THE DISTRIBUTION OF OBSIDIAN AND CERAMICS ACROSS T'AITŐNA PUEBLO

by

Catharine Niuzzo Honaman

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As members of the Master's Committee, we certify that we have read the thesis prepared by: Catharine Niuzzo Honaman

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and recommend that it be accepted as fulfilling the thesis requirement for the Master's

Barbara J. Mills
Barbara J. Mills — Date: Aug 25, 2022

Michael Adler
Michael Adler — Date: Aug 25, 2022

Lindsay Montgomery — Date: Aug 25, 2022

Gary Christopherson — Date: Aug 27, 2022

Final approval and acceptance of this thesis is contingent upon the candidate's submission of the final copies of the thesis to the Graduate College.

I hereby certify that I have read this thesis prepared under my direction and recommend that it be accepted as fulfilling the Master's requirement.

Barbara J. Mills
Barbara J. Mills — Date: Aug 25, 2022
School of Anthropology

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Abstract

The thirteenth century saw a great migration of people into the Northern Rio Grande region. One of the small, dispersed unit pueblos in the area, T'aitöna, experienced an increase in population during this period. There are multiple lines of evidence, including ritual constructions, supporting the possibility that a new cultural group joined with the local group to build the pueblo's multistory 10 room block village. There are also indications that the different cultural groups worked to create a coalescent society, including unique architectural features such as the center-post/basin room support developed at and used throughout T'aitöna Pueblo.

This thesis reports on the spatial analyses conducted on obsidian and ceramic assemblages from the T'aitöna excavations. A 323-piece obsidian assemblage was mapped based on the geological source of each artifact that was obtained through X-ray Fluorescence. At T'aitöna Pueblo, obsidian sourced from El Rechuelos, Valles Grande, and Cerro Toledo in the Jemez Mountains, were distributed in roughly the same proportions for each room block. El Rechuelos was over 50% in each location, with Valles Grande as the second most abundant, and Cerro Toledo the third most represented. Spatial analyses of the distributions of Kwahe'e Black-on-white and Santa Fe Black-on-white ceramics indicate that both pottery types were used during the 70 years that the settlement was occupied. Both the obsidian and the pottery were found in the greatest concentrations in the midden. This may be a strong indication that all the rooms in the pueblo were being used for habitation or storage. The distribution trends found in each spatial analysis support the view that the multiple cultural groups living together at T'aitöna Pueblo were participating in creating a coalescent society.

Chapter 1: The Background of T'aitöna Pueblo

1.1 History of the Excavations at T'aitöna

In the early 1950s, archaeological work in the Taos area by Helen Blumenschein and Stewart Peckham, found the oldest evidence of habitation in the region, pit house structures (Gunnerson 1970). Years earlier, in 1920, Jeançon had done some preliminary excavations of a few rooms which were part of a pueblo that was no longer occupied (Gunnerson 1970; Wetherington 1968). The subsequent survey work undertaken separately by H. P. Mera and then Blumenschein indicated that the area had supported a large population in the past (Mera 1938; Wetherington 1968). In the summer of 1957, the Fort Burgwin Research Center began conducting investigations in the neighboring terrain of northern New Mexico (Figure 1). Students from the affiliated field school initiated an excavation of the thirteenth century pueblo then designated as TA-1 by the research center and now identified as LA260 (Wendorf 1968). Archaeologists in the 1950's referred to this settlement as Pot Creek Pueblo, however, it has a much older name, one which the descendants of the early inhabitants of the region use for it: T'aitöna /T'oyt^{h} əna/ (Duwe 2011; Fowles 2004a; Schillaci et al. 2017).

That first field school, in conjunction with the Fort Burgwin Research Center, was followed by a succession of excavations conducted by Gene Willis, Fred Wendorf, Ronald K. Wetherington, Herbert W. Dick, Patricia L. Crown, and Michael A. Adler (Adler, personal communication 2022; Crown 1996; Wetherington 1968). Each of these excavations has unearthed additional rooms and artifacts and has expanded the understanding of the settlement. However, it was Severin Fowles' graduate work at T'aitöna under Adler, and reported in his

Figure 1. An aerial view of the first excavation at T'aitöna in the 1960s from *Excavations at Pot Creek Pueblo* (Wetherington 1968:17).

dissertation and subsequent publications, that has redefined the archaeology of not just this pueblo but the entire region (Adler, personal communication 2022).

1.2 Situating T'aitöna Chronologically and Geographically

By 1996 enough of the 10 room blocks of the multistoried pueblo had been excavated that archaeologists could place T'aitöna in a few meaningful contexts in their analysis of larger trends in the region (Crown 1991; Crown et al. 1996). They referenced six districts which have been used to delineate the area since Bandelier's time, to elucidate the development of Pueblo societies in the Northern Rio Grande (Figure 2): Gallina, Chama, Taos, Jemez, Pajarito, and Santa Fe (Crown et al. 1996). T'aitöna is situated in the southwestern area of the Taos District, the middle settlement of only three sites (possibly a fourth) found there (Fowles 2004b).

Wetherington (1968:11–12) delineated the Taos district as bordered on the west by the Rio Grande River, on the north by the Red River, on the east by the Sangre de Cristo Mountains, and on the south by the Rio Pueblo (Crown et al. 1996). Elevations in the Taos District vary from 6,000 to 13,000 f.a.s.l., with T'aitöna at 7,20l f.a.s.l. It is situated in the Rio Grande drainage basin in a landscape characterized as piñon-juniper upland also supporting ponderosa pine trees (Crown et al. 1996).

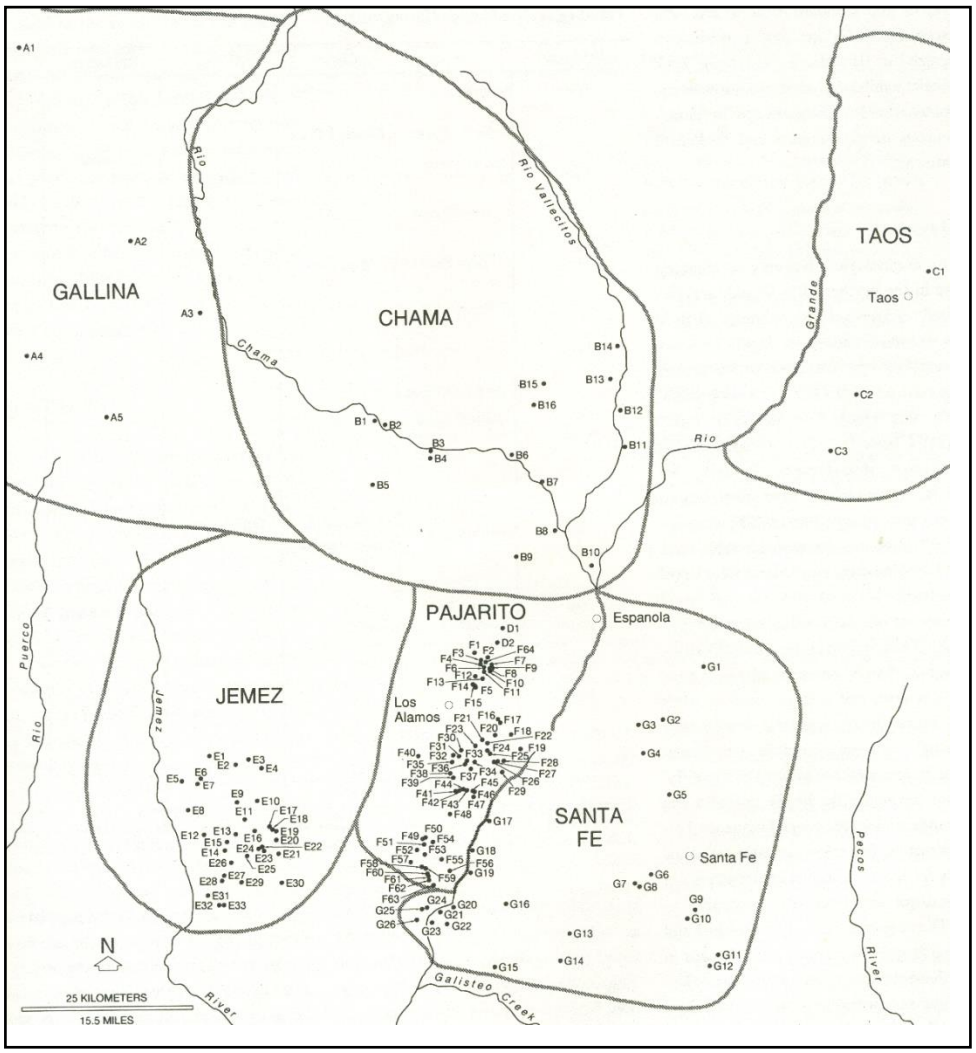

Figure 2. Map of Rio Grande Region from "Pueblo Cultures in Transition: The Northern Rio Grande" in *The Prehistoric Pueblo World, A.D. 1150–1350* (Crown et al. 1996:189).

In terms of the Northern Rio Grande chronology that was presented by Wendorf in 1954 (and further revised by Wendorf and Reed in 1955), the construction and occupation of T'aitöna occurred in the late Coalition period (1200 – 1325 C.E.) and perhaps into the very early Classic Period (1325 – 1600 C.E.) (Figure 3) (Adler and Hegmon 2022; Crown et al. 1996). However, the history of the settlement begins much earlier when the inhabitants of the area began to practice sedentism (Crown 1991). It is during the Developmental period that they constructed pit houses (Adler and Hegmon 2022; Boulanger et al. 2022; Crown et al. 1996; Fowles 2004b; Gunnerson 1970). These small clusters changed to above ground pueblos that grew into larger room blocks during the Coalition period (Adler 2022; Crown et al. 1996).

