ramos Polychrome
EBS0951	A:16:3	Test 1, 0-12"	Ramos Polychrome
EBS0956	A:16:3	Test 1, 0-12"	Babicora Polychrome
EBS0972	E:14:5	Test 2, Mid-level	Babicora Polychrome
EBS0975	H:11:5	Surface Collection	Ramos Polychrome
EBS0979	H:11:5	Surface Collection	Babicora Polychrome
EBS0982	I:9:1	Test 3, 18-24"	Ramos Polychrome
EBS0994	I:15:1	Surface Collection	Babicora Polychrome
EBS0997	I:9:1	12-18"	Babicora Polychrome
EBS1013	D:9:1	Surface Collection	Babicora Polychrome
EBS1021	D:9:1	Surface Collection	Babicora Polychrome
EBS1030	D:3:11	Surface Collection	White Paste Babicora Polychrome
EBS1031	D:3:11	Surface Collection	Babicora Polychrome
EBS1037	D:3:11	Surface Collection	Babicora Polychrome
EBS1039	D:3:11	Surface Collection	Babicora Polychrome
EBS1045	D:3:11	Surface Collection	Babicora Polychrome
EBS1046	D:3:11	Surface Collection	Babicora Polychrome
EBS1047	D:3:11	Surface Collection	Babicora Polychrome
EBS1056	D:3:11	Surface Collection	Ramos Polychrome
EBS1057	D:3:11	Surface Collection	Ramos Polychrome
EBS1059	D:3:11	Surface Collection	Ramos Polychrome
EBS1061	D:3:11	Surface Collection	Ramos Polychrome
EBS1063	D:3:11	Surface Collection	Ramos Polychrome
EBS1064	D:3:11	Surface Collection	Ramos Polychrome
EBS1066	D:3:11	Surface Collection	Ramos Polychrome
EBS1072	D:3:11	Surface Collection	Ramos Polychrome
EBS1086	A:16:3	Test 1, 12-24"	Ramos Polychrome
EBS1102	C:2:1	Surface Collection	Babicora Polychrome
EBS1122	E:9:12	Test 2, 18-24"	Babicora Polychrome
EBS1127	E:14:1	Test B, Above Floor	Babicora Polychrome

ID	Site Number	Provenience	Ceramic Type
EBS1128	I:9:1	24-30"	Babicora Polychrome
EBS1138	I:9:1	18-24"	Babicora Polychrome
EBS1145	E:9:12	Test 2, 12-18"	Ramos Polychrome
EBS1166	H:11:1	36-42"	Ramos Polychrome
EBS1172	H:11:1	Surface Collection	Ramos Polychrome
EBS1173	H:11:1	Surface Collection	Babicora Polychrome
EBS1197	D:3:1	6-12"	Ramos Polychrome
EBS1206	D:3:1	6-12"	Babicora Polychrome
EBS1208	D:3:1	6-12"	Ramos Polychrome
EBS1213	F:13:2	Surface Collection	Ramos Polychrome
EBS1231	F:13:2	Surface Collection	Babicora Polychrome
EBS1236	E:14:4	Surface Collection	Ramos Polychrome
EBS1237	E:14:4	Surface Collection	Babicora Polychrome
EBS1240	E:14:4	Surface Collection	Babicora Polychrome
EBS1247	E:14:4	Surface Collection	White Paste Babicora Polychrome
EBS1256	D:3:9	Surface Collection	Ramos Polychrome
EBS1257	D:3:9	Surface Collection	Ramos Polychrome
EBS1258	D:3:9	Surface Collection	Ramos Polychrome
EBS1262	D:3:9	Surface Collection	Babicora Polychrome
EBS1266	D:3:9	Surface Collection	Babicora Polychrome
EBS1269	D:3:9	Surface Collection	Ramos Polychrome
EBS1278	I:9:9	Surface Collection	Ramos Polychrome
EBS1281	I:9:9	Surface Collection	Babicora Polychrome
EBS1283	I:9:9	Surface Collection	Babicora Polychrome
EBS1285	I:9:9	Surface Collection	Babicora Polychrome
EBS1287	I:9:9	Surface Collection	Babicora Polychrome
EBS1289	I:9:9	Surface Collection	Babicora Polychrome
EBS1320	I:9:11	Test 2, 6-12"	Ramos Polychrome
EBS1339	D:3:11	12-18"	Ramos Polychrome
EBS1343	D:3:11	12-18"	Ramos Polychrome
EBS1345	D:3:11	12-18"	Ramos Polychrome
EBS1346	D:3:11	12-18"	Ramos Polychrome
EBS1351	I:15:1	Surface Collection	Babicora Polychrome
EBS1352	I:15:1	Surface Collection	Babicora Polychrome
EBS1392	D:3:11	24-30"	Ramos Polychrome
EBS1409	I:9:11	Test 1, 12-18"	Babicora Polychrome
EBS1421	E:9:12	Test 3, 18-24"	Ramos Polychrome
EBS1423	E:9:12	Test 3, 18-24"	Babicora Polychrome
EBS1429	E:9:12	Test 3. 18-24"	Ramos Polychrome
EBS1432	E:9:12	Test 3. 18-24"	Ramos Polychrome
EBS1446	E:9:12	Test 3, 0-6"	Babicora Polychrome

ID	Site Number	Provenience	Ceramic Type
EBS1453	E:9:12	Test 3, 0-6"	Ramos Polychrome
EBS1454	E:9:12	Test 3, 0-6"	Ramos Polychrome
EBS1455	E:9:12	Test 3, 0-6"	Ramos Polychrome
EBS1522	F:6:1	Surface Collection	Babicora Polychrome
EBS1523	F:6:1	Surface Collection	White Paste Babicora Polychrome
EBS1526	F:6:1	Surface Collection	Babicora Polychrome
EBS1531	D:3:1	Surface Collection	Babicora Polychrome
EBS1545	D:3:1	Surface Collection	Babicora Polychrome
EBS1549	D:3:1	0-6"	Babicora Polychrome
EBS1561	D:3:1	0-6"	White Paste Babicora Polychrome
EBS1563	D:3:1	Testpit, 0-6"	White Paste Babicora Polychrome
EBS1570	D:3:1	0-6"	White Paste Babicora Polychrome
EBS1577	D:3:1	0-6"	Ramos Polychrome
EBS1581	D:3:1	0-6"	Ramos Polychrome
EBS1582	D:3:1	0-6"	Ramos Polychrome
EBS1583	D:3:1	0-6"	Ramos Polychrome
EBS1587	D:3:1	0-6"	Ramos Polychrome
EBS1588	D:3:1	0-6"	Ramos Polychrome
EBS1591	B:4:1	Surface Collection	Babicora Polychrome
EBS1596	B:4:1	Surface Collection	Babicora Polychrome
EBS1600	B:4:1	Surface Collection	Babicora Polychrome

ID	Long RDF	Long Date	Short RDF	Short Date	As	La
EBS0013	NMB2	11/15/2015	NDW2-S	11/11/2015	5.0950	40.0254
EBS0014	JMA1	1/3/2016	DDT2-S	12/10/2015	7.2754	69.7583
EBS0016	NMA1	11/1/2015	OQT2-S	10/22/2015	17.5207	33.2167
EBS0030	FMA2	1/24/2016	JDW1-S	1/13/2016	4.8604	28.5340
EBS0033	NMC2	11/22/2015	NWT1-S	11/12/2015	1.8514	49.0173
EBS0035	NMD2	11/29/2015	NTT2-S	11/19/2015	2.7791	38.8293
EBS0067	NMA1	11/1/2015	OQT1-S	10/22/2015	4.0938	33.9739
EBS0068	NMB2	11/15/2015	NDW2-S	11/11/2015	3.4775	32.2539
EBS0076	FMA2	1/24/2016	JDW1-S	1/13/2016	6.2773	60.1422
EBS0088	FMA2	1/24/2016	JDW2-S	1/13/2016	5.7078	69.2334
EBS0091	NMA1	11/1/2015	OQT2-S	10/22/2015	3.0441	45.8347
EBS0096	NMB2	11/15/2015	NWT1-S	11/12/2015	2.3963	46.5450
EBS0122	NMA1	11/1/2015	OQT1-S	10/22/2015	2.8742	43.4395
EBS0124	NMD1	11/29/2015	NTT2-S	11/19/2015	5.0678	48.2427
EBS0129	NMD1	11/29/2015	NTT2-S	11/19/2015	9.8166	33.1859
EBS0137	NMB2	11/15/2015	NWT1-S	11/12/2015	2.3812	43.6035
EBS0140	NMD1	11/29/2015	NTT2-S	11/19/2015	2.9451	48.9705
EBS0144	JMA1	1/3/2016	DDT2-S	12/10/2015	3.3105	42.7906
EBS0147	NMA1	11/1/2015	OQT1-S	10/22/2015	3.2062	42.0521
EBS0148	NMB2	11/15/2015	OQT2-S	10/22/2015	2.8092	44.5548
EBS0152	NMA1	11/1/2015	OQT2-S	10/22/2015	2.7893	40.8653
EBS0153	FMA3	1/24/2016	JDW2-S	1/13/2016	2.7498	34.8031
EBS0161	JMA1	1/3/2016	DDT2-S	12/10/2015	1.6676	41.1156
EBS0163	JMA1	1/3/2016	DDT2-S	12/10/2015	13.1561	45.4386
EBS0170	JMA1	1/3/2016	DDT2-S	12/10/2015	9.0755	32.9634
EBS0181	NMC2	11/22/2015	NWT1-S	11/12/2015	2.7117	44.3061
EBS0183	NMA1	11/1/2015	OQT1-S	10/22/2015	3.9398	41.0562
EBS0184	NMA1	11/1/2015	OQT1-S	10/22/2015	5.3622	45.9400
EBS0187	NMA1	11/1/2015	OQT2-S	10/22/2015	4.0470	69.9593
EBS0188	FMA2	1/24/2016	JDW1-S	1/13/2016	3.1851	61.1099
EBS0200	NMB2	11/15/2015	NDW2-S	11/11/2015	3.6676	37.8619
EBS0209	FMA2	1/24/2016	JDW1-S	1/13/2016	2.5778	45.2884
EBS0210	NMA1	11/1/2015	OQT1-S	10/22/2015	4.9949	33.4289
EBS0211	JMA1	1/3/2016	DDT2-S	12/10/2015	2.6049	36.6559
EBS0212	NMA1	11/1/2015	OQT1-S	10/22/2015	3.2220	48.8188
EBS0216	NMA1	11/1/2015	OQT1-S	10/22/2015	3.5261	43.0434
EBS0219	NMA1	11/1/2015	OQT1-S	10/22/2015	9.0352	48.1639
EBS0220	FMA2	1/24/2016	JDW1-S	1/13/2016	3.2068	38.9721
EBS0221	NMB2	11/15/2015	NDW2-S	11/11/2015	3.3648	44.3036
EBS0222	NMB2	11/15/2015	NWT1-S	11/12/2015	2.8907	46.4702
EBS0223	NMB2	11/15/2015	NDW2-S	11/11/2015	3.4856	37.3064

ID	Long RDF	Long Date	Short RDF	Short Date	As	La
EBS0231	FMA2	1/24/2016	JDW1-S	1/13/2016	3.5568	49.1681
EBS0232	NMC2	11/22/2015	NWT1-S	11/12/2015	2.9159	52.5415
EBS0235	NMB2	11/15/2015	NWT1-S	11/12/2015	2.7386	45.1809
EBS0247	NMB2	11/15/2015	NDW2-S	11/11/2015	2.9309	36.0660
EBS0248	JMA1	1/3/2016	DDT2-S	12/10/2015	3.3187	36.4158
EBS0250	JMA1	1/3/2016	DDT2-S	12/10/2015	1.6241	40.1554
EBS0251	FMA2	1/24/2016	JDW1-S	1/13/2016	7.4061	43.0071
EBS0254	NMB2	11/15/2015	NDW2-S	11/11/2015	2.1220	58.1956
EBS0268	FMA2	1/24/2016	JDW1-S	1/13/2016	2.8098	68.0539
EBS0273	FMA3	1/24/2016	JDW2-S	1/13/2016	4.3490	22.4583
EBS0281	JMA1	1/3/2016	DDT2-S	12/10/2015	2.9677	67.4471
EBS0294	JMA1	1/3/2016	DDT2-S	12/10/2015	3.3063	60.4757
EBS0299	FMA2	1/24/2016	JDW1-S	1/13/2016	4.6311	40.4253
EBS0302	NMB2	11/15/2015	NDW2-S	11/11/2015	3.3002	71.4608
EBS0303	NMD1	11/29/2015	NTT2-S	11/19/2015	4.4385	31.3154
EBS0359	FMA3	1/24/2016	JDW2-S	1/13/2016	3.1032	52.5230
EBS0376	FMA2	1/24/2016	JDW1-S	1/13/2016	3.1638	39.1487
EBS0379	FMA2	1/24/2016	JDW1-S	1/13/2016	2.2763	84.0727
EBS0415	FMA2	1/24/2016	JDW1-S	1/13/2016	6.4786	22.4237
EBS0429	JMA1	1/3/2016	DDT2-S	12/10/2015	2.6154	57.3181
EBS0709	NMB2	11/15/2015	NWT1-S	11/12/2015	3.1904	47.7470
EBS0728	NMA1	11/1/2015	OQT2-S	10/22/2015	2.9309	87.6701
EBS0730	FMA2	1/24/2016	JDW1-S	1/13/2016	2.3065	82.8920
EBS0731	NMD2	11/29/2015	NTT2-S	11/19/2015	3.0327	41.6793
EBS0737	FMA2	1/24/2016	JDW1-S	1/13/2016	3.3031	36.2665
EBS0739	FMA2	1/24/2016	JDW1-S	1/13/2016	3.5756	36.2322
EBS0744	FMA2	1/24/2016	JDW1-S	1/13/2016	4.5505	65.4353
EBS0754	JMA1	1/3/2016	DDT2-S	12/10/2015	7.8431	42.5874
EBS0786	NMB2	11/15/2015	OQT2-S	10/22/2015	5.6360	22.2860
EBS0787	NMB2	11/15/2015	NWT1-S	11/12/2015	4.1829	29.9256
EBS0800	NMA1	11/1/2015	OQT1-S	10/22/2015	4.2624	26.5947
EBS0809	FMA2	1/24/2016	JDW1-S	1/13/2016	4.8541	19.6191
EBS0810	NMB2	11/15/2015	NWT1-S	11/12/2015	4.3491	92.8028
EBS0815	JMA1	1/3/2016	DDT2-S	12/10/2015	4.8717	33.8523
EBS0888	NMC2	11/22/2015	NWT1-S	11/12/2015	4.0818	45.1080
EBS0890	NMA1	11/1/2015	OQT1-S	10/22/2015	3.2125	39.4289
EBS0894	NMB2	11/15/2015	NWT1-S	11/12/2015	3.2930	33.0976
EBS0896	FMA2	1/24/2016	JDW1-S	1/13/2016	3.0162	38.6440
EBS0897	NMD2	11/29/2015	NTT2-S	11/19/2015	3.4647	39.8878
EBS0898	NMA1	11/1/2015	OQT2-S	10/22/2015	2.7791	55.1106
EBS0906	FMA2	1/24/2016	JDW1-S	1/13/2016	6.1032	28.3621

ID	Long RDF	Long Date	Short RDF	Short Date	As	La
EBS0911	NMB2	11/15/2015	NDW2-S	11/11/2015	2.0716	49.2029
EBS0914	FMA2	1/24/2016	JDW1-S	1/13/2016	4.5911	23.5649
EBS0916	NMD2	11/29/2015	NTT2-S	11/19/2015	2.1453	70.4870
EBS0918	FMA3	1/24/2016	JDW2-S	1/13/2016	0.0000	72.0935
EBS0924	FMA3	1/24/2016	JDW2-S	1/13/2016	7.3600	41.7131
EBS0933	NMA1	11/1/2015	OQT2-S	10/22/2015	2.6017	36.8037
EBS0934	NMB2	11/15/2015	NWT1-S	11/12/2015	16.1192	40.7791
EBS0935	JMA1	1/3/2016	DDT2-S	12/10/2015	4.8060	41.7595
EBS0944	NMB2	11/15/2015	NWT1-S	11/12/2015	3.7076	38.9244
EBS0945	JMA1	1/3/2016	DDT2-S	12/10/2015	5.3327	51.6032
EBS0947	NMD2	11/29/2015	NTT2-S	11/19/2015	2.3118	62.7250
EBS0948	JMA1	1/3/2016	DDT2-S	12/10/2015	5.9875	44.2850
EBS0951	NMA1	11/1/2015	OQT1-S	10/22/2015	2.3771	43.8895
EBS0956	JMA1	1/3/2016	DDT2-S	12/10/2015	3.3805	43.3098
EBS0972	NMC2	11/22/2015	NWT1-S	11/12/2015	2.4235	45.7823
EBS0975	JMA1	1/3/2016	DDT2-S	12/10/2015	3.8344	72.6761
EBS0979	NMB2	11/15/2015	NWT1-S	11/12/2015	2.5214	98.2551
EBS0982	NMD2	11/29/2015	NTT2-S	11/19/2015	4.3742	37.2797
EBS0994	NMC2	11/22/2015	NWT1-S	11/12/2015	4.6865	30.2185
EBS0997	NMB2	11/15/2015	NDW2-S	11/11/2015	2.5394	90.2600
EBS1013	NMA1	11/1/2015	OQT1-S	10/22/2015	4.8784	30.0460
EBS1021	FMA2	1/24/2016	JDW2-S	1/13/2016	4.2072	32.9012
EBS1030	JMA1	1/3/2016	DDT2-S	12/10/2015	3.0586	44.2068
EBS1031	NMB2	11/15/2015	NDW2-S	11/11/2015	15.9935	38.3910
EBS1037	FMA2	1/24/2016	JDW1-S	1/13/2016	5.2697	43.6054
EBS1039	NMA1	11/1/2015	OQT2-S	10/22/2015	4.1444	40.2078
EBS1045	FMA2	1/24/2016	JDW1-S	1/13/2016	2.4939	41.6719
EBS1046	JMA1	1/3/2016	DDT2-S	12/10/2015	3.8547	32.1767
EBS1047	NMD2	11/29/2015	NTT2-S	11/19/2015	2.1634	41.4499
EBS1056	NMA1	11/1/2015	OQT1-S	10/22/2015	1.1557	39.8132
EBS1057	NMB2	11/15/2015	NDW2-S	11/11/2015	3.6459	35.4449
EBS1059	JMA1	1/3/2016	DDT2-S	12/10/2015	3.1385	42.0172
EBS1061	FMA2	1/24/2016	JDW1-S	1/13/2016	3.9909	47.1650
EBS1063	NMB2	11/15/2015	NDW2-S	11/11/2015	2.2149	40.7758
EBS1064	JMA1	1/3/2016	DDT2-S	12/10/2015	5.0922	40.9256
EBS1066	JMA1	1/3/2016	DDT2-S	12/10/2015	2.8494	44.9945
EBS1072	NMA1	11/1/2015	OQT1-S	10/22/2015	2.8134	35.4980
EBS1086	NMC2	11/22/2015	NWT1-S	11/12/2015	1.9652	55.7908
EBS1102	NMA1	11/1/2015	OQT1-S	10/22/2015	3.9817	56.7142
EBS1122	FMA2	1/24/2016	JDW1-S	1/13/2016	3.0224	51.4841
EBS1127	JMA1	1/3/2016	DDT2-S	12/10/2015	1.5739	81.1299

ID	Long RDF	Long Date	Short RDF	Short Date	As	La
EBS1128	JMA1	1/3/2016	DDT2-S	12/10/2015	2.5480	97.3397
EBS1138	NMA1	11/1/2015	OQT2-S	10/22/2015	1.4039	89.7308
EBS1145	NMA1	11/1/2015	OQT1-S	10/22/2015	3.5310	62.7795
EBS1166	NMA1	11/1/2015	OQT2-S	10/22/2015	2.1981	72.8009
EBS1172	NMD2	11/29/2015	NTT2-S	11/19/2015	3.5454	40.1267
EBS1173	FMA2	1/24/2016	JDW1-S	1/13/2016	3.9812	34.5300
EBS1197	NMB2	11/15/2015	NWT1-S	11/12/2015	3.0033	44.8917
EBS1206	NMA1	11/1/2015	OQT2-S	10/22/2015	2.2653	45.1053
EBS1208	NMA1	11/1/2015	OQT2-S	10/22/2015	1.6007	51.2570
EBS1213	NMB2	11/15/2015	NDW2-S	11/11/2015	4.3305	38.1775
EBS1231	NMB2	11/15/2015	NDW2-S	11/11/2015	4.3121	64.6036
EBS1236	NMD2	11/29/2015	NTT2-S	11/19/2015	3.3016	73.7642
EBS1237	NMA1	11/1/2015	OQT1-S	10/22/2015	4.1016	63.5064
EBS1240	NMA1	11/1/2015	OQT1-S	10/22/2015	12.1750	32.6332
EBS1247	NMD2	11/29/2015	NTT2-S	11/19/2015	16.6848	55.3887
EBS1256	NMC2	11/22/2015	NWT1-S	11/12/2015	17.7359	61.4356
EBS1257	NMA1	11/1/2015	OQT1-S	10/22/2015	2.8793	48.4344
EBS1258	FMA2	1/24/2016	JDW1-S	1/13/2016	9.2534	34.5191
EBS1262	NMD2	11/29/2015	NTT2-S	11/19/2015	7.4681	34.8847
EBS1266	NMB2	11/15/2015	NDW2-S	11/11/2015	9.3971	52.3346
EBS1269	NMB2	11/15/2015	NWT1-S	11/12/2015	3.6765	65.9532
EBS1278	NMA1	11/1/2015	OQT1-S	10/22/2015	1.7396	67.3895
EBS1281	NMB2	11/15/2015	NDW2-S	11/11/2015	2.5606	64.7853
EBS1283	NMB2	11/15/2015	OQT2-S	10/22/2015	2.2066	56.8191
EBS1285	NMD2	11/29/2015	NTT2-S	11/19/2015	2.3161	76.5321
EBS1287	NMA1	11/1/2015	OQT1-S	10/22/2015	1.8930	108.2206
EBS1289	FMA3	1/24/2016	JDW2-S	1/13/2016	0.0000	47.7588
EBS1320	NMB2	11/15/2015	NDW2-S	11/11/2015	4.2160	26.0949
EBS1339	JMA1	1/3/2016	DDT2-S	12/10/2015	1.8035	51.2706
EBS1343	JMA1	1/3/2016	DDT2-S	12/10/2015	20.3607	55.7310
EBS1345	FMA2	1/24/2016	JDW1-S	1/13/2016	4.2700	34.2857
EBS1346	NMD2	11/29/2015	NTT2-S	11/19/2015	4.3892	36.9416
EBS1351	NMA1	11/1/2015	OQW2-S	10/21/2015	4.9894	21.0439
EBS1352	NMB2	11/15/2015	NWT1-S	11/12/2015	4.4173	20.2982
EBS1392	JMA1	1/3/2016	DDT2-S	12/10/2015	2.7860	41.2457
EBS1409	FMA2	1/24/2016	JDW1-S	1/13/2016	5.0486	23.4954
EBS1421	NMA1	11/1/2015	OQT1-S	10/22/2015	1.4931	33.9630
EBS1423	NMB2	11/15/2015	OQT2-S	10/22/2015	3.4732	40.2670
EBS1429	NMA1	11/1/2015	OQW2-S	10/21/2015	3.6094	39.2230
EBS1432	NMA1	11/1/2015	OQW2-S	10/21/2015	3.1915	36.2792
EBS1446	FMA2	1/24/2016	JDW1-S	1/13/2016	5.8933	52.8273

ID	Long RDF	Long Date	Short RDF	Short Date	As	La
EBS1453	FMA3	1/24/2016	JDW2-S	1/13/2016	6.5038	53.8850
EBS1454	NMA1	11/1/2015	OQT1-S	10/22/2015	3.0607	36.8199
EBS1455	FMA3	1/24/2016	JDW2-S	1/13/2016	4.7564	33.5592
EBS1522	NMB2	11/15/2015	OQT2-S	10/22/2015	2.3733	36.6600
EBS1523	JMA1	1/3/2016	DDT2-S	12/10/2015	2.5299	41.9548
EBS1526	FMA2	1/24/2016	JDW1-S	1/13/2016	6.1347	24.3757
EBS1531	NMD2	11/29/2015	NTT2-S	11/19/2015	3.9809	102.1201
EBS1545	NMB2	11/15/2015	NDW2-S	11/11/2015	11.3380	42.4680
EBS1549	NMB2	11/15/2015	NWT1-S	11/12/2015	2.6828	48.1579
EBS1561	NMB2	11/15/2015	NWT1-S	11/12/2015	3.7893	55.1564
EBS1563	NMA1	11/1/2015	OQT1-S	10/22/2015	1.7861	57.3387
EBS1570	JMA1	1/3/2016	DDT2-S	12/10/2015	4.5899	32.2796
EBS1577	NMB2	11/15/2015	NWT1-S	11/12/2015	4.1109	40.7507
EBS1581	NMD2	11/29/2015	NTT2-S	11/19/2015	2.8796	42.8187
EBS1582	FMA2	1/24/2016	JDW1-S	1/13/2016	2.9779	62.1546
EBS1583	NMB2	11/15/2015	NWT1-S	11/12/2015	2.0714	51.1128
EBS1587	NMC2	11/22/2015	NWT1-S	11/12/2015	3.4282	34.0726
EBS1588	NMB2	11/15/2015	NDW2-S	11/11/2015	2.1911	47.4349
EBS1591	NMC2	11/22/2015	NWT1-S	11/12/2015	3.0118	41.4438
EBS1596	NMD2	11/29/2015	NTT2-S	11/19/2015	4.4156	66.7677
EBS1600	NMB2	11/15/2015	NDW2-S	11/11/2015	4.7698	33.4173

ID	Lu	Nd	Sm	U	Yb	Ce
EBS0013	0.6100	28.8581	6.7423	5.1583	4.4685	71.4533
EBS0014	0.6270	53.0159	8.7429	3.8379	4.2021	90.3923
EBS0016	0.4948	27.5486	5.6100	5.3353	3.1842	65.6751
EBS0030	0.4773	20.9033	5.1374	5.0658	3.5349	64.4085
EBS0033	0.5946	39.5584	7.1552	4.6828	3.9458	79.8706
EBS0035	0.7817	33.2309	7.0868	5.9652	5.0647	72.0131
EBS0067	0.6501	25.8513	5.7260	4.7773	4.5272	63.7372
EBS0068	0.4139	26.9408	5.4556	4.3004	2.9704	72.8257
EBS0076	0.7270	50.1819	10.0184	3.8020	5.9311	116.9646
EBS0088	0.7516	66.8127	12.6842	5.4277	5.6036	131.5966
EBS0091	0.7823	39.6860	9.0289	5.5301	5.6512	104.1602
EBS0096	0.7253	37.3819	8.5024	5.4970	4.9209	83.3426
EBS0122	0.7153	35.9008	7.6898	6.0601	5.0337	86.7798
EBS0124	0.7279	41.7314	8.9949	6.5053	4.9172	88.6466
EBS0129	0.6154	28.1089	6.2522	3.5083	4.2075	62.9992
EBS0137	0.6740	34.7475	7.9953	5.8151	4.8789	91.1031
EBS0140	0.7999	41.8257	8.9635	6.4437	5.4646	90.4468
EBS0144	0.7093	36.0092	7.1360	5.9983	4.7279	84.9211
EBS0147	0.7319	32.2004	7.4419	5.5884	5.0030	85.0041
EBS0148	0.8452	34.4849	8.3327	6.6071	5.5536	88.0407
EBS0152	0.6589	35.1892	6.9808	5.2315	4.5538	77.3313
EBS0153	0.5439	25.9970	5.5380	5.0887	3.6850	55.8090
EBS0161	0.7465	33.8823	7.4881	3.7187	5.3880	77.4998
EBS0163	0.8373	36.8180	7.5846	6.3732	5.4497	86.8434
EBS0170	0.6241	28.0755	6.0988	4.7192	4.2295	66.6109
EBS0181	0.7602	37.1126	8.1370	5.3673	5.0437	80.5353
EBS0183	0.6735	32.2298	7.3960	5.3726	4.9908	86.6162
EBS0184	0.5712	38.0303	7.8945	3.8733	4.2234	94.0755
EBS0187	0.7703	60.4695	12.8691	4.6323	5.7767	122.4061
EBS0188	0.6794	58.8444	11.5310	5.5716	4.9313	115.5314
EBS0200	0.6737	27.6301	6.5556	5.2825	4.3928	60.9992
EBS0209	0.7142	41.8789	8.7527	5.3753	5.5478	96.2128
EBS0210	0.6836	25.5429	5.8845	6.0090	4.5778	63.5965
EBS0211	0.7016	29.1390	6.6290	4.3302	4.7974	66.8449
EBS0212	0.7042	36.7214	8.1988	5.2904	4.7800	85.3328
EBS0216	0.7400	33.4636	7.1522	5.3510	5.2683	80.5127
EBS0219	0.7582	38.1813	7.8538	5.6391	5.3869	87.7769
EBS0220	0.6301	31.2853	6.6183	4.7031	4.7889	77.8312
EBS0221	0.8043	35.1259	8.2998	5.7040	5.4432	90.5085
EBS0222	0.7273	37.4528	8.8806	5.6508	5.4298	97.2488
EBS0223	0.6677	28.2736	6.8678	5.1400	4.4876	65.8107

ID	Lu	Nd	Sm	U	Yb	Ce
EBS0231	0.5352	41.7118	8.3524	4.4716	4.2756	102.7033
EBS0232	0.6051	42.4738	8.9041	3.5643	4.7256	100.3740
EBS0235	0.7841	36.4502	8.6170	5.6701	5.3469	94.6274
EBS0247	0.4782	27.6899	6.6558	3.7769	3.6230	77.7580
EBS0248	0.5089	31.4994	6.9847	3.9748	3.4092	79.8838
EBS0250	0.5632	32.9598	6.9451	4.5228	3.8134	95.4269
EBS0251	0.5085	34.3624	6.5734	3.6966	3.6318	88.2220
EBS0254	0.7508	45.7101	9.5654	5.6591	4.9402	90.1596
EBS0268	0.6175	60.9673	11.8304	4.7755	5.0109	124.9803
EBS0273	0.4751	16.6627	4.0500	5.3968	3.1216	49.7412
EBS0281	0.6962	58.9107	11.7515	4.9890	4.6535	117.2190
EBS0294	0.7236	54.4663	10.6404	5.1690	4.7871	124.4781
EBS0299	0.6645	34.3564	7.1107	5.4135	4.9674	77.2542
EBS0302	0.6897	55.7014	11.4146	3.5725	4.8946	113.9315
EBS0303	0.4808	23.5697	4.6273	4.9307	3.0975	64.8874
EBS0359	0.6154	44.9389	8.9789	5.5720	4.1975	104.1334
EBS0376	0.4564	34.0531	5.9946	3.1632	3.0240	64.9253
EBS0379	0.6105	72.4137	12.5965	4.6641	4.6522	132.4805
EBS0415	0.4804	18.8230	4.2707	5.8160	3.3668	63.9160
EBS0429	0.6389	48.7987	9.8537	4.0612	4.5166	93.2012
EBS0709	0.7324	34.8840	7.9389	5.2590	4.7357	78.2046
EBS0728	0.6422	73.4439	13.2021	4.6820	4.6649	130.0405
EBS0730	0.6271	76.1241	12.8555	3.6977	4.5381	124.6592
EBS0731	0.6452	34.9261	7.2133	5.1035	4.6012	71.3574
EBS0737	0.7338	33.0121	7.9329	5.0574	5.9211	81.7918
EBS0739	0.5880	31.4133	7.0678	5.9518	4.3724	57.3647
EBS0744	0.6306	50.6887	8.7064	3.4017	4.8712	114.3355
EBS0754	0.5588	37.7028	7.8054	4.1507	3.9018	93.4927
EBS0786	0.4757	12.7618	3.5008	5.5593	2.9688	64.8345
EBS0787	0.5103	20.6745	5.1365	5.2737	3.2657	68.8589
EBS0800	0.4704	20.0772	4.3460	4.9272	3.0341	57.4052
EBS0809	0.5031	15.9884	3.4854	5.4272	2.8868	65.8760
EBS0810	0.6693	85.6474	17.8729	4.2282	5.7514	157.0624
EBS0815	0.5085	27.0787	5.8426	4.1315	3.3264	67.8276
EBS0888	0.7225	37.2499	8.1497	6.2318	4.4551	79.6263
EBS0890	0.6885	30.6885	6.9014	4.8909	4.7579	73.1460
EBS0894	0.5551	23.8594	5.3466	5.2367	3.6556	60.7770
EBS0896	0.5547	31.0962	6.7401	5.2699	4.1605	73.1486
EBS0897	0.6096	35.6763	6.9460	5.7348	4.3081	77.4498
EBS0898	1.2650	49.5200	11.9709	8.9239	9.2213	161.6492
EBS0906	0.4668	24.3540	5.0551	5.6907	3.3805	85.4530

ID	Lu	Nd	Sm	U	Yb	Ce
EBS0911	0.5714	43.1280	9.5282	4.1299	4.1593	105.9570
EBS0914	0.4249	19.7153	4.2949	4.0676	3.0641	56.0587
EBS0916	0.7135	60.7741	11.9241	5.0066	4.8481	130.3402
EBS0918	0.7175	58.4971	11.5015	4.7126	4.9453	134.5766
EBS0924	0.6592	35.9011	7.2517	4.6456	4.7475	66.9192
EBS0933	0.5303	26.3126	5.5683	3.2848	3.7434	62.6457
EBS0934	0.6012	28.0941	6.3205	4.3529	4.2950	79.0104
EBS0935	0.6873	33.6591	7.3725	5.6802	4.5851	75.5772
EBS0944	0.4749	36.9456	7.7280	3.8315	3.7778	89.2869
EBS0945	0.5942	45.6037	8.9090	4.2409	3.8533	95.4990
EBS0947	0.8437	55.2633	10.3126	6.3142	5.3651	103.3939
EBS0948	0.6592	38.8590	7.9886	5.6117	4.3987	84.3706
EBS0951	0.7662	36.9996	8.0281	5.5126	5.4783	93.8972
EBS0956	0.7212	38.1040	8.1684	4.9440	4.9634	78.5651
EBS0972	0.6369	39.1456	7.9399	5.9918	4.1341	84.5758
EBS0975	0.6723	64.8161	12.1268	4.7354	4.5633	137.6744
EBS0979	0.7394	82.8359	15.9650	5.0990	5.4555	183.2517
EBS0982	0.5048	30.5524	6.1748	4.1334	3.1934	104.7308
EBS0994	0.5283	21.2806	4.9365	5.1464	3.4021	62.5378
EBS0997	0.6289	72.2788	13.7638	5.2281	4.9051	139.6281
EBS1013	0.4383	22.3509	4.8255	5.1574	2.8851	67.5311
EBS1021	0.4455	33.2214	6.4940	4.5265	3.4772	79.4027
EBS1030	0.7027	41.2473	8.2372	7.0404	4.4830	89.6070
EBS1031	0.4420	30.8408	6.5830	3.6401	3.2278	76.3573
EBS1037	0.7138	38.3973	8.4892	5.6298	5.5532	87.4444
EBS1039	0.7065	32.5892	7.1260	5.2594	5.0581	73.8176
EBS1045	0.6815	38.5789	7.9216	5.3528	5.0702	84.8308
EBS1046	0.5579	25.9326	5.3639	5.4957	3.6734	55.6033
EBS1047	0.6864	33.0862	6.9155	4.6760	4.8106	80.1736
EBS1056	0.7288	30.9368	6.8261	3.8714	5.2243	69.3632
EBS1057	0.6246	25.7163	6.2024	5.0332	4.6210	67.0623
EBS1059	0.7599	38.0460	8.1677	5.8568	5.2267	90.9374
EBS1061	0.8388	39.4074	8.7016	4.8082	6.7568	102.2400
EBS1063	0.7190	32.6794	7.5612	4.6729	4.7796	77.7837
EBS1064	0.7818	30.4504	7.0444	6.4222	5.3484	72.5442
EBS1066	0.8060	40.5113	8.5380	6.0004	5.5046	94.5896
EBS1072	0.6538	29.9456	6.6902	5.7617	4.4506	82.6167
EBS1086	0.7795	48.0826	10.3610	5.9189	5.3896	104.2481
EBS1102	0.7270	43.4969	9.1258	3.8724	5.3153	127.6550
EBS1122	0.7081	48.8868	10.2369	5.1518	5.5117	101.2058
EBS1127	0.7963	71.0566	13.5559	6.3111	5.3140	151.2843

