# FROM SHERDS TO SOCIETY:

An Analysis of Kwahe'e Black-on-white and Social Interactions in the Taos District

By Hannah Xiao

**Abstract:** Kwahe'e Black-on-white (Kwahe'e B/W), the earliest decorated ceramic in the Taos region, is a significant indicator of cultural interactions and exchange networks. This study analyzes the production and exchange patterns of Kwahe'e B/W sherds, exploring social interactions and trade networks within the Taos District. The compositional analysis examines pottery sherds from the Eagle Pile and Cerrita sites using portable X-ray fluorescence (pXRF), while the typological analysis generates Kwahe'e B/W ratios within the assemblage and compares the Eagle Pile data with two recorded pottery databases from Pot Creek Pueblo and Old Taos. Through the ceramic analysis, I argue that there is a local production pattern and distinct Kwahe'e B/W compositions across sites. The similarities in Kwahe'e B/W ratios may stem from similar production techniques, common pot usage, shared cultural practices, or trade networks, suggesting cultural connections in the Taos District.

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**Section 1. Introduction**

Centuries prior to the modern world's recognition of the Taos District, a local myth spoke of two distinct groups of people who inhabited the area. The Summer people celebrated the warmth and light of the sun, engaging in activities like farming, gathering wild plants and roots, and other related tasks, while the Winter people found comfort in the cold and preferred activities such as storytelling, pottery making, and tanning hides. The Winter people resided in the northern region of the Taos District, while the Summer people occupied the southern part.

The Winter people were the initial settlers in the area, building their homes, developing their language, and creating their unique culture. Eventually, the Summer people arrived and brought their way of life with them. As their population increased, they began to assert their dominance over the region, constructing larger communities and cultivating land for farming. However, the distinct differences in their seasonal cultures and their disagreements over food exchanges created tensions that led to open conflict. During a fierce battle that lasted several days, the Summer people were armed with bows and arrows, while the Winter people fought with stone knives and clubs. The Summer people succeeded in driving the Winter people not only from their village but into their kiva (Fowles 2004, 112-113). The indigenous account of winter/summer dualism is a significant part of the Taos oral history documents, reflecting the complex cultural dynamics of the region.

The Puebloan community does not possess a single history, but instead, comprises an accumulation of voices from various languages passed down through generations via folklore, memories, songs, and material culture. The myth of the Summer and Winter people not only serves as a local narrative of the past but also forms the conceptual basis for the Taos community. The different populations in the myth correspond closely to the social and ceremonial groups in

current Puebloan communities, providing a framework for understanding the cultural dynamics in the Taos District. The Taos District can be seen as a meeting point between at least two distinct cultural traditions, one with stronger connections to the western Plains while the other ties more closely to the Ancestral Pueblo culture (Fowles 2004, 189). This myth lays the foundation for archaeological discussions of the prehistory of the Puebloan community, revealing the development of culture and social dynamics within the Taos District.

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To further unveil the hidden history of the Taos District, I employ an archaeological lens in this thesis and study the pottery production and trade in the Taos District during the Valdez Phase (A.D. 900 - 1190), exploring the history of relations between the populations living in the area. This thesis involved a month-long excavation research project at the Eagle Pile site within the Taos District, New Mexico, near one of the ancestral homes of the Northern Tiwa, Picuris Pueblo (Fig 1). Our team unearthed a plethora of artifacts in a picturesque setting amidst the Rio

Grande and evergreen forests. Local residents, including Richard Mermejo, a former governor and native storyteller, provided valuable assistance in artifact identification and shared personal anecdotes and local stories, deepening our understanding of the area's buried history.

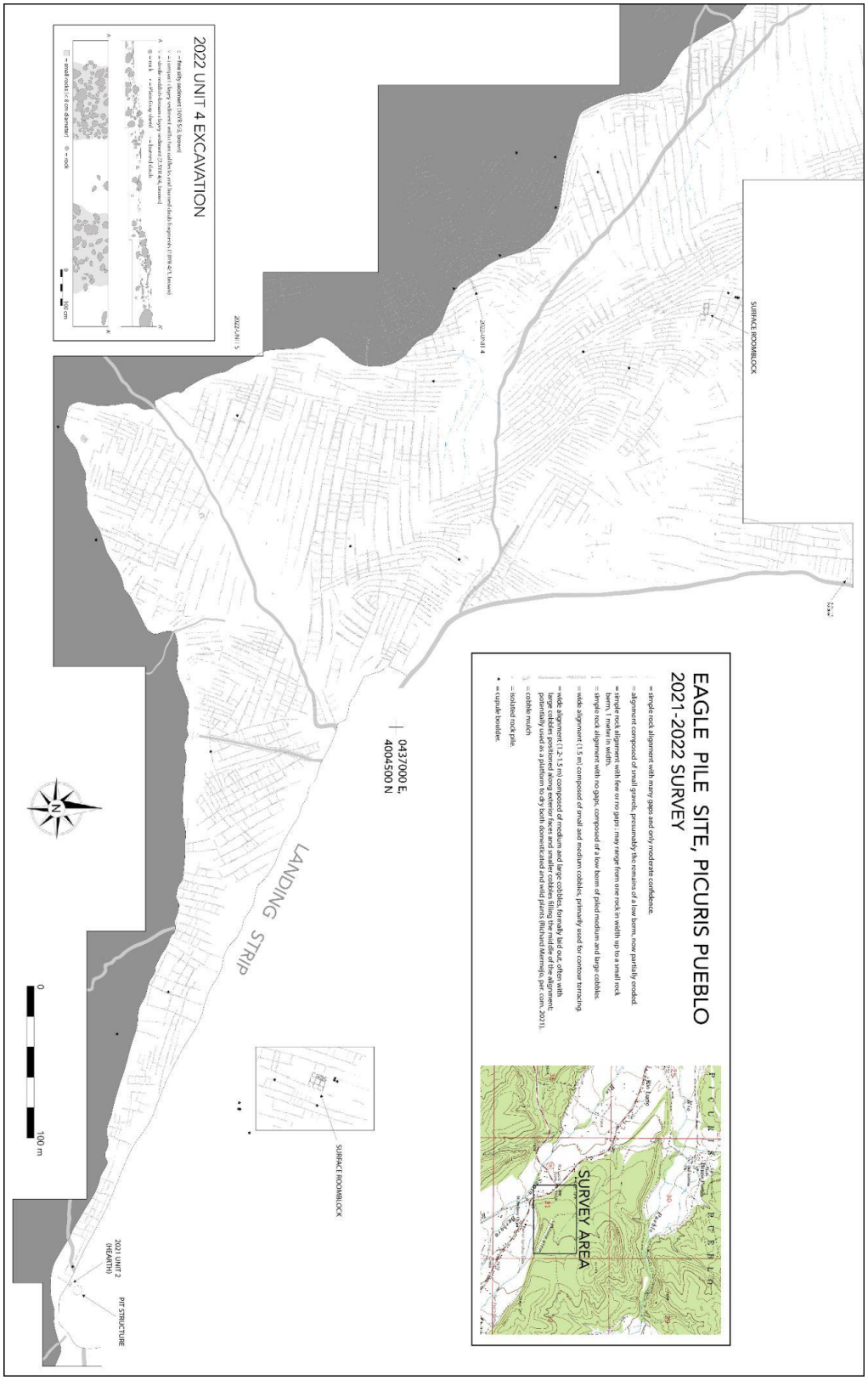


Fig 1. Map of the Eagle Pile Site. (Produced by Fowles, 2022)

The archaeological study of ceramics is of considerable research interest because it helps explore the social, economic, and cultural interactions between Puebloan communities, as well as clarify the origins of inter-group connections. Until now, only a small number of examinations of the chemical composition of ceramics from the Developmental period (AD 600-1200) in the Northern Rio Grande region, where the Taos District is located, have been conducted (Fowles 2004; Fowles et al. 2007). To better understand the cultural history of the Taos District, this thesis focuses on material remains collected in our excavation and aims to piece together Picuris' prehistory, contributing to a broader understanding of the multifaceted history of the Taos District. The excavated pottery at the Eagle Pile site mainly consisted of plain gray wares, whitewares, Smeared Indented Corrugated, Taos Incised, and Kwahe'e Black-on-white (Kwahe'e B/W). In particular, this thesis focuses on Kwahe'e B/W, a whiteware painted with geometric designs in black mineral slip (Wilson 2012). The focus on Kwahe'e B/W wares allows us to examine the social dynamics of a poorly understood period in this region: the Valdez Phase.

The Valdez Phase represents a crucial cultural period, as it signifies an early phase of Puebloan activity in the Taos region. It is defined materially by the presence of Taos Black-on-White (Taos B/W) pottery and, arguably, Kwahe'e B/W pottery (Boyer 1997, 388). The distinction between Taos B/W and Kwahe'e B/W is discussed in Section 1.3. Wetherington (1968) first referred to the "Valdez phase" as the initial Ancestral Pueblo occupation of the region and examined the large Pueblos within the Ancestral Pueblo settlement. Excavations of pithouses and ceramics during the Valdez Phase provide archaeological evidence that complements the origin story of the Pueblo community and its evolutionary trajectory. By further exploring the painted pottery types, particularly Kwahe'e B/W as diagnostic evidence of this period, we can also evaluate their significance to the cultural phase.

The chronology of the Valdez Phase (AD 900-1190) is relatively vague when compared to the subsequent two phases, the Pot Creek (AD 1190-1260) and Talpa (AD 1260-1321). The time periods of the latter two phases are much shorter and clearly dated, and hold significant physical evidence of population displacement. For example, both the number of sites and the count of rooms indicate that the population experienced a tenfold growth in a 600 square mile area in the northern Rio Grande region in the Pot Creek Phase (Stuart and Gauthier 1988, 51). The Talpa phase is characterized by population aggregation along the Rio Grande del Rancho drainage and the founding of "a large village of some 350 ground story rooms"(Fowles 2004, 404). Since the definition of the Valdez Phase heavily relies on Kwahe'e B/W, the ambiguity in the manufacture of Kwahe'e B/W and its origins impacts the dating of the Valdez Phase.

Additionally, more research on Kwahe’e B/W might help solve the existing theoretical contradictions. For example, there is little evidence to prove that early Valdez occupants exerted much effort in producing Kwahe'e B/W, as the black-on-whites ratio versus other types of assemblages, such as plain and incised ceramics, is low in the northern Rio Grande region. This contradicts the idea that Kwahe'e B/W should be in intense production during the Valdez phase, casting doubt on whether the actual local production of black-on-whites occurred at the beginning of the Valdez Phase in the Northeast Pueblo Region. Moreover, due to the vagueness in the typological classification of Kwahe'e B/W (discussed in Section 1.3), the estimated time range for the Valdez Phase spans two centuries. Such an extended timeframe weakens the evaluation of social dynamics and culture change in the Southwest (Fowles 2004, 222).

*1.1 Research Goal*

This thesis delves into the cultural development of the Taos District, primarily focusing on the ceramic sherds recovered from archaeological sites in Picuris Pueblo. The main goal of this research is to explore the production and distribution of Kwahe'e B/W within the Taos District to assess the social and trade networks between Puebloan communities during the Valdez Phase. I ask, were Kwahe'e B/W vessels locally produced or imported? How does Kwahe'e B/W indicate the social interactions and the spread of cultural practices? How does the ratio of Kwahe'e B/W within the overall ceramic assemblage correspond with evidence from compositional analyses? To what extent does the ceramic analysis reveal trade networks and social interactions within the Taos District?

To address these questions, the thesis employs two primary approaches. First, it seeks to investigate the ceramic practices of the Picuris Pueblo region by examining ceramic sherds excavated from a nearby Valdez Phase site. Earlier research, particularly Fowles (2004), has challenged the assumption that all black-on-white ceramics were locally produced during the Valdez Phase. This thesis aims to contribute additional empirical evidence to this discussion through the chemical analysis of Kwahe'e B/W sherds, which may reveal the homogeneity of ceramic sources and production techniques, and consequently the potential trade and exchange of ceramics. Second, the thesis builds upon previous archaeological research conducted in the Rio Grande region, comparing data to gain a more comprehensive understanding of the social network within the Taos District. By generating the ratio of different ceramics across the sites and examining them collectively, this thesis strives to provide a deeper understanding of the Ancient Puebloans' cultural development, focusing specifically on their ceramic practices.