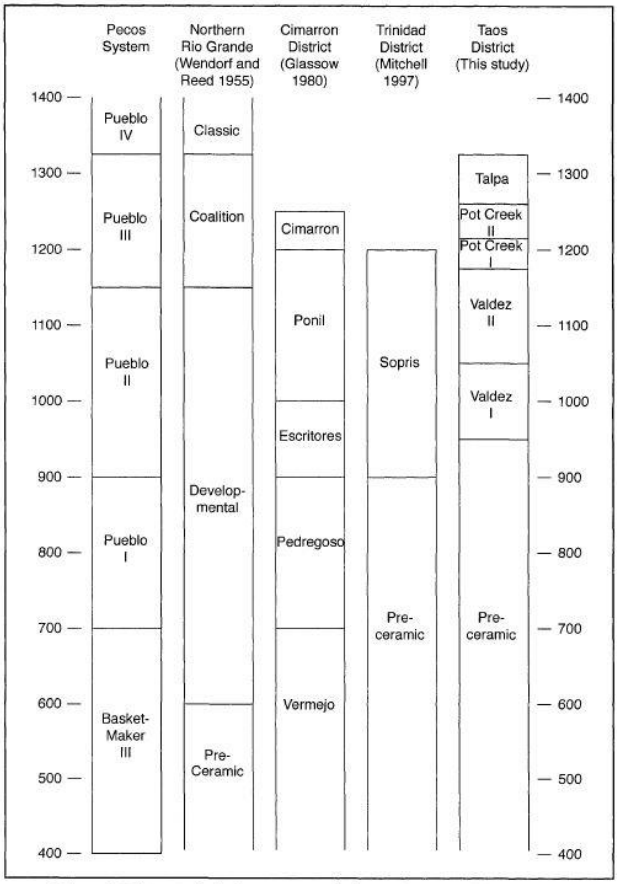

Figure 3.7: Post-Archaic phase systems in the Northeast Pueblo Region.

Figure 3. Multiple chronologies used in describing the occupation period of T'aitöna, from *The Making of a Made People,* (Fowles 2004:145).

It may be more accurate, however, to see the trajectory of T'aitöna in terms of the Taos District chronology, which is a sub-regional refinement of the Rio Grande chronology. In this context it would be best to start looking at the site during the Valdez Phase (980 – 1200 C.E.) when more than 20 small-scale "unit pueblos" were already present (Adler and Hegmon 2022; Fowles 2004b). Perhaps upwards of 300 individuals had begun living in these small groupings, which were just hundreds of meters away from where T'aitöna would be built (Adler and Hegmon 2022). The main occupation of the pueblo took place during the Talpa phase (Boulanger et al. 2022; Gunnerson 1970). During this time people were living in 10 room blocks, a large midden was in use, and the pueblo's kivas were built (Boulanger et al. 2022; Crown 1991; Fowles 2004a; Gunnerson 1968) (Figure 4).

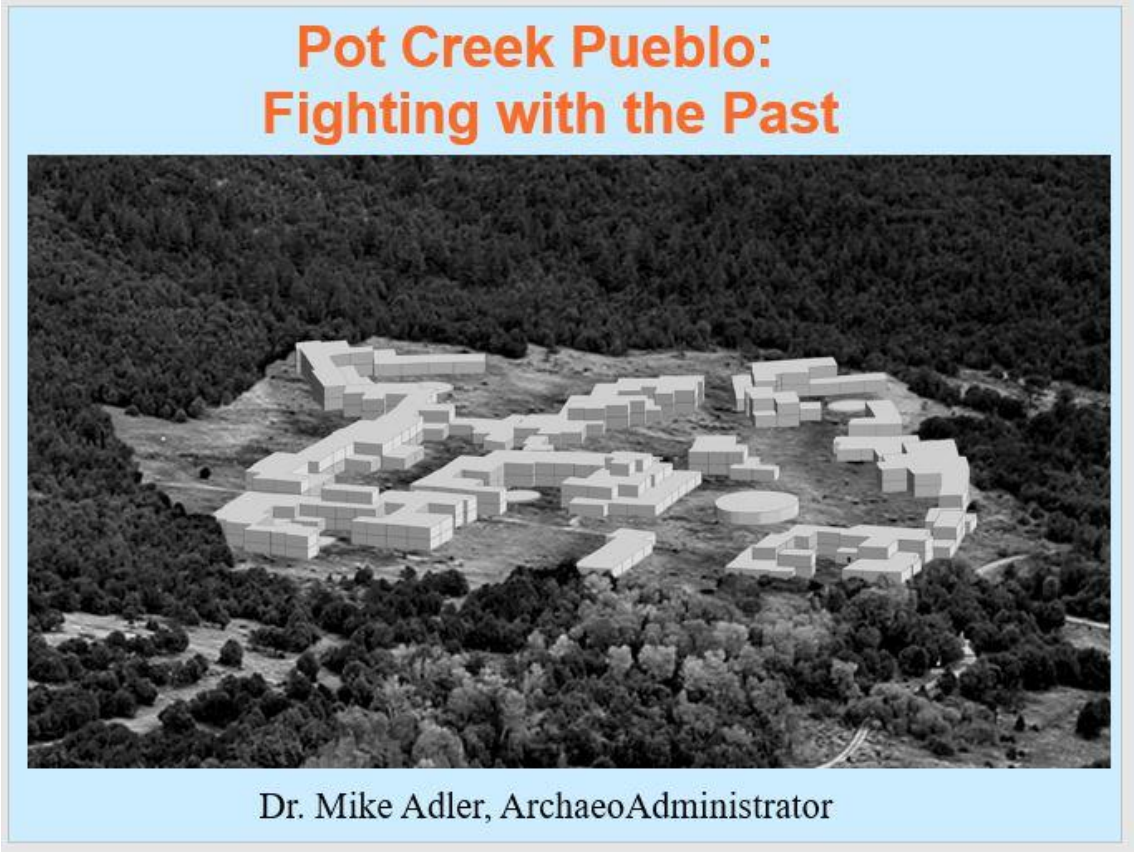

Figure 4. From Michael Adler, adapted from *The Making of a Made People* (after Fowles 2004:423).

1.3 The Dynamics of T'aitöna in a Changing Rio Grande Region

> Indeed, the Southwest was one of the crucibles where American anthropology and archaeology were forged in the early twentieth century and has been a battleground of theory and method ever since (Duwe 2020:6).

This is how Samuel Duwe opens his exploration of the Tewa World, capturing the excitement of constant discovery of different aspects of the Pueblo past. These discoveries, grounded in material culture analyses, continue to lead to more detailed explanations of how the Pueblo people interacted with each other and with their environment. The purpose of the present work is to examine obsidian data, obtained through X-ray Fluorescence (XRF) chemical characterization methods, using spatial analysis to visualize those results in maps that describe the usage patterns across T'aitöna Pueblo. A secondary set of data for two pottery types is also spatially analyzed and visualized in order to highlight any patterns that the pottery usage may have in common with the trends that were seen in the obsidian procurement and usage patterns.

The remainder of this thesis is structured as follows. Chapter 2 begins with a description of T'aitöna Pueblo. A discussion of the probable cultural identities of the people who came together to form T'aitöna Pueblo and the society they created is presented against the backdrop of the great movement and aggregation of peoples in the Pueblo World during the thirteenth and fourteenth centuries. In Chapter 3, I present spatial analysis of the obsidian data obtained from XRF analysis to find trends in the origin and purpose of the obsidian recovered at the T'aitöna Pueblo. I examine the distribution of obsidian from the seven sources by room block for tools and for debitage. In Chapter 4, I look at data for the early Kwahe'e Black-on-white and the later Santa Fe Black-on-white ceramics to discern any trends that show how either ceramic type may have been utilized in the different room blocks of the settlement. In the concluding chapter, I

summarize the results from Chapters 3 and 4 leading to a discussion of identifying a shared culture created from the presence of two different cultural groups at T'aitöna.

My results show that during the approximately 70 years that T'aitöna was occupied, all the currently excavated rooms across the settlement were used for habitation indicating that the groups were living there together, not at separate times. Furthermore, material collected from the room blocks shows that there are consistencies in where both types of pottery were found, pointing to similar patterns of use and discard. The data indicates that all of the people living in the pueblo were using both Kwahe'e Black-on-white and Santa Fe Black-on-white ceramics. In addition, the majority of the ceramic artifacts were found in the midden. And although researchers are just beginning the analyses of the obsidian data this shows the same trends. Across the pueblo the three most common types of obsidian were all from the Jemez Mountains, with samples from El Rechuelos making up over 50% of the assemblage. El Rechuelos was found in every one of the excavated room blocks. The majority of the lithics and the ceramics were unearthed in the large, communal midden. Both the obsidian and ceramics assemblages along with cultural and architectural evidence support the existence of a shared identity at T'aitöna Pueblo.

Chapter 2: Piecing Together Life at T'aitöna

2.1 Description of T'aitöna

Tree-ring data indicate that the first construction episode at T'aitöna can be placed at 1265 C.E., with an intense period of building in the 1270s (Adler and Hegmon 2022; Crown 1991). Dating of rooms involved a combination of tree-ring data, wall-abutment locations, and stratigraphy (Crown 1991). As with other pueblos, roof beams were recycled and stockpiled so corroborating lines of evidence are important in establishing dates (Crown 1991). Pottery assemblages have proven to be valuable in this capacity (Ortman 2012). The first great kiva of the settlement was built in 1318 (Crown et al. 1996). Interestingly, the last cutting date was 1319, and soon thereafter in the early 1320s the inhabitants began to leave, burning their rooms to close them out (Adler and Hegmon 2022). At the height of its occupation, T'aitöna had 10 room blocks (Figure 5). There were from 350 to 450 surface rooms in the pueblo (Boulanger et al. 2022). The room blocks each contained from 10 to 35 rooms, with some two-story and a few three-story rooms (Boulanger et al. 2022). Crown (1991) estimates that the average use-life of the rooms was 19 years. A natural dip in the land formed a drainage running through the settlement, separating it roughly into north and south areas.