ID	Lu	Nd	Sm	U	Yb	Ce
EBS1128	0.9194	88.1429	16.9733	5.3597	6.3856	183.8405
EBS1138	0.6893	71.1420	13.2216	4.6455	5.1829	148.6455
EBS1145	0.9888	52.3398	11.3263	9.2490	6.7023	151.8125
EBS1166	0.6682	63.2899	12.0497	4.5143	4.6358	134.1322
EBS1172	0.4126	30.6926	5.5692	4.1272	2.7069	86.2922
EBS1173	0.6190	27.2987	6.3358	5.6459	4.5435	65.3404
EBS1197	0.6867	35.8334	8.1296	4.8635	5.0059	91.6780
EBS1206	0.8189	39.2363	8.4780	5.8531	5.6801	91.6251
EBS1208	0.7435	43.3811	8.7924	6.5546	5.2618	93.6600
EBS1213	0.6538	30.7373	7.0316	4.8308	5.0660	71.3768
EBS1231	0.8429	62.4228	14.1248	5.5385	5.7269	124.8804
EBS1236	0.9733	76.5967	16.9711	6.5711	7.1087	206.3265
EBS1237	0.6874	52.0676	10.9675	5.8262	4.7590	135.9728
EBS1240	0.8663	33.8005	9.1766	6.3264	6.2069	84.5567
EBS1247	0.7442	42.5905	8.1644	5.7955	5.3544	98.9968
EBS1256	0.8903	46.6776	9.2765	6.0416	6.0556	107.8801
EBS1257	0.8190	40.6102	9.6093	6.0484	5.9625	121.1688
EBS1258	0.6000	26.7349	6.1629	4.4942	4.4871	74.2906
EBS1262	0.5067	29.3750	5.4652	4.5954	3.1572	70.4711
EBS1266	0.4994	41.5056	8.9504	3.5773	4.0454	99.8434
EBS1269	0.7892	54.7001	11.3138	7.6201	5.3680	115.2594
EBS1278	0.7376	54.9196	11.4200	6.7878	5.1350	115.5518
EBS1281	0.6692	55.4945	11.5384	4.8718	4.6247	115.7801
EBS1283	0.6403	46.8583	9.5626	5.5927	4.0479	105.6316
EBS1285	0.5900	67.2346	11.6237	3.9085	4.2874	126.6768
EBS1287	0.7717	87.9701	16.4188	4.6836	5.7109	194.8884
EBS1289	0.3627	44.7261	9.3316	1.5256	2.4151	100.8762
EBS1320	0.5342	17.6421	4.3513	5.8345	3.0734	59.3854
EBS1339	0.6582	45.1567	9.0340	3.2456	4.6234	89.2814
EBS1343	0.9887	43.9030	9.2199	6.2258	6.5822	100.9923
EBS1345	0.5929	26.9537	6.0214	4.5474	4.5133	57.8432
EBS1346	0.7326	30.5738	6.5226	6.1493	4.6350	69.2627
EBS1351	0.4230	15.2522	3.5380	4.4613	2.5914	53.1850
EBS1352	0.4514	14.0713	3.4252	5.1016	2.6281	60.5892
EBS1392	0.7106	35.6290	7.6425	5.2103	4.6490	82.6084
EBS1409	0.4644	15.5652	3.7745	4.5939	2.7281	62.8978
EBS1421	0.6552	29.2997	6.7765	5.9278	4.5992	73.8658
EBS1423	0.6334	29.1012	6.9754	4.4652	4.0148	81.0528
EBS1429	0.6833	31.4213	7.0990	4.8767	5.1136	71.6834
EBS1432	0.7315	30.8546	7.0430	5.9847	5.1194	77.8734
EBS1446	0.8067	48.8490	10.6297	4.4789	6.4799	119.7614

ID	Lu	Nd	Sm	U	Yb	Ce
EBS1453	0.6751	48.7448	9.6395	3.8144	5.0125	89.4708
EBS1454	0.7437	31.8601	7.0600	6.0908	5.0416	80.7153
EBS1455	0.6773	28.3072	6.1351	5.6791	4.8354	67.4678
EBS1522	0.6321	28.8025	6.3020	4.1905	4.6536	69.2063
EBS1523	0.7103	33.9147	7.3017	5.6391	4.7655	80.9579
EBS1526	0.5658	19.0535	5.3920	4.3339	4.2621	46.5018
EBS1531	0.8514	82.3138	14.1363	6.4227	5.2540	172.0931
EBS1545	0.5620	31.3533	5.9235	3.5567	3.7468	88.8495
EBS1549	0.7273	39.5293	8.6604	5.7415	5.4068	83.0293
EBS1561	0.8081	41.4269	9.5786	4.8470	6.2451	95.6020
EBS1563	0.6216	42.5402	7.9086	5.5757	3.9856	87.7946
EBS1570	0.5834	26.3407	5.7292	5.2892	3.8672	71.6289
EBS1577	0.7058	31.3722	7.4289	5.4419	5.4289	66.7246
EBS1581	0.7072	38.8678	8.0324	4.8701	4.9956	83.7237
EBS1582	0.7372	53.0591	10.2777	6.2073	5.4779	112.5912
EBS1583	0.7518	40.8802	8.8835	6.0769	5.1201	94.2091
EBS1587	0.6879	26.4592	6.2418	5.4576	4.4116	67.5761
EBS1588	0.8619	39.7499	9.2179	6.5172	5.9341	104.0308
EBS1591	0.6389	31.7567	7.3611	3.3277	4.4061	75.7202
EBS1596	0.7448	56.4157	10.0137	4.5985	4.7963	109.2932
EBS1600	0.4290	25.6139	5.3603	3.3820	2.9993	65.4487

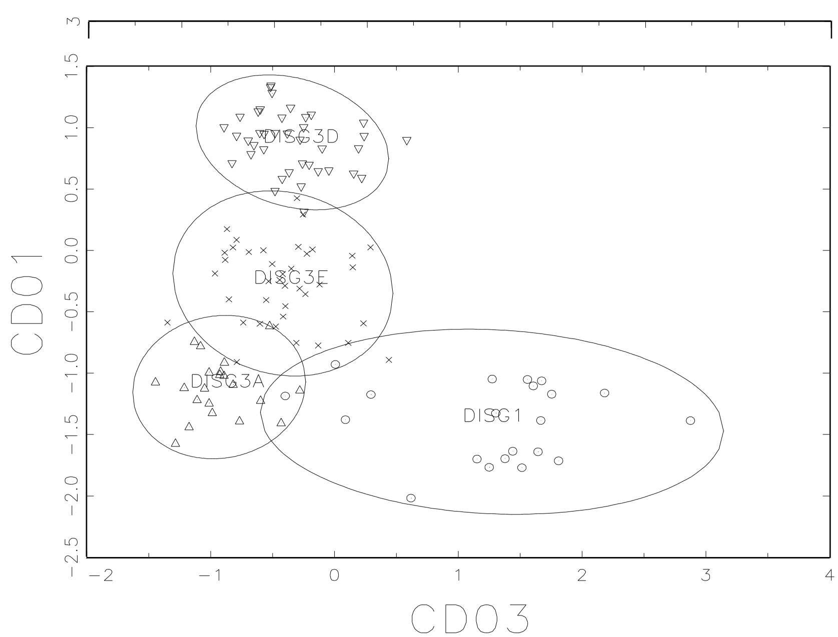
Table F.1: Raw data for neutron activation analysis (NAA).

Appendix G:

Dr. Hector Neff's Report

Brief summary of atterning in NAA data on Casas Grandes Ceramics
Hector Neff

I defined geochemical groups purely on the geochemical data, without any reference to type, provenience, or petrographic data. Basically, I used PCA to identify elements that contribute strongly to the major dimensions in the data and then focused my attention on bivariate plots of those elements. I gradually partitioned off potential groups this way, and then went on to the ungrouped samples, examining additional bivariate plot. In the end, I defined eight groups and left 18 samples unassigned, as the accompanying spreadsheet shows. Illustrating the elemental differences between these eight groups would require a very large number of bivariate elemental concentration plots, but a discriminant analysis of the eight groups provides a better graphic illustration of their differences. The first three plot below show different combinations of the eight canonoical axes identified by the discriminant analysis.



I also used the discriminant axes to test the success of the discriminant analysis, with the results shown in the table below. I did not include one of the groups, Group 3b, in this classification exercise because it only has nine members and it is quite variable, both of which inflate the probabilities of membership for non-members, thus giving an inaccurate assessment of classification success.

MAHALANOBIS DISTANCE CALCULATION AND POSTERIOR CLASSIFICATION
FOR TWO OR MORE GROUPS.

Date: 9/02/17
File: class3.out

Groups are:

1 DISG1
2 DISG2
3 DISG3A
4 DISG3C
5 DISG3D
6 DISG3E
7 DISG3C1

Variables used:

CD01 CD02 CD03 CD04 CD05 CD06

The following specimens are in the file DISG1

Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1	From:	Into:
EBS0247	97.181	0.025	0.009	0.006	0.000	0.000	0.610	1	1
EBS0944	59.969	0.025	0.009	0.003	0.000	0.000	0.441	1	1
EBS0248	95.664	0.012	0.006	0.004	0.000	0.000	0.637	1	1
EBS0231	87.684	0.040	0.017	0.003	0.000	0.000	0.440	1	1
EBS1031	37.677	0.003	0.000	0.005	0.000	0.000	0.302	1	1
EBS0187	65.459	0.004	0.016	0.001	0.000	0.000	0.462	1	1
EBS1021	75.740	0.031	0.003	0.009	0.000	0.000	1.414	1	1
EBS0982	27.832	0.191	0.001	0.021	0.000	0.000	0.768	1	1
EBS0184	90.492	0.022	0.004	0.006	0.000	0.000	0.467	1	1
EBS0754	85.878	0.009	0.001	0.011	0.000	0.000	0.816	1	1
EBS0068	92.439	0.047	0.015	0.017	0.000	0.000	1.134	1	1
EBS1262	90.843	0.100	0.033	0.013	0.000	0.002	0.790	1	1
EBS1266	93.403	0.010	0.004	0.004	0.000	0.000	0.708	1	1

EBS0810	39.117	0.005	0.304	0.001	0.000	0.000	0.421	1	1
EBS1013	88.830	0.090	0.009	0.025	0.000	0.000	1.128	1	1
EBS0815	48.186	22.978	0.021	0.185	0.000	0.016	3.954	1	1
EBS1531	76.155	0.007	0.010	0.006	0.000	0.004	0.764	1	1
EBS1172	47.950	0.066	0.053	0.017	0.000	0.025	2.159	1	1
EBS0251	53.094	0.330	2.558	0.035	0.000	3.702	7.088	1	1
EBS0911	30.658	0.047	1.464	0.004	0.000	0.000	0.767	1	1
EBS0744	44.144	0.275	0.509	0.085	0.000	0.389	7.195	1	1

The following specimens are in the file DISG2

Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1		
								From:	Into:
EBS0030	2.161	82.665	0.003	0.083	0.000	0.000	1.647	2	2
EBS0273	1.077	80.085	0.002	0.032	0.000	0.000	2.042	2	2
EBS0303	15.179	73.004	0.046	0.407	0.000	0.050	4.944	2	2
EBS0415	1.284	92.840	0.002	0.049	0.000	0.000	1.276	2	2
EBS0786	0.706	45.811	0.000	0.012	0.000	0.000	0.686	2	2
EBS0787	15.675	79.101	0.006	0.200	0.000	0.001	2.056	2	2
EBS0800	7.952	81.329	0.016	0.317	0.000	0.001	2.084	2	2
EBS0809	3.737	53.569	0.005	0.066	0.000	0.000	3.085	2	2
EBS0906	3.647	47.622	0.003	0.133	0.000	0.000	1.917	2	2
EBS0914	4.143	86.841	0.000	0.059	0.000	0.000	2.301	2	2
EBS1351	4.565	88.626	0.000	0.044	0.000	0.000	1.618	2	2
EBS1352	0.622	79.146	0.000	0.025	0.000	0.000	1.020	2	2
EBS1409	4.444	78.871	0.002	0.088	0.000	0.000	1.161	2	2
EBS0994	2.014	67.775	0.016	0.389	0.000	0.008	2.552	2	2
EBS1320	5.543	94.320	0.002	0.087	0.000	0.000	2.476	2	2

The following specimens are in the file DISG3A

Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1		
								From:	Into:
EBS1287	0.509	0.001	82.387	0.006	0.000	0.894	6.326	3	3
EBS1128	0.585	0.001	78.132	0.008	0.000	0.400	12.907	3	3
EBS0979	0.295	0.001	55.272	0.005	0.000	0.312	6.297	3	3
EBS1285	25.561	0.010	51.016	0.008	0.000	3.744	4.342	3	3
EBS0728	2.295	0.002	59.623	0.003	0.000	0.024	1.657	3	3
EBS1138	0.688	0.001	68.239	0.007	0.000	1.083	4.531	3	3
EBS0730	4.184	0.002	66.445	0.002	0.000	0.044	1.923	3	3
EBS0429	3.214	0.013	31.444	0.014	0.000	0.595	15.355	3	3
EBS1166	7.254	0.004	90.066	0.006	0.000	2.442	5.146	3	3

EBS1231	1.812	0.008	35.365	0.115	0.000	9.862	15.124	3	3
EBS0975	17.500	0.012	68.551	0.006	0.000	0.908	2.698	3	3
EBS0997	3.221	0.006	91.827	0.016	0.000	5.406	6.647	3	3
EBS0379	1.195	0.002	81.270	0.009	0.000	1.109	7.667	3	3
EBS0088	3.103	0.004	33.909	0.008	0.000	1.054	7.377	3	3
EBS0916	12.064	0.012	75.940	0.018	0.000	6.894	5.730	3	3
EBS1127	1.521	0.002	63.787	0.018	0.000	8.506	16.249	3	3
EBS0268	9.449	0.021	92.486	0.051	0.000	40.072	15.094	3	3
EBS0281	8.733	0.009	98.791	0.021	0.000	21.186	13.633	3	3
EBS1237	4.243	0.012	53.207	0.014	0.000	2.492	4.888	3	3
EBS0918	2.394	0.007	53.036	0.111	0.000	17.929	31.063	3	3
EBS1281	6.184	0.016	87.496	0.034	0.000	20.120	22.494	3	3

The following specimens are in the file DISG3C

Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1	From:	Into:
EBS1455	0.000	0.016	0.000	64.680	0.002	0.000	1.497	4	4
EBS0924	0.001	0.014	0.000	69.958	0.004	0.000	1.937	4	4
EBS0210	0.001	0.015	0.000	73.795	0.008	0.000	2.366	4	4
EBS1064	0.001	0.033	0.000	99.048	0.284	0.000	2.929	4	4
EBS1577	0.000	0.009	0.000	71.777	0.004	0.000	3.062	4	4
EBS0067	0.002	0.012	0.000	94.194	0.081	0.000	4.488	4	4
EBS1587	0.009	0.098	0.000	84.768	2.273	0.007	3.179	4	4
EBS1213	0.001	0.015	0.000	86.277	0.010	0.000	4.394	4	4
EBS0211	0.003	0.014	0.000	89.448	0.095	0.001	5.669	4	4
EBS1429	0.001	0.007	0.000	71.210	0.008	0.000	2.030	4	4
EBS0035	0.005	0.040	0.000	83.969	0.453	0.002	6.636	4	4
EBS1522	0.006	0.068	0.000	83.206	6.399	0.034	5.529	4	4

The following specimens are in the file DISG3D

Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1	From:	Into:
EBS0013	0.097	0.322	0.000	17.595	24.254	0.180	4.012	5	5
EBS0091	0.009	0.125	0.000	3.477	79.578	4.547	2.781	5	5
EBS0122	0.051	1.200	0.001	6.116	81.440	23.597	5.048	5	5
EBS0129	0.056	0.452	0.000	5.714	91.264	20.153	5.716	5	5

EBS0140	0.004	0.124	0.000	4.582	89.268	2.130	2.957	5	5
EBS0148	0.012	0.276	0.000	7.911	85.016	7.692	5.128	5	5
EBS0170	0.068	0.682	0.000	25.014	73.614	0.949	5.419	5	5
EBS0183	0.107	0.315	0.000	3.836	28.873	10.854	4.116	5	5
EBS0200	0.063	0.384	0.001	3.337	54.958	39.364	5.125	5	5
EBS0209	0.007	0.209	0.000	5.842	91.151	3.476	2.962	5	5
EBS0216	0.019	0.434	0.000	6.672	38.827	12.183	5.554	5	5
EBS0220	0.027	0.949	0.000	18.165	42.538	0.911	6.000	5	5
EBS0221	0.003	0.172	0.000	8.388	79.191	1.203	3.245	5	5
EBS0222	0.009	0.211	0.000	4.288	95.685	7.484	3.275	5	5
EBS0223	0.033	0.305	0.000	44.345	66.716	0.948	7.668	5	5
EBS0235	0.011	0.129	0.000	11.859	90.940	2.761	4.001	5	5
EBS0299	0.134	0.290	0.003	10.256	42.616	19.212	10.426	5	5
EBS0737	0.019	0.348	0.000	3.765	24.808	1.843	3.431	5	5
EBS0894	0.093	0.740	0.002	3.895	29.756	12.373	4.356	5	5
EBS0951	0.002	0.084	0.000	3.401	54.131	0.555	1.966	5	5
EBS1039	0.010	0.418	0.000	16.824	60.821	0.983	4.682	5	5
EBS1047	0.092	0.049	0.000	11.767	8.230	3.345	6.713	5	4
EBS1057	0.010	0.174	0.000	9.444	88.027	4.029	4.220	5	5
EBS1059	0.025	0.302	0.000	8.631	99.542	8.710	4.168	5	5
EBS1066	0.001	0.083	0.000	1.931	35.428	0.326	1.627	5	5
EBS1072	0.205	1.197	0.001	5.327	34.735	13.015	3.934	5	5
EBS1173	0.139	0.620	0.000	24.306	55.381	0.510	6.224	5	5
EBS1197	0.026	0.204	0.000	10.025	87.228	10.451	6.523	5	5
EBS1257	0.034	2.179	0.000	5.330	35.187	6.183	3.577	5	5
EBS1345	0.008	0.062	0.000	5.065	40.472	1.172	3.023	5	5
EBS1346	0.039	0.276	0.001	10.437	25.037	4.961	7.380	5	5
EBS1392	0.229	1.306	0.007	2.275	24.358	45.341	7.799	5	6
EBS1421	0.036	0.685	0.000	8.433	66.575	10.326	4.447	5	5
EBS1432	0.027	0.231	0.000	11.813	90.111	6.805	5.710	5	5
EBS1454	0.029	0.279	0.000	4.397	82.205	19.335	4.523	5	5
EBS1523	0.088	0.762	0.001	8.065	64.653	17.958	9.343	5	5
EBS1549	0.032	0.186	0.000	24.156	28.731	1.505	11.459	5	5
EBS1570	0.249	3.143	0.002	9.656	49.515	4.171	6.371	5	5
EBS1588	0.004	0.116	0.000	2.146	56.474	3.615	2.745	5	5

The following specimens are in the file DISG3E

Probabilities:

ID. NO. DISG1 DISG2 DISG3A DISG3C DISG3D DISG3E DISG3C1

From: Into:

EBS0033	3.060	0.141	2.358	0.692	0.000	53.885	91.760	6	7
EBS0076	5.112	0.103	5.944	0.116	0.000	59.656	12.696	6	6
EBS0124	2.868	0.403	1.377	1.675	0.432	97.767	19.546	6	6
EBS0137	3.604	1.618	1.029	0.336	0.002	43.324	14.543	6	6
EBS0147	0.494	2.048	0.022	1.080	1.934	39.710	6.047	6	6
EBS0152	0.490	0.461	0.149	1.436	0.617	89.615	12.795	6	6
EBS0181	0.513	0.339	2.028	0.927	0.004	79.058	22.030	6	6
EBS0188	14.881	0.018	2.419	0.017	0.000	5.392	3.464	6	1
EBS0232	13.898	0.081	7.488	0.170	0.000	60.589	21.821	6	6
EBS0294	2.326	0.009	0.841	0.073	0.000	31.844	16.437	6	6
EBS0359	13.315	0.168	17.752	0.498	0.001	53.552	23.957	6	6
EBS0709	1.266	0.743	2.173	1.066	0.011	75.711	22.199	6	6
EBS0731	0.431	0.424	0.082	4.294	3.651	75.356	20.263	6	6
EBS0739	0.374	0.522	0.073	2.026	1.585	38.156	6.325	6	6
EBS0888	0.872	0.661	0.377	1.776	0.938	97.380	16.290	6	6
EBS0896	1.007	0.600	0.077	1.447	0.761	29.786	13.237	6	6
EBS0897	0.964	0.157	0.098	2.620	1.042	76.047	14.520	6	6
EBS0935	0.951	0.339	0.208	2.257	1.387	70.606	11.188	6	6
EBS0945	3.837	0.015	5.283	0.041	0.000	15.881	6.535	6	6
EBS0948	2.526	0.018	2.487	0.209	0.000	47.275	42.985	6	6
EBS0956	1.069	0.266	0.359	1.247	0.188	89.722	19.216	6	6
EBS1030	4.624	0.584	4.572	1.245	0.006	78.916	55.703	6	6
EBS1037	5.909	2.977	2.767	1.232	0.389	89.253	19.502	6	6
EBS1045	1.609	0.539	3.874	0.743	0.008	95.610	24.605	6	6
EBS1046	0.705	0.940	0.418	2.290	1.027	92.387	16.113	6	6
EBS1086	3.910	0.142	6.385	0.622	0.000	74.908	63.556	6	6
EBS1102	1.748	0.850	0.033	0.897	1.745	61.623	6.388	6	6
EBS1122	0.554	0.308	0.235	0.914	0.115	57.576	10.119	6	6
EBS1206	1.403	0.569	1.674	0.251	0.000	30.416	22.912	6	6
EBS1269	7.724	0.249	14.828	0.629	0.001	97.759	55.019	6	6
EBS1278	2.921	0.015	26.265	0.202	0.000	27.714	32.433	6	7
EBS1283	13.476	0.048	58.090	0.096	0.000	54.288	21.068	6	3
EBS1423	2.737	0.080	0.520	0.885	0.006	35.723	55.841	6	7
EBS1446	1.370	0.182	0.708	0.948	0.014	60.863	19.860	6	6
EBS1545	36.050	1.941	0.311	0.281	0.002	8.003	20.098	6	1
EBS1561	0.255	0.238	0.003	1.877	9.436	48.018	9.618	6	6

EBS1563	5.096	0.047	13.545	0.178	0.000	62.389	75.972	6	7
EBS1581	0.876	0.453	4.078	0.385	0.000	51.031	23.073	6	6
EBS1591	3.472	0.120	1.463	1.362	0.034	75.680	19.666	6	6

The following specimens are in the file DISG3C1

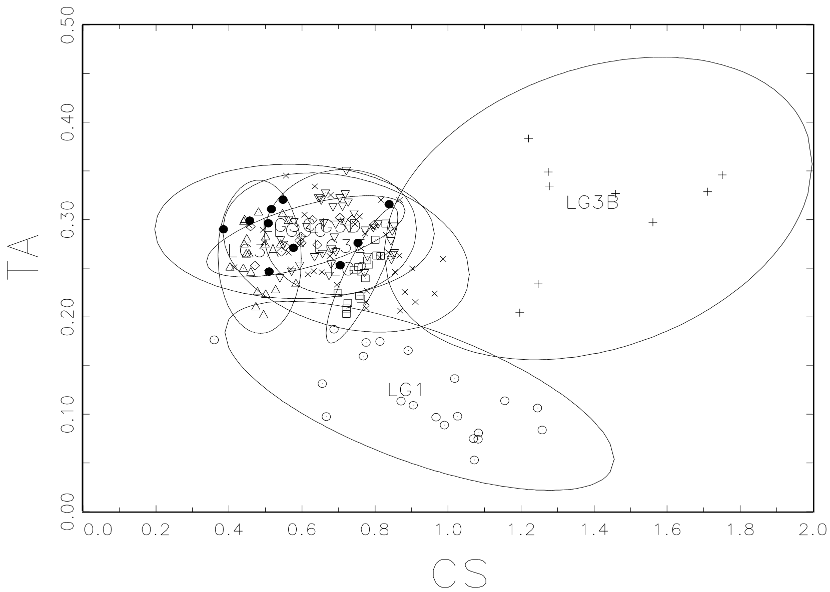
Probabilities:

ID. NO.	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1	From:	Into:
EBS1063	0.299	0.044	0.037	1.144	0.000	5.614	86.422	7	7
EBS0161	0.011	0.023	0.000	1.051	0.000	0.001	77.202	7	7
EBS0212	0.426	0.088	0.078	1.906	0.001	2.033	78.858	7	7
EBS1583	0.108	0.019	0.006	1.405	0.000	0.092	89.454	7	7
EBS1208	0.310	0.027	0.015	1.149	0.000	0.713	91.980	7	7
EBS1339	0.217	0.004	0.025	0.270	0.000	0.598	85.763	7	7
EBS0254	0.137	0.010	0.028	0.730	0.000	0.910	79.263	7	7
EBS0947	0.778	0.026	0.179	0.715	0.000	10.263	98.988	7	7
EBS1582	0.868	0.024	0.297	0.317	0.000	7.149	96.796	7	7
EBS0972	2.402	0.243	0.083	0.316	0.000	5.992	80.161	7	7

Summary of Classification Success:

From: \ Into:	DISG1	DISG2	DISG3A	DISG3C	DISG3D	DISG3E	DISG3C1	Total
DISG1	21	0	0	0	0	0	0	21
DISG2	0	15	0	0	0	0	0	15
DISG3A	0	0	21	0	0	0	0	21
DISG3C	0	0	0	12	0	0	0	12
DISG3D	0	0	0	1	37	1	0	39
DISG3E	2	0	1	0	0	32	4	39
DISG3C1	0	0	0	0	0	0	10	10
Total	23	15	22	13	37	33	14	157

With Group 3b removed, the remaining seven groups have nine out of 157 misclassifications. Although Group 3b is not included in the above table, it is clearly distinct from the other groups because of its high cesium values, as shown in the following plot.



The above plot also illustrates the distinctive composition of Group 1, namely its very low tantalum concentrations. Group 1 also has low thorium. The following list summarizes some of the key compositional characteristics of all eight groups.

- Group 1: low tantalum and thorium relative to all other samples in the database
- Group 2: low rare-earth element concentrations, especially lanthanum, lutetium, and terbium
- Group 3a: high in both rare-earth elements and transition metals, especially the REEs europium and lanthanum and the transition metals iron, scandium, and titanium
- Group 3b: high cesium as shown above, and high antimony in most
- Group 3c: low europium, cerium, chromium, iron, and aluminum
- Group 3c1: similar to Group 3c, but with higher rare earth element concentrations, especially europium
- Group 3d: high chromium relative to Group 3c (like Group 3a) but lower light REEs, especially La and Nd, than Group 3a
- Group 3e: similar to Group 3d, but with higher REEs, especially Eu; Group 3e

is intermediate in REEs between Group 3a and Group 3d.

I did not systematically evaluate patterning of the geochemical groups on petrographic groups, types, or provenience, but the data are shown in the “chem groups” worksheet in the attached Excel file. I believe there are some interesting patterns: for instance, quickly scanning the table it appears that Group 1 is mostly Barbicora whereas Groups 3c, 3c1, and 3d are mostly Ramos. I hope these data are interesting to you and that you find additional patterning among the different chemical, petrographic, and descriptive variable.

Appendix H:

Raw Data and Results from

Detrital Zircon Analysis

U-Pb geochronologic analyses of zircon (Element2 HR ICPMS)

Zircon crystals are extracted from samples by traditional methods of crushing and grinding, followed by separation with a Wilfley table, heavy liquids, and a Frantz magnetic separator. Samples are processed such that all zircons are retained in the final heavy mineral fraction. For detrital analyses, a large split of grains (generally thousands of grains) is incorporated into a 1" epoxy mount together with fragments or loose grains of Sri Lanka, FC-1, and R33 zircon crystals that are used as primary standards. For igneous samples, ~50 high-quality grains are selected and mounted with standards, generally with four samples per mount. The mounts are sanded down to a depth of ~20 microns, polished, imaged, and cleaned prior to isotopic analysis.

U-Pb geochronology of zircons is conducted by laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) at the Arizona LaserChron Center (Gehrels et al., 2006, 2008; Gehrels and Pecha, 2014). The analyses involve ablation of zircon with a Photon Machines Analyte G2 excimer laser equipped with HelEx ablation cell using a spot diameter of 20 microns. The ablated material is carried in helium into the plasma source of an Element2 HR ICPMS, which sequences rapidly through U, Th, and Pb isotopes. Signal intensities are measured with an SEM that operates in pulse counting mode for signals less than 50K cps, in both pulse-counting and analog mode for signals between 50K and 5M cps, and in analog mode above 5M cps. The calibration between pulse-counting and analog signals is determined line-by-line for signals between 50K and 5M cps, and is applied to >5M cps signals. Four intensities are determined and averaged for each isotope, with dwell times of 0.0052 sec for 202, 0.0075 sec for 204, 0.0202 sec for 206, 0.0284 sec for 207, 0.0026 sec for 208, 0.0026 sec for 232, and 0.0104 sec for 238.

With the laser set an energy density of ~5 J/cm2, a repetition rate of 8 hz, and an ablation time of 10 seconds, ablation pits are ~12 microns in depth. Sensitivity with these settings is approximately ~5,000 cps/ppm. Each analysis consists of 5 sec on peaks with the laser off (for backgrounds), 10 sec with the laser firing (for peak intensities), and a 20 second delay to purge the previous sample and save files.

Prior to analysis, grains are imaged to provide a guide for locating analysis pits in optimal locations, and to assist in interpreting results. Images are made with a Hitachi 3400N SEM and a Gatan CL2 detector system (www.geoarizonasem.org). In general, BSE images are made for detrital mounts and CL images are made for igneous mounts.

Following analysis, data reduction is performed with an in-house Python decoding routine and an Excel spreadsheet (E2agecalc) that:

1. Decodes .dat files from the Thermo software such individual intensities for measurement are available (routine written by John Hartman, University of Arizona)

2. Imports intensities and a sample name for each analysis

3. Calculates average intensities for each isotope (based on the sum of all counts while the laser is firing)

4. Subtracts ^{204}Hg from the 204 signal to yield ^{204}Pb intensity (using natural $^{202}Hg/^{204}Hg$ of 4.3). This Hg correction is not significant for most analyses because our Hg backgrounds are low (generally ~150 cps at mass 204).

5. Performs a common Pb correction based on the measured $^{206}Pb/^{204}Pb$ and the assumed composition of common Pb based on Stacey and Kramers (1975)

6. Calculates measured 206/238, 206/207, and 208/232 ratios

7. Compares measured and known ratios for the three standards to determine fractionation factors for 206/238, 206/207, and 208/232. These correction factors are generally <5% for 206/238, <2% for 206/207, and <20% for 208/232.

8. Determines an overdispersion factor if the standard analyses show greater dispersion than expected from measurement uncertainties

9. Uses a sliding-window average to apply fractionation factors to unknowns (generally averaging 8 standard analyses)

10. Calculates fractionation-corrected 206/238, 206/207, and 208/232 ratios and ages for unknowns

11. Propagates measurement uncertainties for 206/238 and 208/232 that are based on the scatter about a regression of measured values. Uncertainties for 206/207 and 206/204 are based on the standard deviation of measured values since these ratios generally do not change during an analysis. The sum of this uncertainty and any overdispersion factor is reported as the internal (or measurement) uncertainty for each analysis. These uncertainties are reported at the 1-sigma level.

12. Calculates the down-hole slope of 206/238 to highlight analyses in which 206/238 is compromised due to heterogeneity in age (e.g., crossing an age boundary) or intersection of a fracture or inclusion.

13. Calculates concentrations of U and Th for unknowns based on the measured

intensity and known concentrations of FC-1.

14. Calculates the external (systematic) uncertainties for 206/238, 206/207, and 208/232, which include contributions from (a) the scatter of standard analyses, (b) uncertainties in the ages of the standards, (c) uncertainties in the composition of common Pb, and (4) uncertainties in the decay constants for ^{235}U and ^{238}U.

15. Determines a "Best Age" for each analysis, which is generally the 206/238 age for <900 Ma ages and the 206/207 age for >900 Ma ages.

16. Provides preliminary filters that highlight analyses with >20% discordance, >5% reverse discordance, or >10% internal (measurement) uncertainty.

17. Corrects 206/238U ages for U-Th disequilibrium. This has a significant impact only on very young (~<2 Ma) ages.

18. Calculates the radiation dosage that the analyzed portion of each zircon has experienced, assuming a value of 2.3 for the Th/U of the magma. This is plotted against 206/238 age to help identify Pb loss.

18. Creates a publication-ready datatable with concentrations, isotope ratios, and ages for unknowns.

For detrital analyses, the ages are shown on Pb*/U concordia diagrams and relative age-probability diagrams using the routines in Isoplot (Ludwig, 2008). The age-probability diagrams show each age and its uncertainty (for measurement error only) as a normal distribution, and sum all ages from a sample into a single curve. Composite age probability plots are made from an in-house Excel program (see Analysis Tools for link) that normalizes each curve according to the number of constituent analyses, such that each curve contains the same area, and then stacks the probability curves.

For igneous analyses, the ages are shown on Pb*/U concordia diagrams and weighted mean diagrams using the routines in Isoplot (Ludwig, 2008). The weighted mean diagrams show the weighted mean (weighting according to the square of the internal uncertainties), the uncertainty of the weighted mean, the external (systematic) uncertainty that corresponds to the ages used, the final uncertainty of the age (determined by quadratic addition of the weighted mean and external uncertainties), and the MSWD of the data set.

References:

Gehrels, G.E., Valencia, V., Ruiz, J., 2008, Enhanced precision, accuracy, efficiency, and spatial resolution of U-Pb ages by laser ablation–multicollector–inductively coupled plasma–mass spectrometry: Geochemistry, Geophysics, Geosystems, v. 9, Q03017, doi:10.1029/2007GC001805.

Gehrels, G.E., Valencia, V., Pullen, A., 2006, Detrital zircon geochronology by Laser-Ablation Multicollector ICPMS at the Arizona LaserChron Center, in Loszewski, T., and Huff, W., eds., Geochronology: Emerging Opportunities, Paleontology Society Short Course: Paleontology Society Papers, v. 11, 10 p.

Gehrels, G. and Pecha, M., 2014, Detrital zircon U-Pb geochronology and Hf isotope geochemistry of Paleozoic and Triassic passive margin strata of western North America: Geosphere, v. 10 (1), p. 49-65.

Ludwig, K.R., 2008, Isoplot 3.60. Berkeley Geochronology Center, Special Publication No. 4, 77 p.

Stacey, J.S., and Kramers, J.D., 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: Earth and Planetary Science Letters, v. 26, p. 207-221.

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Notes to be inserted below data table:

- 1. Analyses with >10% uncertainty (1-sigma) in 206Pb/238U age are not included.
- Analyses with >10% uncertainty (1-sigma) in 206Pb/207Pb age are not included, unless 206Pb/238U age is <400 Ma.
- Best age is determined from 206Pb/238U age for analyses with 206Pb/238U age <900 Ma and from 206Pb/207Pb age for analyses with 206Pb/238Uage >900 Ma.
- Concordance is based on 206Pb/238U age / 206Pb/207Pb age. Value is not reported for 206Pb/238U ages <400 Ma because of large uncertainty in 206Pb/207Pb age.
- Analyses with 206Pb/238U age >400 Ma and with >20% discordance (<80% concordance) are not included.
- Analyses with 206Pb/238U age >400 Ma and with >5% reverse discordance (<105% concordance) are not included.
- All uncertainties are reported at the 1-sigma level, and include only measurement errors.
- Systematic errors are as follows (at 2-sigma level): [sample 1: xxx% (206Pb/238U) & xxx% (206Pb/207Pb)] These values are reported on cells U1

and W1 of E2agecalc.

- Analyses conducted by LA-ICPMS, as described by Gehrels et al. (2008) and Gehrels and Pecha (2014).
- U concentration and U/Th are calibrated relative to FC-1 zircon standard and are accurate to ~20%.
- Common Pb correction is from measured 204Pb with common Pb composition interpreted from Stacey and Kramers (1975).
- Common Pb composition assigned uncertainties of 1.5 for 206Pb/204Pb, 0.3 for 207Pb/204Pb, and 2.0 for 208Pb/204Pb.
- U/Pb and 206Pb/207Pb fractionation is calibrated relative to fragments of large Sri Lanka zircons and individual crystals of FC-1, and R33.
- U decay constants and composition as follows: 238U = 9.8485 x 10-10, 235U = 1.55125 x 10-10, 238U/235U = 137.82.
- U-Th disequilibrium correction is applied to 206/238 ages assuming a value of 2.3 for the magma.
- Weighted mean and concordia plots determined with Isoplot (Ludwig, 2008).

References:

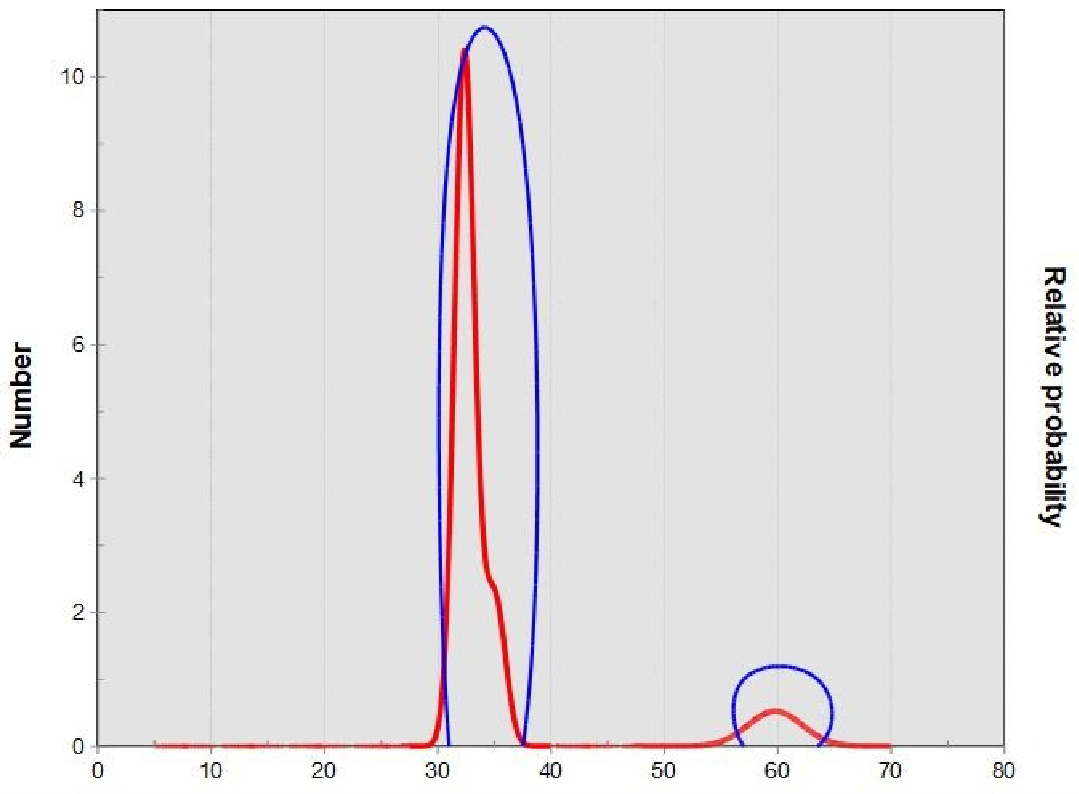
Gehrels, G.E., Valencia, V., Ruiz, J., 2008, Enhanced precision, accuracy, efficiency, and spatial resolution of U-Pb ages by laser ablation-multicollector-inductively coupled plasma-mass spectrometry: Geochemistry, Geophysics, Geosystems, v. 9, Q03017, doi:10.1029/2007GC001805.