*1.2 Description of site*

Ceramic samples from two excavation sites, the Eagle Pile site and the Cerrita site, were used in this thesis. As I participated in the whole excavation in Picuris Pueblo and got the information about the Cerrita site from previous archaeological records, my description of the Eagle Pile site had a higher level of detail compared to the Cerrita site.

*1.2.1 Eagle Pile Site*

The excavation at Picuris Pueblo consisted of five distinct units, Units 4 to 8, with a particular emphasis on the ceramic sherds recovered from Unit 4. Initially, Unit 4 was divided into five subunits, namely Subunit A to Subunit E. Subunits 4A, 4C, and 4E were excavated to level 1 (with a depth of roughly 48-54 cm below datum), while Subunits 4B and 4D were only partially excavated. Due to the increasing arbitrariness of subunit differentiation, Unit 4 was later completed as a single level.

Unit 4 is a trench that runs perpendicularly across three contour terraces, with its placement and interpretation advised by Mermejo. The excavation aimed to uncover the field surfaces, collect sediments and micro-botanical samples, and gain a better understanding of how this type of field system was used. Moist water-and wind-lain sediments, lithics, and Valdez Phase pottery were found between each visible rock alignment on the surface level. In level 1, Unit 4 was subdivided based on the boundaries between these sediments and the contour terrace alignments (Unit 4A to E). The surrounding area in the present day is a pinyon-juniper forest, with trees growing mainly between terraces, a boulder located to the southeast, and other stones found nearby. The largest rocks in each alignment are concentrated on the southern edge, which is headed downslope (see Appendix 1A, 1B). Field notes and level forms were taken of each

day's progress, together with appropriate maps and measurements. The Valdez Phase pottery was taken back to Barnard College, where they were sorted and analyzed.

*1.2.2. Cerrita Site*

Cerrita is a compact but fascinating site that offers valuable insights into the Taos region's prehistory. Although its archaeological record is limited, and ceramic sherds were excavated in 1982 without specific site details, Woosley (1980) provides a fairly comprehensive account that aids in reconstructing the region's prehistory.

Situated on the western slopes of a north-south valley south of modern-day Taos, Cerrita is located on the second of three terraces ascending from the valley floor. The slopes feature a mix of junipers, pinon pines, open grassy areas, and sagebrush clusters. The site was densely populated, likely due to its daily sunlight exposure and protection during cold winters. Cerrita has several occupation levels, such as a pothouse component and at least two surface dwellings. Initial 1978 excavations revealed a workspace with a compacted clay surface and multiple fire pits encircled by burnt stones that served as cooking pot supports.

While the Eagle Pile site's excavation process was thoroughly described, the smaller Cerrita site still offers crucial information about the Taos region's prehistory. The archaeological discoveries at Cerrita suggest a modest settlement advantageously positioned on an upland terrace near a constant water source, providing easy access to different environmental zones and their diverse resources. This prime location enabled inhabitants to cultivate small plots on the terrace, collect or trap riparian resources along the stream, and hunt game at higher forest elevations. Cerrita operated as a farming village with the adaptability to transition towards primarily exploiting wild resources when needed.

Although Cerrita is small in terms of site size, its proximity to Pot Creek Pueblo suggests that the excavation data could contribute to the understanding of the Ancestral Puebloans' cultural history. The goal of analyzing this site and comparing it with Picuris Pueblo is not to obtain a detailed and precise result, but rather to shed light on the prehistory of the Puebloan group within the Taos District. Given Cerrita's complex and puzzling geographical condition, future archaeological work could further explore parallel comparisons between similar small-sized sites or expand into comparisons with intermediate-size settlements like Sagebrush Pueblo.

*1.3 Ceramic Focus*

The primary artifact examined in this study is Kwahe'e Black-on-white (Kwahe'e B/W) (Fig 2A, 2B), the earliest decorated ceramic and the only iron-painted black-on-white ware type discovered in the Taos region (Dick and Adler 1999, 75). This local ware, likely derived from a regionally made version of the non-local Cibola whiteware type Red Mesa Black-on-white (Schillaci 2020, 3), exhibits black-to-gray mineral paint designs and is often interchangeably used with Taos Black-on-white (Taos B/W) due to their subtle differences. Kwahe'e B/W is characterized by clay paste containing crushed rock temper, fine angular quartz crystals, and occasionally mica and grogs, resulting in a homogeneous texture ranging from fine to medium-fine (Wilson 2012). The surface of these ceramics displays varying degrees of polish, with bowls slipped on both sides and jars slipped outside, sometimes also within the mouth. Kwahe'e B/W pottery primarily comprises bowls, but also includes seed jars, canteens, ollas, gourd dippers, and bowl dippers (Wilson 2012).

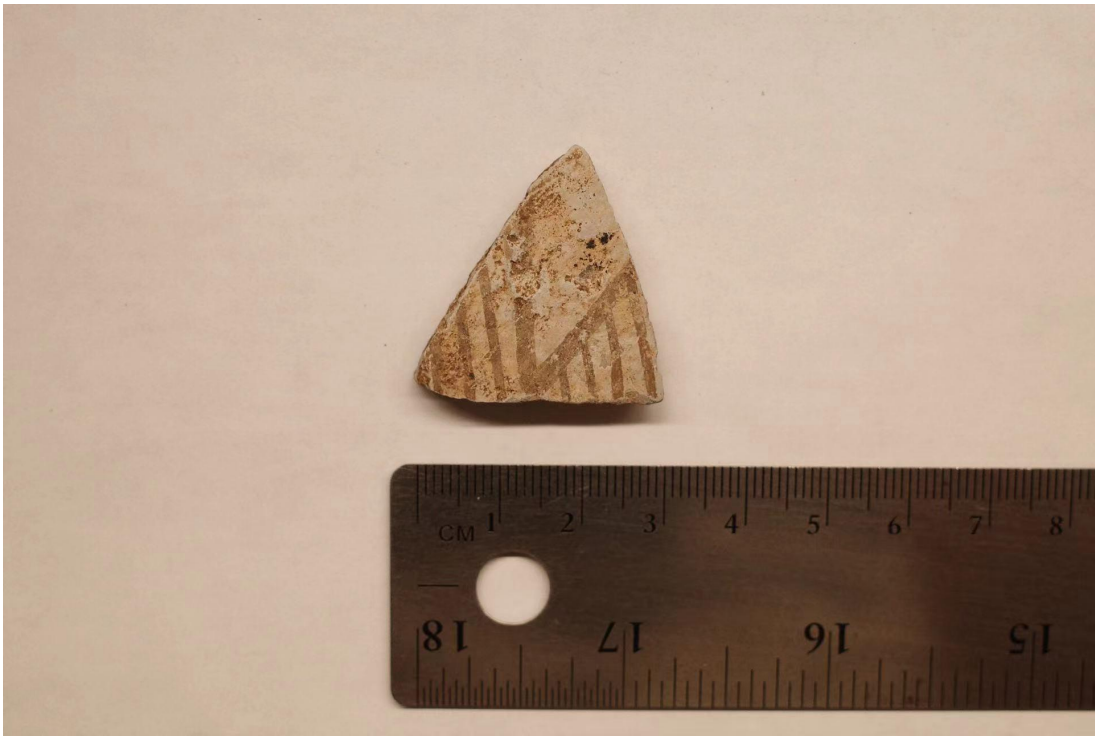


Fig 2A. Sample Kwahe'e B/W sherd, excavated at the Eagle Pile site, FN 135.


Fig 2B. Sample Kwahe'e B/W sherd, excavated at the Eagle Pile site, FN 135.

Kwahe'e B/W designs feature simple geometric patterns arranged in banded layouts on the vessel surface, such as rectilinear bands with diagonal, straight, or cross hatchures. Hatching is the most prevalent pattern. Negative designs created by unlined areas include diamonds, squares, and triangles. Among the 20 ceramic pieces excavated at the Eagle Pile site, hatched vessels, where hatchure is either the sole or predominant design element, constitute 55% of all Kwahe'e B/W ceramics. Solid elements, like checkerboard patterns, make up 25% of the ceramics, and combinations of solid and hatched elements account for 10% of the total. Other prevalent Kwahe'e B/W patterns include dots, opposing triangles, radiating triangles, step triangles, scrolls, and parallel lines (Wilson 2012). These patterns distinguish Kwahe'e B/W from other painted ceramics.

The distinction between Kwahe'e Black-on-white (Kwahe'e B/W) and Taos Black-on-white (Taos B/W) has been a subject of confusion within the literature. Mera (1935) initially differentiated the two based on the thickness of the slip and the raw material used for the temper (Mera 1935, 6), but this definition was later contested since these characteristics proved inconsistent across various ceramic assemblages in the Northern Rio Grande region (Dick and Adler 1999, 75). Consequently, there is insufficient evidence to separate the two types based on typological differences. Fowles (2004) outlines some drawbacks of researchers overly labeling all white ware with black mineral painting as Taos B/W. First, the excessive labeling leads to a longer and more vaguely defined temporal period for the Valdez Phase, which relies on Kwahe'e B/W for dating. This period spans around two centuries, significantly longer than the Pot Creek and Talpa Phases, and hinders archaeologists' ability to generate meaningful insights into local prehistory, such as cultural changes. Second, Kwahe'e B/W is often categorized as Taos B/W due to their similar style, despite its wider distribution. As Taos B/W is locally produced, this

over-labeling results in the assumption that all Valdez Phase painted ceramics with such designs are locally produced, complicating the evaluation of trade activities and dating of the Valdez Phase.

## Section 2. Prehistory of the Taos District

### *2.1 Rio Grande Region*

Before examining specific sites in the Taos District, it is crucial to understand the broader context of the northern Southwest region, with a particular emphasis on the Rio Grande region (Fig 3) and the Ancestral Puebloans group. The ancestral Pueblo world is characterized by the geographic presence of contiguous-walled Pueblo-style architecture and ceramics, and is primarily situated within the Colorado Plateau and Rocky Mountain regions (Adler 1996, 379). The chronology and cultural development of the ancestral Pueblo world provide the foundation for understanding the prehistoric context of the northern Southwest region, guiding further exploration of the Picuris Pueblo and Pot Creek Pueblo.

The prehistory of the ancestral Pueblo world began with the transition from Archaic mobile foraging to semi-sedentary lifestyles around A.D. 200. From that time until the approximate end date of the Valdez phase in A.D. 1350, the northern Southwest experienced significant changes and developments (Table 1). During the Basketmaker III period (A.D. 200 - 700), pottery production emerged, and the reliance on maize, beans, and turkey became widespread. Pit houses were the dominant architectural feature, with both small pit-house sites and large pit-house villages being established. In the Pueblo I period (A.D. 700 - 900), populations increasingly settled in regions suitable for horticulture, and community ritual structures like "great kivas" became more common. Population aggregation was evident in

southwest Colorado and northwest New Mexico during this period. The Pueblo II period (A.D 900 - 1100/1150) witnessed the rise of the Chaco regional system and favorable environmental conditions for maize horticulture. Masonry and adobe structures were built, and circular kivas became more common. The decline of the Chaco regional system also occurred during this period. The Pueblo III period (A.D. 1150 - A.D. 1300/1350) saw a reduction in the geographic extent of the ancestral Pueblo world, with some areas being abandoned. Aggregated settlements became more common during this time, with cliff dwellings such as those at Mesa Verde becoming more prevalent. During the Pueblo IV period (A.D. 1350 - 1540), Puebloan communities became more dispersed, clustering into smaller communities primarily situated in the Rio Grande drainages and some peripheral areas. During this period, the Puebloan peoples increasingly relied on maize horticulture and adopted more intensive food-producing techniques requiring water control and irrigation (Adler 1996, 381-383).

| **Cultural Phase** | **Time period** | **Changes and Developments** |
|---|---|---|
| Basketmaker III | A.D. 200 - 700 | ● Pottery production emerged<br>● Reliance on maize, beans, and turkey<br>● Pit houses were the dominant architectural feature |
| Pueblo I | A.D. 700 - 900 | ● Settlements suitable for horticulture<br>● Community ritual structures like "great kivas" became more common |
| Pueblo II | A.D. 900 - 1100/1150 | ● Rise of the Chaco regional system<br>● Favorable environmental conditions for maize horticulture<br>● Rise and decline of the Chaco regional system |
| Pueblo III | A.D. 1150 - 1300/1350 | ● Reduced geographic range of the ancestral Pueblo world<br>● Aggregated settlements became more prevalent |
| Pueblo IV | A.D. 1350 - 1540 | ● Puebloan communities spread out more<br>● Higher reliance on maize farming and technologies for intensive food production |

Table 1. Significant changes and development in the northern Southwest.