In 1991, when only six room blocks had been excavated, Crown (1991) calculated the population to be 1320. She based this on rooms counts and a stepped population growth model developed by Plog (1975). At the height of the habitation of the pueblo she used the 78% occupancy rate proposed by Hill (1970) (Crown 1991:308). By contrast, making calculations based on household units Arbolino (2001) determined that, in the early 1300s, the number of inhabitants was closer to 400 – 500 people. This is the more accepted estimate (Adler and

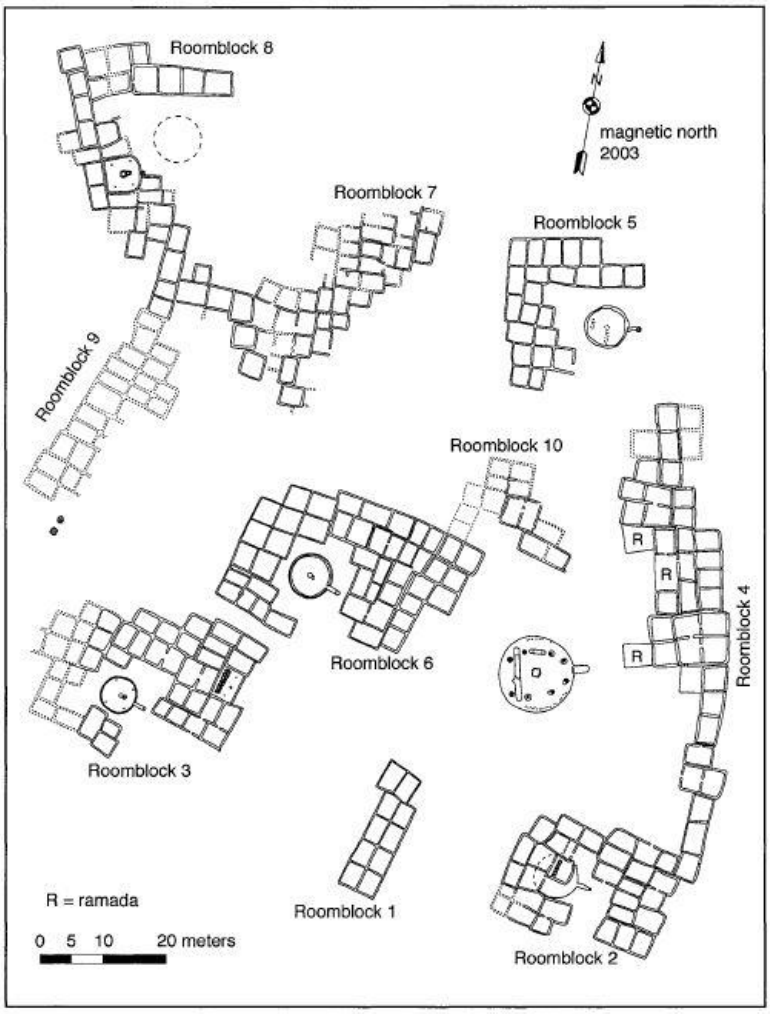

Figure 5. Map of the 10 room blocks of T'aitöna Pueblo with their associated kiva (round) structures. "R" are ramadas and dashed lines show possible walls that have been found. From *The Making of a Made People* (Fowles 2004:406).

Hegmon 2022). T'aitöna appears to have existed as a multistoried pueblo for a span of roughly 50 years from 1260/1270 to 1320 C.E. (Boulanger et al. 2022; Crown 1991; Fowles 2004a). Through the construction and arrangement of successive room blocks a central plaza was eventually created with a great kiva constructed in the last years of its occupation (Crown 1991; Fowles 2004a). But the plan prior to those final years was based on other pueblos in the area like Arroyo Negro (Figure 6), where each room block would have been quite separate with its own kiva (Fowles 2004b). This progression was from an "indigenous" model to one brought in from

another region (Fowles 2004b). The work at T'aitöna continues and currently, the location of approximately 284 surface rooms have been defined with 148 of those having been more thoroughly studied (Boulanger et al. 2022).

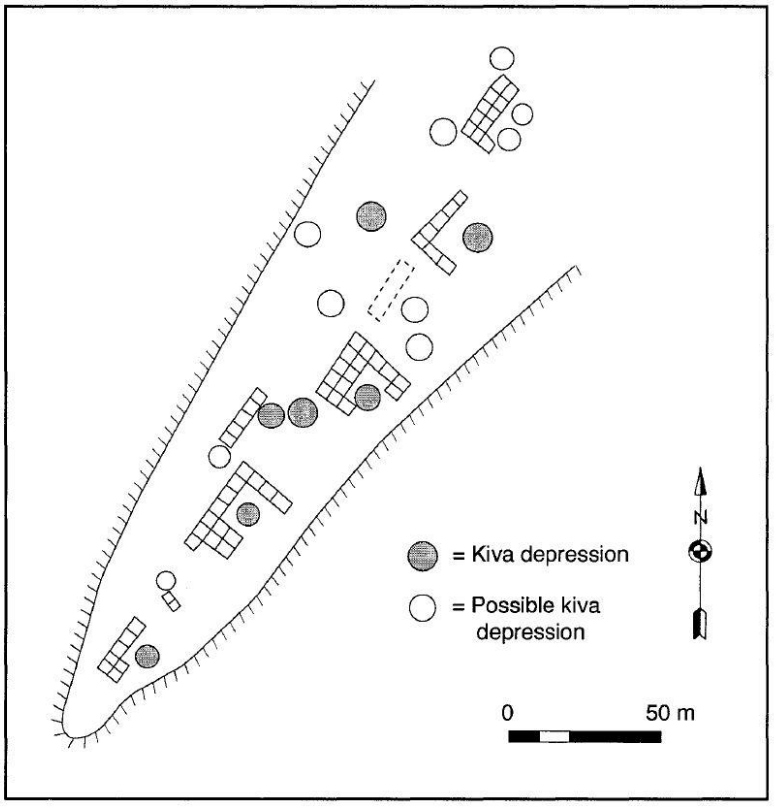

Figure 6. The arrangement of room blocks with their associated kivas at Arroyo Negro. From *The Making of a Made People* (Fowles 2004:208).

There have been various chronologies created to characterize this period in Pueblo history. At the Pecos Conference in 1927 Alfred Kidder established time frames to describe distinct developments in the movement of Pueblo peoples and their types of settlements. During Pueblo II (900 to 1150) there was a great flourishing, culturally and politically, of the multi-storied Chaco World villages on the Colorado Plateau. The Pueblo III period (1150 to 1300) overlaps with the formative years of T'aitöna, and in the earliest Pueblo IV (1300 to 1600) period the people of T'aitöna completed building their great kiva and the last of the 10 multi-

story room blocks before disbanding in approximately 1320 C.E. In this period there was extraordinary cultural metamorphoses as the Pueblo cultural spread across the American Southwest (Adler 1996:vii).

2.2 The Inhabitants of T'aitöna

After understanding the physical layout of this Taos region settlement, a fundamental but a more intangible question about T'aitöna emerges: what was the identity of the people who were living there? This question is bound to the transformation of the American Southwest through waves of migration and return during the thirteenth century. Ortman (2012) takes on the task of explaining this complex set of push and pull factors in *Winds from the North* in the context of the entire region. He considers three highly plausible hypotheses: 1) the *in situ development hypothesis* which understands the growth in the Northern Rio Grande population as completely internal; 2) the *immigration hypothesis,* which explains the expansion as an extended migration from the San Juan area; and 3) the *population movement hypothesis,* which sees the increase in the population of the region as a mass migration event originating in the Mesa Verde area (2012). Ortman favors the third hypothesis because significant archaeological evidence backs it up in terms of the material culture. He uses architecture and artifacts from the Pajarito Plateau region, south of the Taos region and east of the Rio Grande to construct his case that people of the Tewa culture moved from Mesa Verde into the Pajarito region and then some made an additional trek into the Rio Grande area (2012). Ortman pulls in examples from T'aitöna to bolster his case. Lipe (2010) also asserts that numerous lines of evidence support the argument for a massive movement of people from the central Mesa Verde area to the Northern Rio Grande.

It is important to remember that the movement of a people from one region to another is neither simple in its motivations or in its unfolding. Glowacki (2015:84) looks at the complexities of large groups of people translocating and aggregating in the northern San Juan and reminds us that each settlement was responding to a different set of factors. She uses Doringo and Tobler's "Push Pull Migration Laws" (1983) to create a unique perspective for each settlement (Glowacki 2015:19).

Schillaci and colleagues (2017), differ from Ortman because they classify T'aitöna as an ancestral Tiwa pueblo. These scholars base their designation on two lines of evidence. First they use the presence of the two pithouses, that date from the Valdez Phase, which are under the room blocks of the later T'aitöna Pueblo. They are basically espousing that the people who built the later pueblo were (solely) the direct descendants of the pit house inhabitants. Perhaps even more significant, Schillaci et al. (2017) point to the linguistic evidence that the word T'aitöna /T'oyt^{h} ənа/ means "People's House" in Northern Tiwa. Fowles (2004) relates how the people of Taos Pueblo continue to use this word to refer to the settlement. The people of T'aitöna were using a word in the indigenous Tiwa language to describe themselves. There is strong evidence that the members of Taos Pueblo themselves came, in part, from T'aitöna (Fowles 2004a); and so, their use of this Tiwa word to refer to the ancient inhabitants of T'aitöna carries weight. The linguistic and pit house evidence would be in favor of applying the *in situ development hypothesis* for this Taos area settlement; they suggest that the increasing population was of local Tiwa-speaking people.

The demographic landscape of the 1200s in the entire Southwest was a highly dynamic environment (Glowacki 2015). Again, Ortman (2012:289) argues that in the late 1100s and early 1200s there were powerful material pressures that pushed the population from the Mesa Verde

region into the Northern Rio Grande, beginning in the Pajarito Plateau. While Picuris, T'aitöna, and Taos Pueblos are on the northeastern outskirts of the main region of migration, they were still in contact with the Pajarito Plateau through scattered trade (Crown et al. 1996:192). It can be argued that a confluence of communities may have created a settlement with a more established Tiwa group combining with Tewa newcomers from the central Mesa Verde region in what both likely hoped would be a mutually beneficial relationship. Adler and Hegmon (2022:5) describe the established population as, "liv[ing] in small, dispersed settlements in the Pot Creek drainage." The indigenous Tiwa population may have still had strong memories of the inter-pueblo violence that had been experienced in earlier times (Adler and Hegmon 2022; Fowles 2004b; Lipe 2010). Under such conditions new members to their community may have been welcomed as a shield against aggressive forces during a time full of environmental and social challenges (Fowles 2004b:19).

2.3 Discerning the Cultural Identities at T'aitöna

Anschuetz and colleagues (2001) redefined the sense of place in archaeological investigations. The authors opened the concept of the landscape to embrace the significance of *ethnic landscapes*, which is how groups "manipulate material culture and symbols to signify ethnic or cultural boundaries" (Anschuetz et al. 2001:179). These are a necessary complement to *settlement ecology* which "addresses issues of archaeologically observed patterns of land use, occupation, and transformation over time" (Anschuetz et al. 2001:177). Both are tied to the *ritual landscapes* created through "sequences of acts" by a people "to sustain their occupation of their traditional homelands" (Anschuetz et al. 2001:178). All three spatial perspectives assist

researchers as they strive to make their present day view of the landscape align more closely with that of the people who lived in a place many generations before them.

While T'aitöna did have a great kiva by the end of its occupation and there was a central drainage that cut through the middle of the settlement reminiscent of the pueblos found in the central Mesa Verde region, the plaza created by the room blocks is very different than the enclosed plazas found in Mesa Verde pueblos (Fowler 2004b; Lipe 2010). Lipe contends that it is this plaza configuration which rules out the idea that there was only a central Mesa Verde influence on the layout of the pueblo (2010:267–268).