Gehrels, G. and Pecha, M., 2014, Detrital zircon U-Pb geochronology and Hf isotope geochemistry of Paleozoic and Triassic passive margin strata of western North America: Geosphere, v. 10 (1), p. 49-65.

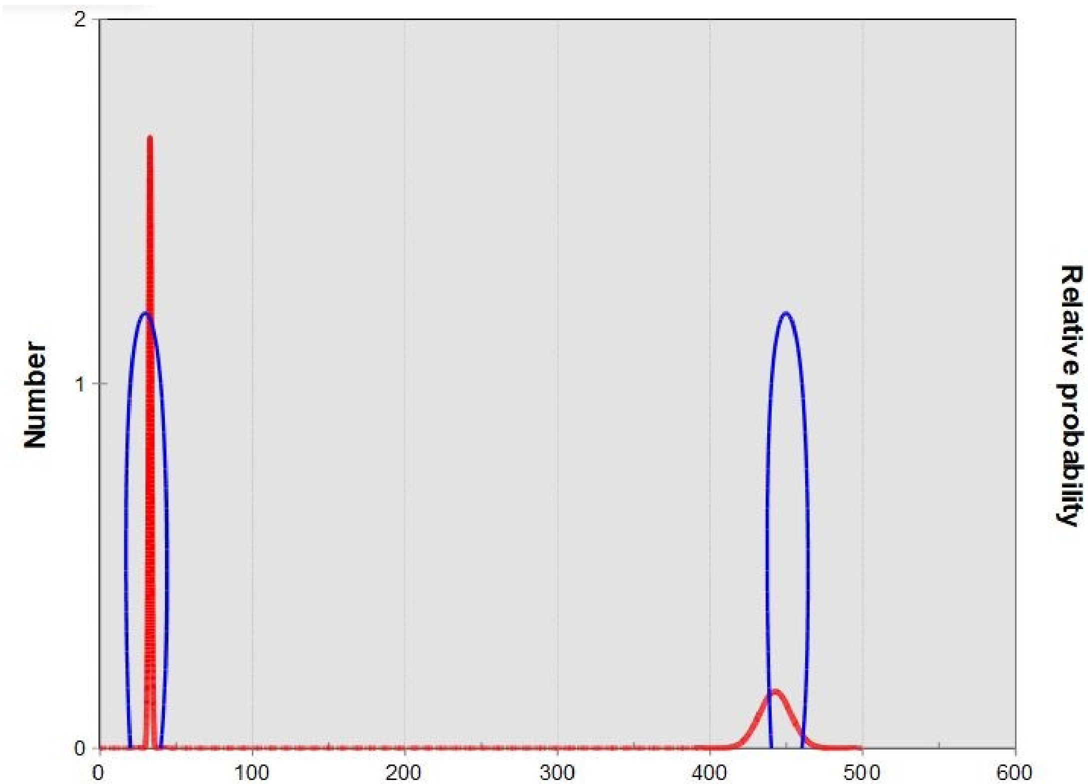
Ludwig, K., 2008, Isoplot 3.6: Berkeley Geochrono9logy Center Special Publication 4, 77 p.

Stacey, J.S., and Kramers, J.D., 1975, Approximation of terrestrial lead isotope evolution by a two stage model: Earth and Planetary Science Letters, v. 26, p. 207-221.

Analysis	U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±	Conc
				Isotope ratios							Apparent ages (Ma)								
	(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)	(%)
-INDV786 Spot 2	167	954	1.1	29.2632	15.4	0.0241	15.7	0.0051	2.9	0.18	32.9	1.0	24.2	3.8	NA	NA	32.9	1.0	NA
-INDV786 Spot 1	1235	107825	5.4	17.6112	1.4	0.5561	2.8	0.0711	2.4	0.86	442.5	10.3	449.0	10.1	483.1	31.1	442.5	10.3	91.6
-INDV303 Spot 7	757	198222	1.1	21.0250	1.5	0.0325	3.1	0.0050	2.7	0.86	31.9	0.8	32.5	1.0	77.5	36.7	31.9	0.8	NA
-INDV303 Spot 2	763	306762	1.3	20.5133	1.7	0.0335	2.8	0.0050	2.2	0.79	32.1	0.7	33.4	0.9	135.8	40.2	32.1	0.7	NA
-INDV303 Spot 9	888	21330	1.2	21.4570	1.6	0.0321	2.9	0.0050	2.4	0.84	32.2	0.8	32.1	0.9	29.0	37.8	32.2	0.8	NA
-INDV303 Spot 8	637	12720	1.5	20.7925	2.0	0.0332	3.3	0.0050	2.7	0.80	32.2	0.9	33.1	1.1	103.9	47.0	32.2	0.9	NA
-INDV303 Spot 1	655	9721	1.5	21.6322	1.6	0.0323	3.1	0.0051	2.6	0.85	32.6	0.9	32.3	1.0	9.5	39.1	32.6	0.9	NA
-INDV303 Spot 3	699	7352	0.9	21.9885	1.5	0.0318	3.1	0.0051	2.7	0.87	32.6	0.9	31.8	1.0	NA	NA	32.6	0.9	NA
-INDV303 Spot 6	724	3963	0.9	22.2386	1.6	0.0316	2.7	0.0051	2.1	0.81	32.8	0.7	31.6	0.8	NA	NA	32.8	0.7	NA
-INDV303 Spot 10	533	4819	1.3	22.4986	1.7	0.0326	3.7	0.0053	3.3	0.89	34.2	1.1	32.5	1.2	NA	NA	34.2	1.1	NA
-INDV303 Spot 5	937	2679	1.0	10.7014	6.7	0.0706	7.1	0.0055	2.4	0.34	35.2	0.9	69.3	4.8	1496.9	127.0	35.2	0.9	NA
-INDV303 Spot 4	26	635	0.8	5.8421	14.6	0.2198	15.2	0.0093	4.0	0.27	59.8	2.4	201.7	27.7	2569.1	245.7	59.8	2.4	NA

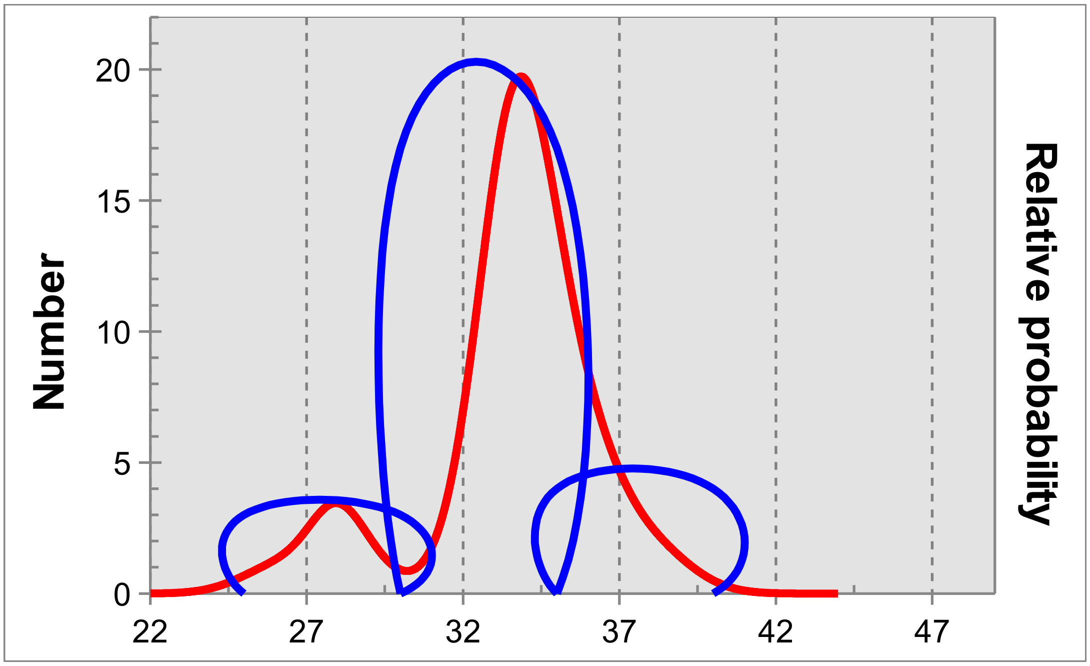


Probability density plot: EBS 303

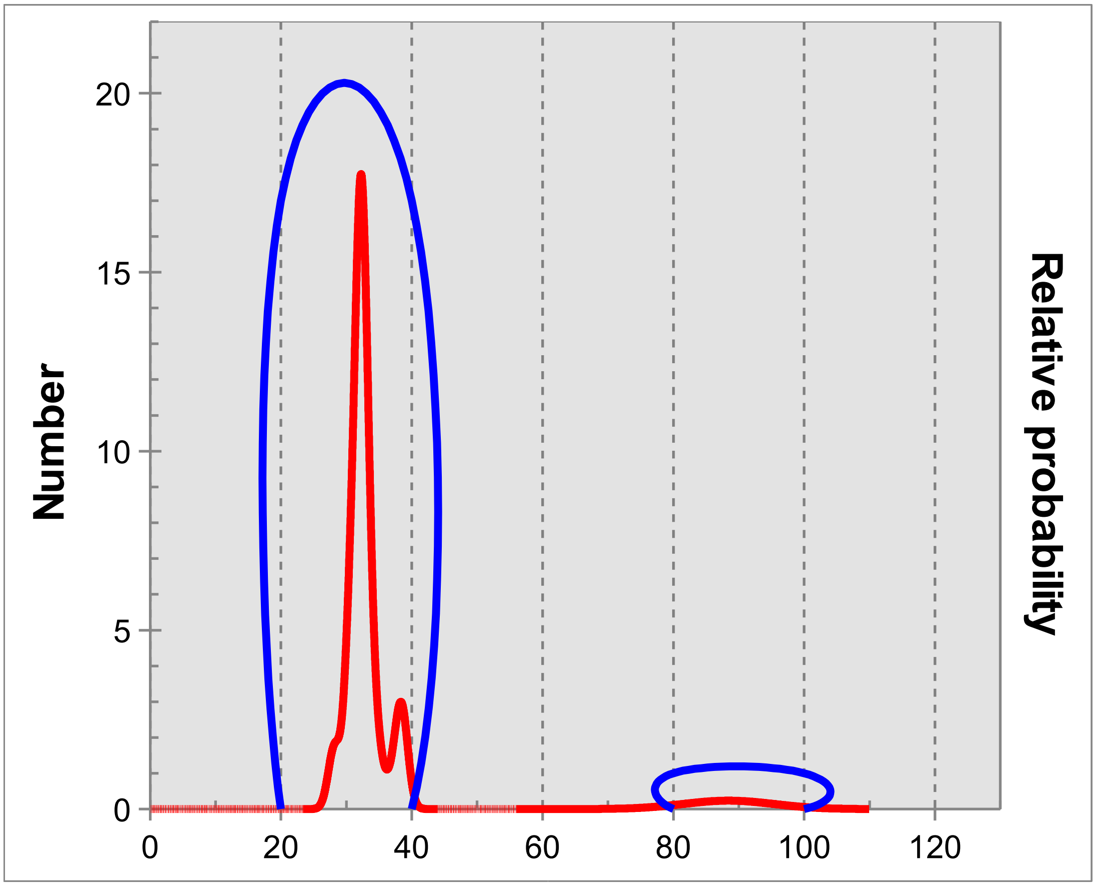


Probably density plot: EBS 786

Analysis	U (ppm)	206Pb / 204Pb	U/Th	206Pb* / 207Pb*	± (%)	207Pb* / 235U*	± (%)	206Pb* / 238U	± (%)	error corr.	206Pb* / 238U*	± (Ma)	207Pb* / 235U	± (Ma)	206Pb* / 207Pb*	± (Ma)	Best age (Ma)	± (Ma)	Conc (%)
INDV273 Spot 3	416	2673	1.0	23.2083	2.0	0.0260	3.9	0.0044	3.4	0.86	28.2	0.9	26.1	1.0	NA	NA	28.2	0.9	NA
INDV273 Spot 11	58	628	1.0	44.1589	42.9	0.0148	43.0	0.0047	2.6	0.06	30.5	0.8	14.9	6.4	NA	NA	30.5	0.8	NA
INDV273 Spot 4	95	3926	0.7	21.8915	4.0	0.0299	5.0	0.0047	3.0	0.61	30.5	0.9	29.9	1.5	NA	NA	30.5	0.9	NA
INDV273 Spot 7	129	2209	1.0	21.2205	7.8	0.0322	8.4	0.0050	3.1	0.37	31.9	1.0	32.1	2.6	55.5	185.7	31.9	1.0	NA
INDV273 Spot 2	846	223501	1.4	20.2175	1.6	0.0338	2.7	0.0050	2.3	0.82	31.9	0.7	33.8	0.9	169.8	36.3	31.9	0.7	NA
INDV273 Spot 5	515	5218	0.9	19.8095	2.5	0.0347	3.9	0.0050	3.0	0.77	32.1	1.0	34.6	1.3	217.2	58.2	32.1	1.0	NA
INDV273 Spot 16	108	803	0.8	36.2777	21.2	0.0190	21.5	0.0050	3.5	0.16	32.1	1.1	19.1	4.1	NA	NA	32.1	1.1	NA
INDV273 Spot 10	1084	37672	1.1	17.0964	1.8	0.0404	3.1	0.0050	2.5	0.82	32.3	0.8	40.3	1.2	548.3	38.6	32.3	0.8	NA
INDV273 Spot 8	500	6498	1.0	21.1414	3.0	0.0327	4.6	0.0050	3.4	0.75	32.3	1.1	32.7	1.5	64.4	71.5	32.3	1.1	NA
INDV273 Spot 12	437	12162	0.8	20.9316	2.3	0.0332	3.8	0.0050	3.0	0.80	32.4	1.0	33.1	1.2	88.1	54.2	32.4	1.0	NA
INDV273 Spot 15	99	5625	1.0	25.6609	3.9	0.0272	5.1	0.0051	3.3	0.64	32.6	1.1	27.3	1.4	NA	NA	32.6	1.1	NA
INDV273 Spot 17	669	3350	1.3	14.5263	2.7	0.0483	4.3	0.0051	3.3	0.78	32.7	1.1	47.9	2.0	894.0	55.4	32.7	1.1	NA
INDV273 Spot 13	95	902	0.7	32.4498	5.8	0.0216	6.7	0.0051	3.4	0.50	32.8	1.1	21.7	1.4	NA	NA	32.8	1.1	NA
INDV273 Spot 6	247	8574	1.4	21.9638	2.9	0.0322	3.8	0.0051	2.5	0.65	33.0	0.8	32.2	1.2	NA	NA	33.0	0.8	NA
INDV273 Spot 18	390	4492	1.4	20.8495	3.5	0.0356	4.6	0.0054	3.0	0.66	34.6	1.0	35.5	1.6	97.4	82.0	34.6	1.0	NA
~~INDV273 Spot 14~~	~~202~~	~~632~~	~~0.6~~	~~5.2257~~	~~47.9~~	~~0.1431~~	~~48.7~~	~~0.0054~~	~~5.4~~	~~0.29~~	~~34.9~~	~~1.9~~	~~135.8~~	~~23.6~~	~~2753.9~~	~~396.7~~	~~34.9~~	~~1.9~~	~~NA~~
INDV273 Spot 19	252	15096	0.7	19.4550	2.2	0.0417	3.9	0.0059	3.2	0.82	37.9	1.2	41.5	1.6	258.9	50.9	37.9	1.2	NA
INDV273 Spot 9	3503	59191	2.7	20.9077	1.2	0.0395	2.7	0.0060	2.4	0.89	38.5	0.9	39.3	1.0	90.9	28.9	38.5	0.9	NA
INDV273 Spot 1	200	3349	1.5	20.7206	5.4	0.0919	9.5	0.0138	7.9	0.83	88.4	6.9	89.2	8.2	112.1	127.2	88.4	6.9	NA
INDV216 80	43	191	0.9	28.5980	5.7	0.0197	7.5	0.0041	4.9	0.65	26.3	1.3	19.8	1.5	NA	NA	26.3	1.3	NA
INDV216 67	60	831	0.8	21.3867	9.9	0.0279	10.4	0.0043	2.9	0.28	27.8	0.8	27.9	2.9	36.9	238.3	27.8	0.8	NA
INDV216 77	424	4329	0.5	21.5625	4.1	0.0285	5.3	0.0045	3.4	0.65	28.6	1.0	28.5	1.5	17.2	97.4	28.6	1.0	NA
INDV216 72	55	767	0.8	36.9200	13.7	0.0191	14.3	0.0051	4.1	0.29	33.0	1.3	19.3	2.7	NA	NA	33.0	1.3	NA
INDV216 64	201	1533	0.7	25.4234	8.4	0.0278	8.8	0.0051	2.8	0.31	33.0	0.9	27.9	2.4	NA	NA	33.0	0.9	NA
INDV216 63	218	18309	0.9	22.1125	3.2	0.0320	4.6	0.0051	3.3	0.71	33.0	1.1	32.0	1.4	NA	NA	33.0	1.1	NA
INDV216 66	165	1311	1.1	26.1216	6.6	0.0272	7.2	0.0051	3.0	0.42	33.1	1.0	27.2	1.9	NA	NA	33.1	1.0	NA
INDV216 76	47	1286	0.7	23.0650	7.9	0.0309	9.0	0.0052	4.4	0.49	33.3	1.5	30.9	2.7	NA	NA	33.3	1.5	NA
INDV216 75	380	6025	0.6	21.7633	3.6	0.0330	4.9	0.0052	3.3	0.68	33.5	1.1	33.0	1.6	NA	NA	33.5	1.1	NA
INDV216 61	55	676	0.7	38.7625	11.1	0.0186	11.7	0.0052	3.7	0.32	33.6	1.2	18.7	2.2	NA	NA	33.6	1.2	NA
INDV216 73	774	16334	1.2	20.3561	2.0	0.0354	3.3	0.0052	2.6	0.78	33.7	0.9	35.4	1.1	153.8	47.6	33.7	0.9	NA
INDV216 60	305	1493	0.8	24.0032	3.0	0.0301	4.1	0.0052	2.8	0.69	33.7	1.0	30.1	1.2	NA	NA	33.7	1.0	NA
INDV216 68	245	8761	0.9	22.0287	2.4	0.0329	3.8	0.0053	2.9	0.77	33.8	1.0	32.9	1.2	NA	NA	33.8	1.0	NA
INDV216 65	71	2170	0.9	25.4135	5.3	0.0286	6.4	0.0053	3.7	0.57	33.9	1.2	28.7	1.8	NA	NA	33.9	1.2	NA
INDV216 70	499	6764	1.4	19.1590	1.9	0.0381	3.4	0.0053	2.8	0.82	34.0	0.9	37.9	1.3	294.0	43.9	34.0	0.9	NA
INDV216 71	89	403	0.5	61.2679	8.0	0.0120	8.5	0.0054	3.1	0.36	34.4	1.1	12.2	1.0	NA	NA	34.4	1.1	NA
INDV216 83	46	1723	2.4	19.0729	7.5	0.0387	8.8	0.0054	4.5	0.52	34.5	1.6	38.6	3.3	304.2	171.2	34.5	1.6	NA
INDV216 84	188	9191	0.8	20.2413	3.4	0.0368	4.4	0.0054	2.8	0.63	34.8	1.0	36.7	1.6	167.0	79.0	34.8	1.0	NA
INDV216 85	826	69976	1.0	20.7987	1.8	0.0359	3.8	0.0054	3.4	0.88	34.8	1.2	35.8	1.4	103.2	42.9	34.8	1.2	NA
INDV216 74	668	23468	1.4	20.5582	1.5	0.0364	2.9	0.0054	2.5	0.86	34.9	0.9	36.3	1.0	130.6	34.5	34.9	0.9	NA
INDV216 69	764	2479	0.6	11.5546	1.6	0.0661	3.3	0.0055	2.9	0.87	35.6	1.0	65.0	2.1	1350.4	31.8	35.6	1.0	NA
INDV216 82	789	128098	0.6	20.3921	1.6	0.0382	3.0	0.0057	2.6	0.85	36.3	0.9	38.1	1.1	149.7	37.5	36.3	0.9	NA
INDV216 79	714	5050	1.1	13.1156	5.1	0.0606	6.0	0.0058	3.1	0.52	37.0	1.2	59.7	3.5	1101.5	102.4	37.0	1.2	NA
INDV216 78	688	7538	0.7	16.3222	2.0	0.0503	3.8	0.0060	3.3	0.85	38.3	1.2	49.8	1.9	648.6	43.5	38.3	1.2	NA
~~INDV216 81~~	~~229~~	~~1173~~	~~0.6~~	~~6.4719~~	~~40.5~~	~~0.1341~~	~~40.9~~	~~0.0063~~	~~4.6~~	~~0.24~~	~~40.5~~	~~1.6~~	~~127.8~~	~~22.7~~	~~2396.5~~	~~217.6~~	~~40.5~~	~~1.6~~	~~NA~~
~~INDV216 62~~	~~379~~	~~543~~	~~0.6~~	~~4.9969~~	~~42.6~~	~~0.1967~~	~~43.8~~	~~0.0070~~	~~5.2~~	~~0.36~~	~~45.0~~	~~2.4~~	~~182.4~~	~~23.1~~	~~2857.1~~	~~309.3~~	~~45.0~~	~~2.4~~	~~NA~~



Probability density plot: EBS 216



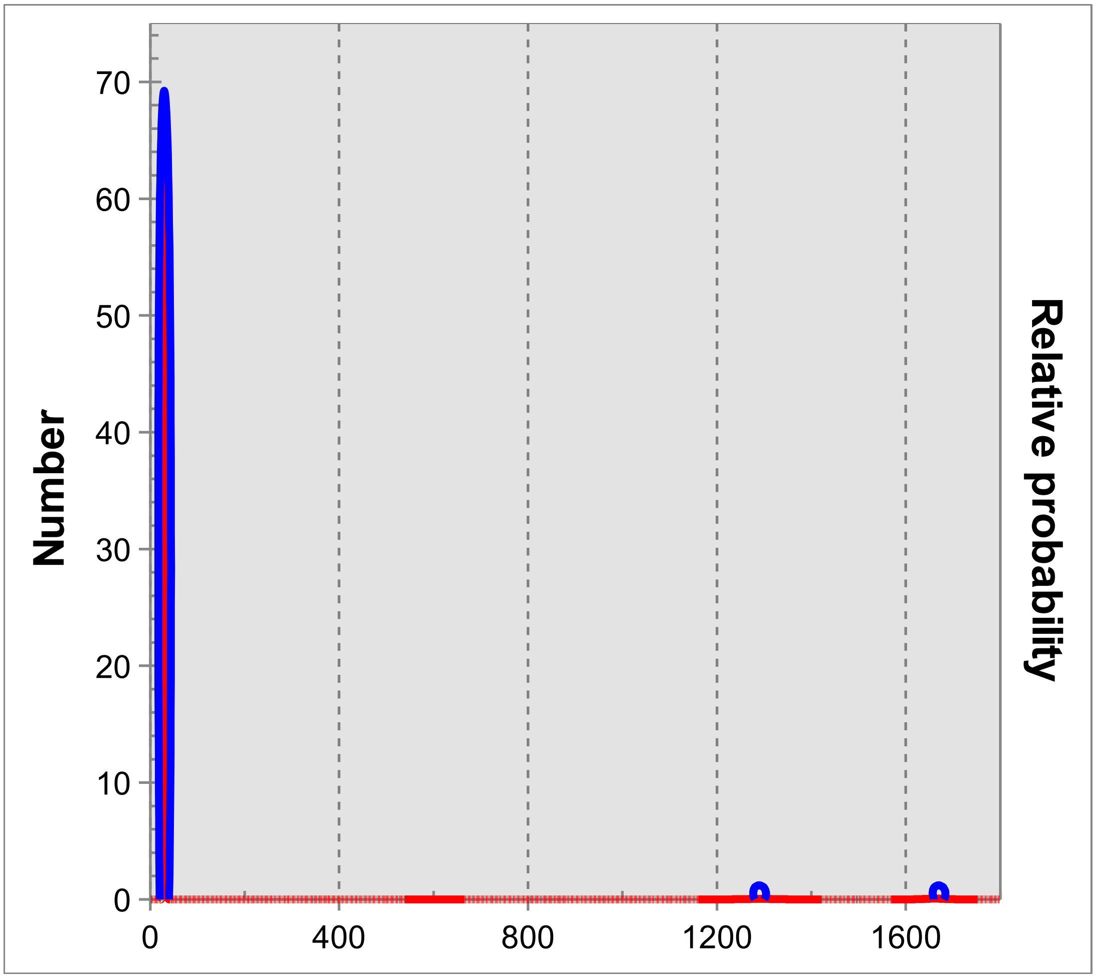
Probability density plot: EBS 273

Analysis	U (ppm)	206Pb/204Pb	U/Th	206Pb*/207Pb*	± (%)	207Pb*/235U*	± (%)	206Pb*/238U	± (%)	error corr.	206Pb*/238U*	± (Ma)	207Pb*/235U	± (Ma)	206Pb*/207Pb*	± (Ma)	Best age (Ma)	± (Ma)	Conc (%)	
				Isotope ratios							Apparent ages (Ma)									
-INDV137 Spot 8	60	5738	0.8	20.9355	5.4	0.0337	6.4	0.0051	3.4	0.54	32.9	1.1	33.6	2.1	87.7	127.1	32.9	1.1	NA	
-INDV137 Spot 12	53	13581	0.8	19.9088	5.0	0.0359	5.9	0.0052	3.0	0.51	33.4	1.0	35.8	2.1	205.6	117.0	33.4	1.0	NA	
-INDV137 Spot 9	99	70921	0.7	19.3956	5.3	0.0371	5.9	0.0052	2.6	0.43	33.6	0.9	37.0	2.2	265.9	122.8	33.6	0.9	NA	
-INDV137 Spot 25	69	33117	0.6	23.6773	3.8	0.0306	4.8	0.0052	3.1	0.63	33.7	1.0	30.6	1.5	NA	NA	33.7	1.0	NA	
-INDV137 Spot 26	331	14671	0.5	21.6479	2.7	0.0334	4.0	0.0053	3.0	0.74	33.8	1.0	33.4	1.3	7.7	64.9	33.8	1.0	NA	
-INDV137 Spot 7	38	5773	0.7	24.5055	4.4	0.0296	6.4	0.0053	4.6	0.72	33.8	1.6	29.6	1.9	NA	NA	33.8	1.6	NA	
-INDV137 Spot 21	350	170157	0.5	20.4781	2.6	0.0354	3.5	0.0053	2.3	0.67	33.8	0.8	35.3	1.2	139.8	61.7	33.8	0.8	NA	
-INDV137 Spot 15	206	10617	0.6	20.3371	2.9	0.0358	4.5	0.0053	3.4	0.75	33.9	1.1	35.7	1.6	156.0	69.0	33.9	1.1	NA	
-INDV137 Spot 17	36	1493	0.7	24.9219	7.5	0.0292	8.4	0.0053	3.8	0.45	34.0	1.3	29.3	2.4	NA	NA	34.0	1.3	NA	
-INDV137 Spot 22	67	31669	0.5	21.3611	4.3	0.0341	5.7	0.0053	3.7	0.65	34.0	1.3	34.1	1.9	39.8	102.3	34.0	1.3	NA	
-INDV137 Spot 19	64	2467	0.6	23.0987	5.1	0.0316	6.3	0.0053	3.7	0.59	34.0	1.3	31.6	2.0	NA	NA	34.0	1.3	NA	
-INDV137 Spot 16	201	33400	0.6	20.4876	3.3	0.0358	4.6	0.0053	3.2	0.69	34.2	1.1	35.7	1.6	138.7	77.4	34.2	1.1	NA	
-INDV137 Spot 13	1145	103806	0.9	21.6392	1.4	0.0340	2.9	0.0053	2.6	0.87	34.3	0.9	33.9	1.0	8.7	34.5	34.3	0.9	NA	
-INDV137 Spot 18	64	4050	0.7	23.9940	4.2	0.0306	6.0	0.0053	4.2	0.71	34.3	1.4	30.7	1.8	NA	NA	34.3	1.4	NA	
-INDV137 Spot 24	46	2907	0.7	25.9945	8.3	0.0283	9.5	0.0053	4.6	0.49	34.4	1.6	28.4	2.6	NA	NA	34.4	1.6	NA	
-INDV137 Spot 5	335	39108	0.6	21.2787	2.0	0.0349	3.9	0.0054	3.3	0.86	34.7	1.1	34.9	1.3	49.0	47.1	34.7	1.1	NA	
-INDV137 Spot 27	37	56496	0.9	20.9257	5.5	0.0355	7.2	0.0054	4.7	0.65	34.7	1.6	35.5	2.5	88.8	130.4	34.7	1.6	NA	
-INDV137 Spot 2	285	9206	1.3	21.1493	2.8	0.0352	4.3	0.0054	3.2	0.76	34.7	1.1	35.1	1.5	63.6	65.7	34.7	1.1	NA	
-INDV137 Spot 11	371	37869	1.2	21.6131	2.1	0.0350	3.6	0.0055	3.0	0.82	35.3	1.0	34.9	1.2	11.6	50.1	35.3	1.0	NA	
-INDV137 Spot 6	136	11777	0.9	21.5624	3.5	0.0352	4.5	0.0055	2.7	0.61	35.4	1.0	35.1	1.5	17.2	85.1	35.4	1.0	NA	
-INDV137 Spot 10	48	2922	0.8	20.7590	5.8	0.0367	6.9	0.0055	3.7	0.54	35.5	1.3	36.6	2.5	107.7	137.6	35.5	1.3	NA	
-INDV137 Spot 23	59	5397	0.7	24.3737	4.5	0.0318	5.4	0.0056	2.9	0.54	36.2	1.1	31.8	1.7	NA	NA	36.2	1.1	NA	
-INDV137 Spot 20	206	6458	0.8	13.3499	6.8	0.0584	7.4	0.0057	3.0	0.40	36.4	1.1	57.6	4.2	1066.0	137.0	36.4	1.1	NA	discordant
-INDV137 Spot 1	526	11129	0.7	14.9739	3.9	0.0521	4.9	0.0057	3.0	0.62	36.4	1.1	51.5	2.5	831.0	80.7	36.4	1.1	NA	discordant
-INDV137 Spot 4	133	3048	0.8	10.7103	8.4	0.0731	9.6	0.0057	4.8	0.50	36.5	1.7	71.7	6.7	1495.4	158.6	36.5	1.7	NA	discordant
-INDV137 Spot 14	357	4820	1.7	6.5182	22.7	0.1354	23.1	0.0064	4.5	0.19	41.1	1.8	128.9	28.0	2384.4	392.1	41.1	1.8	NA	discordant
-INDV96 Spot 29	205	4429	1.4	22.6981	3.3	0.0320	4.5	0.0053	3.0	0.67	33.9	1.0	32.0	1.4	NA	NA	33.9	1.0	NA	too few analyses to further evaluate
-INDV96 Spot 28	920	1341672	1.2	18.2973	1.2	0.4523	3.5	0.0601	3.3	0.95	375.9	12.2	378.9	11.2	398.0	25.9	375.9	12.2	NA	
-INDV122 Spot 32	112	4949	0.9	22.3859	4.4	0.0320	5.7	0.0052	3.7	0.65	33.4	1.2	32.0	1.8	NA	NA	33.4	1.2	NA	too few analyses for PDP
-INDV220 Spot 36	241	37354	1.4	21.3642	2.9	0.0337	3.9	0.0052	2.6	0.66	33.6	0.9	33.7	1.3	39.4	70.5	33.6	0.9	NA	
-INDV122 Spot 33	51	4951	0.6	22.1437	4.9	0.0327	5.5	0.0053	2.5	0.46	33.8	0.8	32.7	1.8	NA	NA	33.8	0.8	NA	
-INDV122 Spot 30	145	3270	1.1	20.9690	3.6	0.0348	5.0	0.0053	3.5	0.70	34.1	1.2	34.8	1.7	83.9	86.0	34.1	1.2	NA	
-INDV122 Spot 31	59	2625	0.6	22.0368	6.2	0.0335	7.2	0.0054	3.7	0.52	34.5	1.3	33.5	2.4	NA	NA	34.5	1.3	NA	
-INDV220 Spot 37	42	13778	0.9	25.5247	4.8	0.0291	5.8	0.0054	3.4	0.58	34.7	1.2	29.1	1.7	NA	NA	34.7	1.2	NA	
-INDV122 Spot 34	88	2468	1.0	25.3576	3.4	0.0294	4.7	0.0054	3.2	0.68	34.8	1.1	29.4	1.4	NA	NA	34.8	1.1	NA	
-INDV220 Spot 35	208	14180	0.7	12.2322	8.9	0.0624	9.6	0.0055	3.5	0.37	35.6	1.3	61.5	5.7	1239.6	175.0	35.6	1.3	NA	discordant
-INDV220 Spot 38	73	2173	0.9	4.5270	8.9	0.2013	9.7	0.0066	3.9	0.40	42.5	1.6	186.2	16.5	2987.2	143.7	42.5	1.6	NA	discordant

Table . U-Pb geochronologic analyses.							
							Isotope ratios
Analysis	U	206Pb	U/Th	206Pb*	±	207Pb*	±
	(ppm)	204Pb		207Pb*	(%)	235U*	(%)
-INDV975 Spot 45	601	1370	0.9	9.2003	5.4	0.0599	5.9
-INDV975 Spot 48	601	2185	0.8	24.2814	1.8	0.0243	3.3
-INDV975 Spot 27	567	17369	1.0	20.3941	2.2	0.0291	3.5
-INDV975 Spot 12	129	356	0.6	207.5062	3.6	0.0029	4.6
-INDV975 Spot 10	459	8859	0.8	21.9348	3.0	0.0273	3.8
-INDV975 Spot 6	472	2983	0.7	23.2053	2.7	0.0258	4.0
-INDV975 Spot 67	333	1472	1.0	20.6846	6.9	0.0290	7.4
-INDV975 Spot 63	371	5902	0.9	21.5883	2.7	0.0279	4.3
-INDV975 Spot 21	399	3040	1.0	21.2122	5.4	0.0284	6.0
-INDV975 Spot 16	473	2408	0.8	23.4043	2.5	0.0259	3.5
-INDV975 Spot 30	460	7006	0.9	20.3846	3.0	0.0298	4.2
-INDV975 Spot 9	200	3142	0.9	22.3929	3.8	0.0271	4.5
-INDV975 Spot 44	218	509	0.8	52.0565	28.6	0.0117	28.7
-INDV975 Spot 2	197	1718	0.5	25.4162	4.7	0.0240	5.9
-INDV975 Spot 50	582	4279	0.9	22.0868	2.5	0.0276	3.1
-INDV975 Spot 25	261	2843	0.7	22.0681	3.2	0.0277	4.2
-INDV975 Spot 39	415	2671	0.9	22.8631	3.5	0.0267	4.1
-INDV975 Spot 46	508	11953	0.8	21.0067	2.0	0.0291	3.3
-INDV975 Spot 36	244	867	1.3	30.3654	14.5	0.0201	14.8
-INDV975 Spot 55	270	1621	0.5	25.3519	4.9	0.0241	5.5
-INDV975 Spot 41	418	2539	1.0	17.2958	4.7	0.0354	6.0
-INDV975 Spot 47	475	2337	0.9	23.4903	7.9	0.0260	8.3
-INDV975 Spot 40	2805	74960	0.4	21.2732	1.3	0.0288	2.4
-INDV975 Spot 51	366	3475	0.9	23.9748	2.7	0.0256	3.8
-INDV975 Spot 33	694	11921	0.4	20.7063	2.0	0.0297	3.3
-INDV975 Spot 13	190	3490	1.2	21.7446	6.3	0.0282	6.6
-INDV975 Spot 24	1524	10709	0.6	19.0362	3.0	0.0323	3.8
-INDV975 Spot 1	5834	25502	1.2	19.6448	2.5	0.0313	3.7
-INDV975 Spot 54	141	1065	0.6	15.0576	4.5	0.0409	5.5
-INDV975 Spot 61	359	2078	0.9	22.7073	8.4	0.0272	8.8
-INDV975 Spot 11	3317	9806	2.3	21.0581	1.8	0.0293	2.7
-INDV975 Spot 8	315	1845	0.8	23.4571	10.1	0.0264	10.3
-INDV975 Spot 58	319	2828	1.1	22.7848	6.6	0.0272	7.2
-INDV975 Spot 66	380	61970	0.9	18.6105	2.7	0.0333	3.5
-INDV975 Spot 34	4708	36682	1.3	21.1649	1.4	0.0294	3.2
-INDV975 Spot 3	410	2392	0.8	21.6577	6.7	0.0288	7.1
-INDV975 Spot 26	473	7706	0.9	18.8126	3.1	0.0331	3.9
-INDV975 Spot 31	401	7386	0.9	21.5504	2.3	0.0290	2.8
-INDV975 Spot 23	440	3980	0.7	19.3477	2.4	0.0323	2.9
-INDV975 Spot 18	463	3985	0.9	9.7394	4.9	0.0644	6.1
-INDV975 Spot 52	379	1023	1.0	28.9485	14.1	0.0217	14.3
-INDV975 Spot 57	360	29389	1.3	16.8380	3.8	0.0374	4.6