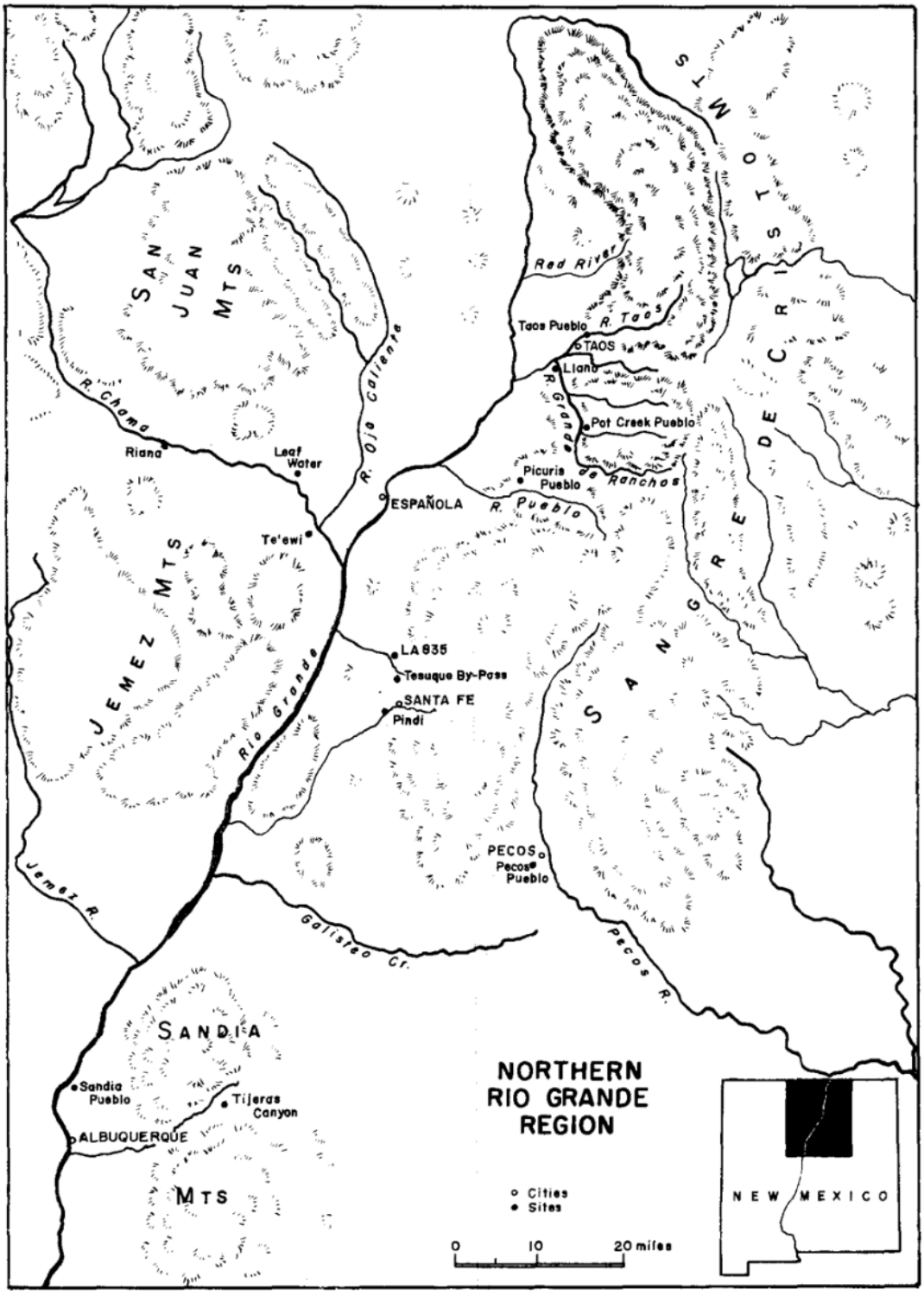


Fig 3. Map of the northern Rio Grande Region with locations of Pot Creek Pueblo and Picuris Pueblo. (Wetherington 1968)

The connection between the Chaco/San Juan area and the Rio Grande region in the northern Southwest (Fig 3) is evident in the discussion of changing geographical boundaries and population density over time. The migration patterns and similarities in material remains demonstrate the significant impact of the Chacoan culture on the Rio Grande region. First, numerous instances of migration from the Chaco/San Juan area to the Rio Grande region can be traced back to around 900 A.D., during the late Basketmaker period. While some researchers initially believed that these people migrated to mostly uninhabited lands in the Rio Grande valley, more recent studies have shown that all areas were already occupied, albeit by smaller populations (Boyer et al. 2010). This population migration into the northern Southwest continued until the Pueblo III period, as Fowles (2004) identified a group of Pueblo people relocating from the south and/or west into the Taos District between A.D. 1190 and 1260 (317).

Moreover, the material remains provide further evidence of the Chaco-San Juan culture's influence on the Rio Grande region. The presence of Chacoan-style black-on-white ceramics suggests the spread of Chacoan culture. During the Developmental period (A.D. 600-1200), there was a rapid increase in ceramics similar to Red Mesa Black-on-whites (Red Mesa B/W). McNutt (1969) posited that there was no evidence to support the idea that this culture originated locally. It is more likely that the Chacoan-like style was introduced by early Pueblo residents who migrated from the Chaco-San Juan area. Furthermore, during the mid-Pueblo II period, the local production of some Black-on-white ceramics, such as Kwahe'e Black-on-white, became prevalent, replacing the Red Mesa B/W as the dominant ceramic type. The design style of these ceramics closely resembled contemporaneous wares in the San Juan Basin, indicating a strong connection and interaction (cf. Mera 1935; Lang 1982; Bretemitz 1982).

The similarity in ceramic designs suggests two possibilities: either the ceramics were imported or exchanged as whole items by immigrants, or the movement of Chacoan culture was in the form of ideas spreading into the Rio Grande region. Considering that Kwahe'e B/W ceramics were produced using local clays and tempering materials while retaining Chacoan-style decorations, the latter possibility seems more plausible. However, archaeologists were unable to find the Chacoan architectural remains, such as Great Houses, and there was a lack of formal roads connecting Chaco Canyon to the Northeast Pueblo region (Fowles 2004, 162). This makes it unclear whether the Northeast Pueblo region was fully integrated into the greater Chacoan system. Nevertheless, it is certain that the material culture in the region strongly reflected Chacoan influences. In conclusion, the development of the Ancestral Pueblo world was highly likely to be independent of the Chacoan system, but it incorporated elements from Chacoan culture.

*2.2 Taos District: Picuris Pueblo*

Zooming into the Taos District, situated between the Rio Grande Gorge to the west and the Sangre de Cristo Mountains to the east, north, and south, it encompasses the Taos Pueblo, Picuris Pueblo, and Pot Creek Pueblo (Fig 4). The Northern Tiwa people, indigenous to the Taos District and part of the Tanoan language family, primarily inhabit Pueblo settlements like Picuris Pueblo and Taos Pueblo. These communities are located in the Sangre de Cristo Mountains and the valleys of the Rio Grande, Rio Hondo, and Rio Pueblo de Taos rivers.

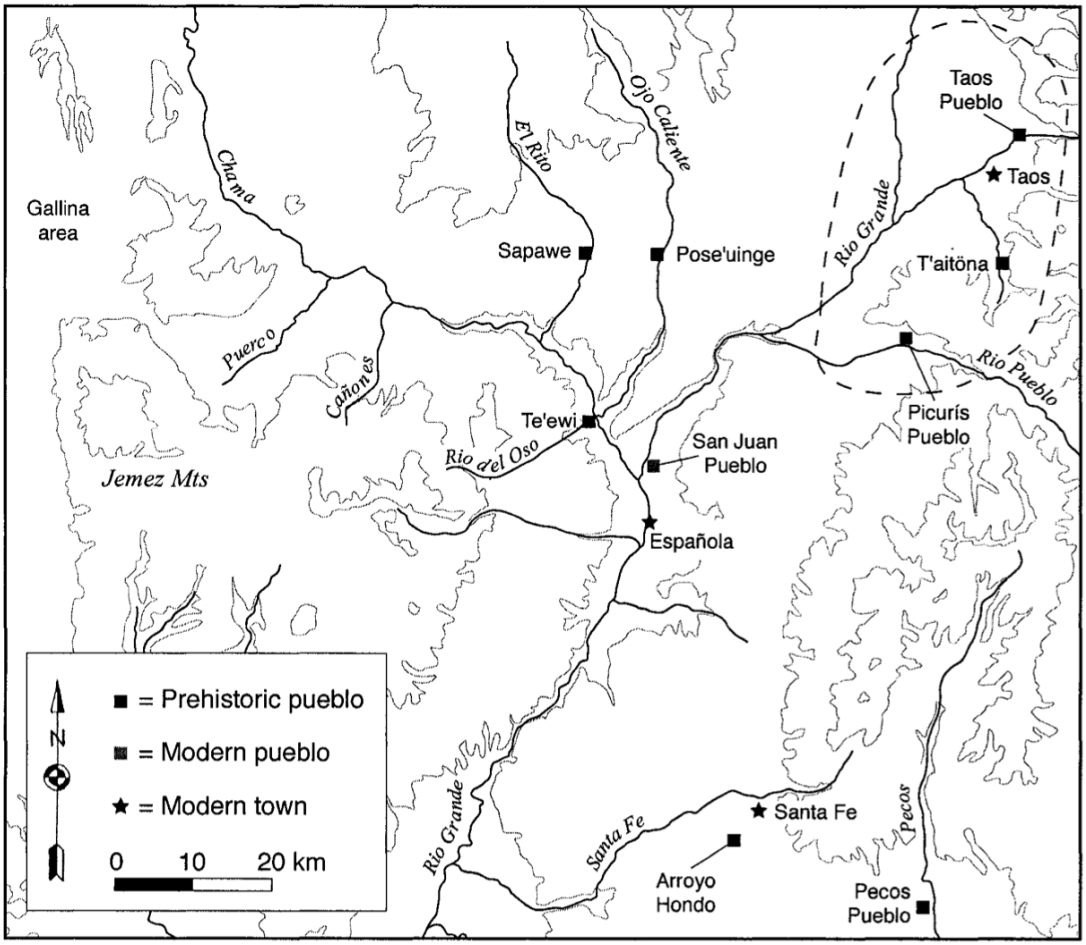


Fig 4. Map of the Taos District in the context of the northern Rio Grande. (Fowles 2004) (Dashed lines indicate the extent of the Taos District, the traditional territory of the Northern Tiwa pueblos)

Picuris Pueblo, one of the eight Northern Pueblo communities in the Taos District, is an archaeological site and home of the living Picuris Pueblo in New Mexico, bordered by the Sangre de Cristo Mountains to the north, east, and south, and the Rio Grande Gorge to the west (Fowles 2004, 192). Picuris Pueblo is a unique Pueblo member, for its remote location on the northeastern edge of the Puebloan world, bordering the Plains groups. Geographic separation is believed to be the main factor behind the cultural differences between Picuris and Taos Pueblos and other parts of the Puebloan world (Wendorf 1954; Wendorf and Reed 1955; Wetherington 1968; Boyer et al. 1994).