Fowles begins his exploration about the influx of new cultures into the Northern Rio Grande by acknowledging that, "the geographic origin of the peoples settling the region at the start of the Pueblo IV period remains unclear" (Fowles 2004b:19). Part of asking about who was living in T'aitöna is exploring the physical presence of certain *place-making practices* that have been discovered at this pueblo. These place-making practices have a material signature at T'aitöna which can be connected to spiritual practices identified with the outside/migrant populations (Ortman 2012:312).

To understand the practices that left behind a physical signature it is valid to look at the spiritual beliefs of present day pueblos. Scholars have re-established that oral histories of the Pueblo peoples *are* indeed historical documents (Duwe 2011, 2020; Fowles 2004a). So, it is requisite to include the Tewa world view, as described in Ortiz's pivotal work *The Tewa World: Space, Time, Being and Becoming in a Pueblo World,* to gain a more authentic understanding of the Tewa practices from earlier times as well. Ortiz (1969) explains how the cosmological correspondences of physical features found in and surrounding Tewa pueblos elucidate the spiritual meaning of the mundane world. The settlement is at the core of a series of widening

circles of spiritual importance with the center of the earth, the *earth-mother earth-naval middle place,* being central to the plaza of the pueblo which has shrines around it, then low hills, and in important line of sight directions as well as mountains (Duwe 2020; Fowles 2004a; Ortman 2012). It is accepted that these shrines were made during the time that the pueblo was occupied (Ortman 2012). The *earth-mother earth-naval middle place* is also known as a *world-quarter* shrine and in historical pueblos can be found adjacent to the pueblo, even a kilometer or more away (Duwe 2020; Ortman 2012).

As previously referenced, Ortman makes a case for the migrants who came into the Northern Rio Grande as coming from the Central Mesa Verde region. The late Coalition villages of Wiyo, in the Santa Cruz watershed, and of Maestas, in the lower Rio Chama drainage are definitive examples of pueblos with *world-quarter* shrines associated with them (Ortman 2012). Among the Northern Rio Grande pueblos of T'aitöna and Picuris, in the Taos region, there are multiple lines of evidence suggesting that Tewa migrants were in residence and had an impact on the ritual life of the community (Michael Adler, personal communication 2022). This may be seen through the presence of *world-quarter* shrines, cupule boulders, and grinding slicks (Fowles 2004a; Ortman 2012:317).

Yet, not all the features of a spiritual nature at T'aitöna can be characterized as Tewa. There are rock circles placed in proximity to springs near the pueblo that belong to Tiwa traditions (Fowles 2004a). Fowles documents "the pervasive pattern of dual organization" as evidenced by the shrines that are a part of T'aitöna and are situated near it, "in the distribution of large bermed circles, elongate upright rocks and large depressions" (2004:547).

Considering there are shrines from the two moieties present at T'aitöna the decision by a migrant Tewa community to create a pueblo within an existing Tiwa village may have had a

dynamic spiritual component to it. This underscores how we need to understand settlement decisions in terms of the whole scope of the landscape and not just through environmental lenses such as food security and resource proximity, or through basic societal issues such as protection from violence. These factors are understood in the context of seeing the landscape as imbued with spiritual meaning. The people living at T'aitöna were able to recognize home through a cosmological ordering of the natural world just as much as through practical considerations. Their world view that was guided by spiritual markers in the natural world probably contributed to making T'aitöna a place where multiple distinct cultural groups could come together to create a mutually beneficial community.

The dynamic relationship that the people who were living at T'aitöna had with the landscape may be discernable in the archaeological record. Specifically, were there multiple spiritual communities in residence at the same time, each creating ritual features in the landscape and each finding elements in the natural world that indicated they were living in the right place? What these features do not immediately show us is if there was crossover between the various groups living together.

2.4 Creating Identity

In his ethnological analysis of the Southwest during the Pueblo IV period, Whiteley (2004) suggests that the distinctions of identity were never completely resolved at T'aitöna. Both Adler (2022) and Fowles (2004a, 2005) have considered this question by using numerous lines of evidence from ceramic assemblages, architectural elements, shrines, room closure practices, and oral histories, to ask how the different groups who came together created this one settlement

(Boulanger et al. 2022; Fowler 2004a, 2005). Researchers have looked at the origins of the moieties at T'aitöna—the Summer People and the Winter People—using the oral traditions of those who continue to live on the Taos Plateau (Boulanger et al. 2022; Fowles 2004a 2004b, 2005). A society supporting dual moieties may be one way to preserve certain aspects of identity while aggregating into a larger group. As part of this complex discussion about maintaining distinction while creating community Whiteley (2004:147) introduces the concept of "interstitial people" who maintain some original boundaries while melting others. A strong example of this process of creating identity within a new society is the architectural element of centerpost/basin support. Fowles (2004b) considers the remarkable roof support system which has been found at T'aitöna (Figure 7), consisting of a central post surrounded by a basin, to be evidence of that struggle to find a local identity. Once this unique post-and-basin design was devised it was adopted by T'aitöna, Picuris, and Taos, and subsequently was used exclusively at T'aitöna for all newly built rooms,

> The center-post/basin complex was not structurally necessary and is not found at other adobe pueblos in the Rio Grande Valley. The rigid uniformity of its application in this sense suggests that the complex was functioning in part as an emblem of what it meant to be Tiwa (Fowles 2004b:24).

Fowles (2004a:434) cites tree-ring data to establish that the center-post and basin complex began to be widely used at T'aitöna at the end of the 1260s. This is early in the settlement's occupation and suggests that the interest in forging a communal identity was present as the cultures came together to forge a single settlement.

These issues of identity may be examined through multiple types of material remains. They have also been recorded in the oral histories as vital to pass on to succeeding generations. Each avenue of inquiry brings greater clarity to our understanding of the social organization and lifeways of the people who created the T'aitöna Pueblo.

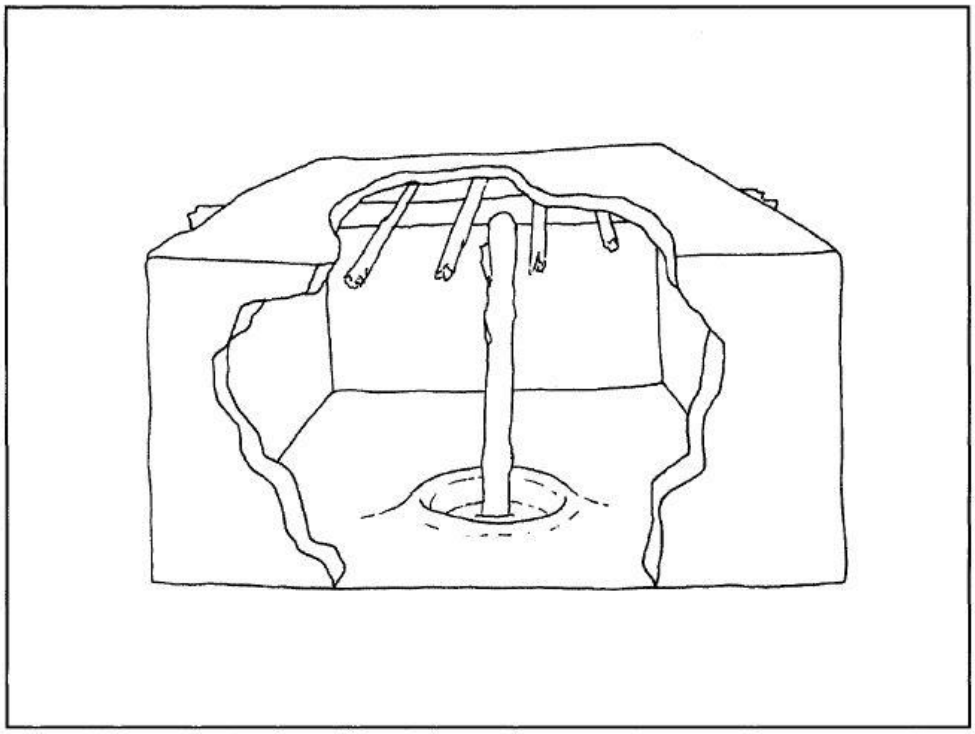

Figure 7. The center-post/basin room support developed at T'aitöna, from *The Making of a Made People (Fowles 2004:436).*

Chapter 3: Obsidian

3.1 The Place of Obsidian Analysis in the Study of Pueblo Settlements

The settlement pattern in the Northern Rio Grande favors sites that are near permanent water supplies and that also have access to arable land and lithic sources (Fowles 2004b). Just as distinctive practices in place-making reinforce the composition of T'aitöna being composed of at least two different groups of people with different histories, it may be possible to see multiple cultural patterns in the sourcing of lithic materials and pottery production (Boulanger et al. 2022).

In their most recent research Adler and his colleagues (2022) have turned their attention to the obsidian found at T'aitöna to see what that class of artifacts can contribute to the understanding of a dual moiety nature of this integrated settlement or to a broader understanding of the movement of peoples in the Rio Grande region. In their research they are considering how the multicultural community of T'aitöna procured a material that was out of their immediate area, 80–90 km away, as a proxy for understanding the behavior of those who were living at T'aitöna.

With X-Ray Fluorescence analysis there is high confidence in the chemical characterization of the obsidian samples found at T'aitöna. This facilitates the ability to link artifacts to the area in which the lithic material was mined or collected. This thesis uses the chemical characterization of the obsidian assemblage from T'aitöna to carry out spatial analysis on different attributes of the obsidian. These are used to identify spatial patterns that will assist in understanding demographic trends at the settlement. ArcGIS Pro version 2.8.1 is used to visualize the data created by Boulanger and Adler with their colleagues. The distribution of obsidian across the pueblo of T'aitöna and the implications for population dynamics are

explored. Using the research of Boulanger et al. (2022) as the starting point this chapter presents an analysis of the distribution of obsidian tools across the T'aitöna Pueblo using ArcGIS Pro software and suggests some implications for population demographics based on that analysis. The distribution of Kwahe'e Black-on-white and Santa Fe Black-on-white pottery are also examined within the same GIS model to see if there is any overlap with the patterns of population dynamics suggested by the obsidian analysis.