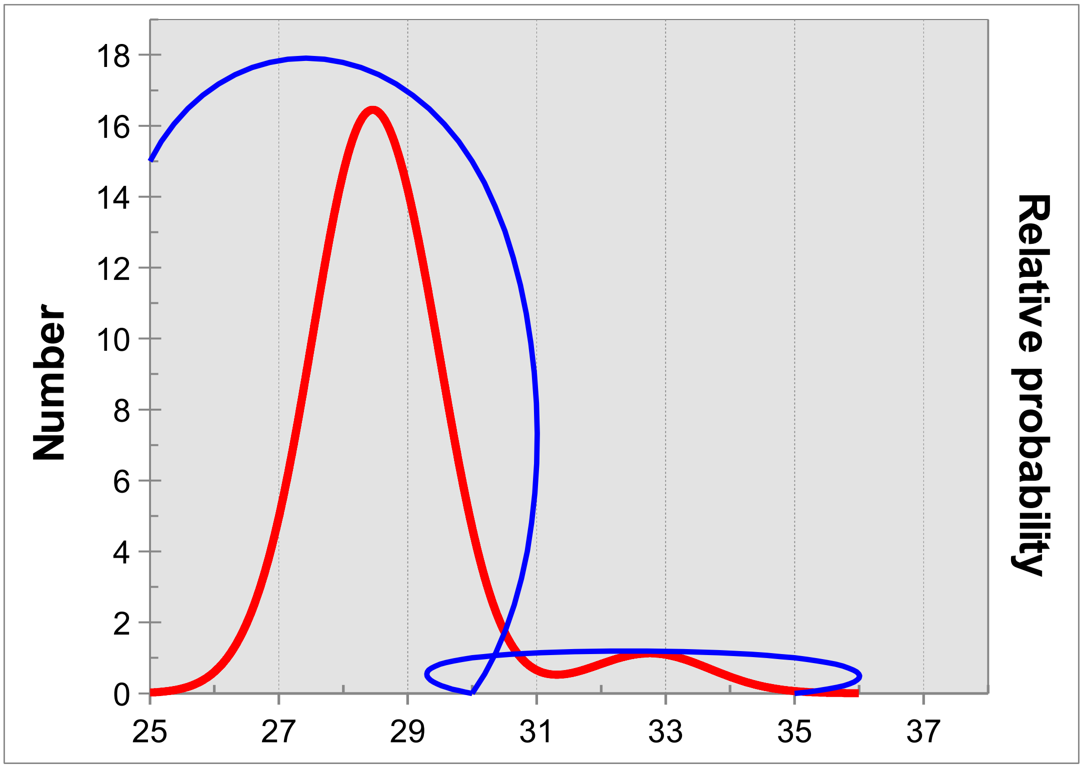
-INDV975 Spot 20	258	1395	0.9	20.7408	3.6	0.0304	4.4
-INDV975 Spot 56	526	9528	0.7	17.4949	2.5	0.0361	3.5
-INDV975 Spot 49	180	8593	0.8	16.8132	2.6	0.0376	4.0
-INDV975 Spot 53	307	4010	0.7	17.1896	2.9	0.0368	3.7
-INDV975 Spot 5	197	1807	0.5	25.4736	4.3	0.0249	4.9
-INDV975 Spot 17	248	3059	0.6	10.7918	3.2	0.0587	4.4
-INDV975 Spot 65	302	3815	1.0	13.9847	5.5	0.0453	6.1
-INDV975 Spot 64	352	2547	0.6	11.8014	2.7	0.0540	3.6
-INDV975 Spot 19	322	5118	0.9	14.5699	4.0	0.0445	4.5
-INDV975 Spot 43	355	84627	0.8	11.0883	3.7	0.0585	4.5
-INDV975 Spot 38	245	7488	1.2	18.5919	3.4	0.0350	4.3
-INDV975 Spot 60	364	3685	0.7	7.2464	17.5	0.0922	17.8
-INDV975 Spot 35	317	250849	1.0	8.6543	7.2	0.0801	7.6
-INDV975 Spot 29	263	1756	1.0	8.7476	5.0	0.0794	6.1
-INDV975 Spot 7	237	1673	1.1	6.3744	3.5	0.1109	4.7
-INDV975 Spot 15	222	2398	0.9	5.4403	6.7	0.1420	7.5
-INDV975 Spot 32	236	43661	1.7	11.9118	1.5	2.1279	2.3
-INDV975 Spot 59	196	192221	1.5	9.8020	1.1	4.2255	2.4
-INDV1208 Spot 72	588	2457	0.5	20.2110	2.5	0.0288	3.6
-INDV1208 Spot 71	516	982	0.6	29.7154	2.8	0.0199	3.9
-INDV1208 Spot 76	792	7833	0.4	20.5419	2.8	0.0289	3.4
-INDV1208 Spot 79	67	721	0.6	34.5940	5.3	0.0172	6.6
-INDV1208 Spot 78	172	3103	0.5	21.8464	3.1	0.0273	5.0
-INDV1208 Spot 69	45	837	0.9	31.6602	7.3	0.0189	8.1
-INDV1208 Spot 73	436	11606	0.5	19.9701	2.5	0.0302	3.3
-INDV1208 Spot 75	68	468	0.6	39.2950	37.2	0.0155	37.3
-INDV1208 Spot 74	130	10210	0.6	19.8070	4.6	0.0309	5.7
-INDV1208 Spot 70	384	3029	0.5	23.1755	3.2	0.0264	4.3
-INDV1208 Spot 68	63	844	0.8	31.7598	5.5	0.0194	6.7
-INDV1208 Spot 77	801	21709	1.0	18.3143	2.0	0.0354	3.3
-INDV1581 Spot 88	164	2130	1.0	25.8508	4.7	0.0272	5.4
-INDV1581 Spot 95	99	488	0.6	39.8086	63.1	0.0177	63.2
-INDV1581 Spot 96	474	2995	0.6	22.6483	4.1	0.0311	4.7
-INDV1581 Spot 85	835	17312	0.7	20.8709	1.9	0.0340	3.5
-INDV1581 Spot 94	71	312	0.7	348.7943	4.8	0.0020	6.0
-INDV1581 Spot 90	669	7172	1.1	21.4600	2.2	0.0334	3.5
-INDV1581 Spot 84	66	2794	0.6	22.4578	5.9	0.0320	6.8
-INDV1581 Spot 83	1845	9329	1.0	18.1743	2.1	0.0396	2.8
-INDV1581 Spot 82	233	4670	0.8	19.7229	2.8	0.0366	3.5
-INDV1581 Spot 87	412	7998	1.1	21.3241	2.2	0.0341	3.7
-INDV1581 Spot 86	1418	10793	1.5	20.9284	1.7	0.0347	2.6
-INDV1581 Spot 91	46	1041	0.8	43.7208	3.9	0.0167	5.9
-INDV1581 Spot 89	177	991	1.9	29.7547	5.3	0.0248	6.2
-INDV1581 Spot 80	47	1829	0.9	21.2168	6.0	0.0348	7.3

-INDV1581 Spot 98	427	2622	0.6	17.9630	4.9	0.0417	5.6
-INDV1581 Spot 93	232	1499	0.7	24.1522	3.7	0.0312	4.4
-INDV1581 Spot 81	44	1019	0.7	6.6251	5.7	0.1177	6.9
-INDV1581 Spot 92	110	426	1.0	4.0372	17.4	0.2267	18.7
-INDV1066 Spot 100	72	886	0.9	38.9119	3.6	0.0189	5.3
-INDV1066 Spot 99	60	12274	1.1	17.2671	5.7	0.0427	6.6
-INDV1066 Spot 101	221	2204	1.4	24.2506	3.3	0.0315	5.0



Probability density plot: EBS 975

						Isotope ratios					Apparent ages (Ma)								
Analysis	U	206Pb	U/Th	206Pb*	±	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±	Best age	±	Conc
	(ppm)	204Pb		207Pb*	(%)	235U*	(%)	238U	(%)	corr.	238U*	(Ma)	235U	(Ma)	207Pb*	(Ma)	(Ma)	(Ma)	(%)
-INDV1166 Spot 15	338	5336	1.0	21.0107	2.5	0.0278	3.7	0.0042	2.7	0.74	27.3	0.7	27.9	1.0	79.1	59.1	27.3	0.7	NA
-INDV1166 Spot 19	565	22280	0.7	20.4684	2.6	0.0293	4.0	0.0044	3.1	0.76	28.0	0.9	29.3	1.2	140.9	61.1	28.0	0.9	NA
-INDV1166 Spot 7	219	13176	0.8	21.3706	3.9	0.0281	4.6	0.0044	2.5	0.53	28.0	0.7	28.1	1.3	38.7	93.9	28.0	0.7	NA
-INDV1166 Spot 13	303	6999	0.6	21.4700	2.8	0.0281	3.6	0.0044	2.2	0.61	28.1	0.6	28.1	1.0	27.6	67.9	28.1	0.6	NA
-INDV1166 Spot 17	210	1825	0.4	25.1179	5.9	0.0240	6.6	0.0044	3.0	0.45	28.1	0.8	24.1	1.6	NA	NA	28.1	0.8	NA
-INDV1166 Spot 4	250	3919	1.1	22.1231	3.1	0.0273	4.3	0.0044	3.1	0.71	28.2	0.9	27.3	1.2	NA	NA	28.2	0.9	NA
-INDV1166 Spot 20	406	33918	0.8	20.6352	2.9	0.0294	3.9	0.0044	2.6	0.67	28.3	0.7	29.4	1.1	121.9	68.3	28.3	0.7	NA
-INDV1166 Spot 8	320	8641	0.8	21.5946	2.4	0.0281	3.3	0.0044	2.3	0.69	28.3	0.6	28.1	0.9	13.7	57.2	28.3	0.6	NA
-INDV1166 Spot 14	303	6840	0.8	21.4431	3.2	0.0285	4.4	0.0044	3.0	0.68	28.5	0.8	28.6	1.2	30.6	77.8	28.5	0.8	NA
-INDV1166 Spot 18	190	25507	0.4	21.4366	3.2	0.0287	4.9	0.0045	3.8	0.77	28.7	1.1	28.8	1.4	31.3	75.7	28.7	1.1	NA
~~-INDV1166 Spot 2~~	~~581~~	~~11553~~	~~0.8~~	~~16.2639~~	~~1.8~~	~~0.0379~~	~~2.8~~	~~0.0045~~	~~2.1~~	~~0.77~~	~~28.8~~	~~0.8~~	~~37.8~~	~~4.0~~	~~656.3~~	~~37.7~~	~~28.8~~	~~0.8~~	~~NA~~d
-INDV1166 Spot 1	178	1694	1.1	23.6497	4.1	0.0261	4.9	0.0045	2.6	0.53	28.9	0.7	26.2	1.3	NA	NA	28.9	0.7	NA
-INDV1166 Spot 3	430	36043	0.9	21.4876	2.4	0.0290	3.9	0.0045	3.0	0.78	29.1	0.9	29.0	1.1	25.6	57.8	29.1	0.9	NA
-INDV1166 Spot 12	389	5134	0.9	21.8162	2.7	0.0286	3.4	0.0045	2.1	0.62	29.1	0.6	28.7	1.0	NA	NA	29.1	0.6	NA
-INDV1166 Spot 22	167	3863	0.9	19.9010	4.5	0.0314	5.1	0.0045	2.4	0.47	29.2	0.7	31.4	1.6	206.5	104.4	29.2	0.7	NA
-INDV1166 Spot 9	237	5494	1.1	22.1309	2.9	0.0283	4.0	0.0046	2.7	0.69	29.3	0.8	28.4	1.1	NA	NA	29.3	0.8	NA
~~-INDV1166 Spot 10~~	~~343~~	~~8321~~	~~0.6~~	~~13.8506~~	~~2.4~~	~~0.0478~~	~~3.5~~	~~0.0048~~	~~2.5~~	~~0.72~~	~~30.9~~	~~0.8~~	~~47.4~~	~~1.6~~	~~891.6~~	~~49.7~~	~~30.9~~	~~0.8~~	~~NA~~d
~~-INDV1166 Spot 11~~	~~1748~~	~~6086~~	~~0.5~~	~~13.1701~~	~~3.3~~	~~0.0508~~	~~3.7~~	~~0.0049~~	~~1.7~~	~~0.45~~	~~31.2~~	~~0.5~~	~~50.3~~	~~1.8~~	~~1093.2~~	~~65.6~~	~~31.2~~	~~0.5~~	~~NA~~d
-INDV1166 Spot 16	558	31493	1.1	21.6965	1.6	0.0324	3.3	0.0051	2.9	0.88	32.8	0.9	32.3	1.0	2.3	38.1	32.8	0.9	NA
~~-INDV1166 Spot 23~~	~~109~~	~~3741~~	~~0.3~~	~~5.0663~~	~~21.3~~	~~0.1583~~	~~23.2~~	~~0.0058~~	~~9.1~~	~~0.39~~	~~37.4~~	~~3.4~~	~~149.2~~	~~32.1~~	~~2804.6~~	~~352.9~~	~~37.4~~	~~3.4~~	~~NA~~d
-INDV1432 Spot 28	1437	26543	1.4	21.3590	1.8	0.0342	2.9	0.0053	2.3	0.79	34.1	0.8	34.2	1.0	40.0	42.6	34.1	0.8	NA
-INDV1432 Spot 27	389	16814	1.5	21.0877	2.5	0.0351	3.4	0.0054	2.2	0.66	34.5	0.8	35.0	1.2	70.5	60.6	34.5	0.8	NA
-INDV1432 Spot 25	53	1030	0.7	27.5043	6.0	0.0279	8.3	0.0056	5.8	0.70	35.8	2.1	28.0	2.3	NA	NA	35.8	2.1	NA
-INDV1432 Spot 30	50	2125	0.8	8.1527	10.8	0.0945	11.8	0.0056	4.9	0.41	35.9	1.7	91.7	10.4	1995.2	192.7	35.9	1.7	NA
-INDV1432 Spot 24	38	773002	2.7	18.0911	1.6	0.5100	3.0	0.0669	2.5	0.84	417.7	10.1	418.4	10.2	423.4	35.8	417.7	10.1	98.7
-INDV898 Spot 37	610	24047	1.4	21.3494	1.5	0.0348	3.6	0.0054	3.3	0.91	34.7	1.1	34.7	1.2	41.1	34.8	34.7	1.1	NA
-INDV898 Spot 34	751	86962	0.7	20.8510	1.6	0.0358	2.7	0.0054	2.1	0.79	34.8	0.7	35.7	0.9	97.2	39.0	34.8	0.7	NA
-INDV898 Spot 36	331	21368	1.8	20.7372	2.5	0.0360	3.3	0.0054	2.1	0.65	34.8	0.7	35.9	1.2	110.2	59.3	34.8	0.7	NA
-INDV898 Spot 33	68	2100	0.5	22.8675	4.0	0.0327	5.4	0.0054	3.6	0.67	34.9	1.3	32.7	1.7	NA	NA	34.9	1.3	NA
-INDV898 Spot 31	309	4612	1.2	21.2152	2.8	0.0360	4.0	0.0055	2.9	0.72	35.6	1.0	35.9	1.4	56.1	66.4	35.6	1.0	NA
-INDV787 Spot 39	2190	42527	1.0	17.3855	2.3	0.0448	3.3	0.0057	2.4	0.72	36.4	0.9	44.5	1.4	511.5	49.8	36.4	0.9	NA



Probability density plot: EBS 1166

Appendix I: Raw Data for Laser Ablation Inductively Coupled Mass Spectroscopy (LA-ICP-MS)

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
610-a	0.09	0.13	12.17	0.07	1.79	72.37
610-b	0.09	0.13	12.3	0.07	1.79	72.15
610-1	0.09	0.13	12.51	0.07	1.84	71.59
612-1	0.01	0.01	12.52	0.01	1.87	73.73
CMG-B-1	0	0	15.69	1.01	4.1	64.19
CMG-C-1	0.01	0	1.05	2.78	0.83	36.21
UCSC-G-1	0	0	0.46	0.4	5.41	30.61
EBS1454-1	0.01	0.01	0.3	0.51	5.6	36.2
EBS1454-2	0.01	0.01	0.29	0.53	7.13	34.34
EBS1454-3	0.01	0.01	0.28	0.47	4.65	27.36
EBS1454-4	0.01	0.01	0.23	0.48	5.58	25.14
EBS815-1	0	0	0.82	2.83	15.77	42.44
EBS815-2	0	0	1	2.55	17.43	46.57
EBS815-3	0	0	0.99	2.14	15.92	43.92
EBS815-4	0	0	1.38	1.86	17.78	52.98
EBS1236-1	0	0	0.81	7.13	7.02	55.24
EBS1236-2	0	0	0.96	6.84	9.48	52.16
EBS1236-3	0	0	1.14	4.62	6.89	56.73
EBS1236-4	0	0	1.34	4.79	9.69	55.32
EBS1289-1	0	0	0.79	1.18	12.15	39.04
EBS1289-2	0	0	0.91	1.01	12.76	38.65
EBS1289-3	0	0	1.04	1.1	14.32	46.59
EBS1289-4	0	0	1.06	1.11	15.44	44.99
EBS210-1	0	0	0.66	1.04	8.3	27.82
EBS210-2	0	0	0.51	1.4	7.46	24.69
EBS210-3	0	0	0.51	1.46	8.01	23.93
EBS210-4	0	0	0.77	1.48	9.94	31.63
610-2	0.1	0.13	13.02	0.07	1.9	70.73
612-2	0.01	0.01	13.54	0.01	2.01	71.94
CMG-B-2	0	0	16.75	1.02	4.39	61.96
CMG-C-2	0.01	0	1.08	2.82	0.85	34.74
UCSC-G-2	0	0	0.48	0.42	5.45	29.63
EBS1429-1	0	0.01	0.31	1.02	5.61	29.13
EBS1429-2	0	0.01	0.21	0.98	5.46	25.25
EBS1429-3	0	0.01	0.25	1.08	6.68	32.28
EBS1429-4	0	0.01	0.29	1.06	6.76	28.18
EBS281-1	0	0.01	0.19	0.91	7.7	30.62
EBS281-2	0	0.01	0.18	0.98	8.7	26.86
EBS281-3	0	0.01	0.15	0.84	9.59	26.8
EBS281-4	0	0.01	0.14	0.9	9.55	24.89
EBS1072-1	0	0	0.55	1.53	10.95	35.08
EBS1072-2	0	0	0.72	1.1	14.42	46.9
EBS1072-3	0	0	0.43	1.37	9.9	30.88
EBS1072-4	0	0	0.5	1.16	11.55	34.69
EBS170-1	0	0	0.24	0.69	5.97	19.15
EBS170-2	0	0	0.38	0.61	6.35	23.12
EBS170-3	0	0	0.38	0.78	7	24.25
EBS170-4	0	0	0.85	0.66	11.75	40.41

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
EBS67-1	0	0	0.93	2.1	11.58	40.18
EBS67-2	0	0	1.55	1.37	14.99	53.39
EBS67-3	0	0	1.3	2.15	12.49	43.72
EBS67-4	0	0	1.78	1.24	15.39	60.13
EBS359-1	0	0	1.69	2.07	16.65	49.17
EBS359-2	0	0	1.54	2.1	15.75	47.49
EBS359-3	0	0	1.64	2.22	17.01	44.81
EBS359-4	0	0	1.48	2.19	15.55	42.87
610-3	0.09	0.13	13.49	0.07	1.96	70.18
612-3	0.01	0.01	13.86	0.01	2.11	71.57
CMG-B-3	0	0	17.06	1.05	4.5	61.52
CMG-C-3	0.01	0	1.11	2.8	0.85	33.76
UCSC-G-3	0	0	0.47	0.42	5.43	29.35
EBS153-1	0	0	0.67	1.35	11.69	43.74
EBS153-2	0	0	0.73	1.28	11.76	44.34
EBS153-3	0	0	0.69	1.12	11.89	46.66
EBS153-4	0	0	0.63	1.32	11.75	43.04
EBS1127-1	0.01	0.01	0.58	1.45	10.77	35.94
EBS1127-2	0.01	0	0.7	1.54	11.37	36.03
EBS1127-3	0.01	0	0.9	1.86	13.42	43.85
EBS1127-4	0.01	0	1.08	1.66	14.44	45.2
EBS1030-1	0	0	1.02	1.57	10.78	46.9
EBS1030-2	0	0	0.87	2.01	10.04	41.45
EBS1030-3	0	0	0.7	1.43	8.11	42.08
EBS1030-4	0	0	0.54	1.69	7.31	36.58
EBS303-1	0.01	0	1.31	2.25	14.05	41.98
EBS303-2	0.01	0.01	1.57	2.01	15.01	42.86
EBS303-3	0.01	0	1.77	2.41	14.84	46.98
EBS303-4	0.01	0	2.12	2.38	16.45	53.76
EBS212-1	0.01	0	0.44	1.53	7.12	23.63
EBS212-2	0	0	1.08	1.13	10.16	35.33
EBS212-3	0	0	0.5	1.41	7.51	24.64
EBS212-4	0	0	1.05	1.04	10.4	34.18
EBS216-1	0	0	0.84	2.73	9.36	29.35
EBS216-2	0	0	1.11	2.21	11.39	35.55
EBS216-3	0	0	0.71	2.06	8.58	25.63
EBS216-4	0	0	0.82	1.98	9.28	26.93
610-4	0.1	0.13	13.96	0.07	2.06	69.4
612-4	0.01	0.01	14.13	0.01	2.1	71.17
CMG-B-4	0	0	17.67	1.05	4.55	60.64
CMG-C-4	0.01	0	1.12	2.81	0.85	33.35
UCSC-G-4	0	0	0.47	0.43	5.43	28.77
EBS1056-1	0	0	0.26	0.9	6.43	28.07
EBS1056-2	0	0	0.27	0.91	6.81	28.51
EBS1056-3	0.01	0	0.27	0.86	6.6	28.41
EBS1056-4	0	0	0.24	0.86	6.8	26.85
EBS947-1	0.01	0	0.21	1.24	5.99	28.98
EBS947-2	0.01	0	0.23	0.89	5.45	26.84

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
EBS947-3	0.01	0	0.24	1.28	5.41	29.29
EBS947-4	0.01	0	0.25	1.01	5.43	27.73
EBS1145-1	0	0	0.11	0.78	3.54	12.86
EBS1145-2	0	0	0.09	0.51	3.2	10.57
EBS1145-3	0	0	0.12	0.8	3.35	12
EBS1145-4	0	0	0.09	0.5	2.99	10.09
610-5	0.1	0.13	14.02	0.07	2.06	69.13
612-5	0.01	0.01	13.84	0.01	2.1	71.07
CMG-B-5	0	0	17.43	1.03	4.63	60.84
CMG-C-5	0.01	0	1.13	2.76	0.83	33.39
UCSC-G-5	0	0	0.46	0.42	5.39	28.7
610-a	0.09	0.12	11.76	0.07	1.83	72.77
610-b	0.09	0.12	12.08	0.07	1.76	72.48
610-1	0.09	0.12	12.23	0.07	1.77	72.38
612-1	0.01	0.01	12.22	0.01	1.86	73.98
CMG-B-1	0	0	15.3	0.97	3.94	64.62
CMG-C-1	0.01	0	1.03	2.67	0.79	36.46
UCSC-G-1	0	0	0.47	0.4	5.25	31.46
EBS1522-1	0	0	0.74	2.91	8	38.48
EBS1522-2	0	0	0.52	2.65	6.62	32.22
EBS1522-3	0	0	0.46	2.9	6.55	32.73
EBS1522-4	0	0	0.52	2.45	7.61	32.91
EBS1432-1	0	0.01	0.05	0.55	4.22	14.8
EBS1432-2	0	0	0.27	0.47	7.33	25.46
EBS1432-3	0	0.01	0.05	0.55	4.68	15.36
EBS1432-4	0	0.01	0.11	0.4	5.89	20.23
EBS30-1	0	0	0.99	1.98	13.5	48.12
EBS30-2	0	0	0.97	1.86	13.32	48.43
EBS30-3	0	0	0.81	2	12.1	47.78
EBS30-4	0	0	0.93	1.75	12.21	47.12
EBS1257-1	0	0	0.94	1.12	8.57	52.07
EBS1257-2	0.01	0	0.87	1.12	8.51	52.14
EBS1257-3	0	0	1	1.11	8.44	52.41
EBS1257-4	0	0	0.95	1.15	8.59	53.1
EBS1320-1	0.01	0	0.55	1.64	13.01	39.87
EBS1320-2	0.01	0	0.65	1.57	13.13	40.9
EBS1320-3	0.01	0.01	0.38	1.39	10.11	31.33
EBS1320-4	0.01	0.01	0.44	1.27	9.88	30.78
610-2	0.09	0.13	12.62	0.07	1.91	71.33
612-2	0.01	0.01	13.03	0.03	2.29	72.41
CMG-B-2	0	0	16.41	1.01	4.18	62.58
CMG-C-2	0.01	0	1.06	2.74	0.8	35.34
UCSC-G-2	0	0	0.46	0.4	5.14	29.72
EBS1269-1	0.01	0	0.36	1.23	7.42	25.48
EBS1269-2	0.01	0	0.31	0.55	4.92	18.94
EBS1269-3	0.01	0	0.25	1.3	8.04	26.52
EBS1269-4	0.01	0	0.42	0.84	7.36	25.78
EBS16-1	0.01	-0.01	7.61	0.47	11.23	39.4

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
EBS16-2	0.01	-0.01	5.95	1.06	9.33	32.52
EBS16-3	0	0	10.92	0.79	9.51	36.44
EBS16-4	-0.04	0	7.33	0.51	6.12	29.36
EBS1231-1	-0.01	0.02	9.51	0.42	6.19	42.68
EBS1231-2	-0.13	0.33	-11.73	-0.46	-6.17	-30.25
EBS1231-3	0.01	0	0.92	2.76	16.57	82.73
EBS1231-4	0.02	-0.03	0.8	1.58	11.56	61.27
EBS1197-1	0	0	1.31	1.22	20.88	65.73
EBS1197-2	0	0	1.2	1.07	20.16	67.45
EBS1197-3	0	0	1.44	1.11	20.01	66.64
EBS1197-4	0	0	1.29	1.04	19.5	67.74
EBS1343-1	0	0	1	1.93	12.09	39.2
EBS1343-2	0	0	1.45	0.84	16.23	56.43
EBS1343-3	0	0	0.7	2.11	9.39	30.48
EBS1343-4	0	0	1.24	1.1	13.22	48.57
610-3	0.09	0.13	13.02	0.07	1.99	70.92
612-3	0.01	0.01	13.17	0.01	2.12	72.33
CMG-B-3	0	0	16.59	1.04	4.22	62.43
CMG-C-3	0.01	0	1.07	2.73	0.79	34.24
UCSC-G-3	0	0	0.48	0.41	5.05	29.55
EBS1455-1	0	0	0.79	0.98	7.03	39.95
EBS1455-2	0	0	0.77	1.14	7.43	40.86
EBS1455-3	0	0	0.73	1.32	8.11	39.38
EBS1455-4	0	0	0.9	1.22	10.5	46.06
EBS1392-1	0.01	0.01	0.77	0.9	9	46.52
EBS1392-2	0	0.01	0.49	0.95	7.44	34.52
EBS1392-3	0	0.01	0.59	1.17	8.21	42.02
EBS1392-4	0	0.01	0.41	1.22	6.71	32.1
EBS1339-1	0	0	1.02	2.3	13.61	49.01
EBS1339-2	0	0	1.36	0.86	14.9	64.6
EBS1339-3	0	0	0.98	2.56	12.96	48.87
EBS1339-4	0	0	1.41	1.1	14.83	61.4
EBS1345-1	0	0	0.59	2.09	7.45	26.15
EBS1345-2	0	0	1.01	1.68	11.17	37.62
EBS1345-3	0	0	0.31	2.21	5.57	24.62
EBS1345-4	0	0	0.31	1.89	5.12	21.54
EBS786-1	0	0	0.53	1.71	11.01	28.92
EBS786-2	0	0	0.77	1.75	13.31	35.24
EBS786-3	0	0	0.74	1.82	12.13	32.04
EBS786-4	0.01	0	1.53	1.82	16.96	50.22
EBS273-1	0	0	0.54	1.81	10.98	31.98
EBS273-2	0	0	0.58	2.03	11.19	34.75
EBS273-3	0	0	0.62	2.21	11.86	35.24
EBS273-4	0	0	0.61	2.25	11.64	36.52
610-4	0.1	0.13	13.46	0.07	1.96	70.01
612-4	0.01	0.01	13.31	0.01	1.99	72.74
CMG-B-4	0	0	16.78	1.02	4.46	61.95
CMG-C-4	0.01	0	1.07	2.75	0.79	34.15

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
UCSC-G-4	0	0	0.46	0.41	4.99	29.23
EBS1061-1	0	0	0.41	1.76	8.03	28.74
EBS1061-2	0	0	0.7	1.27	10.25	40.46
EBS1061-3	0	0	0.5	1.65	8.58	33.67
EBS1061-4	0	0	0.9	1.32	12.23	47.3
EBS188-1	0	0	1.77	1.72	15.52	59.15
EBS188-2	0	0	2.01	1.56	17.74	58.58
EBS188-3	0	0	1.77	2.03	16.98	56.38
EBS188-4	0	0	2.11	1.75	18.2	57.82
EBS211-1	0	0	0.2	1.6	5.91	20.31
EBS211-2	0	0	1.01	1.13	12.9	46.14
EBS211-3	0	0	0.3	1.7	6.74	23.01
EBS211-4	0	0	1.19	1.24	14	51.03
EBS137-1	0	0	0.64	1.22	8.81	28.92
EBS137-2	0	0	0.82	1.16	9.85	33.36
EBS137-3	0	0	0.65	1.23	9.42	30.75
EBS137-4	0	0	0.75	1.19	10.3	33.49
EBS161-1	0.01	0.01	0.49	1.08	10.08	30.78
EBS161-2	0.01	0.01	0.56	1.09	10.52	30.39
EBS161-3	0.01	0.01	0.5	1.21	10.7	35.16
EBS161-4	0.01	0.01	0.52	1.1	10.77	32.7
EBS220-1	0	0.01	0.3	1.06	5.85	25.7
EBS220-2	0	0	0.57	0.97	7.56	29.24
EBS220-3	0	0	0.35	1.06	5.42	25.88
EBS220-4	0	0	0.68	1.04	7.87	33.41
610-5	0.1	0.13	13.53	0.07	1.97	69.75
612-5	0.01	0.01	14.04	0.01	1.93	71.75
CMG-B-5	0	0	17.14	1.05	4.33	61.5
CMG-C-5	0.01	0	1.09	2.69	0.8	33.36
UCSC-G-5	0	0	0.46	0.4	4.98	28.9
610-a	0.09	0.12	11.31	0.07	1.73	73.74
610-b	0.08	0.12	11.35	0.06	1.72	74.11
610-1	0.09	0.12	11.44	0.07	1.72	73.85
612-1	0.01	0.01	11.62	0.01	1.8	75.44
CMG-B-1	0	0	14.55	0.93	3.85	65.8
CMG-C-1	0.01	0	1	2.64	0.8	37.5
UCSC-G-1	0	0	0.44	0.38	5.1	31.67
EBS250-1	0.01	0	0.56	1.88	6.8	42.8
EBS250-2	0.01	0	0.59	1.46	7.1	40.56
EBS250-3	0.01	0	0.55	2.4	7.36	44.87
EBS250-4	0.01	0	0.63	1.92	8.45	44.32
EBS1037-1	0.01	0	0.21	0.38	3.26	21.85
EBS1037-2	0.01	0	0.31	0.33	4.09	24.06
EBS1037-3	0.01	0	0.26	0.59	5.19	27.55
EBS1037-4	0.01	0	0.62	0.52	8.35	34.75
EBS890-1	0	0.01	0.69	1.55	13.26	44.6
EBS890-2	0	0	1.23	1.3	15.97	64.13
EBS890-3	0	0	0.48	1.63	12.65	43.27

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
EBS890-4	0	0	1.33	1.27	16.7	60.71
EBS1173-1	0	0	0.41	1.73	6.08	18.69
EBS1173-2	0	0	1.47	1.49	12.25	51.25
EBS1173-3	0	0	0.26	1.33	4.78	13.26
EBS1173-4	0	0	0.82	1.48	8.92	30.2
EBS209-1	0	0	0.62	1.4	11.43	32.24
EBS209-2	0	0	1.32	1.01	16.75	64.88
EBS209-3	0	0	0.71	1.61	13.84	37.05
EBS209-4	0	0	1.34	1.09	16.18	60.46
610-2	0.09	0.13	12.34	0.07	1.82	72.09
612-2	0.01	0.01	12.81	0.01	1.91	73.54
CMG-B-2	0	0	15.9	0.99	4.15	63.41
CMG-C-2	0.01	0	1.03	2.69	0.78	35.26
UCSC-G-2	0	0	0.44	0.39	5.02	29.91
EBS948-1	0	0	0.37	1.12	6.82	22.67
EBS948-2	0	0	0.97	1.03	13.73	42.01
EBS948-3	0	0	0.43	1.07	7.48	25.59
EBS948-4	0	0	0.73	0.87	10.68	37.71
EBS956-1	0	0	1.01	1.31	11.81	49.13
EBS956-2	0	0	1.37	1	14.59	64.86
EBS956-3	0	0	1.33	0.99	12.77	57.79
EBS956-4	0.01	0	1.39	0.89	13.96	68.97
EBS975-1	0	0	1.33	2.09	16.45	44.47
EBS975-2	0	0	1.89	1.66	19.21	54.92
EBS975-3	0	0	1.26	2.08	15.22	41.07
EBS975-4	0	0	1.73	1.67	17.96	51.73
EBS302-1	0.09	-0.05	2.32	0.74	0.91	31.86
EBS302-2	0.02	0	0.6	0.38	0.22	21.18
EBS302-3	0	0	0.82	0.64	0.82	27.24
EBS302-4	0.01	0	0.45	0.63	0.5	29.77
EBS429-1	0	0.01	0.61	1.18	9.4	27.95
EBS429-2	0	0	0.63	1.2	8.72	26.82
EBS429-3	0	0.01	0.47	0.99	9.25	27.09
EBS429-4	0	0.01	0.5	1.07	8.18	26.18
610-3	0.1	0.13	12.8	0.07	1.93	71.27
612-3	0.01	0.01	12.9	0.01	1.99	73.36
CMG-B-3	0	0	16.25	1.01	4.24	62.76
CMG-C-3	0.01	0	1.04	2.7	0.78	34.64
UCSC-G-3	0	0	0.46	0.4	5.03	29.35
EBS979-1	0	0	1.07	2.35	14.3	48.61
EBS979-2	0	0	1.07	1.82	14.46	52.72
EBS979-3	0	0	1	2.51	14.7	47.82
EBS979-4	0	0	1.08	2.15	15.93	51.38
EBS1587-1	0	0	0.54	1	5.4	18.38
EBS1587-2	0	0	0.79	0.95	7.94	30.24
EBS1587-3	0	0	0.47	1.27	4.26	13.85
EBS1587-4	0	0	1.16	1.09	10.97	42.76
EBS1582-1	0	0	1.24	1.52	13.5	54.36

Inventory Number/ Run	7Li	9Be	23Na	24Mg	27Al	29Si
EBS1582-2	0	0	1.16	1.04	17.55	64.6
EBS1582-3	0	0	1.19	1.49	14.87	55.13
EBS1582-4	0	0	1.2	1.09	17	65.59
EBS235-1	0	0	0.5	1.77	8.23	25.98
EBS235-2	0	0	1.43	1.22	14.53	51
EBS235-3	0	0	0.8	2.11	10.69	36.23
EBS235-4	0	0	1.54	0.9	16.54	64.14
EBS1039-1	0	0	1.36	1.52	14.26	54.31
EBS1039-2	0.01	0	1.64	1	17.86	67.17
EBS1039-3	0	0	1.21	1.85	12.98	47.09
EBS1039-4	0	0	1.71	0.99	18.27	64.17
610-4	0.1	0.13	13.45	0.07	1.96	69.98
612-4	0.01	0.01	13.14	0.01	1.97	72.76
CMG-B-4	0	0	16.76	1.04	4.38	61.59
CMG-C-4	0.01	0	1.04	2.68	0.81	33.57
UCSC-G-4	0	0	0.44	0.39	5.04	28.86
EBS200-1	0.01	0	0.32	1.37	4.96	26.37
EBS200-2	0.01	0	0.74	1.22	11.72	41.68
EBS200-3	0.01	0	0.62	1.31	9.19	36.8
EBS200-4	0.01	0	1.13	1.24	18.32	60.56
EBS1064-1	0	0	0.29	1.3	6.51	18.9
EBS1064-2	0	0	0.41	1.32	7.28	20.49
EBS1064-3	0	0	0.7	1.32	10.35	29.71
EBS1064-4	0	0	1.17	0.96	12.83	44.48
EBS76-1	0	0	0.29	0.86	4.68	14.34
EBS76-2	0	0	0.34	0.85	4.94	15.76
EBS76-3	0	0	0.59	1.13	5.81	17.48
EBS76-4	0	0	1.03	1.06	9.02	32.07
EBS744-1	0.01	0.01	1.34	2.02	14.94	49.26
EBS744-2	0.01	0	1.62	1.45	16.11	59.09
EBS744-3	0.01	0.01	1.35	2.2	13.4	51.16
EBS744-4	0.01	0	1.54	2.08	14.52	57.85
EBS1206-1	0.01	0	0.72	1.1	13.36	45.77
EBS1206-2	0.01	0	1.1	1.19	18.44	66.53
EBS1206-3	0.01	0	0.82	1.02	13.19	43.19
EBS1206-4	0.01	0	1.34	1.09	18.13	65.91
610-5	0.1	0.13	13.21	0.07	2.02	70.23
612-5	0.01	0.01	13.75	0.01	2.07	71.78
CMG-B-5	0	0	16.82	1.05	4.39	61.47
CMG-C-5	0.01	0	1.04	2.66	0.8	33.07
UCSC-G-5	0	0	0.44	0.39	5.04	28.52