Picuris is known for its cultural practices, including its material remains like ceremonial structures and the distinctive style of pottery, which signify changes in the cultural occupation and values of the Pueblo community. One of the most important ceremonial structures in the Pueblo community is the kiva, a site for public ritual performances open to all community members or those who had undergone initiation rites. Attendance at these performances was likely considered a crucial social and religious obligation (Fowles 2004, 19). The kiva is viewed as an instrument for integrating prehistoric pueblos, highlighting the functionalist perspective of religion and its power over political systems in prehistoric pueblo communities (Fowles 2004, 19). Such a ceremonial complex is directly associated with archaeological narratives on kinship structures. For example, although later questioned by archaeologists like Adler (1993), Wetherington (1968:80) inferred that social units in the Valdez phase were nuclear or extended families due to the lack of kivas (Dick and Adler 1999, 71).

Ceramic traditions are another cultural hallmark that makes Picuris significant, both as a material indicator of the time period of occupation and as a reflection of the pueblo's affiliation and social interactions with its surroundings. Ceramic materials are more indicative than other materials like lithics because they can be easily shaped and molded to fit various purposes. This flexibility is evident not only in their physical characteristics but also in how their creation, trade, and use reflect changes in cultural landscapes (Mauche 1995, 167). Ceramics serve as signals for archaeologists to evaluate the chronological sequence of cultural occupations, as changes in their compositional analysis and decorations make cultural shifts visible. The identification of ceramic types is the primary method for establishing a chronological framework and understanding prehistory at Picuris Pueblo, with the occurrence of many extra-local ceramic types that have been accurately dated in other parts of the Southwest being the most fundamental data used in

determining occupation dates for different areas of the site (Dick and Adler 1999, 75). According to conversations with Native interlocutors, the consistent way in which these designs are structured reflects metaphorical visualizations of the fundamental organizational relationships that define life in small agricultural Pueblo communities (Washburn 2013, 28). Previous studies by Wendorf (1954), Reed (Wendorf and Reed 1955), and Dick (1999) suggest the prehistory of Taos as having limited interactions with other prehistoric Puebloan groups to the south and west due to the unique variations of ceramic types over time.

*2.3 Taos District: Pot Creek Pueblo*

Pot Creek Pueblo, also known as T'aitona or "People House," is one of the largest ancestral Pueblo ruins in the northern Rio Grande region. Located along the Rio Grande del Rancho Valley, this late 13th and 14th-century village represents the early Ancient Pueblo settlement in the Taos area. Significantly, it is the only pueblo of its magnitude known in the entire northern region, featuring room blocks of up to four stories and unique elements not found in middle or small-sized settlements.

It is suggested that Pot Creek Pueblo maintained an extensive exchange network or, at the very least, held strong connections to other pueblos within the Taos District. Excavations carried out by Dick at Picuris Pueblo (Dick and Adler 1999) and a short excavation conducted by Ellis and Brod at Taos Pueblo (1964) revealed that Pot Creek Pueblo was inhabited contemporaneously with these two sites, suggesting a potential interconnectedness and a shared ancestral population. Furthermore, the presence of the Great Kiva architectural structure, prevalent in Picuris Pueblo, adjoins the central plaza in Pot Creek Pueblo, indicating a shared sense of ceremonial architecture and practice between pueblos.

In addition to sharing the ritual traditions of the Great Kiva with Picuris Pueblo, Pot Creek Pueblo participated in frequent trades with its neighbors. Exchanged artifacts included jewelry such as steel beads, bone bracelets, and gneiss nose plugs, as well as plants and animals. This interconnectedness is also reflected in the ceramic development of Pot Creek Pueblo. Wetherington (1968) identified three periods of ceramic development at the site, showcasing different ceramic wares, the presence of trade wares, and growing contact with the South. Given the importance of the great kiva in Puebloan life and Pot Creek's expanding trade network, Woosley (1980) suggests that Pot Creek may have once been "the center or focus of 12th and 14th-century Ancestral Pueblo culture in the Taos area" (31). By examining these aspects of Pot Creek Pueblo's culture, we gain a deeper understanding of the interconnectedness and cultural evolution within the broader Taos District.

In summary, the overarching view of the Rio Grande Region's prehistory reveals changing geographical boundaries and population dynamics from a high-level perspective before delving deeper into the cultural interactions between Picuris Pueblo and Pot Creek Pueblo. Both of these Pueblos are situated in the Taos District and display a heavy reliance on material cultures, as well as intricate cultural connections with neighboring communities through extensive exchange networks. By excavating the Eagle Pile site and Cerrita site, two archaeological sites located near these Pueblos, we can investigate potential exchange patterns between them. The comparison between Pot Creek Pueblo and Picuris Pueblo helps explore the social exchange of Northern Tiwa and sheds light on the cultural development and interactions within the Taos District.

*2.4 Cultural development model*

The cultural development model of the Taos area during the Valdez phase has long been a subject of debate, particularly concerning whether the cultural traits found in its archaeological remains originated locally or not. Green (1976), along with Herold (1968), Wetherington (1968), and Woosley (1980), supports the notion of local, independent cultural development. Green posits that there is limited evidence of communication or trade between the Taos Ancestral Puebloans and other Puebloan groups. Her findings in ceramics, agricultural crops, and skeletal remains suggest that the Taos Valley inhabitants descended from local hunter-gatherers who adopted pottery and adobe architecture techniques from Ancestral Pueblo communities in southern regions. While the ceramics and architectural evidence indicate a southern style, the absence of intersite violence in skeletal remains does not demonstrate contact with other Puebloan groups (Boyer 1997, 382).

Adding to Green's argument, Woosley (1986) also proposes a local, gradual cultural change for early Puebloan development, based on her survey data of the Ancestral Pueblo occupation in the Taos Valley. Woosley employs Wendorf and Reed's (1955) categorization, which places the Valdez phase in the Developmental period. Her observations reveal that during the Developmental period, there was an increase in the number of sites per square kilometer, which later decreased during the transition from the late Developmental to Coalition periods. However, she contends that the total population of the Taos District did not decrease. Instead, there was a shift from a more dispersed settlement system with numerous small villages to a greater aggregation of the population into fewer, larger pueblos. According to Woosley, this process of gradual local development was not due to an influx of people from outside the district but rather a Taos District continuum of gradual cultural development within the local Ancestral

Pueblo sequence. She suggests that changes in settlement distribution, increased complexity in site organization, and alterations in material culture assemblages, such as ceramics, can all be interpreted in terms of this local cultural development (Woosley 1986, 150-160). Therefore, this local developmental trajectory perceives this cultural pattern as arising from within the community, not being imported from the outside or as a result of new people moving in.

By contrast, Boyer (1997) holds an opposite model of Taos as a cultural frontier, which suggests that the Ancestral Puebloans' presence in the Taos Valley emerged abruptly around AD 1100, instead of developing from a preceding Basketmaker community. This hypothesis supports that the Ancestral Pueblo tradition was imported rather than locally developed, and is backed by multiple pieces of evidence. First, the shift in architecture in the Valdez Phase occurred abruptly, rather than the gradual transition that might be anticipated in situations of local development. Second, an analysis of chipped stone artifacts shows parallels between Valdez- and Pot Creek-phase sites, signifying that the Valdez-phase Ancestral Puebloans already adopted a reduction strategy typical of more settled groups, in contrast to the lithic reduction approach of hunter-gatherers. Thirdly, ceramic analysis reveals that Ancestral Puebloans in the Taos Valley came with a pre-established ceramic technology, utilizing local clay sources and showcasing painted patterns in line with those found in the middle Rio Grande Valley during the same period. Finally, faunal analysis bolsters the concept of an immigrant population, as the emphasis on small mammals, turkeys, and the intensive use of deer remains corresponds with the habits of an agricultural society with restricted opportunities for large game hunting (Boyer 459-460).

The two contrasting cultural development models reflect the dynamic cultural shifts within the Taos District and propose potential hypotheses for these changes. They suggest that Puebloan traditions either evolved locally and developed in situ, or were introduced by new

groups of people. The local development model implies that cultural changes arose from within the community, emphasizing local adaptability and innovation. Alternatively, the introduction by new groups highlights the role of external influences and migration in shaping the region's prehistory. Combined, these models establish a theoretical framework for interpreting cultural transformations in the Taos District and emphasize the importance of archaeological evidence in substantiating these models. Building on the broader discussion of cultural exchange within the Rio Grande, this thesis delves deeper into examining the specific cultural changes occurring within the Taos District and the implications of these changes for understanding the region's history.

## Section 3. Methodology

### *3.1 Ceramic Samples*

This study examined pottery fragments from two distinct sites: the Eagle Pile and Cerrita sites. For the typological analysis, 476 sherds excavated from Eagle Pile were utilized, as detailed in Table 2. These sherds were mainly comprised of four varieties: Plain Gray (~ 80%), Unidentified Whiteware (~ 12%), Taos Incised (~ 5%), and Kwahe'e B/W (~ 4%). The ceramics selected for the typological analysis were randomly drawn from the Unit 4 ceramic collection at the Eagle Pile site. On the other hand, the primary focus of the compositional analysis was on samples from the 2022 Eagle Pile excavation, with a small number of samples from the 1982 Cerrita collection serving as a comparison. From the Eagle Pile collection, 39 sherds were chosen, while 13 sherds from two bags of ceramics at Southern Methodist University were selected for the Cerrita site. This thesis specifically centers on the analysis of painted ceramics, particularly Kwahe'e B/W, and therefore, the ceramic samples were intentionally chosen to

include a high percentage of Kwahe'e B/W in both sets. For the Eagle Pile pXRF sample group, 30% (10 Kwahe'e B/W sherds) were included, and for the Cerrita pXRF group, 50% (6 sherds) were incorporated. As Kwahe'e B/W represents a relatively low percentage of the entire sample group, the aim was to increase the proportion of Kwahe'e B/W in the sample to emphasize patterns of its production. By integrating it with the rest of the samples, it is anticipated that Kwahe'e B/W will display a distinct compositional pattern in the compositional analysis, which offers valuable insights into the production and exchange network.

| Type | N | Percentage | Weight (g) | Percentage | Site Unit |
|---|---|---|---|---|---|
| Kwahe'e B/W | 20 | 4.20% | 92.51 | 7.22% | Unit 4 (Subunit A, B, E1) |
| Plain Gray | 367 | 77.10% | 897.98 | 70.05% | Unit 4 (Subunit A, B) |
| Smeared Indented Corrugated | 4 | 0.84% | 11.8 | 0.92% | Unit 4 (Subunit A, B, E1) |
| Taos Incised | 24 | 5.04% | 81.07 | 6.32% | Unit 4 (Subunit A, B, E1), Unit 5 (Subunit B) |
| UnID White | 55 | 11.55% | 183.82 | 14.34% | Unit 4 (Subunit A, B, E1) |
| Unclear | 2 | 0.42% | 0.78 | 0.06% | Unit 4 (Subunit A, E1) |
| UnID Unpainted | 2 | 0.42% | 4.83 | 0.38% | Unit 4 (Subunit E1) |
| Redware | 1 | 0.21% | 2.32 | 0.18% | Unit 4 (Subunit B) |
| Tiwa Buff | 1 | 0.21% | 6.78 | 0.53% | Unit 4 (Subunit B) |
| Total | 476 | | 1281.89 | | |

Table 2. Sample Size and SiteProvenience of Ceramic Types Analyze

### *3.2 Compositional Analysis*

Compositional analysis is widely used in archaeological research as it provides strong evidence of past activities in both the production and consumption stages. The composition of chemical elements in ceramics allows archaeologists to determine the intensity and distribution of ceramics. Specifically, the element composition suggests concentrations of ceramic products within and across regions, as well as the relative concentration of producers within the region. If

ceramics with similar chemical compositions and production techniques are found in two separate locations, it is likely that some degree of trade and exchange occurred between them. In particular, the large-scale exchange of ceramics indicates production by specialists. When the discovery of restricted locations for the creation of a specific ceramic style is combined with proof of its extensive distribution, it commonly suggests that the community engaged in specialized production (Mill and Crown 1995, 9). Mill and Crown (1995) summarized archaeological works in the Southwest region, ranging from A.D. 500s to the Protohistoric period, and concluded that specialized production started as early as Basketmaker III (A.D. 575-725). Over the next millennium, ceramics were found to have great variation in terms of concentration and intensity in different geographic expanses and timeframes (13). Therefore, compositional analysis is effective in pottery sourcing and provides evidence for potential trade and specialization in production across different areas.