3.2 Obsidian Characterization in Archaeology

Obsidian is a durable material that can be analyzed using X-Ray Fluorescence (XRF) to produce results that identifies the geological deposit the obsidian originated from with a high degree of confidence (Shackley 1988, 1995, 2005a). Tracing the obsidian back to its volcanic sources has been extensively used by researchers in varying settings throughout the world. In their 2012 compilation, Liritzis and Stevenson presented the breath of contexts in which obsidian sourcing has proved highly useful: in Peru by Dussubieux and Nash (2012); in Bolivia by Glascock and Giesso (2012); in Polynesia by Weisler (2012); in Africa by Dussubieux and Kusimba (2012); and across the Classical world as shown through the work conducted in Italy (Di Bella et al. 2015) and Greece (Acquafredda 2019). In the American Southwest, M. Steven Shackley's edited volume *Archaeological Obsidian Studies: Method and Theory,* provided the first comprehensive source characterization for obsidian in the region. In this Shackley presented the advantages and challenges inherent in chemical variability from obsidian obtained from different depositional contexts by looking at how samples from the American Southwest were analyzed. He identified that the place which obsidian archaeometry has in archaeology was,

> due to the concomitant advances in computer technology and instrumental chemistry, and partly due to a recognition by archaeologists that archaeometrists provide much more than mere measurement (1998:1).

Shackley has transformed the niche of obsidian analysis from that of lithics identification of tool type to a robust quantification method that can verify the original geographic sources of the raw material. The XRF obsidian analysis opens an additional way to track the trends of material usage on T'aitöna. The data obtained from connecting samples to their source locations has the potential to show if there are any differences among the room blocks where the raw material was acquired. These differences may indicate cultural differences at the pueblo.

3.3 The Place of Obsidian Analysis in Pueblo Archaeology

The examination of obsidian assemblages has been a key component in larger analyses of the Pueblo culture in numerous contexts. Graves (2004) uses data pertaining to obsidian procurement during the protohistoric period at the Jumanos pueblos to envision the larger picture of long-distance-exchange practices. Adams (2004) backs up his theory about the style of Homol'ovi settlement hierarchy and their degree of connectedness with Hopi by looking at how Homol'ovi fit into the regional trade of obsidian. Bernardini and Brown (2004) recognize the significance of obsidian in not just the Homol'ovi-Hopi interaction, but as a major export from these mesa settlements in exchange for northern ceramics. One of the most geographically extensive examinations of the place obsidian had in the exchange networks of the Pueblo world was conducted by Mills et al. (2013) in looking at how the frequency of both local and longer distance trade activities revealed insights on the multiple layers of connectivity amongst Southwest settlements.

In discussing the population that lived in the Rio Chama drainage in the fifteenth century Fowles (2004b) uses access to resources to describe the four Tewa subgroups. He considers the availability of Polvadera obsidian and Pedernal chert as an economic criterion that can distinguish the Tewa who lived in the settlements bordered by the El Rito and Cañones drainages from other settlements in the region (Fowles 2004b:21). Polvadera obsidian is currently identified as El Rechuelos Rhyolite (Boulanger 2022:14).

In looking at the great movement of people from the Mesa Verde region to the Northern Rio Grande Arakawa and his colleagues focused on the beginning stages of the migration and argued that using "obsidian procurement patterns" was "an under-utilized line of evidence" (2011:774). Of particular interest in this area, both in the geographic sense and in terms of the material culture, are the investigations of Adler and his colleagues studying T'aitöna. Adler highlights how obsidian sourcing practices have created differing perspectives on population movement (Boulanger et al. 2022). To understand the settlement dynamics of T'aitöna it is beneficial to consider how the obsidian from the Jemez Mountains has been consistently utilized (Boulanger et al. 2022). Several archaeologists view the obsidian sourced from the Jemez Mountains that was found in the Mesa Verde region as an indication that there was substantial interaction between this area and the ancestral Tewa who were living in the region of the Northern Rio Grande (Arakawa et al. 2011; Boulanger et al. 2022; Ortman 2010, 2012). The premise that there was migration of Tewa people into the Northern Rio Grande from Mesa Verde is strengthened by the presence of obsidian sourced from the Jemez Mountains found both in the Northern Rio Grande and in Mesa Verde. Other archaeologists (Moore et al. 2020), however, view these obsidian artifacts from the twelfth and thirteenth century contexts in both the general San Juan Basin and Mesa Verde regions as an indication of greater obsidian tool making and

usage by increasing numbers of people who were living across these landscapes (Boulanger et al. 2022).

On the far eastern end of the Northern Rio Grande region lay the three Pueblo settlements that were inhabited in the twelfth and thirteenth centuries, those of Taos, T'aitöna, and Picuris. Adler and his colleagues took note of the lack of data about the geological sources of the obsidian used in the Taos region in the Moore et al. (2020) study (Boulanger et al. 2022). This is an important omission because the true picture of population movement into and across the Northern Rio Grande during this period was not a centralized activity. As Fowles' (2004a; 2004b) work indicates, in addition to practical environmental factors, ancestral Tewa looked for areas to settle in that had spiritual relevance. The incoming Tewa likely participated in creating a dual moiety community at T'aitöna with an older Tiwa group (Adler and Hegmon 2022; Boulanger et al. 2022; Fowles 2004a, 2004b).

3.4 Analytical Methods and Visualization

The obsidian data for the present analysis was created by Michael Adler and Matthew Boulanger of Southern Methodist University with Evan Sommer and Ian Jorgeson. For their study of the obsidian excavated at T'aitöna Pueblo they obtained the chemical characterization for an assemblage of 323 samples. The obsidian was found in Room Blocks 1, 2, 3, 4, 6 and 8 and in the midden. These samples are part of a larger assemblage of more than 1000 pieces. Dendrochronological analyses conducted at T'aitöna has strongly connected most of these samples to between A.D. 1260–1320 (Boulanger et al. 2022; Crown 1991). In addition, there are a few samples from the earlier pit house occupation sites found under Room Blocks 1 and 2 (Boulanger et al. 2002; Crown 1991; Fowler 2004a; Wetherington 1968). The samples,

excavated between 1957 and 2003, have been conserved at SMU-in-Taos's Fort Burgwin Archaeology Research Repository (Boulanger et al. 2022). Before the study done by Boulanger and his colleagues analytical work had been conducted on the obsidian artifacts found at T'aitöna Pueblo by Wolfman and Newman (Boulanger et al. 2002). In the mid-1990s Wolfman had 24 samples, mainly from Room Block 4 analyzed as part of a study done for the USDA Forest Service (1994). A few years later Newman used the chemical determination from 22 obsidian samples found in Room Block 6 as part of his dissertation (1997). From both of these preliminary studies it appeared that most of the obsidian at T'aitöna Pueblo had originated at El Rechuelos and Valles Grande in the Jemez Mountains, although a few samples could also be connected to No Agua Peaks West (Figure 8) (Boulanger et al. 2002).

A Bruker Tracer 5i handheld portable fluorescence spectrometer was utilized by Boulanger and his colleagues (2022) to obtain the spectra by which the 323 samples could be connected to their geological area of origin. The specimens were analyzed for three minutes each, and then their spectra were calibrated (Boulanger 2022). The calibration method involved comparing the obsidian sample's spectrum to "a suite of 43 well-characterized obsidian reference specimens developed by the Archaeometry Laboratory at the University of Missouri (Glascock and Ferguson 2012; Speakman 2012)" (Boulanger et al. 2022).

Using ArcGIS Pro software, the obsidian data set was joined to a feature dataset which had been constructed from two earlier T'aitöna Pueblo datasets. These older data sets were compiled from the late 1950s through 40 years of excavations. Record keeping priorities changed throughout that period. One of these other datasets contained control points for the rooms of T'aitöna Pueblo which would enable the numeric data connected to room numbers to be visualized in the appropriate rooms of the settlement. By creating independent tables for

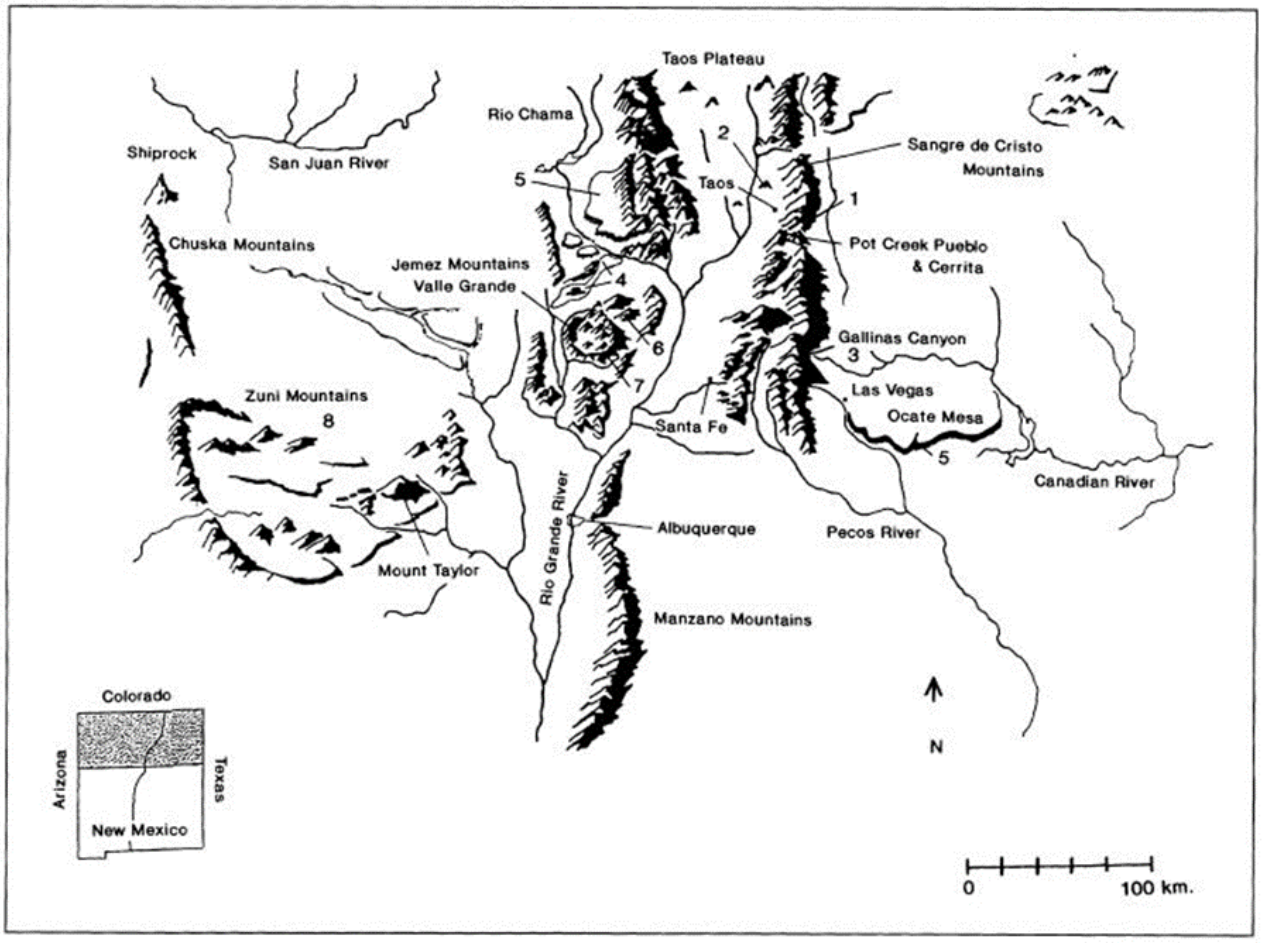

Figure 1. Locations of sites and sources of lithic materials utilized in the study. 1= chert; 2= rhyodacite (Arroyo Hondo/Cerro Negro Mt. source); 3= brown chalcedony (Gallinas Canyon); 4= Cerro Pedernal (San Pedro Mt., and associated deposits); 5= Dakota Morrison (Mesa de los Viejos and Ocate Mesa); 6= Polvadera Peak obsidian; 7= Cerro Toledo obsidian (Obsidian Ridge/Rabbit Mt. and Sierra de Toledo); 8= Zuni Mountains chert.