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
610-a	0.1	0.22	-0.01	10.87	0.07	0.07
610-b	0.1	0.27	0.05	10.81	0.06	0.07
610-1	0.1	0.26	0.07	11.06	0.07	0.07
612-1	0.01	0.3	0.03	11.3	0.01	0.01
CMG-B-1	0.81	-0.29	0.99	8.53	0	0.1
CMG-C-1	0.1	0.14	2.82	5.01	0	0.78
UCSC-G-1	0	0.09	0.81	0.74	0	0.53
EBS1454-1	1.1	-0.6	2.37	1.43	0	0.15
EBS1454-2	0.71	0.58	2.17	1.97	0	0.14
EBS1454-3	1.48	-0.32	1.79	1.62	0	0.18
EBS1454-4	1.09	-0.5	1.43	2.08	0	0.12
EBS815-1	0.85	0.39	2.41	1.93	0	0.58
EBS815-2	0.73	0.26	2.87	2.12	0	0.54
EBS815-3	0.82	0.46	2.82	2.06	0	0.5
EBS815-4	0.6	0.26	4.08	1.71	0	0.47
EBS1236-1	0.86	-0.1	1.6	1	0	0.26
EBS1236-2	0.61	0.71	1.6	1.26	0	0.34
EBS1236-3	0.87	0.43	2.11	1.26	0	0.29
EBS1236-4	0.54	0.12	2.11	1.57	0	0.35
EBS1289-1	2.1	0.14	1.25	2.4	0	0.87
EBS1289-2	1.98	0.11	1.3	2.64	0	0.97
EBS1289-3	2.38	0.31	1.79	2.74	0	0.93
EBS1289-4	2.45	0.27	1.67	2.64	0	0.96
EBS210-1	1.31	0.92	2.15	1.53	0	0.28
EBS210-2	0.54	1.4	1.77	1.81	0	0.21
EBS210-3	2.03	0.86	1.61	2.41	0	0.29
EBS210-4	0.79	0.91	2.13	2.12	0	0.18
610-2	0.1	0.33	0.05	11.26	0.07	0.08
612-2	0.01	0.37	0.02	11.87	0.01	0.01
CMG-B-2	0.83	0.5	1.04	8.4	0	0.11
CMG-C-2	0.1	0.24	2.88	4.97	0	0.79
UCSC-G-2	0	0.21	0.78	0.76	0	0.53
EBS1429-1	0.7	0.28	1.64	1.89	0	0.2
EBS1429-2	0.45	0.04	1.11	1.83	0	0.19
EBS1429-3	1.25	0.25	2.19	2.63	0	0.2
EBS1429-4	0.86	0.15	1.68	2.19	0	0.21
EBS281-1	0.47	0.41	0.77	0.75	0	0.28
EBS281-2	0.47	0.29	0.68	0.93	0	0.3
EBS281-3	0.38	0.52	0.55	0.91	0	0.25
EBS281-4	0.37	0.25	0.51	1.21	0	0.26
EBS1072-1	0.29	0.43	2.42	1.15	0	0.25
EBS1072-2	0.19	0.48	3.58	1.3	0	0.21
EBS1072-3	0.3	0.27	2.05	1.13	0	0.37
EBS1072-4	0.24	0.24	2.46	1.19	0	0.33
EBS170-1	1.3	0.26	0.62	1.27	0	0.14
EBS170-2	0.66	0.17	1.1	0.85	0	0.14
EBS170-3	1.03	0.2	1.28	0.77	0	0.2
EBS170-4	0.73	0.31	2.77	1.07	0	0.25

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
EBS67-1	0.6	0.56	1.96	1.66	0	0.29
EBS67-2	0.31	0.28	3.27	2.11	0	0.27
EBS67-3	0.53	0.5	3.11	1.61	0	0.22
EBS67-4	0.37	0.3	4.46	1.8	0	0.19
EBS359-1	0.44	0.4	2.02	3.46	0	0.53
EBS359-2	0.44	0.37	2.03	2.86	0	0.48
EBS359-3	0.42	0.29	1.56	4.42	0	0.76
EBS359-4	0.41	0.38	1.66	3.37	0	0.9
610-3	0.1	0.34	0.05	11.2	0.07	0.08
612-3	0.01	0.4	0.01	11.8	0.01	0.01
CMG-B-3	0.82	0.49	1.06	8.33	0	0.11
CMG-C-3	0.1	0.24	2.94	5	0	0.78
UCSC-G-3	0	0.19	0.79	0.73	0	0.53
EBS153-1	0.39	0.8	2.98	1.07	0	0.41
EBS153-2	0.45	0.89	2.87	1.33	0	0.39
EBS153-3	0.55	0.77	3.04	1.15	0	0.31
EBS153-4	0.45	0.84	2.85	1.37	0	0.32
EBS1127-1	0.2	0.26	3.87	1.2	0	0.51
EBS1127-2	0.18	0.25	3.68	1.3	0	0.52
EBS1127-3	0.21	0.31	5.12	1.6	0	0.6
EBS1127-4	0.16	0.36	5.15	1.42	0	0.61
EBS1030-1	0.21	0.73	3.31	1.23	0	0.23
EBS1030-2	0.16	0.8	2.79	1.21	0	0.26
EBS1030-3	0.18	0.94	2.82	1.25	0	0.21
EBS1030-4	0.14	1.06	2.09	1.12	0	0.23
EBS303-1	0.14	0.29	5.13	3.06	0	1.17
EBS303-2	0.13	0.3	5.66	2.63	0	1.41
EBS303-3	0.15	0.32	5.89	3.66	0	0.57
EBS303-4	0.2	0.45	5.91	4.47	0	0.49
EBS212-1	0.21	0.38	1.33	0.92	0	0.26
EBS212-2	0.12	0.45	2.05	1.26	0	0.27
EBS212-3	0.19	0.37	1.33	0.89	0	0.26
EBS212-4	0.12	0.49	2.01	1.24	0	0.2
EBS216-1	0.89	0.28	1.9	2.51	0	0.36
EBS216-2	0.73	0.33	2.89	2.37	0	0.31
EBS216-3	0.81	0.37	1.39	2.73	0	0.3
EBS216-4	0.75	0.37	1.98	2.44	0	0.33
610-4	0.1	0.38	0.07	11.35	0.07	0.08
612-4	0.01	0.44	0.01	11.89	0.01	0.01
CMG-B-4	0.82	0.58	1.07	8.48	0	0.11
CMG-C-4	0.1	0.24	2.97	4.91	0	0.78
UCSC-G-4	0	0.2	0.8	0.73	0	0.51
EBS1056-1	0.06	0.45	1.12	0.71	0	0.14
EBS1056-2	0.05	0.56	1.22	0.69	0	0.15
EBS1056-3	0.11	0.48	1.22	0.81	0	0.15
EBS1056-4	0.06	0.51	1.13	0.68	0	0.15
EBS947-1	0.2	0.59	1.4	0.95	0	0.36
EBS947-2	0.26	0.54	1.53	2.46	0	0.33

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
EBS947-3	0.24	0.7	1.4	0.71	0	0.35
EBS947-4	0.28	0.62	1.5	0.7	0	0.34
EBS1145-1	0.23	0.08	0.71	1.02	0	0.09
EBS1145-2	0.2	0.13	0.42	1.08	0	0.06
EBS1145-3	0.22	0.04	0.67	1.01	0	0.08
EBS1145-4	0.19	0.1	0.39	1.02	0	0.06
610-5	0.1	0.41	0.05	11.55	0.07	0.08
612-5	0.01	0.38	0.02	12.03	0.01	0.01
CMG-B-5	0.8	0.6	1.06	8.46	0	0.11
CMG-C-5	0.1	0.23	2.97	4.86	0	0.76
UCSC-G-5	0	0.2	0.8	0.73	0	0.51
610-a	0.07	0.29	0.08	10.74	0.07	0.07
610-b	0.07	0.36	0.05	10.84	0.06	0.07
610-1	0.07	0.27	0.06	10.82	0.07	0.07
612-1	0.01	0.36	0.01	11.35	0.01	0.01
CMG-B-1	0.58	0.5	1.02	8.16	0	0.1
CMG-C-1	0.07	0.23	2.92	4.89	0	0.73
UCSC-G-1	0	0.2	0.75	0.74	0	0.49
EBS1522-1	0.34	0.44	1.31	1.89	0	0.35
EBS1522-2	0.15	0.38	1.21	1	0	0.23
EBS1522-3	0.33	0.32	1	1.56	0	0.32
EBS1522-4	0.09	0.48	1.35	1.12	0	0.2
EBS1432-1	0.19	0.15	0.34	0.42	0	0.1
EBS1432-2	0.16	0.33	1.12	1.06	0	0.13
EBS1432-3	0.19	0.13	0.31	0.65	0	0.08
EBS1432-4	0.18	0.17	0.6	0.78	0	0.09
EBS30-1	0.51	0.35	1.82	4.94	0	0.43
EBS30-2	0.49	0.3	1.94	5.24	0	0.36
EBS30-3	0.42	0.26	1.59	4.63	0	0.38
EBS30-4	0.41	0.53	1.95	5.09	0	0.33
EBS1257-1	0.14	0.54	3.02	1.69	0	0.46
EBS1257-2	0.14	0.67	2.94	1.79	0	0.48
EBS1257-3	0.17	0.64	3.31	1.04	0	0.41
EBS1257-4	0.15	0.23	3.14	1.53	0	0.47
EBS1320-1	0.24	0.67	2.07	1.71	0	0.32
EBS1320-2	0.21	0.5	2.3	1.55	0	0.3
EBS1320-3	0.3	0.78	1.34	1.85	0	0.27
EBS1320-4	0.24	0.63	1.49	1.72	0	0.27
610-2	0.07	0.38	0.08	11.13	0.07	0.08
612-2	0.02	0.34	0.14	11.42	0.01	0.01
CMG-B-2	0.59	0.5	1.1	8.58	0	0.1
CMG-C-2	0.07	0.24	2.93	4.91	0	0.72
UCSC-G-2	0.01	0.19	0.79	0.73	0	0.49
EBS1269-1	0.11	0.33	2.32	0.81	0	0.2
EBS1269-2	0.08	0.39	1.87	0.66	0	0.13
EBS1269-3	0.08	0.34	2.16	0.99	0	0.22
EBS1269-4	0.07	0.33	2.14	0.84	0	0.18
EBS16-1	1.88	-0.16	1.71	21.81	0	1.81

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
EBS16-2	0.7	15.32	1.52	18.13	0	1.43
EBS16-3	0.24	8.14	0.62	14.84	0	1.19
EBS16-4	-0.26	29.85	0.18	12.29	0.01	0.77
EBS1231-1	-1.83	-15.01	33.15	7.69	0	0.38
EBS1231-2	-5.55	218.05	-1.62	-34.08	-0.04	0.08
EBS1231-3	2.21	-28.35	5.27	2.62	0	1.42
EBS1231-4	0.57	12.1	3.47	-0.53	0	1.35
EBS1197-1	0.12	0.51	4.58	2.25	0	0.31
EBS1197-2	0.09	0.15	4.94	1.97	0	0.23
EBS1197-3	0.12	0.06	4.28	2.58	0	0.27
EBS1197-4	0.1	0.35	5	2.15	0	0.24
EBS1343-1	0.16	0.57	3.05	2	0	0.2
EBS1343-2	0.11	0.36	4.71	2.09	0	0.16
EBS1343-3	0.19	0.82	2.56	1.59	0	0.25
EBS1343-4	0.13	0.54	4.29	1.65	0	0.17
610-3	0.07	0.32	0.09	11.05	0.07	0.08
612-3	0.01	0.32	0.04	11.71	0.01	0.01
CMG-B-3	0.57	0.48	1.06	8.46	0	0.1
CMG-C-3	0.07	0.22	3.01	4.84	0	0.74
UCSC-G-3	0	0.18	0.8	0.72	0	0.49
EBS1455-1	0.42	3.19	2.92	2.15	0	0.2
EBS1455-2	0.38	2.53	2.82	2.1	0	0.2
EBS1455-3	0.8	3.01	2.92	3.27	0	0.24
EBS1455-4	0.47	1.77	3.73	2.22	0	0.21
EBS1392-1	0.18	0.64	3.12	1.12	0	0.17
EBS1392-2	0.15	1.29	2.11	1.2	0	0.19
EBS1392-3	0.16	0.71	2.87	1.23	0	0.18
EBS1392-4	0.15	1.24	1.99	1.24	0	0.2
EBS1339-1	0.11	0.97	3.49	1.96	0	0.29
EBS1339-2	0.03	0.4	4.62	1.54	0	0.16
EBS1339-3	0.18	1.11	3.24	2.42	0	0.27
EBS1339-4	0.06	0.46	4.5	1.7	0	0.18
EBS1345-1	0.3	0.26	1.82	1.82	0	0.3
EBS1345-2	0.17	0.4	3.41	1.94	0	0.37
EBS1345-3	0.54	0.38	1.21	2.03	0	0.26
EBS1345-4	0.35	0.41	1.3	1.39	0	0.23
EBS786-1	0.58	0.31	2.36	3.77	0	0.46
EBS786-2	0.5	0.34	2.71	5.97	0	0.41
EBS786-3	0.61	0.35	2.28	4.69	0	0.4
EBS786-4	0.45	0.45	3.02	8.97	0	0.37
EBS273-1	1.07	0.33	1.74	1.33	0	0.41
EBS273-2	1.06	0.29	2.01	1.33	0	0.42
EBS273-3	1.3	0.3	2.05	1.54	0	0.45
EBS273-4	1.22	0.21	2.06	1.45	0	0.48
610-4	0.1	0.39	0.06	11.45	0.07	0.08
612-4	0.01	0.34	0.02	11.35	0.01	0.01
CMG-B-4	0.59	0.53	1.08	8.41	0	0.1
CMG-C-4	0.07	0.21	2.99	4.87	0	0.72

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
UCSC-G-4	0	0.15	0.8	0.71	0	0.49
EBS1061-1	0.58	0.63	1.7	2.15	0	0.24
EBS1061-2	0.2	0.75	2.93	1.9	0	0.17
EBS1061-3	0.37	0.88	1.98	1.87	0	0.26
EBS1061-4	0.17	0.64	3.41	2.08	0	0.18
EBS188-1	0.29	0.4	3.8	1.4	0	0.49
EBS188-2	0.24	0.43	4.05	1.58	0	0.4
EBS188-3	0.26	0.49	3.78	1.64	0	0.54
EBS188-4	0.23	0.47	4.47	1.71	0	0.44
EBS211-1	0.11	0.37	0.54	0.68	0	0.18
EBS211-2	0.09	0.41	2.64	1.64	0	0.17
EBS211-3	0.11	0.39	0.79	0.71	0	0.41
EBS211-4	0.09	0.39	3.31	1.58	0	1.16
EBS137-1	0.22	0.3	2.22	1.37	0	0.28
EBS137-2	0.19	0.24	2.46	1.63	0	0.22
EBS137-3	0.21	0.29	2.28	1.6	0	0.28
EBS137-4	0.21	0.38	2.61	1.75	0	0.28
EBS161-1	0.47	0.71	2.12	2.33	0	0.3
EBS161-2	0.44	0.53	2.01	2.18	0	0.3
EBS161-3	0.5	0.59	2.33	2	0	0.36
EBS161-4	0.54	0.51	2.06	2.07	0	0.36
EBS220-1	0.11	0.27	0.65	2.6	0	0.14
EBS220-2	0.08	0.31	1.53	1.62	0	0.16
EBS220-3	0.08	0.24	0.87	1.8	0	0.15
EBS220-4	0.07	0.25	2.02	1.49	0	0.17
610-5	0.07	0.37	0.07	11.56	0.07	0.08
612-5	0.01	0.27	-0.01	11.76	0.01	0.01
CMG-B-5	0.57	0.46	1.06	8.69	0	0.1
CMG-C-5	0.07	0.23	2.99	4.83	0	0.69
UCSC-G-5	0	0.15	0.78	0.72	0	0.48
610-a	0.09	0.4	0.05	10.41	0.06	0.07
610-b	0.09	0.19	0.05	10.26	0.06	0.07
610-1	0.09	0.24	0.05	10.37	0.06	0.07
612-1	0.01	0.31	0.01	10.61	0.01	0.01
CMG-B-1	0.73	0.46	1	7.94	0	0.09
CMG-C-1	0.09	0.25	2.91	4.74	0	0.71
UCSC-G-1	0.01	0.08	0.78	0.71	0	0.47
EBS250-1	0.19	0.72	3.37	2.79	0	0.4
EBS250-2	0.17	0.71	2.77	3.03	0	0.53
EBS250-3	0.14	0.64	3.13	3.36	0	0.45
EBS250-4	0.12	0.58	2.67	3.73	0	0.67
EBS1037-1	0.12	3.06	0.74	1.01	0	0.12
EBS1037-2	0.07	2.58	0.91	0.9	0	0.13
EBS1037-3	0.11	1.78	0.91	0.98	0	0.17
EBS1037-4	0.07	1.18	1.99	0.9	0	0.25
EBS890-1	0.37	0.32	1.86	2.34	0	0.25
EBS890-2	0.1	0.13	3.89	2.05	0	0.3
EBS890-3	0.36	0.27	1.39	3.55	0	0.23

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
EBS890-4	0.13	0.33	3.37	2.85	0	0.33
EBS1173-1	0.81	0.11	0.91	1.36	0	0.1
EBS1173-2	0.31	0.35	2.51	3.3	0	0.23
EBS1173-3	0.8	0.35	0.57	1.19	0	0.08
EBS1173-4	0.53	0.22	1.37	3.05	0	0.16
EBS209-1	0.18	0.42	1.76	1.28	0	0.2
EBS209-2	0.09	0.34	4.29	1.6	0	0.24
EBS209-3	0.25	0.34	2.1	1.55	0	0.24
EBS209-4	0.13	0.37	4.14	1.8	0	0.2
610-2	0.09	0.39	0.05	10.8	0.07	0.07
612-2	0.01	0.33	0.01	11.15	0.01	0.01
CMG-B-2	0.74	0.51	1.07	8.21	0	0.1
CMG-C-2	0.09	0.18	2.92	4.65	0	0.7
UCSC-G-2	0	0.16	0.77	0.68	0	0.47
EBS948-1	0.28	0.31	1.17	1.29	0	0.29
EBS948-2	0.18	0.4	3.58	1.87	0	0.41
EBS948-3	0.26	0.23	1.48	1.29	0	0.29
EBS948-4	0.21	0.38	2.99	1.34	0	0.34
EBS956-1	0.22	0.19	2.56	1.35	0	0.39
EBS956-2	0.17	0.33	4.11	1.39	0	0.42
EBS956-3	0.15	0.31	3.18	1.42	0	0.36
EBS956-4	0.13	0.45	4.07	1.2	0	0.32
EBS975-1	0.28	0.33	2.29	3.11	0	0.63
EBS975-2	0.2	0.37	3.92	2.91	0	0.5
EBS975-3	0.32	0.28	1.82	3.37	0	0.38
EBS975-4	0.25	0.43	3.16	3	0	0.48
EBS302-1	4.99	1.66	11.5	-2.4	0	0.5
EBS302-2	4.74	54.1	3.96	-12.43	-0.02	0.15
EBS302-3	2.67	4.39	4.02	1.2	0	3.61
EBS302-4	2.37	15.88	2.26	0.85	0	0.16
EBS429-1	1.15	0.18	1.26	1.72	0	0.38
EBS429-2	1.12	0.18	1.27	1.61	0	0.38
EBS429-3	1.35	0.34	0.9	1.58	0	0.49
EBS429-4	1.08	0.11	0.95	1.47	0	0.52
610-3	0.09	0.41	0.05	10.96	0.07	0.07
612-3	0.01	0.39	0.01	11.11	0.01	0.01
CMG-B-3	0.75	0.51	1.06	8.29	0	0.1
CMG-C-3	0.09	0.24	2.96	4.67	0	0.69
UCSC-G-3	0	0.19	0.82	0.69	0	0.47
EBS979-1	1.2	0.43	3.31	2.93	0	0.88
EBS979-2	0.93	0.4	3.72	2.61	0	0.85
EBS979-3	1.35	0.34	3.22	2.58	0	0.72
EBS979-4	1.07	0.34	3.7	2.77	0	0.56
EBS1587-1	0.13	0.2	1.13	0.57	0	0.11
EBS1587-2	0.08	0.33	1.92	0.79	0	0.13
EBS1587-3	0.1	0.32	0.8	0.57	0	0.1
EBS1587-4	0.08	0.3	2.93	1.23	0	0.18
EBS1582-1	0.27	0.47	4.34	2.03	0	0.28

Inventory Number/ Run	31P	33S	39K	43Ca	45Sc	47Ti
EBS1582-2	0.31	0.43	6.88	1.69	0	0.28
EBS1582-3	0.25	0.64	5.01	2.13	0	0.34
EBS1582-4	0.3	0.32	6.66	1.63	0	0.32
EBS235-1	0.58	0.38	0.68	4.11	0	0.19
EBS235-2	0.22	0.39	3.27	3.56	0	0.2
EBS235-3	0.57	0.27	1.76	2.84	0	0.18
EBS235-4	0.24	0.41	4.55	2.37	0	0.13
EBS1039-1	0.09	0.37	3.09	2.02	0	0.23
EBS1039-2	0.06	0.29	4.39	1.93	0	0.21
EBS1039-3	0.1	0.26	2.61	1.95	0	0.22
EBS1039-4	0.07	0.31	4.15	2.2	0	0.24
610-4	0.09	0.44	0.05	11.45	0.07	0.08
612-4	0.01	0.39	0.01	11.5	0.01	0.01
CMG-B-4	0.76	0.57	1.1	8.58	0	0.1
CMG-C-4	0.09	0.25	2.98	4.66	0	0.71
UCSC-G-4	0	0.16	0.78	0.71	0	0.46
EBS200-1	0.08	0.27	1.51	1.02	0	0.15
EBS200-2	0.07	0.37	3.47	1.1	0	0.31
EBS200-3	0.09	0.37	2.84	1.13	0	0.32
EBS200-4	0.09	0.54	5.02	1.32	0	0.58
EBS1064-1	0.27	0.18	0.56	1.73	0	0.39
EBS1064-2	0.2	0.25	1.01	1.41	0	0.38
EBS1064-3	0.15	0.16	2.01	1.2	0	0.3
EBS1064-4	0.12	0.26	3.43	1.24	0	0.2
EBS76-1	0.3	0.31	0.32	1.59	0	0.16
EBS76-2	0.28	0.21	0.45	1.34	0	0.16
EBS76-3	0.33	0.35	0.66	1.55	0	0.22
EBS76-4	0.2	0.31	1.7	1.81	0	0.27
EBS744-1	0.13	0.43	3.53	1.29	0	0.31
EBS744-2	0.12	0.42	4.43	1.55	0	0.25
EBS744-3	0.13	0.43	3.39	1.12	0	0.39
EBS744-4	0.08	0.24	3.9	1.36	0	0.43
EBS1206-1	0.1	0.37	2.77	2.2	0	0.33
EBS1206-2	0.06	0.37	4.41	1.45	0	0.39
EBS1206-3	0.16	0.36	2.73	2.02	0	0.43
EBS1206-4	0.05	0.4	4.3	1.47	0	0.39
610-5	0.09	0.39	0.06	11.39	0.07	0.08
612-5	0.01	0.34	0.01	11.81	0.01	0.01
CMG-B-5	0.75	0.57	1.11	8.59	0	0.1
CMG-C-5	0.09	0.23	3	4.65	0	0.71
UCSC-G-5	0	0.13	0.78	0.71	0	0.47

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
610-a	0.08	0.06	0.05	0.08	0.05	0.06
610-b	0.08	0.06	0.06	0.08	0.05	0.06
610-1	0.08	0.06	0.06	0.08	0.05	0.06
612-1	0.01	0	0	0.01	0	0
CMG-B-1	0.03	0.01	0.26	0.36	0.04	0.1
CMG-C-1	0.01	0	0	0.32	0.19	0.02
UCSC-G-1	0	0	1.31	2.27	0	0
EBS1454-1	0.09	0	28.43	20.7	0.02	0.01
EBS1454-2	0.1	0	30.52	17.54	0.01	0
EBS1454-3	0.1	0	35.11	23.12	0.02	0.01
EBS1454-4	0.12	0	37.89	21.8	0.01	0
EBS815-1	0.06	0.01	13.23	6.97	0.01	0.01
EBS815-2	0.05	0.01	10.32	6.82	0.01	0.01
EBS815-3	0.06	0.01	11.2	5.81	0.01	0.01
EBS815-4	0.04	0.01	5.71	5.2	0.01	0.01
EBS1236-1	0.02	0.01	5.98	19.46	0.01	0
EBS1236-2	0.03	0.01	6.05	19.11	0	0
EBS1236-3	0.02	0.01	5.11	20.1	0.01	0
EBS1236-4	0.03	0.01	5.19	18.17	0	0
EBS1289-1	0.07	0.01	29.89	7.8	0.02	0.01
EBS1289-2	0.07	0.01	29.76	7.77	0.02	0.01
EBS1289-3	0.05	0.01	18.08	8.92	0.02	0.01
EBS1289-4	0.05	0.01	18.76	9.13	0.02	0.01
EBS210-1	0.03	0	9	39.16	0.01	0
EBS210-2	0.03	0	12.19	39.68	0.01	0
EBS210-3	0.03	0	9.5	45.09	0.01	0
EBS210-4	0.03	0	9.67	33.82	0.01	0
610-2	0.08	0.06	0.06	0.07	0.05	0.06
612-2	0.01	0.01	0	0.01	0	0
CMG-B-2	0.03	0.01	0.26	0.35	0.04	0.1
CMG-C-2	0.01	0	0	0.31	0.18	0.02
UCSC-G-2	0	0	1.33	2.24	0	0
EBS1429-1	0.11	0	18.59	30.5	0.01	0
EBS1429-2	0.13	0	21.8	32.15	0.01	0
EBS1429-3	0.1	0	15.37	30.16	0.01	0
EBS1429-4	0.1	0	18.49	31.03	0.01	0
EBS281-1	0.17	0.01	38.75	3.52	0.02	0.01
EBS281-2	0.19	0.01	40.56	3.17	0.02	0
EBS281-3	0.17	0	39.45	3.09	0.02	0.01
EBS281-4	0.18	0	41.68	3.02	0.02	0.01
EBS1072-1	0.03	0.02	14.71	31.04	0.01	0
EBS1072-2	0.02	0.01	9.98	19.9	0	0
EBS1072-3	0.04	0.01	18.69	32.01	0.01	0.01
EBS1072-4	0.03	0.01	17.35	28.13	0.01	0.01
EBS170-1	0.09	0.01	28.72	35.16	0.04	0.01
EBS170-2	0.07	0.01	27.79	34.43	0.03	0
EBS170-3	0.06	0.01	23.9	35.48	0.01	0
EBS170-4	0.05	0.01	15.01	21.95	0.01	0

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
EBS67-1	0.04	0.01	11.61	23.53	0.01	0.02
EBS67-2	0.03	0	5.42	11.46	0	0.01
EBS67-3	0.04	0	9.82	19.74	0.01	0.01
EBS67-4	0.03	0	3.16	6.1	0	0
EBS359-1	0.04	0.02	7.71	14.12	0.01	0.01
EBS359-2	0.04	0.02	9.01	16.02	0.01	0.01
EBS359-3	0.03	0.02	8.19	16.57	0.01	0.01
EBS359-4	0.03	0.02	9.63	19.4	0.01	0.01
610-3	0.08	0.06	0.1	0.07	0.05	0.06
612-3	0.01	0.01	0	0.01	0	0.01
CMG-B-3	0.03	0.01	0.26	0.36	0.04	0.1
CMG-C-3	0.01	0	0	0.31	0.18	0.02
UCSC-G-3	0	0	1.33	2.23	0	0
EBS153-1	0.02	0	6.53	15.18	0	0
EBS153-2	0.02	0	5.72	14.61	0	0
EBS153-3	0.02	0	5.25	12.78	0	0
EBS153-4	0.02	0	6.35	15.32	0	0
EBS1127-1	0.07	0	28.67	9.52	0.01	0
EBS1127-2	0.06	0	28.07	10.04	0.01	0
EBS1127-3	0.05	0	15.95	11.59	0.01	0
EBS1127-4	0.03	0	12.26	14.17	0.01	0
EBS1030-1	0.09	0.01	12.61	9.04	0	0
EBS1030-2	0.08	0.01	17.19	11.45	0.01	0
EBS1030-3	0.11	0.01	15.9	13.07	0.01	0
EBS1030-4	0.09	0.01	20.27	15.96	0.01	0
EBS303-1	0.03	0.01	15.96	8.74	0	0
EBS303-2	0.03	0.01	16.12	7.29	0	0
EBS303-3	0.02	0.01	11.6	8.71	0	0
EBS303-4	0.02	0.01	5.78	6.37	0	0
EBS212-1	0.03	0	21.39	27.98	0.01	0
EBS212-2	0.03	0	13.91	17.72	0.01	0
EBS212-3	0.03	0	20.61	24.8	0.01	0
EBS212-4	0.04	0	13.67	16.4	0.01	0
EBS216-1	0.06	0.01	18.67	31.12	0.02	0.01
EBS216-2	0.05	0.01	15.41	25.51	0.02	0.01
EBS216-3	0.06	0.01	20.81	34.34	0.02	0.01
EBS216-4	0.06	0.01	20.23	32.77	0.02	0.01
610-4	0.08	0.06	0.06	0.07	0.05	0.06
612-4	0.01	0.01	0	0.01	0	0
CMG-B-4	0.03	0.01	0.26	0.35	0.04	0.1
CMG-C-4	0.01	0	0	0.31	0.18	0.02
UCSC-G-4	0	0	1.33	2.23	0	0
EBS1056-1	0.03	0.01	18.29	3.35	0	0
EBS1056-2	0.03	0.01	18.71	3.51	0	0
EBS1056-3	0.05	0.01	16.22	4.09	0	0
EBS1056-4	0.04	0.01	18.53	4.73	0	0
EBS947-1	0.11	0.01	19.63	6.84	0.01	0
EBS947-2	0.21	0.01	18.93	6.76	0.01	0

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
EBS947-3	0.11	0.01	17.81	6.31	0.01	0
EBS947-4	0.18	0.01	17.97	6.15	0.01	0
EBS1145-1	0.07	0	18.81	57.49	0.01	0
EBS1145-2	0.09	0	19.18	59.62	0.01	0
EBS1145-3	0.07	0	19.78	57.54	0.01	0
EBS1145-4	0.09	0	19.24	60.48	0.01	0
610-5	0.08	0.06	0.06	0.08	0.05	0.06
612-5	0	0.01	0.01	0.32	0	0.01
CMG-B-5	0.03	0.01	0.26	0.35	0.04	0.09
CMG-C-5	0.01	0	0	0.31	0.18	0.02
UCSC-G-5	0	0	1.36	2.2	0	0
610-a	0.08	0.06	0.05	0.1	0.05	0.06
610-b	0.08	0.06	0.05	0.07	0.05	0.06
610-1	0.08	0.06	0.05	0.08	0.05	0.06
612-1	0.01	0.01	0	0.01	0	0
CMG-B-1	0.03	0.01	0.24	0.36	0.04	0.1
CMG-C-1	0.01	0	0	0.32	0.19	0.02
UCSC-G-1	0	0.01	1.26	2.29	0	0
EBS1522-1	0.02	0.01	7.72	34.72	0	0
EBS1522-2	0.02	0	9.94	41.31	0.01	0
EBS1522-3	0.02	0.01	9.47	41.37	0.01	0
EBS1522-4	0.02	0	9.86	38.16	0.01	0
EBS1432-1	0.07	0.01	35.46	38.65	0.02	0.01
EBS1432-2	0.07	0	28.25	29.65	0.02	0
EBS1432-3	0.1	0.01	33.18	38.96	0.02	0
EBS1432-4	0.09	0	29.42	36.09	0.01	0
EBS30-1	0.03	0.01	11.81	12.22	0.03	0.01
EBS30-2	0.03	0.01	12.16	11.88	0.03	0.01
EBS30-3	0.05	0.01	15.08	10.75	0.03	0.01
EBS30-4	0.05	0.01	15.31	10.55	0.03	0.01
EBS1257-1	0.03	0.01	9.35	15.04	0.01	0
EBS1257-2	0.03	0	10.37	14.51	0.01	0
EBS1257-3	0.03	0.01	11.55	15.8	0.01	0
EBS1257-4	0.04	0.01	12.39	13.08	0.01	0
EBS1320-1	0.08	0	21.13	5.5	0.01	0
EBS1320-2	0.08	0	21.93	5.32	0.01	0
EBS1320-3	0.11	0	29.65	7.16	0.02	0
EBS1320-4	0.11	0	31.3	7.93	0.02	0
610-2	0.08	0.06	0.06	0.1	0.05	0.06
612-2	0.01	0.01	0.01	0.12	0	0.01
CMG-B-2	0.03	0.01	0.24	0.37	0.04	0.1
CMG-C-2	0.01	0	0	0.32	0.19	0.02
UCSC-G-2	0	0	1.26	2.26	0	0
EBS1269-1	0.07	0	23.53	33.42	0.01	0
EBS1269-2	0.09	0	29.09	37.03	0.01	0
EBS1269-3	0.07	0	22.86	32.24	0.01	0
EBS1269-4	0.08	0	23.68	31.34	0.01	0
EBS16-1	0	0.15	0.18	3.49	0	0.03

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
EBS16-2	0	0.25	0.14	2.98	0	0.04
EBS16-3	0	0.21	0.02	2.83	0	0.02
EBS16-4	0	0.38	0.02	1.51	0	0.01
EBS1231-1	0.01	0.22	0.02	1.08	0.01	0.04
EBS1231-2	-0.11	-0.72	-0.1	-3.19	0	-0.15
EBS1231-3	0.05	0.01	0.2	13.25	0	-0.01
EBS1231-4	0.03	0.04	0.1	7.49	0	0
EBS1197-1	0.01	0	0.05	2.68	0	0
EBS1197-2	0.01	0	0.04	2.17	0	0
EBS1197-3	0.01	0	0.11	2.94	0	0
EBS1197-4	0.01	0	0.06	2.16	0	0
EBS1343-1	0.03	0.01	9.93	23.59	0.02	0
EBS1343-2	0.02	0	3.09	8.04	0	0
EBS1343-3	0.03	0.01	14.87	29.49	0.03	0
EBS1343-4	0.04	0.01	6.74	12.37	0.01	0
610-3	0.08	0.06	0.06	0.1	0.05	0.06
612-3	0.01	0.01	0.04	0.04	0	0.01
CMG-B-3	0.03	0.01	0.25	0.37	0.04	0.1
CMG-C-3	0.01	0	0	0.31	0.19	0.02
UCSC-G-3	0	0	1.26	2.21	0	0
EBS1455-1	0.09	0	8.49	6.85	0.01	0.01
EBS1455-2	0.1	0	10.09	7.57	0.01	0.01
EBS1455-3	0.08	0	8.33	7.77	0.01	0.01
EBS1455-4	0.08	0	7.19	6.1	0.01	0.01
EBS1392-1	0.1	0	14.09	5.47	0.01	0
EBS1392-2	0.09	0	25.56	7.5	0.01	0
EBS1392-3	0.11	0.01	18.8	9.22	0.01	0
EBS1392-4	0.11	0	28.42	11.53	0.02	0
EBS1339-1	0.05	0	11.81	9.64	0.01	0
EBS1339-2	0.02	0	2.87	2.48	0	0
EBS1339-3	0.04	0	10.8	10.78	0.01	0
EBS1339-4	0.03	0	3.48	3.39	0	0
EBS1345-1	0.03	0.01	24.5	31.14	0.02	0
EBS1345-2	0.02	0.01	15.7	22.87	0.01	0
EBS1345-3	0.04	0.01	28.52	30.9	0.02	0
EBS1345-4	0.03	0.01	30.28	33.71	0.02	0
EBS786-1	0.07	0.01	31.88	6.16	0.01	0.01
EBS786-2	0.06	0.01	23.7	5.42	0.01	0
EBS786-3	0.06	0.01	27.99	6.38	0.01	0
EBS786-4	0.05	0	8.23	4.32	0	0
EBS273-1	0.08	0.01	31.99	5.26	0.01	0.01
EBS273-2	0.07	0.01	30.08	5.32	0.01	0
EBS273-3	0.08	0.01	27.04	6.61	0.01	0.01
EBS273-4	0.08	0.01	27.07	6.29	0.01	0
610-4	0.08	0.06	0.06	0.08	0.05	0.06
612-4	0.01	0.01	0.01	0.02	0	0
CMG-B-4	0.03	0.01	0.25	0.36	0.04	0.1
CMG-C-4	0.01	0	0	0.31	0.18	0.02