In order to conduct rigorous chemical composition analyses on ceramics, this research applies Portable X-ray Fluorescence (pXRF) spectroscopy to identify patterns in the elemental variation of pottery found near Picuris Pueblo (Eagle Pile site) and Pot Creek Pueblo (Cerrita site). pXRF is a non-destructive analytical technique widely used in the field of archaeology to identify and characterize the elemental composition of archaeological materials. The pXRF technology works by bombarding the sample with high-energy X-rays, which in turn excite the atoms in the sample and cause them to emit characteristic X-ray radiation. The radiation is detected and measured by the instrument, allowing for identification and quantification of the elemental composition of the sample. The usefulness of pXRF depends on being able to interpret the data in meaningful ways, such as identifying differences in raw material acquisition and technological choices. There has been an increase in the use of pXRF to study ceramics in the

last five years, as shown by the number of published studies on archaeological ceramics and other clay-based artifacts (Frahm 2017, 13).

The pXRF device is utilized for detecting specific elements in a sample and typically consists of an X-ray tube, detector, X-ray collimators, and signal processing electronics. The primary X-ray beam generated by the X-ray tube interacts with the sample, which leads to the emission of secondary X-rays detected by the detector. These X-rays are then transformed into electrical signals, and signal-processing electronics evaluate the elements present in the sample. When bombarding a sample with electrons, the instrument removes electrons within the sample's atomic structure, prompting the emission of fluorescent X-rays, having a unique frequency for each element. Identification of specific elements in the sample is achievable by detecting the particular frequency of the expressed fluorescence. The collimator (spot size) is 8 mm. The X-ray tube generated data on certain elements, including both heavy elements (Ti to U) and light elements (Mg to Zn), in a standard air beam path. The X-ray source was run for 75 seconds to generate distributional data for these elements. In terms of software, the device comes with a software package, which includes various analysis modes such as standardless analysis, empirical calibrations, and user-defined calibrations.

pXRF is often preferred in ceramic analyses because of its adaptability and portability, which makes it a great tool for measuring chemical compositions. Firstly, pXRF is non-destructive, which is advantageous in provenance studies. Generally, non-destructive analytical techniques are preferred over destructive methods, as long as the selected technique offers adequate resolution in the final data to accurately classify potential groups (Craig 2007, 2013). Second, pXRF is affordable and field portable, so it is ideal for conducting precise analyses for elements on artifacts outside of a lab setting, such as museum or excavation

artifacts. pXRF can accurately measure elements such as iron, rubidium, and strontium, which helps to identify ceramics that have a consistent geochemical composition. McCormick and Wells (2014) carried out studies using pXRF to analyze the chemical composition of local ceramics and determine whether it was possible to imitate styles from other river valleys using local clays. pXRF has proven effective in comparing sites within geologically heterogeneous areas (LeMoine and Halperin 2021, 3).

While pXRF devices offer several advantages in terms of portability and non-destructive analysis, they also have some notable limitations. One of these limitations is their inferior precision in element detection and black box data calibration. As Bruker does not disclose its calibration process, which can result in less accurate measurements, especially in the case of inter-instrument operations. pXRF is suggested to be internally accurate and as accurate as laboratory-based XRF instruments (Nazaroff et al., 2010). However, the potential for inter-instrument inconsistencies is higher, even when devices possess the same analytical settings (Goodale et al., 2012). Additionally, the collimator used in pXRF instruments has a size of 8 mm, which may be adequate to include temper or natural inclusions in the sample, but not large enough to provide a representative analysis of the entire sample. This can limit the device's ability to provide accurate data on the overall composition of the ceramics being analyzed in this thesis.

In conjunction with pXRF, this thesis employs Principal Component Analysis (PCA) to further examine the compositional data obtained from ceramic samples. To address potential variability in pXRF readings, I conducted three measurements for each sherd in my experiment and calculated the average. This approach of acquiring multiple analyses, typically three, for each sample sherd is similar to the method used by researchers conducting elemental

compositional analyses using spot techniques like Electron Microprobe Analysis (Frahm, 628). PCA, a prevalent multivariate statistical method in archaeology, simplifies complex datasets by reducing dimensionality while retaining maximum variance. By transforming original variables into a new set of linearly uncorrelated variables called principal components, PCA enables researchers to discern patterns and relationships within the data, revealing underlying structures that might not be immediately apparent. In the context of this study, PCA can elucidate the connections between elemental concentrations in the Kwahe'e B/W samples, providing insights into raw materials, technological choices, and potential trade networks.

*3.3 Typological analysis*

I also utilize a typological database to assess potential exchange patterns within the Taos area. The typological database compiles the attributes of ceramic sherds, serving as the standard for evaluating the excavated pottery types. Attributes encompass ware group, vessel form, vessel part, interior and exterior paint, interior and exterior manipulation, interior and exterior slip, and design style. Analytical classification is a widely employed method in archaeology for identifying and categorizing material remains, assisting in recognition of recurring variants within the same classification (Adams 2010). In this thesis, the attribute database not only aids in the analytical classification of painted ceramics, whiteware, and plain gray ware but also establishes a foundation for further analysis of painted ware distribution within the entire assemblage.

Furthermore, we gather and calculate typological data among various ceramic types. The ratio of painted wares offers ample potential for comparison and analysis, as a significant ratio difference between two nearby sites may indicate the presence of exchange or trade. For

comparisons, we use existing synthetic databases from cyberSW, a platform that integrates archaeological data archived in different locations in the Southwest into a single, scalable, networked database. Specifically, we compare data from Pot Creek Pueblo by Ellis and Brody (1964) and from the Old Taos area by Wetherington (1968).

By elaborating on the ceramic samples, compositional analysis, and typological and stylistic analysis, we aim to deliver a more lucid and comprehensive understanding of the prehistory within Taos area during the Valdez phase. Through the application of pXRF and a typological database, this research aims to better comprehend the ceramic distribution within the region and identify potential patterns of trade and specialized production.

### *3.4 Hypothesis*

Building on the earlier discussions of typological and compositional analysis, we could construct several hypotheses regarding the distribution of Kwahe'e B/W ceramics within the Taos District. Compositional analysis provides insights into the variation that exists in composition within a particular region, and therefore the distribution of different production techniques and potential exchange networks. Conversely, stylistic analysis traces the flow of ideas, as it uncovers the sequence in which the Kwahe'e B/W style was introduced to the region and determines whether its occurrence was synchronous across various villages in the Taos District. By integrating these analytical approaches, we will be able to paint a comprehensive picture of the complex interactions between goods and ideas in the context of Kwahe'e B/W ceramics.

For compositional analysis, after conducting PCA, we are able to identify the possible groups made with different clay sources within the testing samples. Several hypotheses can be formulated regarding the chemical composition of these ceramics. One possibility is that the plot

reveals distinct clusters, suggesting that the Kwahe'e B/W ceramics were produced using diverse clay sources or varied techniques within the same site. This could indicate that multiple local production centers existed using heterogenous raw materials or that the site was engaged in importing ceramics from different locations.

Another interpretation of the PCA plot could be that the Kwahe'e B/W ceramics exhibit a continuous and uniform distribution, implying that the ceramics were produced using a single, homogeneous clay source or a highly standardized production process. This could suggest that the site had access to abundant resources or that the community followed a strict set of practices when manufacturing Kwahe'e B/W ceramics.

Alternatively, the PCA plot may display a combination of clusters and continuous distribution, indicating that the Kwahe'e B/W ceramics were produced using both local and non-local materials or through a mix of production techniques. This could suggest that the site was involved in both local production and trade with other communities, obtaining ceramics from various sources.

Turning to the typological part, when examining the ratio of painted ceramics within a diverse ceramic collection at the Eagle Pile site and comparing it to the data in two other sites, several hypotheses can be formulated regarding the distribution of Kwahe'e B/W ceramics. Style and identity are “multidimensional, layered, and associated with various social processes and scales” (Casella and Fowler 2005; Plog 1990). Compared to compositional analysis, this suggests the flow of ideas and the social development of different communities. One possibility is that the ratios of painted ceramics are consistent across all three sites. This could suggest that the communities shared a common ceramic production process or that they were engaged in a regional exchange network. This uniform distribution of this design style might indicate a strong

cultural connection. Given that Kwahe'e B/W is a significant marker for the start date of the Valdez phase, a similar ratio may suggest a synchronous dating for the Valdez Phase among the communities. Alternatively, the ratios of painted ceramics might vary significantly among the three sites. This could suggest that each site had its own distinct production process or unique set of resources, leading to differing quantities of painted ceramics. Such variation may also imply that the sites participated in localized exchange networks or that the communities had distinct cultural practices and preferences for ceramics. Differences in its ratio may suggest variations in the sequence of when the Kwahe'e B/W style was introduced into the regions.

In cases where the ratios of painted ceramics are similar between two sites but differ significantly from the third, it could be hypothesized that the two sites with similar ratios shared a closer cultural connection or had more extensive trade relations with each other. The site with the differing ratio may have been more isolated, had a unique production process, or had limited access to certain resources or trade networks. By considering these various hypotheses, we can gain a deeper understanding of the distribution and production of Kwahe'e B/W ceramics and their role in the social, economic, and cultural dynamics within the Taos District.

## Section 4. Results & Discussion

### *4.1 Compositional Analysis Results*

In this thesis, PCA analysis was conducted to assess 1) the chemical variability of Kwahe'e B/W groups, 2) the elemental distribution of Kwahe'e B/W in comparison to all sherds, and 3) the chemical variability between the Eagle Pile site and the Cerrita site. First, PCA analysis was performed on Kwahe'e B/W for both the Eagle Pile site and the Cerrita site. The PCA results for the Kwahe'e B/W group at the Eagle Pile site (Fig 3A) reveal a uniform

distribution of dots across both axes on the chart. However, as highlighted in the chart, three potential clusters emerge: one in the lower left corner, another in the lower right corner, and a third near the upper edge. These clusters suggest that there might be some degree of chemical variability within the Kwahe'e B/W ceramics at Picuris Pueblo. The presence of potential clusters could indicate that the ceramics might have been produced using different raw materials or techniques, possibly reflecting local production using heterogeneous clays or the import of ceramics from non-local sources.

Similarly, we conducted PCA analysis for the Cerrita site (Fig 3B). The PCA result for the Cerrita site suggests a continuous distribution, indicating local production. However, the small sample size might be the reason for the lack of a detectable pattern among the dots. Fowles (2004) found a different pattern in his study on Kwahe'e B/W at Pot Creek Pueblo sites, with a relatively large range of chemical variability for local sherds. His conclusion suggests that, due to the intense production of Kwahe'e B/W during the Valdez Phase, producers may have used a variety of clay sources from the northern regions along the drainage, causing the observed variability.