Figure 8. The locations of the Jemez Mountain obsidian types used at T'aitöna Pueblo (Pot Creek Pueblo) in "Lithic Reduction Technologies" (Newman 1994:492).

each of the room blocks and the midden the obsidian data for each of those areas could be analyzed for frequency of different attributes. The resulting tables were related to the room blocks in the *room block* feature class. This made the spatial analysis of the obsidian data possible. Pie charts utilizing two dimensions (proportional diameter and percentage) were then created to visualize the data across the pueblo.

3.5 The Spatial Analysis

The assemblage consisted of samples from Room Block 1 (n=28), Room Block 2 (n=15), Room Block 3 (n=47), Room Block 4 (n=18), Room Block 6 (n=6), Room Block 8 (n=30), 172 samples from the midden, and 7 samples that did not have a location associated with them (Table 1). Of the 323 obsidian samples 308 (95%), were identified as coming from four obsidian sources in the Jemez Mountains. These four sources were El Rechuelos (n=193), Valles Grande (n=83), Cerro Toledo (n=30), and Canoves Canyon (n= 2). In addition, there were also samples from No Agua Peaks West, in northern New Mexico (n=12); Obsidian Cliff, Wyoming (n=2); and the Mineral Mountains in Utah (n=1).

Table 1. The frequency of obsidian artifacts from the Jemez Mountains and other sources by room blocks and the midden.

Room Block	El Rechuelos, Jemez Mtns.	Cerro Toledo, Jemez Mtns.	Valles Grande, Jemez Mtns.	No Agua Peaks West, NM	Obsidian Cliff, WY	Canoves Canyon, Jemez Mtns.	Mineral Mountains, UT	Row Totals
1	15	3	5	3	1	0	1	28
2	9	1	5	0	0	0	0	15
3	30	5	10	2	0	0	0	47
4	15	0	2	0	0	1	0	18
6	3	0	2	0	0	1	0	6
8	20	1	8	1	0	0	0	30
midden	97	18	50	6	1	0	0	172
No location	4	2	1	0	0	0	0	7
Column totals	193	30	83	12	2	2	1	323

The distribution across T'aitöna Pueblo of the obsidian obtained from the three areas of the Jemez Mountains that had the highest counts was visualized cartographically (Figure 9). On

this map, most of the obsidian found at the pueblo from the assemblage of 323 artifacts was chemically sourced to El Rechuelos with the second greatest amount from Valles Grande. The obsidian from the three main sources were chosen for analysis on this map since they represent 95% of the obsidian assemblage.

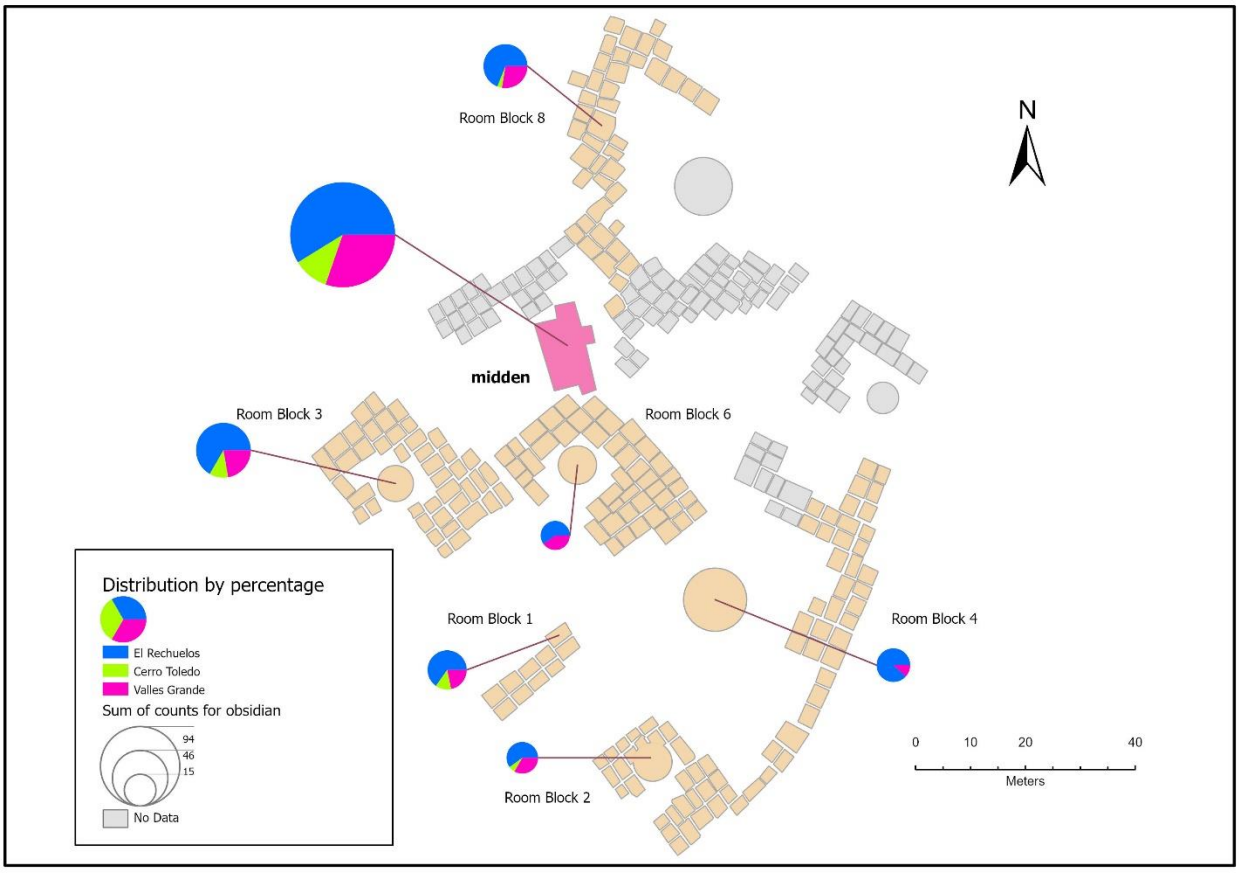

Figure 9. The distribution of obsidian excavated at T'aitöna which was obtained from the three most commonly used areas in the Jemez Mountains: El Rechuelos, Cerro Toledo, and Valles Grande. (Map by author)

This holds true for all locations in the pueblo. The least amount of these three sources of obsidian came from Cerro Toledo. In fact, in two locations, Room Blocks 4 and 6, there were no

samples from Cerro Toledo (Figure 10). The predominance of El Rechuelos and Valles Grande obsidian is consistent with the findings of Boulanger and Adler and their colleagues (2022:8).

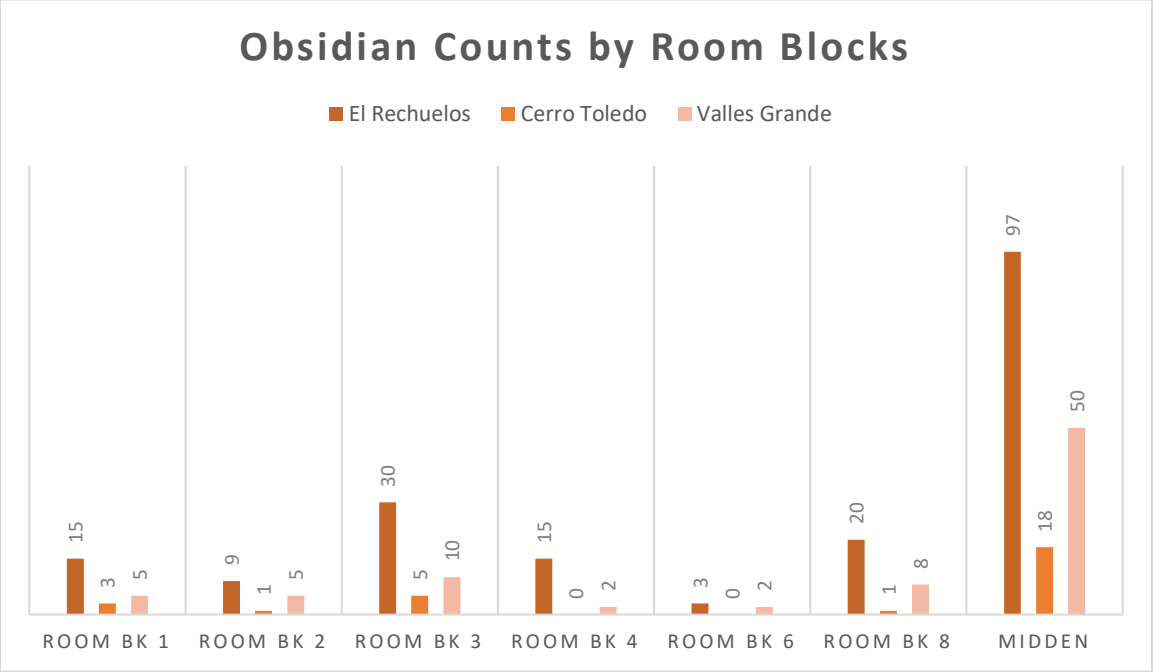

Figure 10. The counts of obsidian artifacts found from three locations in the Jemez Mountains by room blocks and the midden at T'aitöna Pueblo.