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
UCSC-G-4	0	0	1.25	2.25	0	0
EBS1061-1	0.04	0.01	32.89	15.49	0.01	0
EBS1061-2	0.04	0	23.52	9.64	0.01	0
EBS1061-3	0.04	0.01	29.61	14.21	0.01	0
EBS1061-4	0.04	0	16.37	7.97	0.01	0
EBS188-1	0.02	0.01	7.42	6.69	0.01	0.01
EBS188-2	0.02	0.01	6.64	5.55	0.01	0.01
EBS188-3	0.02	0.01	7.38	7.34	0.01	0.01
EBS188-4	0.02	0.01	5.74	5.84	0.01	0.01
EBS211-1	0.02	0	10.62	55.44	0	0
EBS211-2	0.02	0	4.5	19.9	0	0
EBS211-3	0.02	0	10.09	51.55	0	0
EBS211-4	0.02	0	2.85	14.6	0	0
EBS137-1	0.03	0.01	25.02	27.81	0.02	0.01
EBS137-2	0.02	0	22.05	25.05	0.01	0.01
EBS137-3	0.03	0.01	23.66	26.67	0.02	0.01
EBS137-4	0.03	0	21.51	24.62	0.01	0.01
EBS161-1	0.2	0	41.97	4.37	0.02	0.02
EBS161-2	0.2	0	42.87	4.23	0.02	0.02
EBS161-3	0.18	0	36.81	5.06	0.02	0.02
EBS161-4	0.18	0	40.22	4.72	0.02	0.02
EBS220-1	0.04	0	16.17	44.04	0.02	0
EBS220-2	0.03	0	13.81	41.19	0.01	0
EBS220-3	0.03	0	17.31	44.25	0.01	0
EBS220-4	0.03	0	13.04	37.79	0.01	0
610-5	0.08	0.06	0.06	0.18	0.05	0.06
612-5	0.01	0.01	0.01	0.01	0	0
CMG-B-5	0.03	0.01	0.25	0.36	0.04	0.1
CMG-C-5	0.01	0	0	0.32	0.18	0.02
UCSC-G-5	0	0	1.25	2.19	0	0
610-a	0.08	0.06	0.05	0.08	0.05	0.06
610-b	0.08	0.05	0.05	0.07	0.05	0.06
610-1	0.07	0.06	0.05	0.08	0.05	0.06
612-1	0.01	0	0	0.01	0	0
CMG-B-1	0.03	0.01	0.24	0.34	0.04	0.09
CMG-C-1	0.01	0	0	0.31	0.18	0.02
UCSC-G-1	0	0	1.28	2.24	0	0
EBS250-1	0.02	0.01	7.57	9.11	0.01	0.01
EBS250-2	0.02	0	6.4	6.92	0	0
EBS250-3	0.02	0.01	5.8	9.31	0	0.01
EBS250-4	0.03	0	4.7	8.04	0	0
EBS1037-1	0.14	0	30.41	4.8	0.01	0
EBS1037-2	0.13	0	26.76	3.74	0.01	0
EBS1037-3	0.1	0	26.95	3.86	0.01	0
EBS1037-4	0.09	0	18.88	3.09	0.01	0
EBS890-1	0.02	0.01	7.8	10.31	0.01	0
EBS890-2	0.01	0	1.55	3.72	0	0
EBS890-3	0.03	0.01	9.76	9.06	0.01	0

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
EBS890-4	0.02	0	2.17	3.97	0	0
EBS1173-1	0.02	0.02	18.23	47.3	0.01	0
EBS1173-2	0.02	0.01	6.67	18.31	0	0
EBS1173-3	0.03	0.02	20.43	51.5	0.01	0
EBS1173-4	0.02	0.01	14.11	35.25	0.01	0
EBS209-1	0.02	0.01	11.83	34.23	0.01	0
EBS209-2	0.01	0	1.81	4.99	0	0
EBS209-3	0.02	0.01	9.9	28.68	0.01	0
EBS209-4	0.01	0	2.84	8.91	0	0
610-2	0.08	0.06	0.05	0.08	0.05	0.06
612-2	0.01	0.01	0.01	0.02	0	0
CMG-B-2	0.03	0.01	0.25	0.36	0.04	0.1
CMG-C-2	0.01	0	0	0.31	0.18	0.02
UCSC-G-2	0	0	1.3	2.28	0	0
EBS948-1	0.05	0.01	9.69	51.57	0.01	0
EBS948-2	0.04	0.01	5.57	27.22	0	0
EBS948-3	0.05	0.01	9.91	47.63	0.01	0
EBS948-4	0.04	0.01	7.63	33.5	0	0
EBS956-1	0.01	0.03	5	26.14	0.01	0
EBS956-2	0.01	0.01	1.89	9.2	0	0
EBS956-3	0.01	0.02	3.74	17.34	0	0
EBS956-4	0.01	0.01	1.65	6.51	0	0
EBS975-1	0.03	0.01	20.04	5.27	0.01	0.01
EBS975-2	0.02	0.01	7.85	5.27	0	0
EBS975-3	0.03	0.01	25.77	5.21	0	0.01
EBS975-4	0.03	0.01	12.91	5.05	0	0.01
EBS302-1	0.1	0.02	13.33	6.51	0.07	-0.04
EBS302-2	0.09	0.13	10.28	4.39	0.04	0.09
EBS302-3	0.16	0.02	36.86	6.06	0.1	0.01
EBS302-4	0.14	0.01	35.45	5.31	0.08	0
EBS429-1	0.08	0	42.59	5.08	0.02	0.01
EBS429-2	0.08	0	45.64	4.84	0.02	0.01
EBS429-3	0.12	0.01	40.41	6.51	0.02	0.01
EBS429-4	0.11	0.01	45.12	6.06	0.02	0.01
610-3	0.08	0.06	0.06	0.08	0.05	0.06
612-3	0.01	0.01	0	0.01	0	0
CMG-B-3	0.03	0.01	0.29	0.37	0.04	0.1
CMG-C-3	0.01	0	0	0.31	0.18	0.02
UCSC-G-3	0	0	1.27	2.23	0	0
EBS979-1	0.02	0.01	16.01	6.8	0.01	0
EBS979-2	0.02	0.01	12.88	6.68	0.01	0
EBS979-3	0.02	0.01	16.84	7.25	0.01	0
EBS979-4	0.02	0.01	13.59	5.93	0.01	0
EBS1587-1	0.01	0.01	23.62	45.85	0.02	0
EBS1587-2	0.01	0	19.81	34.57	0.02	0
EBS1587-3	0.02	0.01	26.57	48.76	0.02	0
EBS1587-4	0.01	0	13.85	23.76	0.01	0
EBS1582-1	0.03	0.01	5.96	10.47	0	0

Inventory Number/ Run	51V	52Cr	55Mn	57Fe	59Co	60Ni
EBS1582-2	0.01	0	1.05	2.85	0	0
EBS1582-3	0.03	0.01	5.07	8.99	0	0
EBS1582-4	0.01	0	1	3	0	0
EBS235-1	0.02	0.01	15.13	40.2	0	0
EBS235-2	0.01	0	5.51	14.21	0	0
EBS235-3	0.01	0.01	10.71	30.87	0	0
EBS235-4	0.01	0	1.58	4.11	0	0
EBS1039-1	0.01	0.02	9.06	12.47	0.01	0
EBS1039-2	0.01	0	1.81	3.06	0	0
EBS1039-3	0.01	0.02	13.94	16.3	0.01	0
EBS1039-4	0.01	0	2.95	3.97	0	0
610-4	0.08	0.06	0.06	0.08	0.05	0.06
612-4	0.01	0.01	0.01	0.01	0	0
CMG-B-4	0.03	0.01	0.26	0.37	0.04	0.1
CMG-C-4	0.01	0	0.01	0.31	0.17	0.02
UCSC-G-4	0	0	1.29	2.19	0	0
EBS200-1	0.02	0	24.82	33.08	0.01	0
EBS200-2	0.02	0	12.93	19.06	0.01	0
EBS200-3	0.02	0	16.57	22.59	0.01	0
EBS200-4	0.01	0	2.72	6.15	0	0
EBS1064-1	0.03	0.01	14.76	49.75	0.01	0
EBS1064-2	0.03	0.01	13.5	47.2	0.01	0
EBS1064-3	0.02	0.01	10.17	34.42	0.01	0
EBS1064-4	0.02	0	5.81	19.53	0	0
EBS76-1	0.03	0.01	29.67	42.43	0.02	0
EBS76-2	0.03	0.01	29.19	41.74	0.02	0
EBS76-3	0.02	0.01	26.1	41.53	0.01	0
EBS76-4	0.02	0.01	19.04	30.09	0.01	0
EBS744-1	0.02	0	13.4	6.08	0	0
EBS744-2	0.02	0	4.11	3.93	0	0
EBS744-3	0.03	0	11.62	7.18	0	0
EBS744-4	0.02	0	4.9	5.46	0	0
EBS1206-1	0.02	0	8.88	22.19	0	0
EBS1206-2	0.01	0	0.63	5.04	0	0
EBS1206-3	0.02	0	10	23.44	0	0
EBS1206-4	0.01	0	0.99	5.46	0	0
610-5	0.08	0.06	0.06	0.08	0.05	0.06
612-5	0.01	0.01	0	0.01	0	0.01
CMG-B-5	0.03	0.01	0.26	0.37	0.04	0.1
CMG-C-5	0.01	0	0	0.31	0.17	0.02
UCSC-G-5	0	0	1.28	2.17	0	0

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
610-a	0.05	0.05	0.05	0.05	0.06	0.06
610-b	0.05	0.05	0.05	0.05	0.06	0.06
610-1	0.05	0.06	0.05	0.05	0.06	0.06
612-1	0	0	0.01	0	0.01	0
CMG-B-1	2.78	0.22	0	0	0.02	0
CMG-C-1	1.14	0.06	0	0.01	0.32	0
UCSC-G-1	11.71	2.65	0	0	0	0
EBS1454-1	0.02	0.21	0.13	0.01	0.12	0
EBS1454-2	0.01	0.13	0.08	0.01	0.17	0
EBS1454-3	0.02	0.21	0.15	0.01	0.15	0
EBS1454-4	0.02	0.15	0.09	0.01	0.2	0
EBS815-1	0.17	0.34	0	0.01	0.35	0
EBS815-2	0.15	0.28	0	0.01	0.32	0
EBS815-3	0.12	0.33	0	0.01	0.43	0
EBS815-4	0.07	0.18	0	0.02	0.34	0
EBS1236-1	0.01	0.22	0	0.01	0.01	0
EBS1236-2	0.01	0.2	0	0.01	0.02	0
EBS1236-3	0.01	0.2	0	0.02	0.01	0
EBS1236-4	0.01	0.17	0	0.02	0.02	0
EBS1289-1	0.04	0.33	0	0	0.08	0
EBS1289-2	0.03	0.26	0	0	0.09	0.01
EBS1289-3	0.02	0.22	0	0.01	0.08	0
EBS1289-4	0.02	0.19	0	0	0.08	0.01
EBS210-1	1.45	0.16	0.07	0.02	0.05	0.01
EBS210-2	2.1	0.23	0.07	0.01	0.06	0.01
EBS210-3	0.51	0.23	0.07	0.01	0.05	0.02
EBS210-4	0.57	0.23	0.07	0.01	0.07	0.01
610-2	0.05	0.06	0.05	0.05	0.06	0.06
612-2	0	0	0.01	0	0.01	0.01
CMG-B-2	2.85	0.22	0	0	0.02	0
CMG-C-2	1.14	0.06	0	0.01	0.33	0
UCSC-G-2	11.87	2.62	0	0	0	0
EBS1429-1	0.21	0.16	0.03	0.01	0.16	0.01
EBS1429-2	0.19	0.12	0.03	0	0.18	0.01
EBS1429-3	0.16	0.16	0.02	0.01	0.17	0.01
EBS1429-4	0.15	0.12	0.01	0.01	0.18	0.01
EBS281-1	1.26	0.09	0.04	0	0.28	0
EBS281-2	1.05	0.08	0.03	0	0.38	0
EBS281-3	1.14	0.09	0.01	0	0.36	0
EBS281-4	1.15	0.09	0.01	0	0.4	0
EBS1072-1	0.1	0.33	0	0.01	0.04	0
EBS1072-2	0.06	0.21	0	0.02	0.04	0.01
EBS1072-3	0.14	0.35	0	0.01	0.09	0
EBS1072-4	0.12	0.3	0	0.01	0.07	0.01
EBS170-1	0.01	0.27	0	0	0.18	0.01
EBS170-2	0.01	0.21	0	0	0.1	0.01
EBS170-3	0.02	0.21	0	0	0.1	0.01
EBS170-4	0.02	0.12	0	0.01	0.13	0.01

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
EBS67-1	0.01	0.43	0.01	0.01	0.11	0.01
EBS67-2	0.01	0.19	0.01	0.02	0.13	0.01
EBS67-3	0.01	0.38	0	0.02	0.09	0.01
EBS67-4	0	0.1	0	0.02	0.1	0.01
EBS359-1	0.48	0.23	0.01	0.01	0.08	0
EBS359-2	0.64	0.24	0.01	0.01	0.07	0
EBS359-3	0.48	0.3	0	0.01	0.13	0
EBS359-4	0.67	0.3	0	0.01	0.1	0
610-3	0.05	0.06	0.05	0.05	0.06	0.06
612-3	0	0	0.01	0	0.01	0.01
CMG-B-3	2.85	0.22	0	0	0.02	0
CMG-C-3	1.15	0.05	0	0.01	0.33	0
UCSC-G-3	11.97	2.58	0	0	0	0
EBS153-1	0.81	0.11	0.01	0.01	0.09	0.01
EBS153-2	0.64	0.08	0.01	0.01	0.1	0.01
EBS153-3	0.73	0.08	0.01	0.01	0.09	0
EBS153-4	0.81	0.09	0.02	0.01	0.09	0.01
EBS1127-1	1.38	0.07	0.06	0.01	0.13	0
EBS1127-2	1.3	0.06	0.05	0.01	0.12	0
EBS1127-3	1.39	0.05	0.04	0.02	0.07	0
EBS1127-4	1.27	0.04	0.04	0.02	0.05	0
EBS1030-1	2.79	0.14	0.02	0.02	0.02	0
EBS1030-2	2.66	0.16	0.02	0.01	0.04	0
EBS1030-3	3.92	0.14	0.02	0.02	0.04	0
EBS1030-4	4.01	0.16	0.03	0.01	0.04	0
EBS303-1	1.61	0.77	0.02	0.01	0.11	0
EBS303-2	1.53	0.65	0.01	0.01	0.09	0
EBS303-3	0.37	0.58	0.01	0.01	0.08	0
EBS303-4	0.22	0.27	0.01	0.02	0.05	0
EBS212-1	7.11	0.36	0.03	0.01	0.09	0
EBS212-2	3.89	0.18	0.03	0.01	0.15	0.01
EBS212-3	8.42	0.3	0.04	0.01	0.1	0
EBS212-4	5.6	0.17	0.04	0.01	0.17	0.01
EBS216-1	0.03	0.18	0.01	0.01	0.11	0
EBS216-2	0.03	0.14	0.01	0.01	0.11	0.01
EBS216-3	0.03	0.16	0.01	0.01	0.15	0
EBS216-4	-0.01	0.13	0.01	0.01	0.13	0.01
610-4	0.05	0.06	0.05	0.05	0.06	0.06
612-4	0	0	0.01	0	0.01	0.01
CMG-B-4	2.84	0.22	0	0	0.02	0
CMG-C-4	1.15	0.05	0	0.01	0.33	0
UCSC-G-4	12.09	2.55	0	0	0	0
EBS1056-1	8.56	0.13	0.04	0.01	0.07	0
EBS1056-2	7.03	0.09	0.04	0.01	0.08	0
EBS1056-3	8.92	0.1	0.05	0.01	0.08	0
EBS1056-4	8.19	0.08	0.04	0.01	0.11	0
EBS947-1	8.86	0.3	0.06	0.01	0.04	0
EBS947-2	7.94	0.27	0.07	0.01	0.04	0

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
EBS947-3	9.04	0.35	0.07	0.01	0.04	0
EBS947-4	7.92	0.3	0.07	0.01	0.04	0
EBS1145-1	0.04	0.09	0.05	0	0.15	0.01
EBS1145-2	0.16	0.08	0.08	0	0.16	0.01
EBS1145-3	0.04	0.1	0.05	0	0.15	0.01
EBS1145-4	0.03	0.08	0.08	0	0.16	0.01
610-5	0.05	0.06	0.05	0.05	0.06	0.06
612-5	0	0.01	0.01	0	0.01	0.01
CMG-B-5	2.84	0.22	0	0	0.02	0
CMG-C-5	1.13	0.05	0	0.01	0.33	0
UCSC-G-5	12.15	2.53	0	0	0	0
610-a	0.05	0.05	0.05	0.04	0.06	0.06
610-b	0.05	0.05	0.05	0.04	0.06	0.05
610-1	0.05	0.05	0.05	0.04	0.06	0.05
612-1	0	0	0.01	0	0.01	0
CMG-B-1	2.79	0.21	0	0	0.02	0
CMG-C-1	1.17	0.06	0	0.01	0.31	0
UCSC-G-1	11.92	2.65	0	0	0	0
EBS1522-1	0.1	0.45	0	0.01	0.06	0.01
EBS1522-2	0.12	0.59	0	0.01	0.05	0.01
EBS1522-3	0.13	0.79	0	0.01	0.05	0.01
EBS1522-4	0.14	0.88	0.01	0.01	0.07	0.01
EBS1432-1	0.01	0.18	0	0	0.11	0
EBS1432-2	0.01	0.12	0	0	0.17	0.01
EBS1432-3	0.02	0.19	0	0	0.21	0
EBS1432-4	0.01	0.11	0	0	0.22	0.01
EBS30-1	0.43	0.75	0.01	0.01	0.05	0
EBS30-2	0.45	0.67	0	0.01	0.04	0
EBS30-3	0.37	0.56	0.01	0.01	0.07	0
EBS30-4	0.37	0.51	0.01	0.01	0.07	0
EBS1257-1	3.56	0.12	0.01	0.02	0.08	0
EBS1257-2	3.01	0.11	0.01	0.02	0.08	0
EBS1257-3	3.7	0.18	0.01	0.02	0.04	0
EBS1257-4	2.48	0.17	0.01	0.02	0.06	0
EBS1320-1	8.53	0.16	0.06	0.01	0.22	0
EBS1320-2	7.41	0.15	0.06	0.02	0.19	0
EBS1320-3	8.92	0.19	0.1	0.01	0.3	0
EBS1320-4	8.01	0.18	0.09	0.01	0.28	0
610-2	0.05	0.06	0.05	0.04	0.06	0.05
612-2	0.01	0	0.01	0	0.01	0
CMG-B-2	2.83	0.22	0	0	0.02	0
CMG-C-2	1.16	0.05	0	0.01	0.31	0
UCSC-G-2	12.16	2.56	0	0	0	0
EBS1269-1	0.34	0.17	0.03	0.01	0.07	0
EBS1269-2	0.36	0.16	0.04	0.01	0.1	0
EBS1269-3	0.31	0.17	0.03	0.01	0.08	0
EBS1269-4	0.26	0.13	0.04	0.01	0.09	0.01
EBS16-1	0.27	9.6	0.02	0	0.02	0

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
EBS16-2	0.27	9.81	0.04	0	0.02	0
EBS16-3	0.06	14.09	-0.03	0	0.02	0
EBS16-4	0.04	11.81	0.02	0	0.01	0
EBS1231-1	0.04	15.29	-0.02	0.01	0.03	0
EBS1231-2	-0.13	-23.63	-0.09	-0.05	-0.02	0
EBS1231-3	0.04	0.01	0.01	0.04	0.03	0
EBS1231-4	0.02	0	-0.01	0.03	0.01	0
EBS1197-1	0	0.01	0	0.03	0.02	0.01
EBS1197-2	0	0.01	0	0.02	0.03	0.01
EBS1197-3	0	0.01	0	0.02	0.03	0.01
EBS1197-4	0	0.01	0	0.03	0.03	0.01
EBS1343-1	1.59	0.25	0.01	0.02	0.1	0.01
EBS1343-2	0.47	0.07	0.01	0.02	0.13	0.01
EBS1343-3	3.3	0.33	0.01	0.02	0.07	0.01
EBS1343-4	1.29	0.12	0.01	0.02	0.13	0.01
610-3	0.05	0.06	0.05	0.05	0.06	0.06
612-3	0	0	0.01	0	0.01	0
CMG-B-3	2.92	0.21	0	0	0.02	0
CMG-C-3	1.17	0.05	0	0.01	0.31	0
UCSC-G-3	11.96	2.51	0	0	0	0
EBS1455-1	1.43	0.62	0.01	0.02	0.37	0.01
EBS1455-2	1.55	0.69	0.01	0.02	0.32	0.01
EBS1455-3	0.92	0.86	0.01	0.02	0.37	0.01
EBS1455-4	0.72	0.63	0.01	0.02	0.27	0.01
EBS1392-1	1.43	0.06	0.04	0.02	0.17	0
EBS1392-2	1.77	0.07	0.05	0.01	0.24	0
EBS1392-3	2.01	0.09	0.04	0.01	0.21	0
EBS1392-4	2.19	0.09	0.05	0.01	0.24	0
EBS1339-1	0.22	0.35	0.04	0.02	0.06	0.01
EBS1339-2	0.05	0.07	0.02	0.02	0.07	0
EBS1339-3	0.22	0.31	0.03	0.02	0.07	0.01
EBS1339-4	0.07	0.08	0.02	0.02	0.08	0.01
EBS1345-1	0.02	0.33	0.01	0.01	0.1	0
EBS1345-2	0.02	0.22	0.01	0.01	0.11	0
EBS1345-3	0.02	0.32	0.01	0	0.11	0
EBS1345-4	0.02	0.3	0.01	0	0.09	0
EBS786-1	2.68	0.29	0	0.01	0.35	0
EBS786-2	2.1	0.22	0.01	0.01	0.31	0
EBS786-3	1.75	0.28	0	0.01	0.33	0
EBS786-4	0.65	0.13	0	0.01	0.18	0
EBS273-1	0.31	0.24	0	0.01	0.39	0
EBS273-2	0.33	0.23	0	0.01	0.37	0
EBS273-3	0.28	0.2	0	0.01	0.28	0
EBS273-4	0.28	0.2	0	0.01	0.25	0
610-4	0.05	0.06	0.05	0.05	0.06	0.06
612-4	0	0.01	0.01	0	0.01	0
CMG-B-4	2.92	0.22	0	0	0.02	0
CMG-C-4	1.16	0.05	0	0.01	0.31	0

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
UCSC-G-4	12.05	2.49	0	0	0	0
EBS1061-1	0.27	0.8	0.01	0.01	0.25	0.01
EBS1061-2	0.24	0.41	0.02	0.01	0.31	0.01
EBS1061-3	0.16	0.65	0.01	0.01	0.24	0.01
EBS1061-4	0.08	0.31	0.02	0.01	0.31	0.01
EBS188-1	0.1	0.13	0.01	0.02	0.05	0
EBS188-2	0.09	0.08	0.01	0.02	0.06	0.01
EBS188-3	0.11	0.15	0.01	0.02	0.06	0
EBS188-4	0.09	0.09	0	0.02	0.06	0
EBS211-1	0.04	0.15	0.02	0	0.07	0.01
EBS211-2	0.01	0.07	0.03	0.01	0.1	0.01
EBS211-3	0.04	0.17	0.02	0	0.06	0.01
EBS211-4	0.01	0.06	0.03	0.01	0.08	0.01
EBS137-1	0.01	0.26	0	0.01	0.13	0
EBS137-2	0.01	0.19	0	0.01	0.13	0
EBS137-3	0.01	0.22	0	0.01	0.13	0.01
EBS137-4	0.01	0.16	0	0.01	0.14	0.01
EBS161-1	0.02	0.25	0.04	0.01	0.15	0.01
EBS161-2	0.02	0.2	0.05	0.01	0.15	0.01
EBS161-3	0.02	0.26	0.04	0.01	0.15	0.01
EBS161-4	0.02	0.21	0.04	0.01	0.13	0.01
EBS220-1	0.15	0.09	0	0	0.15	0
EBS220-2	0.12	0.08	0	0.01	0.11	0.01
EBS220-3	0.11	0.05	0.01	0	0.11	0.01
EBS220-4	0.08	0.04	0	0.01	0.08	0
610-5	0.05	0.06	0.05	0.05	0.06	0.06
612-5	0	0.01	0.01	0	0.01	0
CMG-B-5	2.95	0.21	0	0	0.02	0
CMG-C-5	1.17	0.05	0	0.01	0.32	0
UCSC-G-5	11.76	2.48	0	0	0	0
610-a	0.05	0.05	0.04	0.04	0.06	0.05
610-b	0.05	0.05	0.04	0.04	0.05	0.05
610-1	0.05	0.05	0.04	0.04	0.06	0.05
612-1	0	0	0	0	0.01	0
CMG-B-1	2.72	0.21	0	0	0.01	0
CMG-C-1	1.16	0.05	0	0.01	0.3	0
UCSC-G-1	11.7	2.58	0	0	0	0
EBS250-1	1.82	0.21	0	0.02	0.24	0
EBS250-2	1.36	0.2	0	0.02	0.24	0
EBS250-3	2.45	0.06	0	0.02	0.32	0
EBS250-4	2	0.05	0	0.02	0.28	0
EBS1037-1	0.45	0.16	0.08	0	0.5	0
EBS1037-2	0.34	0.13	0.07	0	0.45	0
EBS1037-3	0.3	0.12	0.06	0	0.35	0
EBS1037-4	0.18	0.08	0.05	0.01	0.27	0
EBS890-1	0.03	0.13	0.01	0.01	0.88	0.01
EBS890-2	0.01	0.04	0	0.02	0.44	0.01
EBS890-3	0.02	0.13	0.01	0	0.95	0.01

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
EBS890-4	0.01	0.04	0	0.01	0.61	0.01
EBS1173-1	0.01	0.05	0	0	0.27	0
EBS1173-2	0	0.02	0	0.01	0.18	0
EBS1173-3	0.01	0.05	0	0	0.4	0
EBS1173-4	0.01	0.03	0.01	0	0.32	0
EBS209-1	0.14	0.17	0	0.01	0.12	0.01
EBS209-2	0.02	0.04	0	0.02	0.06	0.01
EBS209-3	0.09	0.13	0	0.01	0.11	0.01
EBS209-4	0.03	0.05	0	0.02	0.07	0.01
610-2	0.05	0.06	0.05	0.04	0.06	0.05
612-2	0	0	0	0	0.01	0
CMG-B-2	2.83	0.22	0	0	0.02	0
CMG-C-2	1.16	0.05	0	0.01	0.3	0
UCSC-G-2	11.64	2.54	0	0	0	0
EBS948-1	0.17	0.07	0.01	0	0.2	0
EBS948-2	0.09	0.05	0	0.01	0.14	0
EBS948-3	0.18	0.09	0.01	0	0.2	0
EBS948-4	0.14	0.07	0	0.01	0.17	0
EBS956-1	0.01	0.07	0	0.01	0.04	0.01
EBS956-2	0	0.03	0	0.02	0.04	0.01
EBS956-3	0	0.04	0	0.02	0.04	0.01
EBS956-4	0	0.02	0	0.02	0.03	0.01
EBS975-1	0.1	0.07	0	0.01	0.18	0.02
EBS975-2	0.07	0.05	0	0.01	0.09	0.01
EBS975-3	0.22	0.11	0.01	0.01	0.18	0
EBS975-4	0.16	0.08	0	0.01	0.1	0.01
EBS302-1	18.55	1.03	3.26	0.02	0.07	0
EBS302-2	6.3	0.27	2.31	0.01	0.05	0
EBS302-3	9.92	0.22	0.06	0.01	0.02	0
EBS302-4	4.69	0.07	0.03	0.01	0.02	0
EBS429-1	0.01	0.22	0.01	0	0.27	0.01
EBS429-2	0.01	0.28	0.01	0	0.24	0.01
EBS429-3	0.01	0.28	0.02	0	0.32	0.01
EBS429-4	0.01	0.34	0.03	0	0.25	0.01
610-3	0.05	0.06	0.05	0.05	0.06	0.05
612-3	0	0	0	0	0.01	0
CMG-B-3	2.89	0.21	0	0	0.02	0
CMG-C-3	1.14	0.05	0	0.01	0.3	0
UCSC-G-3	11.64	2.51	0	0	0	0
EBS979-1	0.86	0.14	0	0.01	0.04	0.01
EBS979-2	0.79	0.1	0	0.01	0.04	0.01
EBS979-3	0.72	0.11	0	0.01	0.03	0
EBS979-4	0.63	0.09	0	0.01	0.04	0
EBS1587-1	0.06	0.07	0	0.01	0.08	0
EBS1587-2	0.05	0.05	0	0.01	0.08	0
EBS1587-3	0.08	0.07	0	0	0.07	0
EBS1587-4	0.03	0.04	0	0.01	0.06	0.01
EBS1582-1	0.27	0.39	0.01	0.02	0.09	0.01