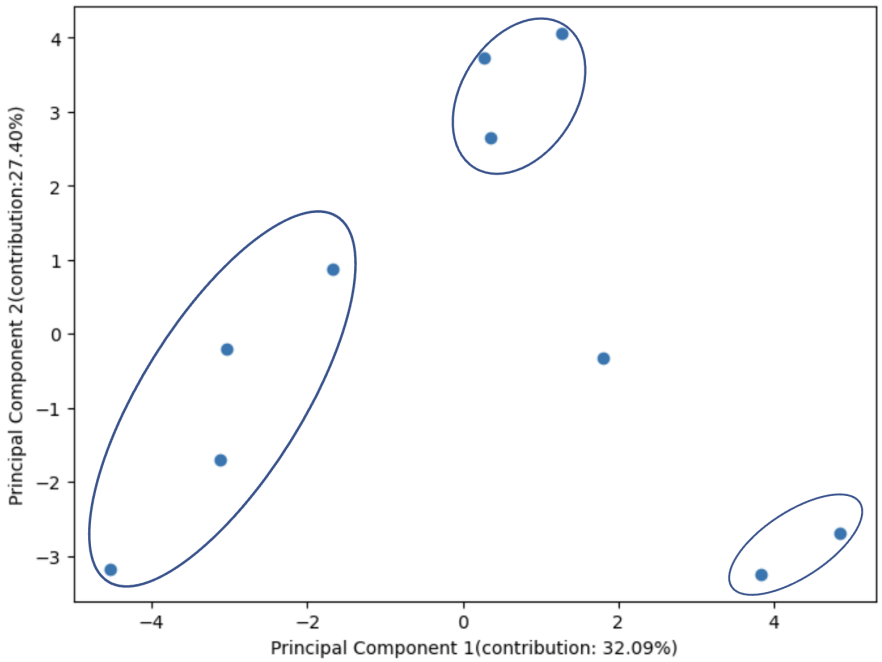


Fig 3A. PCA analysis on the Kwahe’e B/W groups from the Eagle Pile site

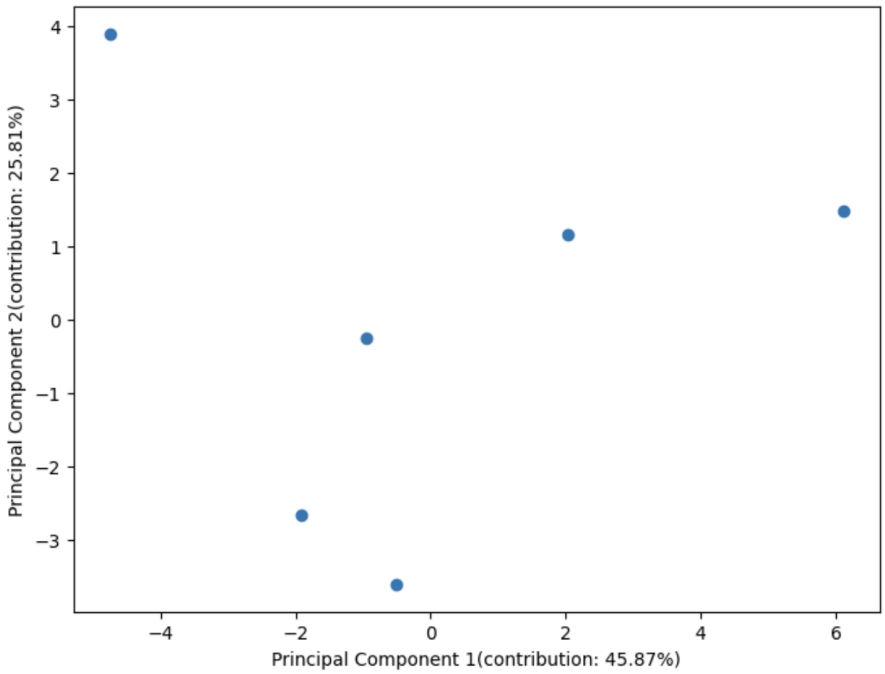


Fig 3B. PCA analysis on the Kwahe’e B/W groups from the Cerrita site

When comparing Kwahe'e B/W with the entire ceramic group (Fig 4A, 4B), the situation changes. In the Eagle Pile group, which shows potential clusters in Fig 3A, no visible clusters for

Kwahe'e B/W are apparent, but there is a clear distinction between Kwahe'e B/W and white wares in the Cerrita site. Based on Fig 4A, Kwahe'e B/W sherds in the Picuris Pueblo region seem to have a similar elemental composition to that of other ceramic types, suggesting they were produced using similar clay sources or techniques. This similar way of making pottery is counter-intuitive, as painted and unpainted ceramics underwent different production procedures, which should result in a more clustered chart.

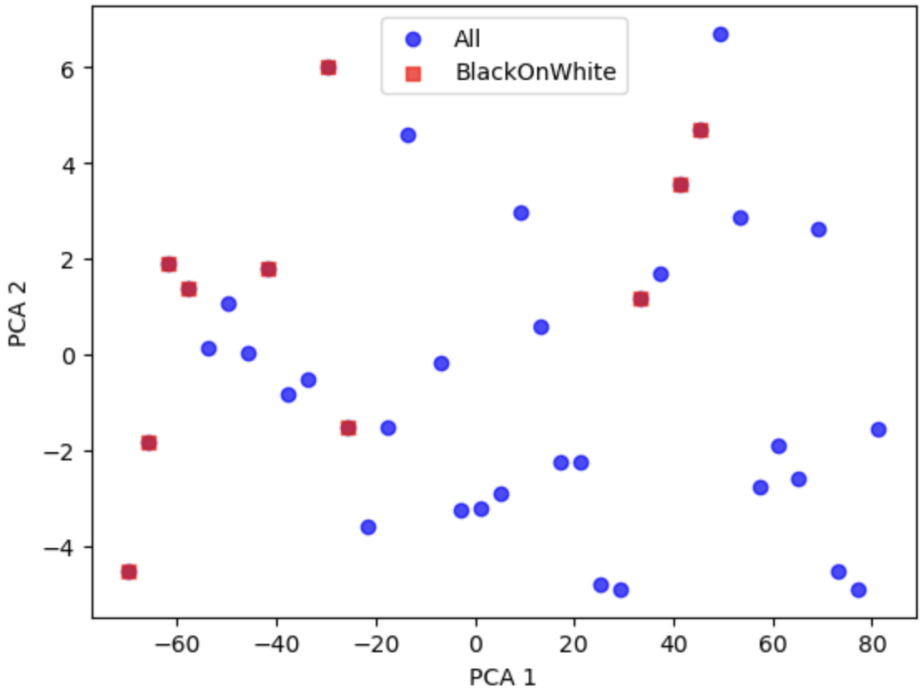


Fig 4A. Comparison between Kwahe'e B/W and all other groups (Eagle Pile site)

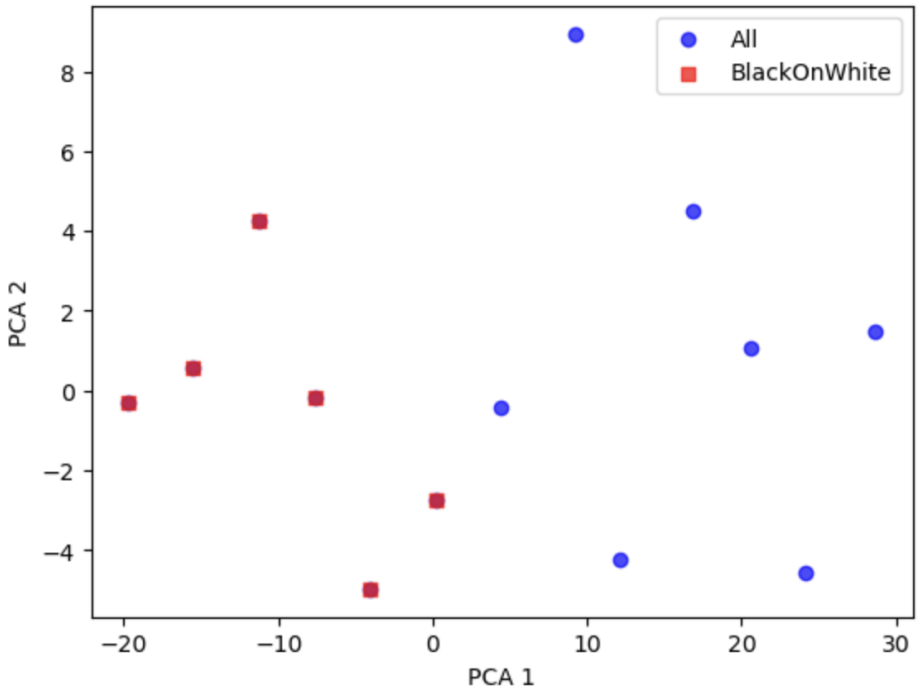


Fig 4B. Comparison between Kwahe'e B/W and all other groups (Cerrita site)

However, there might be several reasons behind this observation. One possibility is that the community living in the region had limited access to clay sources, resulting in the use of similar raw materials for different ceramic types. Another possibility is that the sample size is not large enough, making it difficult to detect a pattern based on the limited number of sample sherds and negatively impacting data precision. To investigate this further, I represented the elemental distribution of plain gray sherds with another color in Fig 4C. Since the plain gray sherds and Kwahe'e B/W should have different clay sources, a similar outcome in Fig 4C suggests that limited data precision and sample size could be the main reason behind the observation.

Figure 5 compares the chemical composition of Kwahe'e B/W ceramics between the Eagle Pile and Cerrita sites. Although there is a relatively continuous distribution in the ceramic PCA chart, the ceramics from the two sites form two clearly distinct groups in terms of

composition. This observation suggests that Kwahe'e B/W production at both sites might be local, but the processes or raw materials used were not identical, possibly indicating site-specific production techniques or distinct clay sources. The separate groups in their composition also imply that there may not be strong evidence of Kwahe'e B/W trade between the two sites. Noticeably, there seems to be a broader distribution of Kwahe'e B/W ceramics at the Eagle Pile, suggesting a fairly wide variety of ways of making black-on-white wares at Eagle Pile site and a more restricted way of production at the Cerrita site. The reason behind this distinction in chemical composition might be that the modes of making different types of pottery at the Eagle Pile site are not as strictly defined as those at the Cerrita site, and the number of pottery makers could also be a contributing factor. Since our sample size is small, and the two groups lie close to each other, further studies using larger sample sizes are required to verify this tentative finding. As the sample size increases, it is also possible to observe an overlap between the two sites, indicating an overlapping in production and more potential for exchange.

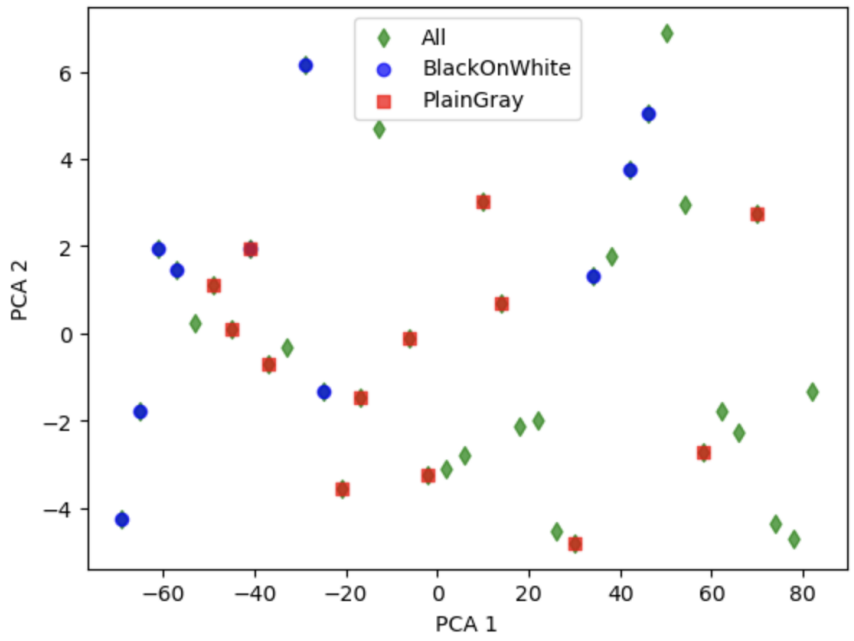


Fig 4C. Comparison between Kwahe'e B/W, Plain Gray, and all other groups (Eagle Pile site)