The pattern of finding El Rechuelos and Valles Grande obsidian in higher amounts in the room blocks holds true for the midden as well. Although Cerro Toledo obsidian was also found in the midden it only makes up 11% of the total. The midden assemblage has two important quantitative aspects. First, of the three sources from the Jemez Mountains El Rechuelos constitutes 59% of the total, a significant percentage. Second, the midden's obsidian represents 53% of the entire 323-piece assemblage. What was found in the midden reflects proportional patterns from both the rest of the pueblo as a whole and from the individual room blocks. This would suggest that the inhabitants of all the room blocks were creating their obsidian tools and discarding the debitage in much the same way.

From multiple lines of evidence, it appears that all the rooms in the pueblo were being lived in during the period of occupation (Adler and Hegmon 2022). A later culture did not come in after the original inhabitants left; instead, the earlier residents created an integrated settlement with the group of people arriving later (Fowler 2004a, 2004b, 2005). And the obsidian depositional patterns would support the view that all the inhabitants at T'aitöna Pueblo were participating in similar life ways.

In looking at the visualization of the distribution data of the three most abundant types of obsidian from the Jemez Mountains, it initially appears that a pattern may be present with Room Blocks 4 and 6. Neither of these areas have any Cerro Toledo obsidian. To investigate further if a pattern is present in all of the room blocks a Chi-square test was run (Table 2). To help in the analysis I created H_0: the room block (where the obsidian was found) is not independent of where the obsidian came from in the Jemez Mountains. The values for the expected frequencies were derived from the proportions of the different types of obsidian found in the midden because the midden has the largest amount of obsidian of any location in the settlement, accounting for over half of the total amount. The Chi-square test resulted in a test statistic (χ^2=7.7) that is smaller than the critical value (18.31) which fails to reject the null hypothesis. This may indicate that the cultural group living in a certain room block was partial to using obsidian from a certain location in the Jemez Mountains or avoided another one. As more of the larger 1000 sample obsidian assemblage is analyzed with XRF additional data may support that this is indeed a pattern.

In other parts of the Northern Rio Grande region, the Pajarito Plateau and even in Mesa Verde Cerro Toledo was, in contrast, the most abundant form of obsidian found in assemblages

at sites dating from the twelfth and thirteenth centuries (Boulanger et al. 2022:2). But T'aitöna Pueblo does not follow this same trend (Boulanger et al. 2022:2). The question becomes why

Table 2. Summary of the Chi-square calculation to test for the independence of type of obsidian to room block location where artifact was found. The null hypothesis was rejected.

Sources of Obsidian Artifacts				
Site	Type of Obsidian	Observed	Expected	Chi-square values
RB 1	E R	15	15.8	0
	C T	3	1.7	1
	V G	5	5.5	0
RB 2	E R	9	10.3	0.2
	C T	1	1.1	0
	V G	5	3.6	0.6
RB 3	E R	30	30.9	0
	C T	5	3.4	0.8
	V G	10	10.7	0.1
RB 4	E R	15	11.7	0.9
	C T	0	1.3	1.3
	V G	2	4.1	1
RB 6	E R	3	3.4	0.1
	C T	0	0.4	0.4
	V G	2	1.2	0.5
RB 8	E R	20	19.9	0
	C T	1	2.2	0.6
	V G	8	6.9	0.2
Chi-square = 7.7				
Critical Value (.05,10) = 18.31				

Cerro Toledo does not show up in a greater amount at T'aitöna. What are the interactions or networking conditions that developed into this observed pattern of obsidian usage?

When Boulanger and his colleagues (2022) did a least cost path analysis for the locations where the three most abundant types of obsidian, El Rechuelos, Valles Grande and Cerro Toledo, were obtained from they concluded that the differences in distance (87.6 km, 97.1 km, and 94.6 km respectively) were too small to have a decisive impact on gathering practices. The inhabitants

of T'aitöna appear to have sought out specific types of obsidian, not by picking up cobbles from the closest alluvial deposits, but by having a preference for certain obsidian types and perhaps by even using paths which avoided contact with other pueblos (Boulanger et al. 2022).

The obsidian assemblage was also examined to see if there were differences in the spatial distribution of tools and debitage (Figure 11). Debitage, often identified as flakes in the sample set, would indicate on site production and possibly even direct procurement of the raw material. Every location at T'aitöna did not contain artifacts from both categories (Table 3). In Room Block 4 no flakes were found, only 18 tools. The converse is true of Room Block 6 where six flakes were noted. The areas of the pueblo which had higher amounts of obsidian artifacts in this assemblage are Room Block 3 (n=47), Room Block 8 (n=30), and Room Block 1 (n=28). All these locations had roughly a 60/40 ratio of debitage to tools. By far, the greatest number of obsidian artifacts were from the midden with a count of 172, 53% of all the samples in the assemblage. Perhaps it is not surprising that the ratio in the midden is 69/31 debitage to tools. It would be expected that the discarded material from making tools would go into the trash area.

Table 3. The count by location (room block or midden) of obsidian artifacts by tool or flake/debitage.

Room Block	Flake/ Debitage count	Percentage of Room Block Total	Tools count	Percentage of Room Block Total	Totals
1	18	64	10	36	28
2	4	27	11	73	15
3	29	62	18	38	47
4	0	0	18	100	18
6	6	100	0	0	6
8	18	60	12	40	30
Midden	119	69	53	31	172
No location	7	100	0	0	7
Totals	201		122		323

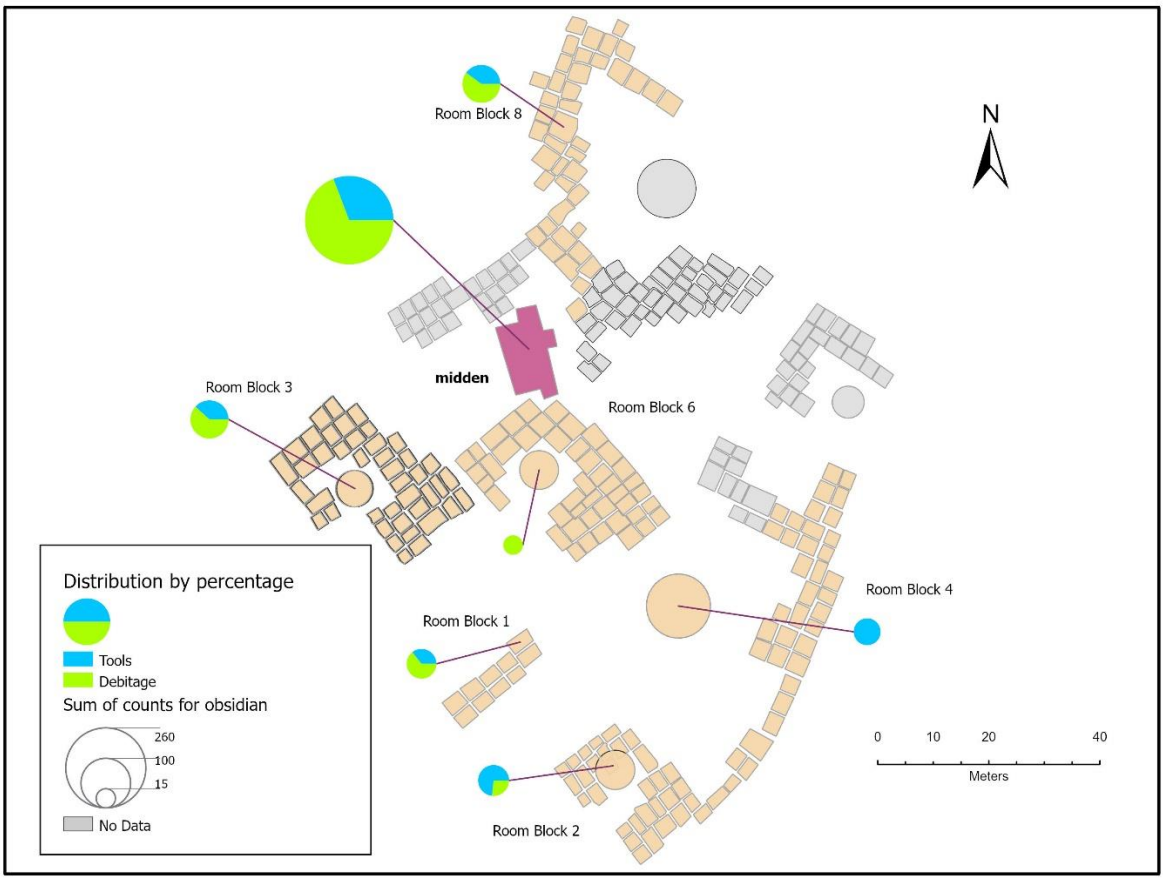

Figure 11. The distribution of obsidian excavated at T'aitöna showing the proportion of tools to debitage. (Map by author)

When looking at the distribution of obsidian tools and debitage across the pueblo it appears that most of the locations had a high proportion of debitage to tools. This would support the view that the raw material was brought to T'aitöna, and then it was worked at the pueblo to make a variety of tools and weapons. In the assemblage there were projectile points, drills, scrapers, gravers, blades, bifaces, and unifaces. That tools were found in the midden may indicate that they had become damaged and were judged to be unusable. Of the 53 tools excavated from the midden 32 are described as fragments. Most of the sample are projectile points (n=42). Biface projectile points account for the most of the fragments: distal fragments

(n=8), proximal fragments (n=4), corner notched proximal fragments (n=10), medial fragments (n=7), triangular proximal fragments (n=2), and fragments just recorded as biface (n=3), although there are a few uniface projectile point fragments (n=3) as well. Some tools were not recorded with any indication of their condition such as the drills, scrapers and gravers. Interestingly, the flakes are recorded as cortical, primary cortical, secondary, and tertiary, although some are only called flakes and broken flakes.

The obsidian sources for the tools which were found in the different areas of (Figure 12) T'aitöna Pueblo presents an interesting contrast to the sources of the obsidian for the debitage (Figure 13). Room Blocks 3 and 8, and the midden all had obsidian for the tools from the same four sources, and they are all on the western side of the pueblo. For both the tools and the debitage Room Block 3 and the midden have the same obsidian profiles. Interestingly, though Room Block 1 only has tools made from El Rechuelos obsidian, the sources for the debitage are from six areas, including rare samples from locations in Utah and Wyoming. However, Room Block 1 actually does follow the pattern of Room Blocks 3 and 8 and the midden. This is because the two obsidian samples that come from Obsidian Cliff and the Mineral Mountains have been identified as Valdez Phase artifacts (Boulanger 2022:9).