Inventory Number/ Run	63Cu	66Zn	75As	85Rb	88Sr	89Y
EBS1582-2	0.07	0.06	0	0.02	0.05	0.01
EBS1582-3	0.28	0.29	0.01	0.02	0.08	0.01
EBS1582-4	0.07	0.05	0	0.02	0.04	0.01
EBS235-1	0.07	0.41	0	0	0.06	0.01
EBS235-2	0.02	0.14	0	0.02	0.07	0.01
EBS235-3	0.04	0.19	0	0.01	0.07	0.01
EBS235-4	0.01	0.04	0	0.02	0.05	0.01
EBS1039-1	0.01	0.11	0	0.02	0.04	0
EBS1039-2	0	0.02	0	0.02	0.03	0
EBS1039-3	0.01	0.23	0	0.01	0.05	0
EBS1039-4	0	0.05	0	0.02	0.05	0
610-4	0.05	0.06	0.05	0.05	0.06	0.06
612-4	0	0	0	0	0.01	0
CMG-B-4	2.94	0.22	0	0	0.02	0
CMG-C-4	1.14	0.05	0	0.01	0.31	0
UCSC-G-4	11.61	2.47	0	0	0	0
EBS200-1	0.03	0.18	0.06	0.01	0.06	0
EBS200-2	0.01	0.09	0.03	0.02	0.05	0.01
EBS200-3	0.02	0.13	0.04	0.02	0.06	0
EBS200-4	0	0.03	0.01	0.03	0.03	0.01
EBS1064-1	0.01	0.16	0	0	0.19	0
EBS1064-2	0.01	0.14	0	0	0.19	0
EBS1064-3	0.02	0.14	0	0.01	0.17	0
EBS1064-4	0.01	0.08	0	0.01	0.12	0
EBS76-1	0.03	0.14	0	0	0.17	0
EBS76-2	0.03	0.13	0	0	0.16	0
EBS76-3	0.04	0.14	0	0	0.14	0
EBS76-4	0.03	0.09	0	0.01	0.11	0
EBS744-1	0.26	0.08	0.02	0.02	0.03	0.01
EBS744-2	0.1	0.04	0.01	0.02	0.03	0
EBS744-3	0.25	0.1	0.02	0.02	0.03	0
EBS744-4	0.11	0.05	0.02	0.02	0.03	0
EBS1206-1	0.01	0.04	0	0.02	0.1	0.01
EBS1206-2	0	0.03	0	0.02	0.02	0.01
EBS1206-3	0.01	0.04	0	0.01	0.11	0.01
EBS1206-4	0	0.02	0	0.02	0.03	0.01
610-5	0.05	0.06	0.05	0.05	0.06	0.06
612-5	0	0	0	0	0.01	0
CMG-B-5	2.95	0.21	0	0	0.02	0
CMG-C-5	1.13	0.05	0	0.01	0.31	0
UCSC-G-5	11.52	2.44	0	0	0	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
610-a	0.06	0.03	0.03	0.05	0.05	0.04
610-b	0.06	0.03	0.03	0.06	0.05	0.04
610-1	0.06	0.03	0.03	0.06	0.05	0.04
612-1	0.01	0	0	0	0	0
CMG-B-1	0.02	0.01	0	0.03	0.5	0
CMG-C-1	0.01	0	0	0.19	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1454-1	0	0	0	0.03	0.11	0
EBS1454-2	0.01	0	0	0.01	0.06	0
EBS1454-3	0	0	0	0.01	0.12	0
EBS1454-4	0	0	0	0.01	0.08	0
EBS815-1	0.03	0	0	0	0	0
EBS815-2	0.02	0	0	0	0	0
EBS815-3	0.02	0	0	0	0	0
EBS815-4	0.02	0	0	0	0	0
EBS1236-1	0	0	0	0.01	0.01	0
EBS1236-2	0.01	0	0	0.01	0.01	0
EBS1236-3	0.01	0	0	0.01	0.01	0
EBS1236-4	0.01	0	0	0.01	0.01	0
EBS1289-1	0.04	0	0	0.01	0.01	0
EBS1289-2	0.04	0	0	0.01	0.01	0
EBS1289-3	0.04	0	0	0.02	0.01	0
EBS1289-4	0.04	0	0	0.01	0.01	0
EBS210-1	0.01	0	0	0.02	0.08	0
EBS210-2	0.01	0	0	0.01	0.07	0
EBS210-3	0.02	0	0	0.03	0.09	0
EBS210-4	0.02	0	0	0.01	0.06	0
610-2	0.06	0.03	0.03	0.06	0.06	0.04
612-2	0.01	0	0	0.01	0	0
CMG-B-2	0.02	0.01	0	0.03	0.53	0
CMG-C-2	0.01	0	0	0.2	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1429-1	0.01	0	0	0.01	0.09	0
EBS1429-2	0.01	0	0	0	0.09	0
EBS1429-3	0.01	0	0	0.01	0.06	0
EBS1429-4	0.01	0	0	0	0.06	0
EBS281-1	0.01	0	0	0	0.01	0
EBS281-2	0.01	0	0	0	0.01	0
EBS281-3	0.01	0	0	0	0.01	0
EBS281-4	0.01	0	0	0	0.01	0
EBS1072-1	0.02	0	0	0.01	0.06	0
EBS1072-2	0.03	0	0	0.01	0.04	0
EBS1072-3	0.01	0	0	0.02	0.05	0
EBS1072-4	0.01	0	0	0.01	0.04	0
EBS170-1	0.01	0	0	0	0.03	0
EBS170-2	0.01	0	0	0	0.03	0
EBS170-3	0.01	0	0	0.01	0.04	0
EBS170-4	0.02	0	0	0	0.02	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
EBS67-1	0.02	0	0	0.04	0.01	0
EBS67-2	0.02	0	0	0.01	0.01	0
EBS67-3	0.02	0	0	0.04	0.01	0
EBS67-4	0.02	0	0	0.01	0.01	0
EBS359-1	0.02	0	0	0.01	0.06	0
EBS359-2	0.03	0	0	0	0.07	0
EBS359-3	0.02	0	0	0	0.07	0
EBS359-4	0.02	0	0	0	0.07	0
610-3	0.07	0.03	0.03	0.06	0.06	0.04
612-3	0.01	0	0	0.01	0	0
CMG-B-3	0.02	0.01	0	0.03	0.52	0
CMG-C-3	0.01	0	0	0.2	0	0
UCSC-G-3	0	0	0	0	0	0
EBS153-1	0.02	0	0	0.01	0.05	0
EBS153-2	0.02	0	0	0	0.06	0
EBS153-3	0.01	0	0	0.01	0.05	0
EBS153-4	0.01	0	0	0	0.07	0
EBS1127-1	0.02	0	0	0	0.05	0
EBS1127-2	0.02	0	0	0	0.05	0
EBS1127-3	0.02	0	0	0	0.04	0
EBS1127-4	0.04	0	0	0	0.04	0
EBS1030-1	0.01	0	0	0.01	0.04	0
EBS1030-2	0.01	0	0	0.01	0.05	0
EBS1030-3	0.02	0	0	0	0.05	0
EBS1030-4	0.03	0	0	0	0.06	0
EBS303-1	0.04	0	0	0.01	0.12	0
EBS303-2	0.03	0	0	0.01	0.13	0
EBS303-3	0.02	0	0	0.01	0.08	0
EBS303-4	0.02	0	0	0.01	0.04	0
EBS212-1	0.01	0	0	0.05	0.05	0
EBS212-2	0.02	0	0	0.02	0.02	0
EBS212-3	0.01	0	0	0.03	0.04	0
EBS212-4	0.01	0	0	0.01	0.02	0
EBS216-1	0.02	0	0	0.02	0.03	0
EBS216-2	0.02	0	0	0.01	0.02	0
EBS216-3	0.01	0	0	0.02	0.03	0
EBS216-4	-0.07	0	0	0.02	0.02	0
610-4	0.07	0.03	0.03	0.06	0.06	0.04
612-4	0.01	0	0	0	0.01	0
CMG-B-4	0.02	0.01	0	0.03	0.55	0
CMG-C-4	0.01	0	0	0.2	0	0
UCSC-G-4	0	0	0	0	0	0
EBS1056-1	0.01	0.01	0	0	0.06	0
EBS1056-2	0.01	0.01	0	0	0.05	0
EBS1056-3	0.01	0.01	0	0	0.05	0
EBS1056-4	0.01	0.01	0	0	0.05	0
EBS947-1	0.01	0.01	0	0	0.69	0
EBS947-2	0.01	0.01	0	0	0.64	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
EBS947-3	0.01	0.01	0	0	0.7	0
EBS947-4	0.01	0.01	0	0	0.66	0
EBS1145-1	0.01	0	0	0	0.11	0
EBS1145-2	0	0	0	0	0.12	0
EBS1145-3	0	0	0	0	0.11	0
EBS1145-4	0	0	0	0	0.12	0
610-5	0.06	0.03	0.03	0.06	0.06	0.04
612-5	0.01	0	0	0.01	0	0
CMG-B-5	0.02	0.01	0	0.03	0.55	0
CMG-C-5	0.01	0	0	0.19	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.06	0.03	0.03	0.05	0.05	0.03
610-b	0.06	0.03	0.03	0.05	0.05	0.04
610-1	0.06	0.03	0.03	0.05	0.05	0.03
612-1	0	0	0	0	0	0
CMG-B-1	0.02	0.01	0	0.02	0.44	0
CMG-C-1	0.01	0	0	0.17	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1522-1	0.03	0	0	0	0.05	0
EBS1522-2	0.02	0	0	0	0.07	0
EBS1522-3	0.02	0	0	0	0.07	0
EBS1522-4	0.01	0	0	0	0.08	0
EBS1432-1	0	0	0	0.01	0.03	0
EBS1432-2	0.01	0	0	0.01	0.02	0
EBS1432-3	0	0	0	0.01	0.02	0
EBS1432-4	0.01	0	0	0	0.03	0
EBS30-1	0.03	0	0	0.01	0	0
EBS30-2	0.02	0	0	0	0	0
EBS30-3	0.02	0	0	0.01	0	0
EBS30-4	0.02	0	0	0	0	0
EBS1257-1	0.01	0	0	0	0.02	0
EBS1257-2	0.01	0	0	0	0.02	0
EBS1257-3	0.01	0	0	0	0.02	0
EBS1257-4	0.02	0	0	0	0.02	0
EBS1320-1	0.03	0	0	0.01	0.01	0
EBS1320-2	0.02	0.01	0	0	0.01	0
EBS1320-3	0.02	0	0	0.01	0.02	0
EBS1320-4	0.01	0	0	0.01	0.01	0
610-2	0.06	0.03	0.03	0.05	0.05	0.04
612-2	0.01	0	0	0	0	0
CMG-B-2	0.02	0.01	0	0.03	0.48	0
CMG-C-2	0.01	0	0	0.18	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1269-1	0.01	0	0	0	0.06	0
EBS1269-2	0.01	0	0	0	0.07	0
EBS1269-3	0.01	0	0	0	0.06	0
EBS1269-4	0.19	0	0	0	0.06	0
EBS16-1	0.1	0.01	0	0.03	0.01	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
EBS16-2	0.07	0.01	-0.01	0.04	0	0
EBS16-3	0.06	0	0	0.01	0	0
EBS16-4	0.03	0	0	0.01	0	0
EBS1231-1	0.04	0	0.01	0.03	0	0
EBS1231-2	-0.06	-0.01	0.03	-0.06	0	0
EBS1231-3	0.01	0	0	0.01	0	0.01
EBS1231-4	0.02	0.01	0.01	0.01	0.01	0
EBS1197-1	0.07	0	0	0.01	0	0
EBS1197-2	0.21	0	0	0.01	0	0
EBS1197-3	0.02	0	0	0.01	0.02	0
EBS1197-4	0.02	0	0	0.01	0	0
EBS1343-1	0.02	0	0	0.02	0.04	0
EBS1343-2	0.02	0	0	0.01	0.02	0
EBS1343-3	0.01	0	0	0.02	0.07	0
EBS1343-4	0.02	0	0	0.01	0.03	0
610-3	0.06	0.03	0.03	0.05	0.05	0.04
612-3	0	0	0	0	0	0
CMG-B-3	0.02	0.01	0	0.03	0.49	0
CMG-C-3	0.01	0	0	0.18	0	0
UCSC-G-3	0	0	0	0	0	0
EBS1455-1	0.01	0	0	0	6.75	0
EBS1455-2	0.01	0	0	0	5.81	0
EBS1455-3	0.01	0	0	0.01	5.26	0
EBS1455-4	0.01	0	0	0	3.11	0
EBS1392-1	0.01	0	0	0.01	0.04	0
EBS1392-2	0.01	0	0	0.01	0.03	0
EBS1392-3	0.01	0	0	0.01	0.03	0
EBS1392-4	0.01	0	0	0.01	0.04	0
EBS1339-1	0.01	0	0	0.01	0.02	0
EBS1339-2	0.01	0	0	0	0	0
EBS1339-3	0.01	0	0	0.01	0.02	0
EBS1339-4	0.01	0	0	0	0.01	0
EBS1345-1	0.01	0	0	0.01	0.04	0
EBS1345-2	0.01	0	0	0.01	0.03	0
EBS1345-3	0.01	0	0	0.02	0.04	0
EBS1345-4	0.01	0	0	0.01	0.04	0
EBS786-1	0.02	0	0	0	0.01	0
EBS786-2	0.02	0	0	0	0	0
EBS786-3	0.02	0	0	0	0	0
EBS786-4	0.02	0	0	0	0	0
EBS273-1	0.02	0	0	0.01	4.03	0
EBS273-2	0.02	0	0	0	3.86	0
EBS273-3	0.02	0	0	0.01	4.48	0
EBS273-4	0.02	0	0	0.01	4.45	0
610-4	0.06	0.03	0.03	0.05	0.05	0.04
612-4	0	0	0	0	0	0
CMG-B-4	0.02	0.01	0	0.03	0.5	0
CMG-C-4	0.01	0	0	0.18	0	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
UCSC-G-4	0	0	0	0	0	0
EBS1061-1	0.01	0	0	0.01	0.02	0
EBS1061-2	0.01	0	0	0	0.02	0
EBS1061-3	0.02	0	0	0.01	0.02	0
EBS1061-4	0.02	0	0	0.01	0.01	0
EBS188-1	0.03	0	0	0	0.02	0
EBS188-2	0.02	0	0	0	0.01	0
EBS188-3	0.03	0	0	0	0.02	0
EBS188-4	0.03	0	0	0	0.01	0
EBS211-1	0.01	0	0	0.01	0.14	0
EBS211-2	0.02	0	0	0	0.04	0
EBS211-3	0.01	0	0	0.01	0.13	0
EBS211-4	0.02	0	0	0	0.03	0
EBS137-1	0.01	0	0	0.01	0.02	0
EBS137-2	0.01	0	0	0.01	0.02	0
EBS137-3	0.03	0	0	0.01	0.02	0
EBS137-4	0.02	0	0	0.01	0.02	0
EBS161-1	0.02	0	0	0	0	0
EBS161-2	0.02	0	0	0	0	0
EBS161-3	0.02	0	0	0	0	0
EBS161-4	0.02	0	0	0	0	0
EBS220-1	0.04	0	0	0.01	0.08	0
EBS220-2	0.05	0	0	0.01	0.08	0
EBS220-3	0.01	0	0	0.01	0.03	0
EBS220-4	0.01	0	0	0	0.03	0
610-5	0.06	0.03	0.03	0.06	0.05	0.04
612-5	0.01	0	0	0	0	0
CMG-B-5	0.02	0.01	0	0.03	0.5	0
CMG-C-5	0.01	0	0	0.18	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.05	0.03	0.03	0.05	0.04	0.03
610-b	0.05	0.03	0.03	0.05	0.04	0.03
610-1	0.05	0.03	0.03	0.05	0.04	0.03
612-1	0	0	0	0	0	0
CMG-B-1	0.02	0.01	0	0.02	0.41	0
CMG-C-1	0.01	0	0	0.17	0	0
UCSC-G-1	0	0	0	0	0	0
EBS250-1	0.01	0.01	0	0	0.76	0
EBS250-2	0.01	0.02	0	0	0.67	0
EBS250-3	0.01	0.02	0	0	0.54	0
EBS250-4	0.01	0.02	0	0	0.47	0
EBS1037-1	0	0	0	0	0.03	0
EBS1037-2	0.01	0.01	0	0	0.02	0
EBS1037-3	0.01	0	0	0	0.02	0
EBS1037-4	0.01	0	0	0	0.01	0
EBS890-1	0.02	0	0	0.01	0	0
EBS890-2	0.02	0	0	0	0	0
EBS890-3	0.02	0	0	0.01	0	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
EBS890-4	0.02	0	0	0	0	0
EBS1173-1	0.01	0	0	0.01	0.06	0
EBS1173-2	0.02	0	0	0.01	0.02	0
EBS1173-3	0.01	0	0	0.01	0.06	0
EBS1173-4	0.01	0	0	0.01	0.04	0
EBS209-1	0.02	0	0	0.02	0.03	0
EBS209-2	0.22	0	0	0.01	0	0
EBS209-3	0.01	0	0	0.02	0.02	0
EBS209-4	0.02	0	0	0.01	0.01	0
610-2	0.06	0.03	0.03	0.05	0.05	0.04
612-2	0	0	0	0	0	0
CMG-B-2	0.02	0.01	0	0.02	0.45	0
CMG-C-2	0.01	0	0	0.17	0	0
UCSC-G-2	0	0	0	0	0	0
EBS948-1	0.01	0	0	0.01	0.08	0
EBS948-2	0.03	0	0	0	0.03	0
EBS948-3	0.01	0	0	0.01	0.07	0
EBS948-4	0.02	0	0	0	0.04	0
EBS956-1	0.21	0	0	0	0.03	0
EBS956-2	0.03	0	0	0	0.01	0
EBS956-3	0.02	0	0	0	0.02	0
EBS956-4	0.02	0	0	0	0.01	0
EBS975-1	0.04	0	0	0.01	0.05	0
EBS975-2	0.05	0	0	0	0.02	0
EBS975-3	0.02	0	0	0.01	0.1	0
EBS975-4	0.1	0	0	0	0.05	0
EBS302-1	0.01	0	0	0.2	0.02	0
EBS302-2	0	0	-0.01	0.07	0.01	0
EBS302-3	0	0	0	0.08	0.02	0
EBS302-4	0	0	0	0.04	0.01	0
EBS429-1	0.02	0	0	0	0	0
EBS429-2	0.02	0	0	0	0	0
EBS429-3	0.02	0	0	0.01	0.01	0
EBS429-4	0.02	0	0	0	0.01	0
610-3	0.06	0.03	0.03	0.05	0.05	0.04
612-3	0	0	0	0	0	0
CMG-B-3	0.02	0.01	0	0.02	0.47	0
CMG-C-3	0	0	0	0.17	0	0
UCSC-G-3	0	0	0	0	0	0
EBS979-1	0.02	0	0	0.04	0.05	0
EBS979-2	0.02	0	0	0.01	0.04	0
EBS979-3	0.01	0	0	0.07	0.04	0
EBS979-4	0.01	0	0	0.01	0.04	0
EBS1587-1	0.01	0	0	0.01	0.02	0
EBS1587-2	0.01	0	0	0	0.01	0
EBS1587-3	0.01	0	0	0.01	0.01	0
EBS1587-4	0.02	0	0	0	0.01	0
EBS1582-1	0.02	0	0	0	2.96	0

Inventory Number/ Run	90Zr	107Ag	111Cd	118Sn	121Sb	133Cs
EBS1582-2	0.03	0	0	0	0.29	0
EBS1582-3	0.03	0	0	0	2.61	0
EBS1582-4	0.03	0	0	0	0.26	0
EBS235-1	0.01	0	0	0.04	0.04	0
EBS235-2	0.02	0	0	0.01	0.02	0
EBS235-3	0.01	0	0	0.07	0.02	0
EBS235-4	0.02	0	0	0.01	0.01	0
EBS1039-1	0.02	0	0	0.01	0	0
EBS1039-2	0.02	0	0	0	0	0
EBS1039-3	0.02	0	0	0.01	0.01	0
EBS1039-4	0.02	0	0	0	0	0
610-4	0.06	0.03	0.03	0.05	0.05	0.04
612-4	0	0	0	0	0	0
CMG-B-4	0.02	0.01	0	0.03	0.48	0
CMG-C-4	0.01	0	0	0.17	0	0
UCSC-G-4	0	0	0	0	0	0
EBS200-1	0.01	0	0	0	0.08	0
EBS200-2	0.02	0	0	0	0.04	0
EBS200-3	0.01	0	0	0	0.05	0
EBS200-4	0.03	0	0	0	0.01	0
EBS1064-1	0.01	0	0	0.01	0.07	0
EBS1064-2	0.01	0	0	0.01	0.07	0
EBS1064-3	0.01	0	0	0.01	0.06	0
EBS1064-4	0.01	0	0	0	0.03	0
EBS76-1	0.01	0	0	0.01	0.02	0
EBS76-2	0.01	0	0	0.01	0.01	0
EBS76-3	0.01	0	0	0.01	0.01	0
EBS76-4	0.01	0	0	0.01	0.01	0
EBS744-1	0.01	0	0	0.02	0.09	0
EBS744-2	0.01	0	0	0	0.02	0
EBS744-3	0.01	0	0	0.01	0.08	0
EBS744-4	0.01	0	0	0	0.02	0
EBS1206-1	0.02	0	0	0	0	0
EBS1206-2	0.02	0	0	0	0	0
EBS1206-3	0.01	0	0	0	0	0
EBS1206-4	0.02	0	0	0	0	0
610-5	0.06	0.03	0.03	0.05	0.05	0.04
612-5	0.01	0	0	0	0	0
CMG-B-5	0.02	0.01	0	0.03	0.48	0
CMG-C-5	-0.01	0	0	0.17	0	0
UCSC-G-5	0	0	0	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
610-a	0.05	0.05	0.06	0.05	0.05	0.05
610-b	0.05	0.05	0.06	0.05	0.05	0.05
610-1	0.05	0.05	0.06	0.05	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0.08	0	0	0	0	0
CMG-C-1	13.79	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1454-1	2.91	0	0.02	0	0	0
EBS1454-2	3.34	0	0.03	0	0	0
EBS1454-3	3.33	0	0.02	0	0	0
EBS1454-4	3.86	0	0.02	0	0	0
EBS815-1	10.74	0.01	0.01	0	0	0
EBS815-2	7.85	0	0.01	0	0	0
EBS815-3	12.29	0.01	0.01	0	0	0
EBS815-4	7.21	0	0.01	0	0	0
EBS1236-1	0.24	0	0.01	0	0	0
EBS1236-2	0.34	0	0.01	0	0.01	0
EBS1236-3	-0.08	0	0.03	0	0	0
EBS1236-4	0.31	0	0.01	0	0.01	0
EBS1289-1	1.67	0.01	0.02	0	0.01	0
EBS1289-2	1.51	0.01	0.01	0	0.01	0
EBS1289-3	1.24	0.01	0.02	0	0.01	0
EBS1289-4	1	0.01	0.02	0	0.01	0
EBS210-1	0.73	0.01	0.04	0	0.01	0
EBS210-2	0.9	0.01	0.04	0	0.01	0
EBS210-3	0.73	0.01	0.05	0	0.01	0
EBS210-4	0.87	0.01	0.04	0	0.01	0
610-2	0.05	0.06	0.06	0.06	0.05	0.06
612-2	0.01	0	0	0	0	0
CMG-B-2	0.09	0	0	0	0	0
CMG-C-2	13.91	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1429-1	4.59	0.01	0.01	0	0.01	0
EBS1429-2	4.82	0.01	0.02	0	0.01	0
EBS1429-3	3.82	0.01	0.01	0	0.01	0
EBS1429-4	4.16	0.01	0.02	0	0.01	0
EBS281-1	13.69	0	0.01	0	0	0
EBS281-2	15.06	0	0.01	0	0	0
EBS281-3	15.61	0	0.01	0	0	0
EBS281-4	15.29	0	0.01	0	0	0
EBS1072-1	0.93	0	0.01	0	0	0
EBS1072-2	0.75	0	0.01	0	0	0
EBS1072-3	1.79	0	0.01	0	0	0
EBS1072-4	1.5	0	0.01	0	0	0
EBS170-1	5.75	0.01	0.05	0	0.01	0
EBS170-2	3.85	0	0.03	0	0	0
EBS170-3	4.19	0.01	0.01	0	0	0
EBS170-4	3.79	0.01	0.01	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
EBS67-1	1.97	0.01	0.02	0	0.01	0
EBS67-2	1.52	0.01	0.01	0	0.01	0
EBS67-3	1.6	0.01	0.01	0	0.01	0
EBS67-4	1.32	0.01	0.01	0	0	0
EBS359-1	0.7	0	0.01	0	0	0
EBS359-2	0.62	0.01	0.01	0	0	0
EBS359-3	0.95	0	0.01	0	0	0
EBS359-4	0.84	0.01	0.02	0	0.01	0
610-3	0.05	0.05	0.06	0.06	0.05	0.06
612-3	0	0	0	0	0	0
CMG-B-3	0.11	0	0	0	0	0
CMG-C-3	14.01	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS153-1	0.64	0	0.01	0	0	0
EBS153-2	0.64	0	0.01	0	0	0
EBS153-3	0.51	0	0.01	0	0	0
EBS153-4	0.46	0	0.01	0	0	0
EBS1127-1	4.69	0.01	0.01	0	0	0
EBS1127-2	4.14	0.01	0.01	0	0	0
EBS1127-3	2.59	0.01	0.01	0	0	0
EBS1127-4	1.73	0.01	0.01	0	0.01	0
EBS1030-1	0.6	0	0.01	0	0	0
EBS1030-2	0.47	0	0.01	0	0	0
EBS1030-3	0.89	0	0.01	0	0	0
EBS1030-4	0.85	0	0.01	0	0	0
EBS303-1	3.1	0	0.01	0	0	0
EBS303-2	2.42	0	0	0	0	0
EBS303-3	1.83	0	0	0	0	0
EBS303-4	0.91	0	0.01	0	0	0
EBS212-1	1.96	0	0.01	0	0	0
EBS212-2	2.51	0.01	0.01	0	0	0
EBS212-3	2.06	0	0.01	0	0	0
EBS212-4	2.97	0	0.01	0	0	0
EBS216-1	1.03	0	0.02	0	0	0
EBS216-2	1.03	0.01	0.02	0	0	0
EBS216-3	1.37	0	0.02	0	0	0
EBS216-4	1.31	0.01	0.02	0	0	0
610-4	0.06	0.06	0.06	0.06	0.05	0.06
612-4	0	0	0	0	0	0
CMG-B-4	0.09	0	0	0	0	0
CMG-C-4	14.27	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS1056-1	1.79	0	0	0	0	0
EBS1056-2	1.99	0	0	0	0	0
EBS1056-3	1.97	0	0	0	0	0
EBS1056-4	2.45	0	0	0	0	0
EBS947-1	0.89	0	0	0	0	0
EBS947-2	0.84	0	0.01	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
EBS947-3	1.08	0	0	0	0	0
EBS947-4	0.99	0	0	0	0	0
EBS1145-1	2.66	0	0.01	0	0	0
EBS1145-2	2.83	0	0.01	0	0	0
EBS1145-3	2.73	0	0.01	0	0	0
EBS1145-4	2.82	0	0.01	0	0	0
610-5	0.05	0.06	0.06	0.06	0.05	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0.09	0	0	0	0	0
CMG-C-5	14.1	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.05	0.05	0.05	0.04	0.05	0.05
610-b	0.05	0.05	0.05	0.05	0.04	0.05
610-1	0.05	0.05	0.05	0.05	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0.08	0	0	0	0	0
CMG-C-1	13.14	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1522-1	0.91	0.01	0.01	0	0.01	0
EBS1522-2	0.98	0.01	0.01	0	0	0
EBS1522-3	0.84	0.01	0.01	0	0.01	0
EBS1522-4	1.17	0.01	0.01	0	0.01	0
EBS1432-1	4.57	0	0.02	0	0	0
EBS1432-2	5.27	0	0.02	0	0	0
EBS1432-3	5.23	0	0.01	0	0	0
EBS1432-4	5.49	0	0.02	0	0	0
EBS30-1	1.78	0.01	0.04	0	0.01	0
EBS30-2	1.55	0.01	0.04	0	0.01	0
EBS30-3	2.84	0.01	0.04	0	0.01	0
EBS30-4	2.52	0.01	0.05	0	0.01	0
EBS1257-1	2.28	0	0	0	0	0
EBS1257-2	2.05	0	0.01	0	0	0
EBS1257-3	1.06	0	0	0	0	0
EBS1257-4	1.33	0	0.01	0	0	0
EBS1320-1	3.96	0	0.01	0	0	0
EBS1320-2	3.49	0	0.01	0	0	0
EBS1320-3	5.55	0	0.01	0	0	0
EBS1320-4	5.13	0	0.01	0	0	0
610-2	0.05	0.05	0.05	0.05	0.05	0.05
612-2	0.01	0	0	0	0	0
CMG-B-2	0.08	0	0	0	0	0
CMG-C-2	13.04	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1269-1	1.89	0	0.01	0	0	0
EBS1269-2	2.68	0	0.01	0	0	0
EBS1269-3	1.94	0	0.01	0	0	0
EBS1269-4	2.1	0	0.01	0	0	0
EBS16-1	0.03	0	0.01	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
EBS16-2	0.01	0	0.01	0	0	0
EBS16-3	0	0	0	0	0	0
EBS16-4	0.01	0	0	0	0.01	0
EBS1231-1	0.01	0	0	0	0	-0.01
EBS1231-2	-0.08	0	0	0	-0.01	0.02
EBS1231-3	0.06	0.01	0.03	0	0.01	0
EBS1231-4	0.03	0	0.01	0	0.01	0
EBS1197-1	0.12	0.01	0.01	0	0	0
EBS1197-2	0.13	0.01	0.01	0	0.01	0
EBS1197-3	0.12	0.01	0.02	0	0.01	0
EBS1197-4	0.13	0.01	0.01	0	0.01	0
EBS1343-1	1.19	0.01	0.02	0	0.01	0
EBS1343-2	1.39	0.01	0.02	0	0.01	0
EBS1343-3	0.91	0.01	0.01	0	0.01	0
EBS1343-4	1.87	0.01	0.02	0	0.01	0
610-3	0.05	0.05	0.06	0.05	0.05	0.05
612-3	0.01	0	0	0	0	0
CMG-B-3	0.08	0	0	0	0	0
CMG-C-3	13.38	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS1455-1	11.68	0	0.01	0	0	0
EBS1455-2	8.7	0	0.01	0	0	0
EBS1455-3	11.43	0.01	0.01	0	0.01	0
EBS1455-4	7.92	0	0.01	0	0	0
EBS1392-1	4.92	0	0	0	0	0
EBS1392-2	6.13	0	0.01	0	0	0
EBS1392-3	5.86	0	0	0	0	0
EBS1392-4	5.74	0	0.01	0	0	0
EBS1339-1	0.81	0	0.01	0	0	0
EBS1339-2	0.98	0	0.01	0	0	0
EBS1339-3	0.89	0.01	0.01	0	0	0
EBS1339-4	1.19	0	0.02	0	0	0
EBS1345-1	2.22	0	0.01	0	0	0
EBS1345-2	1.86	0	0.01	0	0	0
EBS1345-3	2.67	0	0.01	0	0	0
EBS1345-4	2.59	0	0.01	0	0	0
EBS786-1	8.81	0	0.01	0	0	0
EBS786-2	7.07	0	0.01	0	0	0
EBS786-3	8.06	0	0.01	0	0	0
EBS786-4	2.56	0	0.01	0	0	0
EBS273-1	7.39	0	0.01	0	0	0
EBS273-2	5.98	0	0.01	0	0	0
EBS273-3	5.61	0	0.01	0	0	0
EBS273-4	4.83	0	0.01	0	0	0
610-4	0.05	0.05	0.06	0.05	0.05	0.05
612-4	0	0	0	0	0	0
CMG-B-4	0.08	0	0	0	0	0
CMG-C-4	13.49	0	0	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
UCSC-G-4	0	0	0	0	0	0
EBS1061-1	5.44	0.01	0.02	0	0.01	0
EBS1061-2	6	0.01	0.02	0	0.01	0
EBS1061-3	4.61	0.01	0.02	0	0.01	0
EBS1061-4	5.26	0.01	0.02	0	0.01	0
EBS188-1	0.83	0.01	0.03	0	0.01	0
EBS188-2	0.79	0.01	0.02	0	0.01	0
EBS188-3	0.87	0.01	0.03	0	0.01	0
EBS188-4	0.8	0.01	0.02	0	0.01	0
EBS211-1	1.99	0.01	0.01	0	0.01	0
EBS211-2	1.57	0.01	0.01	0	0.01	0
EBS211-3	1.8	0.01	0.01	0	0.01	0
EBS211-4	1.16	0.01	0.01	0	0	0
EBS137-1	2.38	0	0.02	0	0	0
EBS137-2	2.16	0	0.02	0	0	0
EBS137-3	2.15	0	0.02	0	0	0
EBS137-4	2.14	0	0.02	0	0	0
EBS161-1	4.14	0.02	0.02	0	0.01	0
EBS161-2	3.85	0.02	0.02	0	0.01	0
EBS161-3	3.69	0.02	0.03	0	0.01	0
EBS161-4	3.43	0.02	0.02	0	0.02	0
EBS220-1	2.27	0	0.02	0	0	0
EBS220-2	1.86	0	0.01	0	0	0
EBS220-3	1.97	0	0.01	0	0	0
EBS220-4	1.4	0	0.01	0	0	0
610-5	0.05	0.05	0.06	0.05	0.05	0.05
612-5	0	0	0	0	0	0
CMG-B-5	0.08	0	0	0	0	0
CMG-C-5	13.41	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.04	0.04	0.05	0.04	0.04	0.05
610-b	0.05	0.04	0.05	0.04	0.04	0.04
610-1	0.04	0.04	0.05	0.04	0.04	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0.07	0	0	0	0	0
CMG-C-1	12.33	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS250-1	0.28	0	0.01	0	0	0
EBS250-2	0.22	0	0.01	0	0	0
EBS250-3	0.25	0	0.01	0	0	0
EBS250-4	0.19	0	0.01	0	0	0
EBS1037-1	9.52	0	0.01	0	0	0
EBS1037-2	7.97	0	0.01	0	0	0
EBS1037-3	6.71	0	0.01	0	0	0
EBS1037-4	4.22	0	0.01	0	0	0
EBS890-1	14.68	0.01	0.01	0	0	0
EBS890-2	3.96	0	0.01	0	0	0
EBS890-3	15.36	0.01	0.01	0	0	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
EBS890-4	4.87	0	0.02	0	0	0
EBS1173-1	3.76	0	0.01	0	0	0
EBS1173-2	1.53	0	0.01	0	0	0
EBS1173-3	4.81	0	0.01	0	0	0
EBS1173-4	3.4	0	0.01	0	0	0
EBS209-1	3.01	0	0.01	0	0	0
EBS209-2	0.76	0	0.01	0	0	0
EBS209-3	2.56	0	0.01	0	0	0
EBS209-4	1.01	0	0.01	0	0	0
610-2	0.05	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0.08	0	0	0	0	0
CMG-C-2	12.61	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS948-1	3.56	0	0.01	0	0	0
EBS948-2	1.95	0	0.01	0	0	0
EBS948-3	3.5	0	0.01	0	0	0
EBS948-4	2.77	0	0.01	0	0	0
EBS956-1	0.39	0.01	0.02	0	0.01	0
EBS956-2	0.44	0.01	0.01	0	0.01	0
EBS956-3	0.38	0.01	0.02	0	0.01	0
EBS956-4	0.29	0.01	0.01	0	0	0
EBS975-1	3.09	0.01	0.02	0	0.01	0
EBS975-2	0.9	0.01	0.01	0	0.01	0
EBS975-3	2.44	0.01	0.01	0	0.01	0
EBS975-4	1.01	0.01	0.01	0	0.01	0
EBS302-1	4.57	0	0.01	0	0	0
EBS302-2	3.02	0	0	0	0	0
EBS302-3	1.01	0	0.01	0	0	0
EBS302-4	1.23	0	0.01	0	0	0
EBS429-1	7.69	0.02	0.04	0.01	0.02	0
EBS429-2	6.77	0.03	0.03	0.01	0.02	0
EBS429-3	9.67	0.02	0.03	0	0.02	0
EBS429-4	7.84	0.02	0.03	0	0.02	0
610-3	0.05	0.05	0.06	0.05	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0.08	0	0	0	0	0
CMG-C-3	12.9	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS979-1	0.83	0.01	0.01	0	0.01	0
EBS979-2	0.75	0.01	0.01	0	0.01	0
EBS979-3	0.56	0.01	0.01	0	0.01	0
EBS979-4	0.57	0.01	0.01	0	0.01	0
EBS1587-1	2.74	0	0.01	0	0	0
EBS1587-2	2.12	0	0.01	0	0	0
EBS1587-3	2.59	0	0.01	0	0	0
EBS1587-4	1.38	0	0.01	0	0	0
EBS1582-1	0.7	0.01	0.02	0	0.01	0

Inventory Number/ Run	137Ba	139La	140Ce	141Pr	146Nd	147Sm
EBS1582-2	0.44	0.01	0.02	0	0.01	0
EBS1582-3	0.67	0.01	0.03	0	0.01	0
EBS1582-4	0.4	0.01	0.02	0	0.01	0
EBS235-1	0.9	0	0.01	0	0	0
EBS235-2	0.92	0	0.01	0	0	0
EBS235-3	1.36	0	0.01	0	0	0
EBS235-4	0.56	0.01	0.01	0	0	0
EBS1039-1	0.93	0	0.01	0	0	0
EBS1039-2	0.44	0	0.01	0	0	0
EBS1039-3	1.08	0	0.01	0	0	0
EBS1039-4	0.77	0	0.01	0	0	0
610-4	0.05	0.05	0.06	0.05	0.05	0.05
612-4	0	0	0	0	0	0
CMG-B-4	0.08	0	0	0	0	0
CMG-C-4	12.97	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS200-1	2.88	0	0.01	0	0	0
EBS200-2	1.92	0.01	0.01	0	0	0
EBS200-3	2.42	0	0.01	0	0	0
EBS200-4	0.48	0.01	0.01	0	0.01	0
EBS1064-1	4.21	0	0.01	0	0	0
EBS1064-2	4.47	0	0.01	0	0	0
EBS1064-3	4.26	0	0.01	0	0	0
EBS1064-4	2.5	0	0.01	0	0	0
EBS76-1	4.55	0	0.01	0	0	0
EBS76-2	4.25	0	0.01	0	0	0
EBS76-3	3.76	0	0.01	0	0	0
EBS76-4	2.8	0.01	0.01	0	0	0
EBS744-1	0.31	0	0.01	0	0	0
EBS744-2	0.26	0.01	0.01	0	0	0
EBS744-3	0.29	0	0.01	0	0	0
EBS744-4	0.26	0	0.01	0	0	0
EBS1206-1	1.73	0.01	0.01	0	0.01	0
EBS1206-2	0.14	0.01	0.01	0	0.01	0
EBS1206-3	1.93	0.08	0.12	0.01	0.03	0
EBS1206-4	0.2	0.01	0.01	0	0.01	0
610-5	0.05	0.05	0.06	0.05	0.05	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0.08	0	0	0	0	0
CMG-C-5	12.98	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
610-a	0.05	0.05	0.05	0.05	0.05	0.05
610-b	0.05	0.05	0.05	0.05	0.05	0.05
610-1	0.05	0.05	0.05	0.05	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1454-1	0	0	0	0	0	0
EBS1454-2	0	0	0	0	0	0
EBS1454-3	0	0	0	0	0	0
EBS1454-4	0	0	0	0	0	0
EBS815-1	0	0	0	0	0	0
EBS815-2	0	0	0	0	0	0
EBS815-3	0	0	0	0	0	0
EBS815-4	0	0	0	0	0	0
EBS1236-1	0	0	0	0	0	0
EBS1236-2	0	0	0	0	0	0
EBS1236-3	0	0	0	0	0	0
EBS1236-4	0	0	0	0	0	0
EBS1289-1	0	0	0	0	0	0
EBS1289-2	0	0	0	0	0	0
EBS1289-3	0	0	0	0	0	0
EBS1289-4	0	0	0	0	0	0
EBS210-1	0	0	0	0	0	0
EBS210-2	0	0	0	0	0	0
EBS210-3	0	0	0	0	0	0
EBS210-4	0	0	0	0	0	0
610-2	0.06	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1429-1	0	0	0	0	0	0
EBS1429-2	0	0	0	0	0	0
EBS1429-3	0	0	0	0	0	0
EBS1429-4	0	0	0	0	0	0
EBS281-1	0	0	0	0	0	0
EBS281-2	0	0	0	0	0	0
EBS281-3	0	0	0	0	0	0
EBS281-4	0	0	0	0	0	0
EBS1072-1	0	0	0	0	0	0
EBS1072-2	0	0	0	0	0	0
EBS1072-3	0	0	0	0	0	0
EBS1072-4	0	0	0	0	0	0
EBS170-1	0	0	0	0	0	0
EBS170-2	0	0	0	0	0	0
EBS170-3	0	0	0	0	0	0
EBS170-4	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
EBS67-1	0	0	0	0	0	0
EBS67-2	0	0	0	0	0	0
EBS67-3	0	0	0	0	0	0
EBS67-4	0	0	0	0	0	0
EBS359-1	0	0	0	0	0	0
EBS359-2	0	0	0	0	0	0
EBS359-3	0	0	0	0	0	0
EBS359-4	0	0	0	0	0	0
610-3	0.06	0.06	0.05	0.05	0.06	0.06
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS153-1	0	0	0	0	0	0
EBS153-2	0	0	0	0	0	0
EBS153-3	0	0	0	0	0	0
EBS153-4	0	0	0	0	0	0
EBS1127-1	0	0	0	0	0	0
EBS1127-2	0	0	0	0	0	0
EBS1127-3	0	0	0	0	0	0
EBS1127-4	0	0	0	0	0	0
EBS1030-1	0	0	0	0	0	0
EBS1030-2	0	0	0	0	0	0
EBS1030-3	0	0	0	0	0	0
EBS1030-4	0	0	0	0	0	0
EBS303-1	0	0	0	0	0	0
EBS303-2	0	0	0	0	0	0
EBS303-3	0	0	0	0	0	0
EBS303-4	0	0	0	0	0	0
EBS212-1	0	0	0	0	0	0
EBS212-2	0	0	0	0	0	0
EBS212-3	0	0	0	0	0	0
EBS212-4	0	0	0	0	0	0
EBS216-1	0	0	0	0	0	0
EBS216-2	0	0	0	0	0	0
EBS216-3	0	0	0	0	0	0
EBS216-4	0	0	0	0	0	0
610-4	0.06	0.06	0.05	0.05	0.06	0.06
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS1056-1	0	0	0	0	0	0
EBS1056-2	0	0	0	0	0	0
EBS1056-3	0	0	0	0	0	0
EBS1056-4	0	0	0	0	0	0
EBS947-1	0	0	0	0	0	0
EBS947-2	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
EBS947-3	0	0	0	0	0	0
EBS947-4	0	0	0	0	0	0
EBS1145-1	0	0	0	0	0	0
EBS1145-2	0	0	0	0	0	0
EBS1145-3	0	0	0	0	0	0
EBS1145-4	0	0	0	0	0	0
610-5	0.06	0.06	0.06	0.05	0.06	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.05	0.05	0.05	0.05	0.05	0.05
610-b	0.05	0.05	0.05	0.05	0.05	0.05
610-1	0.05	0.05	0.05	0.05	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1522-1	0	0	0	0	0	0
EBS1522-2	0	0	0	0	0	0
EBS1522-3	0	0	0	0	0	0
EBS1522-4	0	0	0	0	0	0
EBS1432-1	0	0	0	0	0	0
EBS1432-2	0	0	0	0	0	0
EBS1432-3	0	0	0	0	0	0
EBS1432-4	0	0	0	0	0	0
EBS30-1	0	0	0	0	0	0
EBS30-2	0	0	0	0	0	0
EBS30-3	0	0	0	0	0	0
EBS30-4	0	0	0	0	0	0
EBS1257-1	0	0	0	0	0	0
EBS1257-2	0	0	0	0	0	0
EBS1257-3	0	0	0	0	0	0
EBS1257-4	0	0	0	0	0	0
EBS1320-1	0	0	0	0	0	0
EBS1320-2	0	0	0	0	0	0
EBS1320-3	0	0	0	0	0	0
EBS1320-4	0	0	0	0	0	0
610-2	0.05	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1269-1	0	0	0	0	0	0
EBS1269-2	0	0	0	0	0	0
EBS1269-3	0	0	0	0	0	0
EBS1269-4	0	0	0	0	0	0
EBS16-1	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
EBS16-2	0	0	0	0	0	0
EBS16-3	0	0	0	0	0	0
EBS16-4	0	0	0	0	0	0
EBS1231-1	0	0	0	0	0	0
EBS1231-2	0	0	0	0	0	0
EBS1231-3	0	0	0	0	0	0
EBS1231-4	0	0	0	0	0	0
EBS1197-1	0	0	0	0	0	0
EBS1197-2	0	0	0	0	0	0
EBS1197-3	0	0	0	0	0	0
EBS1197-4	0	0	0	0	0	0
EBS1343-1	0	0	0	0	0	0
EBS1343-2	0	0	0	0	0	0
EBS1343-3	0	0	0	0	0	0
EBS1343-4	0	0	0	0	0	0
610-3	0.05	0.05	0.05	0.05	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS1455-1	0	0	0	0	0	0
EBS1455-2	0	0	0	0	0	0
EBS1455-3	0	0	0	0	0	0
EBS1455-4	0	0	0	0	0	0
EBS1392-1	0	0	0	0	0	0
EBS1392-2	0	0	0	0	0	0
EBS1392-3	0	0	0	0	0	0
EBS1392-4	0	0	0	0	0	0
EBS1339-1	0	0	0	0	0	0
EBS1339-2	0	0	0	0	0	0
EBS1339-3	0	0	0	0	0	0
EBS1339-4	0	0	0	0	0	0
EBS1345-1	0	0	0	0	0	0
EBS1345-2	0	0	0	0	0	0
EBS1345-3	0	0	0	0	0	0
EBS1345-4	0	0	0	0	0	0
EBS786-1	0	0	0	0	0	0
EBS786-2	0	0	0	0	0	0
EBS786-3	0	0	0	0	0	0
EBS786-4	0	0	0	0	0	0
EBS273-1	0	0	0	0	0	0
EBS273-2	0	0	0	0	0	0
EBS273-3	0	0	0	0	0	0
EBS273-4	0	0	0	0	0	0
610-4	0.05	0.05	0.05	0.05	0.05	0.05
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
UCSC-G-4	0	0	0	0	0	0
EBS1061-1	0	0	0	0	0	0
EBS1061-2	0	0	0	0	0	0
EBS1061-3	0	0	0	0	0	0
EBS1061-4	0	0	0	0	0	0
EBS188-1	0	0	0	0	0	0
EBS188-2	0	0	0	0	0	0
EBS188-3	0	0	0	0	0	0
EBS188-4	0	0	0	0	0	0
EBS211-1	0	0	0	0	0	0
EBS211-2	0	0	0	0	0	0
EBS211-3	0	0	0	0	0	0
EBS211-4	0	0	0	0	0	0
EBS137-1	0	0	0	0	0	0
EBS137-2	0	0	0	0	0	0
EBS137-3	0	0	0	0	0	0
EBS137-4	0	0	0	0	0	0
EBS161-1	0	0	0	0	0	0
EBS161-2	0	0	0	0	0	0
EBS161-3	0	0	0	0	0	0
EBS161-4	0	0	0	0	0	0
EBS220-1	0	0	0	0	0	0
EBS220-2	0	0	0	0	0	0
EBS220-3	0	0	0	0	0	0
EBS220-4	0	0	0	0	0	0
610-5	0.05	0.05	0.05	0.05	0.05	0.05
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.04	0.05	0.04	0.04	0.04	0.04
610-b	0.04	0.05	0.04	0.04	0.04	0.04
610-1	0.04	0.04	0.04	0.04	0.04	0.04
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS250-1	0	0	0	0	0	0
EBS250-2	0	0	0	0	0	0
EBS250-3	0	0	0	0	0	0
EBS250-4	0	0	0	0	0	0
EBS1037-1	0	0	0	0	0	0
EBS1037-2	0	0	0	0	0	0
EBS1037-3	0	0	0	0	0	0
EBS1037-4	0	0	0	0	0	0
EBS890-1	0	0	0	0	0	0
EBS890-2	0	0	0	0	0	0
EBS890-3	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
UCSC-G-4	0	0	0	0	0	0
EBS1061-1	0	0	0	0	0	0
EBS1061-2	0	0	0	0	0	0
EBS1061-3	0	0	0	0	0	0
EBS1061-4	0	0	0	0	0	0
EBS188-1	0	0	0	0	0	0
EBS188-2	0	0	0	0	0	0
EBS188-3	0	0	0	0	0	0
EBS188-4	0	0	0	0	0	0
EBS211-1	0	0	0	0	0	0
EBS211-2	0	0	0	0	0	0
EBS211-3	0	0	0	0	0	0
EBS211-4	0	0	0	0	0	0
EBS137-1	0	0	0	0	0	0
EBS137-2	0	0	0	0	0	0
EBS137-3	0	0	0	0	0	0
EBS137-4	0	0	0	0	0	0
EBS161-1	0	0	0	0	0	0
EBS161-2	0	0	0	0	0	0
EBS161-3	0	0	0	0	0	0
EBS161-4	0	0	0	0	0	0
EBS220-1	0	0	0	0	0	0
EBS220-2	0	0	0	0	0	0
EBS220-3	0	0	0	0	0	0
EBS220-4	0	0	0	0	0	0
610-5	0.05	0.05	0.05	0.05	0.05	0.05
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.04	0.05	0.04	0.04	0.04	0.04
610-b	0.04	0.05	0.04	0.04	0.04	0.04
610-1	0.04	0.04	0.04	0.04	0.04	0.04
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS250-1	0	0	0	0	0	0
EBS250-2	0	0	0	0	0	0
EBS250-3	0	0	0	0	0	0
EBS250-4	0	0	0	0	0	0
EBS1037-1	0	0	0	0	0	0
EBS1037-2	0	0	0	0	0	0
EBS1037-3	0	0	0	0	0	0
EBS1037-4	0	0	0	0	0	0
EBS890-1	0	0	0	0	0	0
EBS890-2	0	0	0	0	0	0
EBS890-3	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
EBS890-4	0	0	0	0	0	0
EBS1173-1	0	0	0	0	0	0
EBS1173-2	0	0	0	0	0	0
EBS1173-3	0	0	0	0	0	0
EBS1173-4	0	0	0	0	0	0
EBS209-1	0	0	0	0	0	0
EBS209-2	0	0	0	0	0	0
EBS209-3	0	0	0	0	0	0
EBS209-4	0	0	0	0	0	0
610-2	0.05	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS948-1	0	0	0	0	0	0
EBS948-2	0	0	0	0	0	0
EBS948-3	0	0	0	0	0	0
EBS948-4	0	0	0	0	0	0
EBS956-1	0	0	0	0	0	0
EBS956-2	0	0	0	0	0	0
EBS956-3	0	0	0	0	0	0
EBS956-4	0	0	0	0	0	0
EBS975-1	0	0	0	0	0	0
EBS975-2	0	0	0	0	0	0
EBS975-3	0	0	0	0	0	0
EBS975-4	0	0	0	0	0	0
EBS302-1	0	0	0	0	0	0
EBS302-2	0	0	0	0	0	0
EBS302-3	0	0	0	0	0	0
EBS302-4	0	0	0	0	0	0
EBS429-1	0	0	0	0	0	0
EBS429-2	0	0	0	0	0	0
EBS429-3	0	0	0	0	0	0
EBS429-4	0	0	0	0	0	0
610-3	0.05	0.05	0.05	0.05	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS979-1	0	0	0	0	0	0
EBS979-2	0	0	0	0	0	0
EBS979-3	0	0	0	0	0	0
EBS979-4	0	0	0	0	0	0
EBS1587-1	0	0	0	0	0	0
EBS1587-2	0	0	0	0	0	0
EBS1587-3	0	0	0	0	0	0
EBS1587-4	0	0	0	0	0	0
EBS1582-1	0	0	0	0	0	0