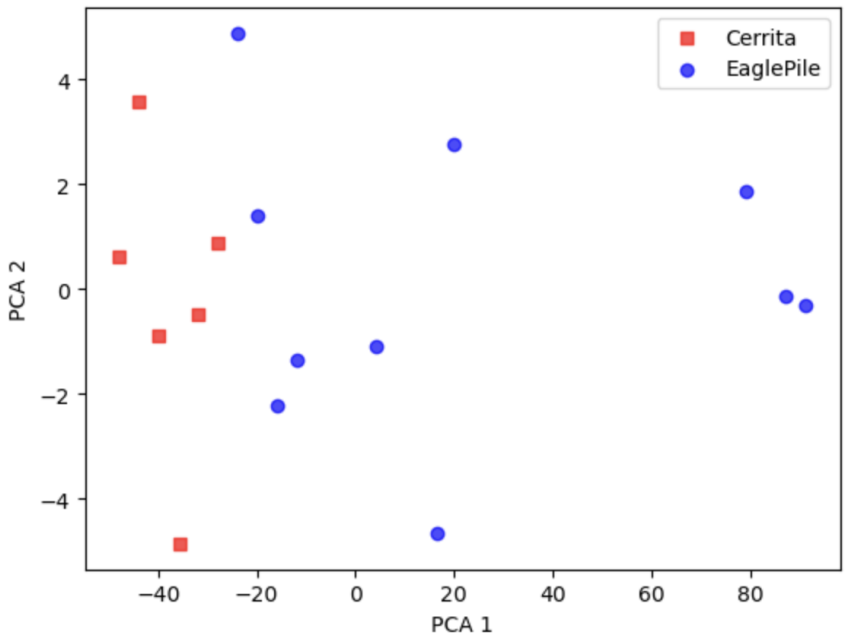


Fig 5. Comparison between Kwahe'e B/W (Eagle Pile site vs. Cerrita Site)

In conclusion, the results of the PCA analysis suggest that Kwahe'e B/W ceramics in the Picuris Pueblo region were locally produced, but the indistinct clusters indicate some level of chemical variability. When comparing the Eagle Pile and Cerrita sites, the distinct compositions of Kwahe'e B/W ceramics imply local production with different approaches to making pots. The reason behind this difference may be rooted in the variation in modes of pottery production or the disparity in the number of producers between the two sites. This observation suggests a possible but not strong trade relationship between the sites, as the chemical composition groups are separate but display some degree of closeness. Further studies with larger sample sizes are required to confirm these findings.

*4.2 Typological Analysis Results*

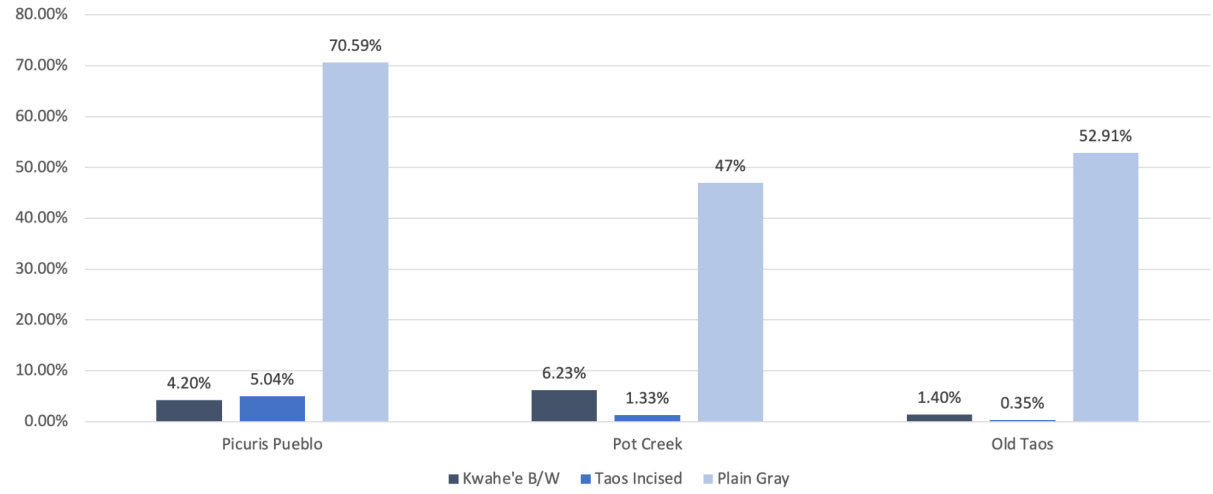


Fig 6. Ceramic ratio across three excavation sites in percentage
(Picuris Pueblo vs. Pot Creek vs. Old Taos)

The two sites used for comparison are from previous excavations in the 20th century. Ellis and Brod (1964) conducted "a brief trenching of (Taos) oldest refuse mound and of their ancestral ruin 200 years to the east of the present site (316)." Thus, their site is referred to as Old Taos. Another excavation of Pot Creek Pueblo began in 1957 as part of the Fort Burgwin Research Center project, with the ceramic data gathered by Wetherington. The site proper covers over two acres of the valley bottoms of the Rio Grande del Ranchos, located on unsurveyed land in the Rancho del Rio Grande Grant.

At the Eagle Pile site, 20 Kwahe'e B/W ceramics were collected out of a total of 476 sherds, making the percentage of Kwahe'e B/W around 4% in terms of ceramic count. When calculating the ratio in terms of weight, according to Table 1, Kwahe'e B/W occupies a ratio of around 7% within the pile. This ratio is consistent with the one at the Pot Creek Site (6.23%), while the data also suggests a lower percentage of Kwahe'e B/W in Old Taos, at roughly 1%.

The similar ratio between Picuris Pueblo and Pot Creek Pueblo may be explained by various interpretations. Though the chemical composition of Kwahe'e B/W at the Cerrita site and Eagle Pile site seems to be relatively distinct, the similarity suggests shared production techniques and potential exchange networks. This similarity could indicate a comparable level of local Kwahe'e B/W ceramic production at each site, with shared techniques, similar resources, or a common understanding of the pots' intended use in various activities. An alternative interpretation is that the similar ratios could be evidence of a widespread trade and exchange network, which facilitated the movement of this specific design style and production techniques between Pot Creek Pueblo and Picuris Pueblo.

Building on the second hypothesis, a third interpretation of the consistent ratios across the three sites is that they indicate shared cultural practices, beliefs, or preferences related to the use of Kwahe'e B/W ceramics and other ceramic types. For example, Plain Gray ceramics occupy half of the collection for Old Taos and Pot Creek, and 70% for Picuris Pueblo. Such prevalence suggests Plain Gray ceramics were frequently used in daily life activities like food storage, preparation, serving, and water storage. In contrast, Kwahe'e B/W was not the dominant ceramic type during the Valdez Phase, but may have had ritual or symbolic significance in Ancestral Pueblo society as a sign of group or individual identity. Given the geographical proximity and the occurrence of great kivas in both Pot Creek Pueblo and Picuris Pueblo, it is very likely that they share similar cultural and ritual practices.

On the other hand, the significantly lower ratio of Kwahe'e B/W ceramics at the Old Taos site might suggest a lower demand for painted ceramics, especially Kwahe'e B/W, or a slower introduction of the Kwahe'e B/W style. As discussed earlier, the demand for Kwahe'e B/W might be based on a shared cultural or religious system that uses painted ceramics for ritual purposes,

so a lower demand may suggest that Old Taos did not align with the other two communities in their religious practices. As for the second possibility, given that 1) the precedent ceramic style of Kwahe'e B/W was Red Mesa B/W, which was brought by early Chacoan immigrants from the Southern area like the San Juan Basin, and 2) the geographical distance between Taos and the San Juan Basin is the longest among the three, it is likely that the introduction of such a decorative style was relatively delayed for the Taos area.

Lastly, to eliminate the possibility that similar ratios are merely coincidental, I conducted a Chi-squared test to validate the statistical significance of the typological data. Based on the Chi-squared test (see Appendix 3A, 3B), the low p-value suggests that there's a statistically significant association between the ceramic types and the archaeological sites. The expected ratio of Kwahe'e B/W within the whole assemblage at each site is around 9% for Picuris Pueblo, and roughly 6% for both Taos Pueblo and Old Taos. By comparing the actual and expected ratios, we can see that both the Kwahe'e B/W in Picuris Pueblo and Old Taos has a significantly lower ratio than expected. Because Kwahe'e B/W are more eye-catching wares compared to gray wares, so if we see a higher-than-expected ratio, there might be a bias caused by excavators' inclination to focus on decorated wares. This result suggests that it is unlikely that there was a bias in the excavation process. Therefore, through the Chi-squared test, we see that the distribution of ceramic types across the three sites is statistically meaningful, and is unlikely to be caused by practical errors, which shifts the interpretation of the comparison result toward production techniques and cultural interactions.

In conclusion, the typological analysis of Kwahe'e B/W ceramics and their ratios among the three sites provides interesting insights into the potential social networks of the Ancestral Pueblo communities. The similar ratios observed at Picuris Pueblo and Pot Creek Pueblo suggest

a possible connection between these sites, which may result from shared production techniques, similar features of pots' use, cultural practices, or trade networks. Conversely, the significantly lower ratio of Kwahe'e B/W ceramics at the Old Taos site could indicate differences in cultural practices or a delayed introduction of the Kwahe'e B/W style. As previously discussed, typological analysis often indicates the transmission of ideas rather than physical goods. Therefore, based on the data, I infer that the potential sequence of idea dissemination may depend on geographical proximity and the degree of cultural similarity within the communities.

*4.3 Conclusion*

Kwahe'e Black-on-whites, despite their small percentage within ceramic assemblages, have been regarded as significant artifacts for dating the Valdez Phase and providing evidence for interactions within the Taos District. This study presents additional empirical evidence, both compositional and typological, supporting such interactions. We observed strong evidence for local production of Kwahe'e B/W as well as other ceramic types in the Picuris Pueblo area. The compositional differences between the Eagle Pile and Cerrita sites also suggest a wider variety of modes of pottery production or varying numbers of pottery producers. Our typological analysis, despite the disparity in compositional results, shows cultural similarity and close social relationships between Picuris Pueblo and Pot Creek Pueblo, suggesting that the potential sequence of idea dissemination may depend on geographical proximity and the degree of cultural similarity within the communities. Building on the compositional and typological data, we identify a possibility for the existence of trade networks or frequent social interactions within the Taos District, especially between Picuris Pueblo and Pot Creek Pueblo.

There are some limitations to the present study. As briefly discussed earlier, our sample size is not large enough to make statistically significant inferences, and this small sample size may result in a biased representation of the actual distribution of Kwahe'e B/W. Additionally, several prior databases and excavations collected by other institutions were used for comparison, introducing confounding factors that may contribute to data imprecision.

Based on the patterns detected in this thesis, more future studies could be engaged to further explore the production mode and social interactions within the Taos District. Future studies could narrow the research focus down to the local production patterns within Picuris Pueblo, as our chemical composition results suggest a strong local production pattern with significant differences in the variety of pottery production and producer numbers at the Cerrita site. Moreover, more rigorous and diverse research is required to validate trade networks and social interactions. As both the sampling and analyzing methodologies applied in this thesis are limited, future researchers may focus on other ceramic artifacts or architectures to examine specific pathways and cultural practices that facilitated the movement of goods and ideas within the Taos District.

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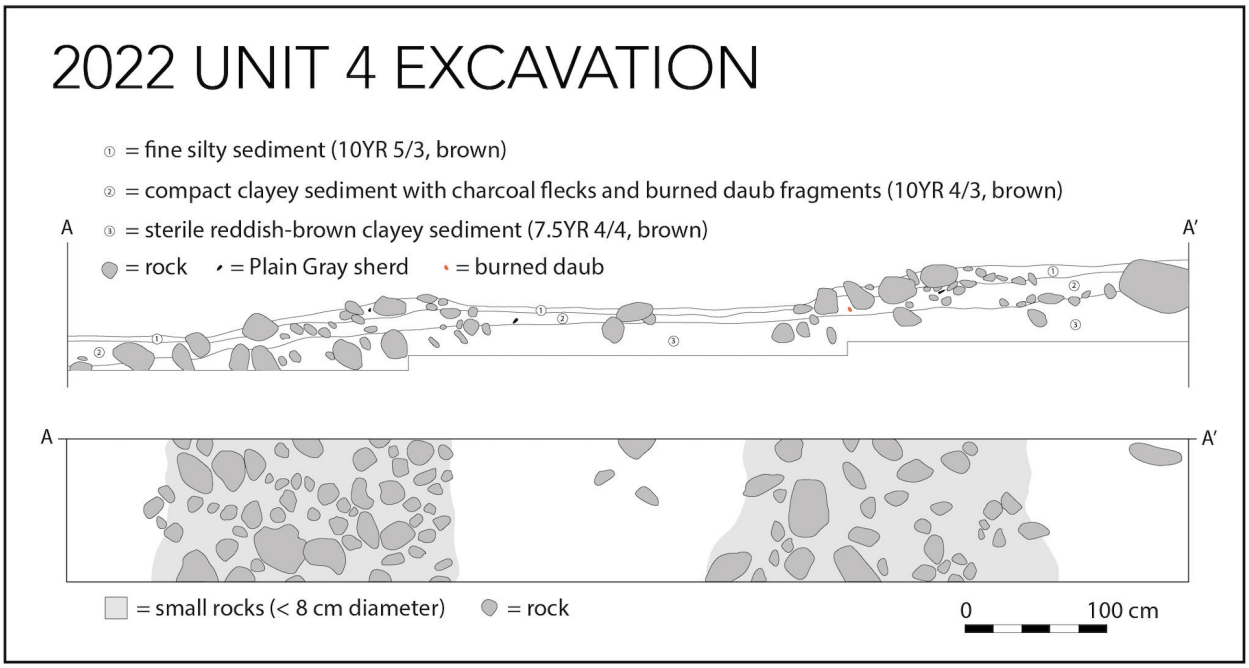
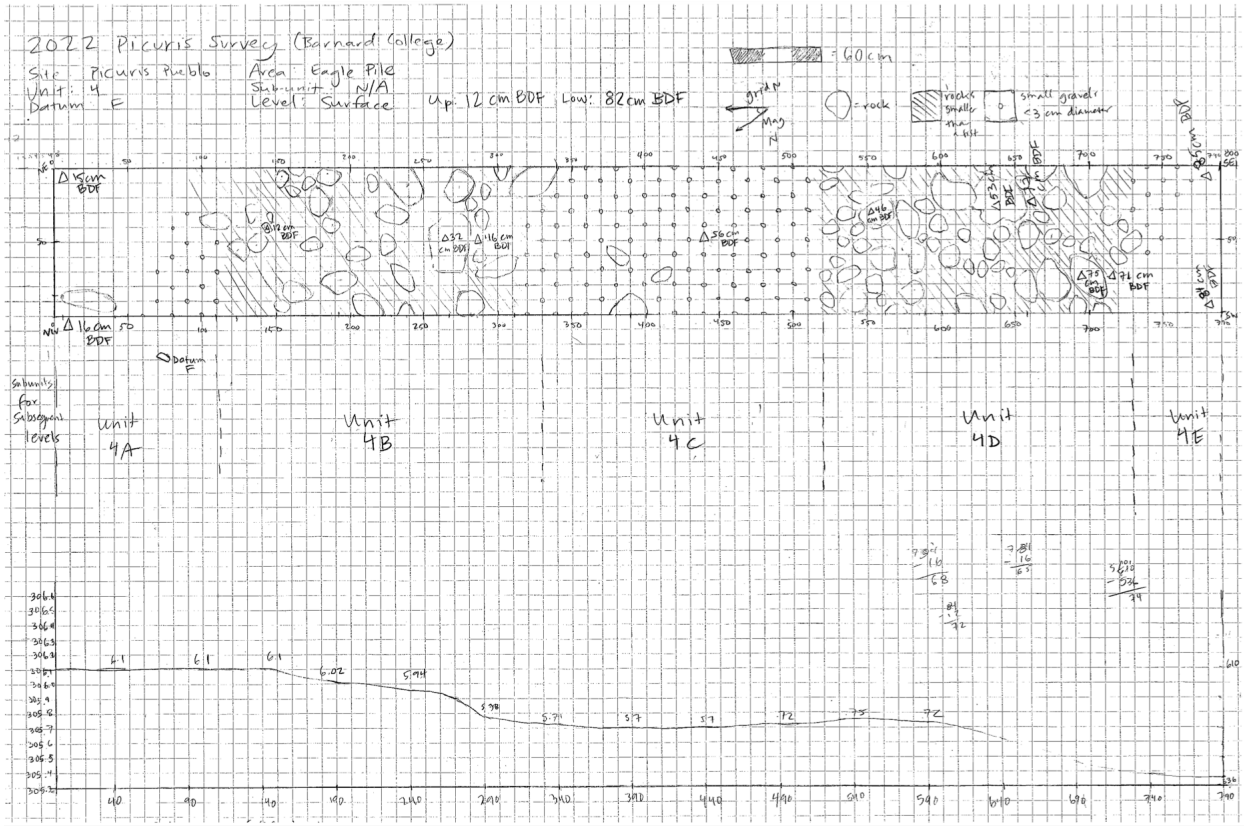
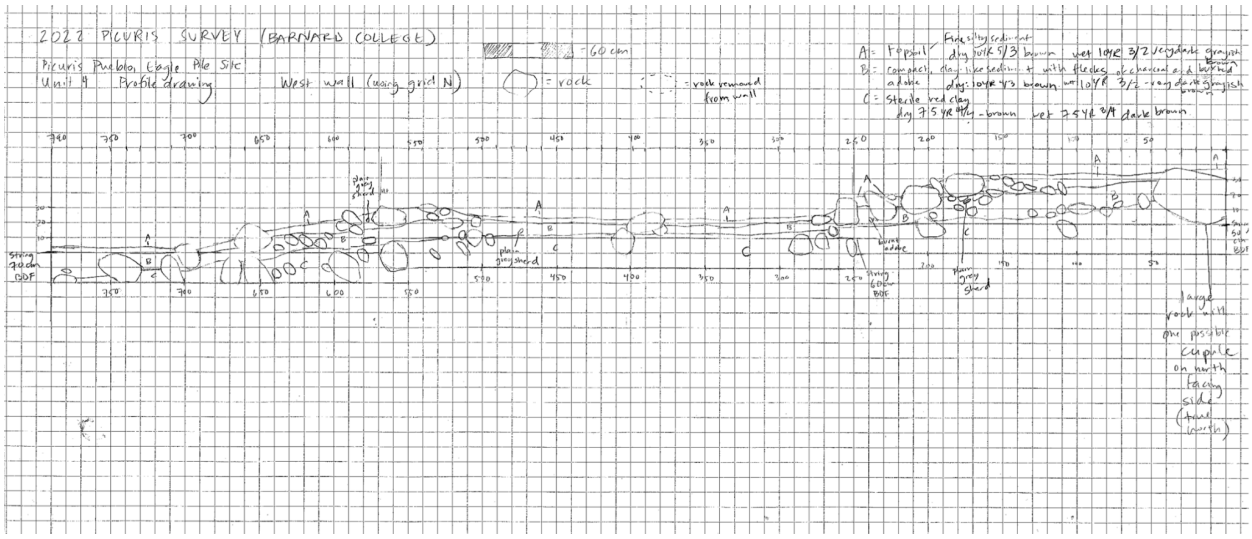
## Appendix

Appendix 1A. Unit 4 Excavation, produced by Fowles, 2022

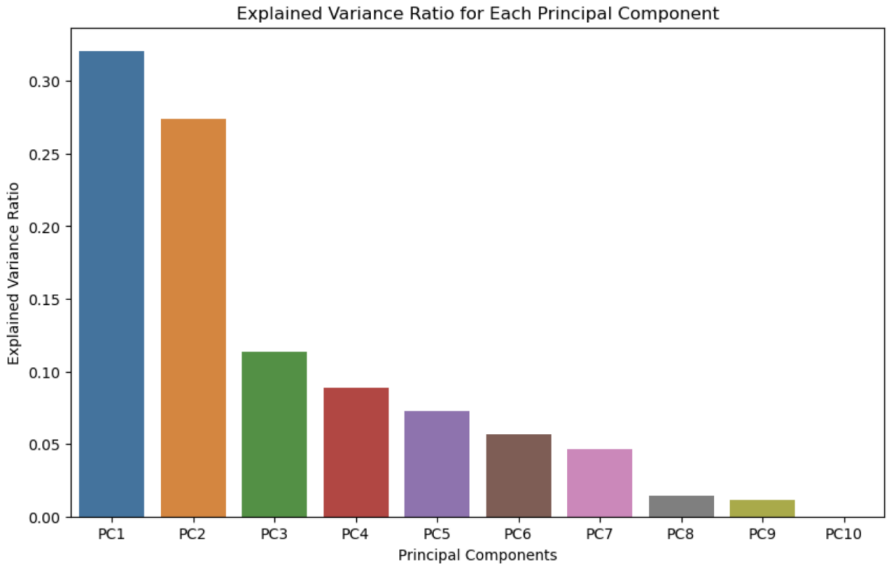


Appendix 1B. Surface level maps of Unit 4, produced by Barnard College excavation crew, 2022



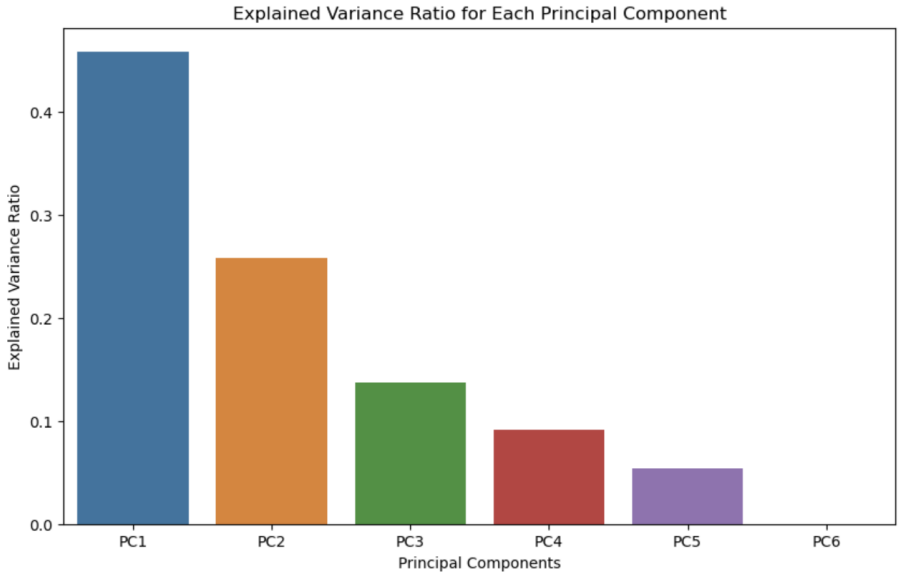



Appendix 2A. Explained variance ratio for each principal component for Fig 3A




PC1 explains 32.09% of the total variance.
PC2 explains 27.40% of the total variance.

Appendix 2B. Explained variance ratio for each principal component for Fig 3B




Appendix Fig B. Contribution of principle components for Cerrita site
PC1 explains 45.87% of the total variance.
PC2 explains 25.81% of the total variance.

Appendix 3A. Chi-squared test result for typological analysis

```
Chi-square statistic: 92.22734256874767
P-value: 4.428268731900441e-19
Degrees of freedom: 4
Expected frequencies:
Site          Picuris Pueblo  Pot Creek Pueblo    Old Taos
Kwahe'e B/W        41.606700       1672.151365   51.241935
Taos Incised        9.617866        386.536973   11.845161
Plain Gray        328.775434      13213.311663  404.912903
```

Appendix 3B. Calculation of the expected percentage of Kwahe'e B/W within the whole assemblage in each site

| | Picuris Pueblo | Taos Pueblo | Old Taos |
|---|---|---|---|
| Expected Frequencies | 41.606700 | 1672.151365 | 51.241935 |
| Assemblage Size | 476 | 27991 | 860 |
| Expected Percentage | 8.74% | 5.97% | 5.96% |