Inventory Number/ Run	153Eu	157Gd	159Tb	163Dy	165Ho	166Er
EBS1582-2	0	0	0	0	0	0
EBS1582-3	0	0	0	0	0	0
EBS1582-4	0	0	0	0	0	0
EBS235-1	0	0	0	0	0	0
EBS235-2	0	0	0	0	0	0
EBS235-3	0	0	0	0	0	0
EBS235-4	0	0	0	0	0	0
EBS1039-1	0	0	0	0	0	0
EBS1039-2	0	0	0	0	0	0
EBS1039-3	0	0	0	0	0	0
EBS1039-4	0	0	0	0	0	0
610-4	0.05	0.05	0.05	0.05	0.05	0.05
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS200-1	0	0	0	0	0	0
EBS200-2	0	0	0	0	0	0
EBS200-3	0	0	0	0	0	0
EBS200-4	0	0	0	0	0	0
EBS1064-1	0	0	0	0	0	0
EBS1064-2	0	0	0	0	0	0
EBS1064-3	0	0	0	0	0	0
EBS1064-4	0	0	0	0	0	0
EBS76-1	0	0	0	0	0	0
EBS76-2	0	0	0	0	0	0
EBS76-3	0	0	0	0	0	0
EBS76-4	0	0	0	0	0	0
EBS744-1	0	0	0	0	0	0
EBS744-2	0	0	0	0	0	0
EBS744-3	0	0	0	0	0	0
EBS744-4	0	0	0	0	0	0
EBS1206-1	0	0	0	0	0	0
EBS1206-2	0	0	0	0	0	0
EBS1206-3	0	0	0	0	0	0
EBS1206-4	0	0	0	0	0	0
610-5	0.05	0.06	0.05	0.05	0.05	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
610-a	0.05	0.05	0.05	0.05	0.06	0.06
610-b	0.05	0.05	0.05	0.05	0.06	0.06
610-1	0.05	0.05	0.05	0.05	0.06	0.06
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1454-1	0	0	0	0	0	0.01
EBS1454-2	0	0	0	0	0	0.01
EBS1454-3	0	0	0	0	0	0.01
EBS1454-4	0	0	0	0	0	0.01
EBS815-1	0	0	0	0	0	0
EBS815-2	0	0	0	0	0	0
EBS815-3	0	0	0	0	0	0
EBS815-4	0	0	0	0	0	0
EBS1236-1	0	0	0	0	0	0
EBS1236-2	0	0	0	0	0	0
EBS1236-3	0	0	0	0	0	0
EBS1236-4	0	0	0	0	0	0
EBS1289-1	0	0	0	0	0	0.01
EBS1289-2	0	0	0	0	0	0.01
EBS1289-3	0	0	0	0	0	0
EBS1289-4	0	0	0	0	0	0
EBS210-1	0	0	0	0	0	0
EBS210-2	0	0	0	0	0	0
EBS210-3	0	0	0	0	0	0
EBS210-4	0	0	0	0	0	0
610-2	0.05	0.05	0.05	0.05	0.06	0.06
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1429-1	0	0	0	0	0	0.02
EBS1429-2	0	0	0	0	0	0.02
EBS1429-3	0	0	0	0	0	0.01
EBS1429-4	0	0	0	0	0	0.01
EBS281-1	0	0	0	0	0	0.01
EBS281-2	0	0	0	0	0	0
EBS281-3	0	0	0	0	0	0
EBS281-4	0	0	0	0	0	0
EBS1072-1	0	0	0	0	0	0
EBS1072-2	0	0	0	0	0	0
EBS1072-3	0	0	0	0	0	0
EBS1072-4	0	0	0	0	0	0
EBS170-1	0	0	0	0	0	0
EBS170-2	0	0	0	0	0	0
EBS170-3	0	0	0	0	0	0
EBS170-4	0	0	0	0	0	0

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
EBS67-1	0	0	0	0	0	0
EBS67-2	0	0	0	0	0	0
EBS67-3	0	0	0	0	0	0
EBS67-4	0	0	0	0	0	0
EBS359-1	0	0	0	0	0	0.03
EBS359-2	0	0	0	0	0	0.06
EBS359-3	0	0	0	0	0	0.02
EBS359-4	0	0	0	0	0	0.02
610-3	0.05	0.05	0.05	0.05	0.06	0.06
612-3	0	0	0	0	0	0.01
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS153-1	0	0	0	0	0	0
EBS153-2	0	0	0	0	0	0
EBS153-3	0	0	0	0	0	0
EBS153-4	0	0	0	0	0	0
EBS1127-1	0	0	0	0	0	0.45
EBS1127-2	0	0	0	0	0	0.37
EBS1127-3	0	0	0	0	0	0.21
EBS1127-4	0	0	0	0	0	0.14
EBS1030-1	0	0	0	0	0	0.02
EBS1030-2	0	0	0	0	0	0.03
EBS1030-3	0	0	0	0	0	0.03
EBS1030-4	0	0	0	0	0	0.03
EBS303-1	0	0	0	0	0	0
EBS303-2	0	0	0	0	0	0
EBS303-3	0	0	0	0	0	0.01
EBS303-4	0	0	0	0	0	0
EBS212-1	0	0	0	0	0	0
EBS212-2	0	0	0	0	0	0
EBS212-3	0	0	0	0	0	0
EBS212-4	0	0	0	0	0	0
EBS216-1	0	0	0	0	0	0
EBS216-2	0	0	0	0	0	0
EBS216-3	0	0	0	0	0	0
EBS216-4	0	0	0	0	0	0
610-4	0.05	0.06	0.05	0.05	0.06	0.06
612-4	0	0	0	0	0	0.01
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS1056-1	0	0	0	0	0	0.09
EBS1056-2	0	0	0	0	0	0.09
EBS1056-3	0	0	0	0	0	0.09
EBS1056-4	0	0	0	0	0	0.08
EBS947-1	0	0	0	0	0	0.03
EBS947-2	0	0	0	0	0	0.04

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
EBS947-3	0	0	0	0	0	0.03
EBS947-4	0	0	0	0	0	0.04
EBS1145-1	0	0	0	0	0	0.01
EBS1145-2	0	0	0	0	0	0.01
EBS1145-3	0	0	0	0	0	0.01
EBS1145-4	0	0	0	0	0	0.01
610-5	0.05	0.06	0.05	0.06	0.06	0.06
612-5	0	0	0	0	0	0.01
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.05	0.05	0.05	0.05	0.05	0.05
610-b	0.04	0.05	0.05	0.05	0.05	0.05
610-1	0.05	0.05	0.05	0.05	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS1522-1	0	0	0	0	0	0
EBS1522-2	0	0	0	0	0	0
EBS1522-3	0	0	0	0	0	0
EBS1522-4	0	0	0	0	0	0
EBS1432-1	0	0	0	0	0	0
EBS1432-2	0	0	0	0	0	0
EBS1432-3	0	0	0	0	0	0
EBS1432-4	0	0	0	0	0	0
EBS30-1	0	0	0	0	0	0.01
EBS30-2	0	0	0	0	0	0.01
EBS30-3	0	0	0	0	0	0.01
EBS30-4	0	0	0	0	0	0
EBS1257-1	0	0	0	0	0	0
EBS1257-2	0	0	0	0	0	0
EBS1257-3	0	0	0	0	0	0
EBS1257-4	0	0	0	0	0	0
EBS1320-1	0	0	0	0	0	0.02
EBS1320-2	0	0	0	0	0	0.01
EBS1320-3	0	0	0	0	0	0.02
EBS1320-4	0	0	0	0	0	0.02
610-2	0.05	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS1269-1	0	0	0	0	0	0.01
EBS1269-2	0	0	0	0	0	0.02
EBS1269-3	0	0	0	0	0	0.01
EBS1269-4	0	0	0	0	0	0.01
EBS16-1	0	0	0	0	0	0

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
EBS16-2	0	0	0	0	0	0.02
EBS16-3	0	0	0	0	0	0
EBS16-4	0	0	0	0	0	0
EBS1231-1	0	0	0	0	0	0
EBS1231-2	0	0	0	0	0	0
EBS1231-3	0	0	0	0	0	0
EBS1231-4	0	0	0	0	0	0
EBS1197-1	0	0	0	0	0	0
EBS1197-2	0	0	0	0	0	0
EBS1197-3	0	0	0	0	0	0
EBS1197-4	0	0	0	0	0	0
EBS1343-1	0	0	0	0	0	0
EBS1343-2	0	0	0	0	0	0
EBS1343-3	0	0	0	0	0	0
EBS1343-4	0	0	0	0	0	0
610-3	0.05	0.05	0.05	0.05	0.05	0.06
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS1455-1	0	0	0	0	0	0
EBS1455-2	0	0	0	0	0	0
EBS1455-3	0	0	0	0	0	0
EBS1455-4	0	0	0	0	0	0
EBS1392-1	0	0	0	0	0	0.03
EBS1392-2	0	0	0	0	0	0.04
EBS1392-3	0	0	0	0	0	0.03
EBS1392-4	0	0	0	0	0	0.04
EBS1339-1	0	0	0	0	0	0
EBS1339-2	0	0	0	0	0	0
EBS1339-3	0	0	0	0	0	0
EBS1339-4	0	0	0	0	0	0
EBS1345-1	0	0	0	0	0	0
EBS1345-2	0	0	0	0	0	0
EBS1345-3	0	0	0	0	0	0
EBS1345-4	0	0	0	0	0	0
EBS786-1	0	0	0	0	0	0
EBS786-2	0	0	0	0	0	0
EBS786-3	0	0	0	0	0	0
EBS786-4	0	0	0	0	0	0
EBS273-1	0	0	0	0	0	0.01
EBS273-2	0	0	0	0	0	0.01
EBS273-3	0	0	0	0	0	0
EBS273-4	0	0	0	0	0	0
610-4	0.05	0.05	0.05	0.05	0.05	0.06
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
UCSC-G-4	0	0	0	0	0	0
EBS1061-1	0	0	0	0	0	0
EBS1061-2	0	0	0	0	0	0.01
EBS1061-3	0	0	0	0	0	0
EBS1061-4	0	0	0	0	0	0.01
EBS188-1	0	0	0	0	0	0.03
EBS188-2	0	0	0	0	0	0.02
EBS188-3	0	0	0	0	0	0.02
EBS188-4	0	0	0	0	0	0.01
EBS211-1	0	0	0	0	0	0.01
EBS211-2	0	0	0	0	0	0
EBS211-3	0	0	0	0	0	0
EBS211-4	0	0	0	0	0	0
EBS137-1	0	0	0	0	0	0
EBS137-2	0	0	0	0	0	0
EBS137-3	0	0	0	0	0	0
EBS137-4	0	0	0	0	0	0
EBS161-1	0	0	0	0	0	0.02
EBS161-2	0	0	0	0	0	0.02
EBS161-3	0	0	0	0	0	0.02
EBS161-4	0	0	0	0	0	0.02
EBS220-1	0	0	0	0	0	0
EBS220-2	0	0	0	0	0	0
EBS220-3	0	0	0	0	0	0
EBS220-4	0	0	0	0	0	0
610-5	0.05	0.05	0.05	0.05	0.05	0.06
612-5	0	0	0	0	0	0.01
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0
610-a	0.04	0.04	0.04	0.04	0.04	0.05
610-b	0.04	0.04	0.04	0.04	0.05	0.05
610-1	0.04	0.04	0.04	0.04	0.04	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0	0	0	0
CMG-C-1	0	0	0	0	0	0
UCSC-G-1	0	0	0	0	0	0
EBS250-1	0	0	0	0	0	0
EBS250-2	0	0	0	0	0	0
EBS250-3	0	0	0	0	0	0
EBS250-4	0	0	0	0	0	0
EBS1037-1	0	0	0	0	0	0.01
EBS1037-2	0	0	0	0	0	0.01
EBS1037-3	0	0	0	0	0	0
EBS1037-4	0	0	0	0	0	0
EBS890-1	0	0	0	0	0	0.01
EBS890-2	0	0	0	0	0	0
EBS890-3	0	0	0	0	0	0.01

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
EBS890-4	0	0	0	0	0	0
EBS1173-1	0	0	0	0	0	0
EBS1173-2	0	0	0	0	0	0
EBS1173-3	0	0	0	0	0	0
EBS1173-4	0	0	0	0	0	0
EBS209-1	0	0	0	0	0	0
EBS209-2	0	0	0	0	0	0
EBS209-3	0	0	0	0	0	0
EBS209-4	0	0	0	0	0	0
610-2	0.04	0.05	0.05	0.05	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0	0	0	0
CMG-C-2	0	0	0	0	0	0
UCSC-G-2	0	0	0	0	0	0
EBS948-1	0	0	0	0	0	0
EBS948-2	0	0	0	0	0	0
EBS948-3	0	0	0	0	0	0
EBS948-4	0	0	0	0	0	0
EBS956-1	0	0	0	0	0	0
EBS956-2	0	0	0	0	0	0
EBS956-3	0	0	0	0	0	0
EBS956-4	0	0	0	0	0	0
EBS975-1	0	0	0	0	0	0
EBS975-2	0	0	0	0	0	0
EBS975-3	0	0	0	0	0	0.01
EBS975-4	0	0	0	0	0	0
EBS302-1	0	0	0	0	0	0.01
EBS302-2	0	0	0	0	0	0.01
EBS302-3	0	0	0	0	0	0
EBS302-4	0	0	0	0	0	0
EBS429-1	0	0	0	0	0	0
EBS429-2	0	0	0	0	0	0
EBS429-3	0	0	0	0	0	0
EBS429-4	0	0	0	0	0	0
610-3	0.05	0.05	0.05	0.05	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0	0	0	0
CMG-C-3	0	0	0	0	0	0
UCSC-G-3	0	0	0	0	0	0
EBS979-1	0	0	0	0	0	0.01
EBS979-2	0	0	0	0	0	0.01
EBS979-3	0	0	0	0	0	0
EBS979-4	0	0	0	0	0	0
EBS1587-1	0	0	0	0	0	0
EBS1587-2	0	0	0	0	0	0
EBS1587-3	0	0	0	0	0	0
EBS1587-4	0	0	0	0	0	0
EBS1582-1	0	0	0	0	0	0.01

Inventory Number/ Run	169Tm	172Yb	175Lu	178Hf	181Ta	182W
EBS1582-2	0	0	0	0	0	0
EBS1582-3	0	0	0	0	0	0.01
EBS1582-4	0	0	0	0	0	0
EBS235-1	0	0	0	0	0	0.01
EBS235-2	0	0	0	0	0	0.01
EBS235-3	0	0	0	0	0	0.01
EBS235-4	0	0	0	0	0	0
EBS1039-1	0	0	0	0	0	0
EBS1039-2	0	0	0	0	0	0
EBS1039-3	0	0	0	0	0	0
EBS1039-4	0	0	0	0	0	0
610-4	0.05	0.05	0.05	0.05	0.05	0.06
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0	0	0	0
CMG-C-4	0	0	0	0	0	0
UCSC-G-4	0	0	0	0	0	0
EBS200-1	0	0	0	0	0	0
EBS200-2	0	0	0	0	0	0
EBS200-3	0	0	0	0	0	0
EBS200-4	0	0	0	0	0	0
EBS1064-1	0	0	0	0	0	0
EBS1064-2	0	0	0	0	0	0
EBS1064-3	0	0	0	0	0	0
EBS1064-4	0	0	0	0	0	0
EBS76-1	0	0	0	0	0	0
EBS76-2	0	0	0	0	0	0
EBS76-3	0	0	0	0	0	0
EBS76-4	0	0	0	0	0	0
EBS744-1	0	0	0	0	0	0.07
EBS744-2	0	0	0	0	0	0.05
EBS744-3	0	0	0	0	0	0.08
EBS744-4	0	0	0	0	0	0.06
EBS1206-1	0	0	0	0	0	0
EBS1206-2	0	0	0	0	0	0
EBS1206-3	0	0	0	0	0	0
EBS1206-4	0	0	0	0	0	0
610-5	0.05	0.05	0.05	0.06	0.06	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0	0	0	0
CMG-C-5	0	0	0	0	0	0
UCSC-G-5	0	0	0	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
610-a	0	0.01	0.03	0.04	0.05	0.05
610-b	0	0.01	0.03	0.04	0.05	0.05
610-1	0	0.01	0.04	0.04	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0.43	0	0	0
CMG-C-1	0	0	34.22	0.01	0	0
UCSC-G-1	0	0	42.99	0	0	0
EBS1454-1	0	0	0.1	0	0	0
EBS1454-2	0	0	0.06	0	0	0
EBS1454-3	0	0	0.06	0	0	0
EBS1454-4	0	0	0.04	0	0	0
EBS815-1	0	0	0.03	0	0	0
EBS815-2	0	0	0.03	0	0	0
EBS815-3	0	0	0.02	0	0	0
EBS815-4	0	0	0.03	0	0	0
EBS1236-1	0	0	0.14	0	0	0
EBS1236-2	0	0	0.17	0	0	0
EBS1236-3	0	0	0.16	0	0	0
EBS1236-4	0	0	0.17	0	0	0
EBS1289-1	0	0	0.02	0	0	0
EBS1289-2	0	0	0.02	0	0	0
EBS1289-3	0	0	0.02	0	0	0
EBS1289-4	0	0	0.02	0	0	0
EBS210-1	0	0	5.11	0	0	0
EBS210-2	0	0	4.73	0	0	0
EBS210-3	0	0	2.39	0	0	0
EBS210-4	0	0	4.51	0	0	0
610-2	0	0.01	0.04	0.04	0.05	0.06
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0.44	0	0	0
CMG-C-2	0	0	35.35	0.01	0	0
UCSC-G-2	0	0	43.68	0	0	0
EBS1429-1	0	0	4.67	0	0	0
EBS1429-2	0	0	4.87	0	0	0
EBS1429-3	0	0	3.05	0	0	0
EBS1429-4	0	0	4.19	0	0	0
EBS281-1	0	0	0	0	0	0
EBS281-2	0	0	0	0	0	0
EBS281-3	0	0	0	0	0	0
EBS281-4	0	0	0	0	0	0
EBS1072-1	0	0	0.01	0	0	0
EBS1072-2	0	0	0.02	0	0	0
EBS1072-3	0	0	0.04	0	0	0
EBS1072-4	0	0	0.02	0	0	0
EBS170-1	0	0	0	0	0	0
EBS170-2	0	0	0.01	0	0	0
EBS170-3	0	0	0.01	0	0	0
EBS170-4	0	0	0.01	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
EBS67-1	0	0	2.26	0	0	0
EBS67-2	0	0	3.55	0	0	0
EBS67-3	0	0	2.54	0	0	0
EBS67-4	0	0	3.41	0	0	0
EBS359-1	0	0	0.01	0	0	0
EBS359-2	0	0	0.01	0	0	0
EBS359-3	0	0	0.01	0	0	0
EBS359-4	0	0	0.02	0	0	0
610-3	0	0.01	0.04	0.04	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0.47	0	0	0
CMG-C-3	0	0	36.12	0	0	0
UCSC-G-3	0	0	43.97	0	0	0
EBS153-1	0	0	13.37	0	0	0
EBS153-2	0	0	14.01	0	0	0
EBS153-3	0	0	14.24	0	0	0
EBS153-4	0	0	14.14	0	0	0
EBS1127-1	0	0	0.05	0	0	0
EBS1127-2	0	0	0.05	0	0	0
EBS1127-3	0	0	0.04	0	0	0
EBS1127-4	0	0	0.03	0	0	0
EBS1030-1	0	0	8.56	0	0	0
EBS1030-2	0	0	8.19	0	0	0
EBS1030-3	0	0	8	0	0	0
EBS1030-4	0	0	7.64	0	0	0
EBS303-1	0	0	0.03	0	0	0
EBS303-2	0	0	0.04	0	0	0
EBS303-3	0	0	0.03	0	0	0
EBS303-4	0	0	0.02	0	0	0
EBS212-1	0	0	5.05	0	0	0
EBS212-2	0	0	9.6	0	0	0
EBS212-3	0	0	6.39	0	0	0
EBS212-4	0	0	10.1	0	0	0
EBS216-1	0	0	0.4	0	0	0
EBS216-2	0	0	0.67	0	0	0
EBS216-3	0	0	0.3	0	0	0
EBS216-4	0	0	0.44	0	0	0
610-4	0	0.01	0.05	0.04	0.05	0.06
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0.46	0	0	0
CMG-C-4	0	0	36.34	0	0	0
UCSC-G-4	0	0	44.46	0	0	0
EBS1056-1	0	0	29.38	0	0	0
EBS1056-2	0	0	29.14	0	0	0
EBS1056-3	0	0	29.43	0	0	0
EBS1056-4	0	0	28.36	0	0	0
EBS947-1	0	0	22.54	0	0	0
EBS947-2	0	0	25.64	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
EBS947-3	0	0	24.77	0	0	0
EBS947-4	0	0	27.74	0	0	0
EBS1145-1	0	0	1.03	0	0	0
EBS1145-2	0	0	1.36	0	0	0
EBS1145-3	0	0	1.06	0	0	0
EBS1145-4	0	0	1.4	0	0	0
610-5	0	0.01	0.04	0.04	0.05	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0.46	0	0	0
CMG-C-5	0	0	36.59	0	0	0
UCSC-G-5	0	0	44.55	0	0	0
610-a	0	0.01	0.11	0.04	0.05	0.05
610-b	0	0.01	0.03	0.04	0.05	0.05
610-1	0	0.01	0.03	0.04	0.05	0.05
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0.43	0	0	0
CMG-C-1	0	0	34.8	0	0	0
UCSC-G-1	0	0	42.09	0	0	0
EBS1522-1	0	0	1.42	0	0	0
EBS1522-2	0	0	1.85	0	0	0
EBS1522-3	0	0	0.99	0	0	0
EBS1522-4	0	0	2.81	0	0	0
EBS1432-1	0	0	0	0	0	0
EBS1432-2	0	0	0	0	0	0
EBS1432-3	0	0	0	0	0	0
EBS1432-4	0	0	0	0	0	0
EBS30-1	0	0	0.12	0	0	0
EBS30-2	0	0	0.15	0	0	0
EBS30-3	0	0	0.11	0	0	0
EBS30-4	0	0	0.14	0	0	0
EBS1257-1	0	0	0.9	0	0	0
EBS1257-2	0	0	1.06	0	0	0
EBS1257-3	0	0	1.02	0	0	0
EBS1257-4	0	0	1.06	0	0	0
EBS1320-1	0	0	0.15	0	0	0
EBS1320-2	0	0	0.13	0	0	0
EBS1320-3	0	0	0.14	0	0	0
EBS1320-4	0	0	0.11	0	0	0
610-2	0	0.01	0.04	0.04	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0.45	0	0	0
CMG-C-2	0	0	35.88	0	0	0
UCSC-G-2	0	0	43.83	0	0	0
EBS1269-1	0	0	2.07	0	0	0
EBS1269-2	0	0	2.45	0	0	0
EBS1269-3	0	0	2.26	0	0	0
EBS1269-4	0	0	3.99	0	0	0
EBS16-1	0	0	0.28	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
EBS16-2	0	0	0.33	0	0	0
EBS16-3	0	0	0.01	0	0	0
EBS16-4	0	0	0.02	0	0	0
EBS1231-1	0	0	0.02	0	0	0
EBS1231-2	0	0	-0.05	0	0	0
EBS1231-3	0	0	0.04	0	0	0
EBS1231-4	0	0	0.01	0	0	0
EBS1197-1	0	0	0.05	0	0.01	0
EBS1197-2	0	0	0.05	0	0	0
EBS1197-3	0	0	0.1	0	0	0
EBS1197-4	0	0	0.1	0	0	0
EBS1343-1	0	0	2.93	0	0	0
EBS1343-2	0	0	4.26	0	0	0
EBS1343-3	0	0	2.67	0	0	0
EBS1343-4	0	0	6.38	0	0	0
610-3	0	0.01	0.04	0.04	0.05	0.05
612-3	0	0	0	0	0	0
CMG-B-3	0	0	0.47	0	0	0
CMG-C-3	0	0	36.63	0	0	0
UCSC-G-3	0	0	44.38	0	0	0
EBS1455-1	0	0	5.96	0	0	0
EBS1455-2	0	0	6.83	0	0	0
EBS1455-3	0	0	5.08	0	0	0
EBS1455-4	0	0	6.8	0	0	0
EBS1392-1	0	0	11.15	0	0	0
EBS1392-2	0	0	10.12	0	0	0
EBS1392-3	0	0	6.38	0	0	0
EBS1392-4	0	0	6.22	0	0	0
EBS1339-1	0	0	4.14	0	0	0
EBS1339-2	0	0	4.89	0	0	0
EBS1339-3	0	0	4.14	0	0	0
EBS1339-4	0	0	5.94	0	0	0
EBS1345-1	0	0	0.72	0	0	0
EBS1345-2	0	0	1.3	0	0	0
EBS1345-3	0	0	0.14	0	0	0
EBS1345-4	0	0	0.28	0	0	0
EBS786-1	0	0	0.01	0	0	0
EBS786-2	0	0	0.01	0	0	0
EBS786-3	0	0	0	0	0	0
EBS786-4	0	0	0.01	0	0	0
EBS273-1	0	0	0	0	0	0
EBS273-2	0	0	0.01	0	0	0
EBS273-3	0	0	-0.24	0	0	0
EBS273-4	0	0	0	0	0	0
610-4	0	0.01	0.04	0.04	0.05	0.06
612-4	0	0	0.01	0	0	0
CMG-B-4	0	0	0.48	0	0	0
CMG-C-4	0	0	36.64	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
UCSC-G-4	0	0	44.72	0	0	0
EBS1061-1	0	0	0.42	0	0	0
EBS1061-2	0	0	1.07	0	0	0
EBS1061-3	0	0	0.55	0	0	0
EBS1061-4	0	0	1.28	0	0	0
EBS188-1	0	0	0.02	0	0	0
EBS188-2	0	0	0.02	0	0	0
EBS188-3	0	0	0.01	0	0	0
EBS188-4	0	0	0.02	0	0	0
EBS211-1	0	0	1.51	0	0	0
EBS211-2	0	0	7.53	0	0	0
EBS211-3	0	0	1.87	0	0	0
EBS211-4	0	0	7.11	0	0	0
EBS137-1	0	0	0.26	0	0	0
EBS137-2	0	0	0.31	0	0	0
EBS137-3	0	0	0.25	0	0	0
EBS137-4	0	0	0.3	0	0	0
EBS161-1	0	0	0.26	0	0	0
EBS161-2	0	0	0.23	0	0	0
EBS161-3	0	0	0.21	0	0	0
EBS161-4	0	0	0.21	0	0	0
EBS220-1	0	0	0.21	0	0	0
EBS220-2	0	0	0.53	0	0	0
EBS220-3	0	0	0.21	0	0	0
EBS220-4	0	0	0.43	0	0	0
610-5	0	0.01	0.04	0.05	0.06	0.06
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0.48	0	0	0
CMG-C-5	0	0	37.56	0	0	0
UCSC-G-5	0	0	45.45	0	0	0
610-a	0	0.01	0.03	0.04	0.05	0.04
610-b	0	0.01	0.03	0.04	0.05	0.04
610-1	0	0.01	0.03	0.04	0.05	0.04
612-1	0	0	0	0	0	0
CMG-B-1	0	0	0.41	0	0	0
CMG-C-1	0	0	34.77	0	0	0
UCSC-G-1	0	0	42.54	0	0	0
EBS250-1	0	0	20.38	0	0	0
EBS250-2	0	0	26.96	0	0	0
EBS250-3	0	0	18.25	0	0	0
EBS250-4	0	0	21.05	0	0	0
EBS1037-1	0	0	23.1	0	0	0
EBS1037-2	0	0	26.96	0	0	0
EBS1037-3	0	0	23.93	0	0	0
EBS1037-4	0	0	24.43	0	0	0
EBS890-1	0	0	0.8	0	0	0
EBS890-2	0	0	1.07	0	0	0
EBS890-3	0	0	0.74	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
EBS890-4	0	0	1.2	0	0	0
EBS1173-1	0	0	0	0	0	0
EBS1173-2	0	0	0	0	0	0
EBS1173-3	0	0	0	0	0	0
EBS1173-4	0	0	0	0	0	0
EBS209-1	0	0	0.8	0	0	0
EBS209-2	0	0	1.46	0	0	0
EBS209-3	0	0	0.69	0	0	0
EBS209-4	0	0	1.27	0	0	0
610-2	0	0.01	0.04	0.04	0.05	0.05
612-2	0	0	0	0	0	0
CMG-B-2	0	0	0.46	0	0	0
CMG-C-2	0	0	36.85	0	0	0
UCSC-G-2	0	0	44.41	0	0	0
EBS948-1	0	0	0.2	0	0	0
EBS948-2	0	0	0.62	0	0	0
EBS948-3	0	0	0.17	0	0	0
EBS948-4	0	0	0.29	0	0	0
EBS956-1	0	0	0.01	0	0	0
EBS956-2	0	0	0.01	0	0	0
EBS956-3	0	0	0.01	0	0	0
EBS956-4	0	0	0.01	0	0	0
EBS975-1	0	0	0	0	0	0
EBS975-2	0	0	0	0	0	0
EBS975-3	0	0	0	0	0	0
EBS975-4	0	0	0	0	0	0
EBS302-1	0	0	0.14	0	0	0
EBS302-2	0	0	0.03	0	0	0
EBS302-3	0	0	0.02	0	0	0
EBS302-4	0	0	0.01	0	0	0
EBS429-1	0	0	0.01	0	0	0
EBS429-2	0	0	0.01	0	0	0
EBS429-3	0	0	0.01	0	0	0
EBS429-4	0	0	0.01	0	0	0
610-3	0	0.01	0.04	0.04	0.05	0.05
612-3	0	0	0.01	0	0	0
CMG-B-3	0	0	0.47	0	0	0
CMG-C-3	0	0	37.06	0	0	0
UCSC-G-3	0	0	44.94	0	0	0
EBS979-1	0	0	0	0	0	0
EBS979-2	0	0	0	0	0	0
EBS979-3	0	0	0	0	0	0
EBS979-4	0	0	0	0	0	0
EBS1587-1	0	0	0.03	0	0	0
EBS1587-2	0	0	0.05	0	0	0
EBS1587-3	0	0	0.02	0	0	0
EBS1587-4	0	0	0.06	0	0	0
EBS1582-1	0	0	0.99	0	0	0

Inventory Number/ Run	197Au	205Tl	208Pb	209Bi	232Th	238U
EBS1582-2	0	0	1.13	0	0	0
EBS1582-3	0	0	0.77	0	0	0
EBS1582-4	0	0	0.92	0	0	0
EBS235-1	0	0	0.62	0	0	0
EBS235-2	0	0	3.15	0	0	0
EBS235-3	0	0	1.11	0	0	0
EBS235-4	0	0	2.72	0	0	0
EBS1039-1	0	0	0.01	0	0	0
EBS1039-2	0	0	0.01	0	0	0
EBS1039-3	0	0	0.01	0	0	0
EBS1039-4	0	0	0.01	0	0	0
610-4	0	0.01	0.04	0.05	0.06	0.05
612-4	0	0	0	0	0	0
CMG-B-4	0	0	0.51	0	0	0
CMG-C-4	0	0	38.03	0	0	0
UCSC-G-4	0	0	45.58	0	0	0
EBS200-1	0	0	2.68	0	0	0
EBS200-2	0	0	5.07	0	0	0
EBS200-3	0	0	5.35	0	0	0
EBS200-4	0	0	1.65	0	0	0
EBS1064-1	0	0	0.62	0	0	0
EBS1064-2	0	0	1.58	0	0	0
EBS1064-3	0	0	4.78	0	0	0
EBS1064-4	0	0	7.11	0	0	0
EBS76-1	0	0	0.03	0	0	0
EBS76-2	0	0	0.06	0	0	0
EBS76-3	0	0	0.07	0	0	0
EBS76-4	0	0	0.26	0	0	0
EBS744-1	0	0	6.26	0.02	0	0
EBS744-2	0	0	6.29	0.01	0	0
EBS744-3	0	0	6.65	0.01	0	0
EBS744-4	0	0	6.95	0.01	0	0
EBS1206-1	0	0	0.22	0	0	0
EBS1206-2	0	0	0.1	0	0	0
EBS1206-3	0	0	0.21	0	0.01	0
EBS1206-4	0	0	0.09	0	0	0
610-5	0	0.01	0.04	0.05	0.06	0.05
612-5	0	0	0	0	0	0
CMG-B-5	0	0	0.51	0	0	0
CMG-C-5	0	0	38.59	0	0	0
UCSC-G-5	0	0	46.1	0	0	0

Table: I.1: Raw data for laser ablation-inductively couple mass spectrometry (LA-ICP-MS).

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