Room Block 4 only had tools and Room Block 6 only had debitage. As there were differences between the type of obsidian the tools were made from and that of the debitage in Room Blocks 1, 2, and 8 I did a Chi-square test for all the room blocks (Table 4). Using a Chi-square methodology based on Albert Spaulding's work but tailored to archaeological samples (explained in Appendix A) I calculated adjusted residuals as a further test of significance. From the variation among the room blocks I expect that where the obsidian sample was found at the settlement is independent of where the raw material was sources from. So, I created the H_0: the

Figure 12. The obsidian sources of the tools excavated at T'aitöna Pueblo. Both major and minor sources are represented. (Map by author)

room block where the obsidian was found is not independent of where the raw material was sourced from. The significance chosen was α=.05. The Chi-square test resulted in a test statistic (χ^2=36.26) that is larger than the critical value (11.07) which rejects the null hypothesis. In looking at the sources of the obsidian found at the settlement we should not expect that they are dependent on the room block at which they were excavated. In other words, the obsidian profile should be rather consistent across the pueblo. Boulanger et al. (2022) also arrived at this

Figure 13. The obsidian sources of the debitage excavated at T'aitöna Pueblo. Both major and minor sources are represented. (Map by author)

conclusion by including earlier obsidian samples analyzed by Newman (1997) and Wolfman (1994) and excluding all non-local obsidian artifacts.

To statistically determine which room block's tools or debitage have an observed frequency close to what we would expect I compared the adjusted residuals to the critical values for α=.05, which fall between 1.96 and -1.96. The adjusted residuals indicate that the differences between the observed and the expected frequencies of the debitage found in Room Blocks 1, 3, 6, and 8 are not significant. Since most of the obsidian that was chemically characterized

Table 4. Chi-square test to determine if the frequency of tools vs. debitage for the room blocks where artifacts were found is significant. Bolded values are greater or less than the significant range of values (1.96 to -1.96).

location	obsidian	observed	expected	chi-square	residuals	adjusted residuals
RB 1	tool	10	13.31	0.83	-0.90	**-3.00**
	debitage	18	14.69	0.74	0.86	0.91
RB 2	tool	10	4.76	5.63	-2.37	**-81.18**
	debitage	4	7.34	1.49	-1.22	**-13.30**
RB 3	tool	18	22.35	0.83	-0.91	**-3.02**
	debitage	29	24.65	0.75	0.87	0.91
RB 4	tool	18	8.56	10.27	3.21	**10.37**
	debitage	0	9.44	9.40	-3.07	**-3.16**
RB 6	tool	0	2.85	2.90	-1.70	**-5.57**
	debitage	6	3.15	2.71	1.65	1.72
RB 8	tool	12	14.27	0.37	-0.61	**-2.01**
	debitage	18	15.73	0.34	0.58	0.61
		Chi-Square value		36.26		
		Critical Value (.05, 5)		11.07		

(62%) was debitage the sample size is large enough to start to see trends. As more of the 1000-piece obsidian assemblage is analyzed it is hoped that it will be possible to see trends in the types of tools that were found in the different room blocks. If the people living at T'aitöna were actively creating a settlement identity the similarities seen in the large debitage sample set may be evident in the tool sample set as well. But there is also the possibility that an extensive but cohesive settlement would have different communities of practice specializing in producing the multitude of material goods needed to support daily life. Most prominently, the lithic and ceramic needs of the pueblo might be produced in specific areas of T'aitöna or at certain room blocks.

The purpose of the spatial analyses of the 323-piece obsidian assemblage analyzed through XRF for this study was to visualize the data in order to discern patterns. These spatial analyses focused on where the obsidian came from and what proportion of the artifacts from each location on T'aitöna Pueblo were tools and debitage. From the four GIS analyses, it is clear that a little over half of what was left behind or intentionally discarded ended up in the midden. This supports the current understanding that all the rooms were being used for habitation and none appear to have taken on a second use life as a trash area. A further question concerns similarities by room block for where the obsidian of the tools used at the pueblo came from. As more debitage is analyzed we may begin to assess where the raw material that was consumed by the settlement was worked. From the data already analyzed there is a discernable similarity in the types of obsidian debitage and the proportion they were found in for Room Blocks 1, 3, 8, and the midden. As noted above Room Block 6 only had debitage (n=6) and Room Block 4 only had tools but both had small sample sizes. It appears that there are trends in where obsidian was obtained which encompass most of the settlement. This data supports the concept that the people of T'aitöna were functioning as a unified society and not as autonomous groups.

The proportions of obsidian obtained from the three areas in the Jemez Mountains was displayed rather dramatically. The map showing the distribution of obsidian by where it came from also supports the analysis by Boulanger and Adler and their colleagues (2022). Most of the obsidian samples in the assemblage came from El Rechuelos and Valles Grande. Interestingly, the latter represents a different procurement behavior; it is theorized by Boulanger (2022) and his team that the residents of T'aitöna went to the geological source, the caldera itself, to obtain the Valles Grande material. The samples that can be traced back to Cerro Toledo point to another behavior common to T'aitöna Pueblo. Although it is the variety that occurs in highest amounts in

the Rio Grande deposits the people of T'aitöna did not utilize it as other Puebloan groups were doing (Boulanger et al. 2002; Church 2000; Shackley 2021). And this quite definite behavior is evidenced across the pueblo, just as El Rechuelos is the obsidian type found in greatest abundance across the settlement. As described above with the beam and basin room support the people at T'aitöna Pueblo developed ways of doing things that were unique to their settlement. The multiple groups which came together to create T'aitöna appear to have responded to the demands of living in the Northern Rio Grande by creating lifeways that are indicative of a shared settlement-scale identity. In the following chapter two ceramic assemblages will be spatially analyzed to see if the pottery of the pueblo supports this view of a unified society.

Chapter 4: The Ceramic Distribution at T'aitöna

4.1 The Pottery Found at T'aitöna

Pottery has been used as a proxy for human behavior and the movement of peoples in the American Southwest since archaeologists such as J. Walter Fewkes and Frank H. Cushing began seriously studying this region in the nineteenth century (Peckham 1990:6). Ceramic analysis has unquestionably played a foundational role in our understanding of the Pueblo world. Therefore, in considering the lifeways at T'aitöna by analyzing the distribution of obsidian there are two pottery types that bare a look as well: Kwahe'e Black-on-white (hereafter Kwahe'e B/W) and Santa Fe Black-on-white (Santa Fe B/W) (Figure 14). Habicht-Mauche dates Kwahe'e B/W to A.D. 1075–1175, falling in the Developmental Period (Duwe 2011; Habicht-Mauche 1993). However, Fowles (2007) argues that this pottery type was more lasting in its appeal, and its usage persisted into the late thirteenth century. Santa Fe B/W is dated to A.D. 1175–1425, spanning the late Developmental, Coalition, and early Classic Periods (Duwe 2011; Habicht-Mauche 1993). Both pottery types would have been made and used during the time that T'aitöna was occupied.

Abundant in the Rio Grande region in the eleventh and twelfth centuries, Kwahe'e B/W has a paste composed of quartz and volcanic ash with a mineral-based paint (Duwe 2011). Fowles et al. (2007:129) describe both the bowls and jars as having "a bright white slip decorated with a typically vibrant black or brownish-black mineral-based paint." Mera described a variety of this pottery type that was found in the Taos area, called Taos Black-on-white, which

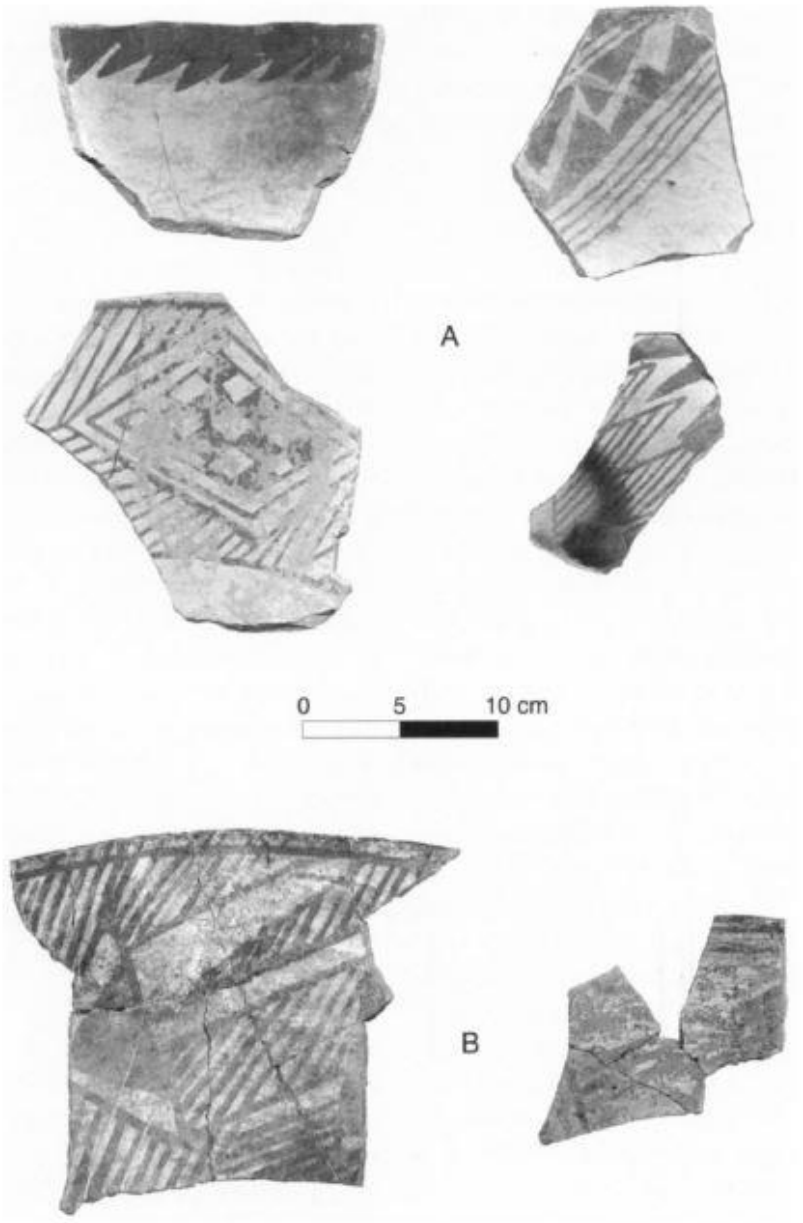

Figure 14. The pottery of the Taos district of the Northern Rio Grande: (A) the Kwahe'e Black-on-white; (B) the Santa Fe Black-on-white. Both are the Taos variations, from *Clay, Conflict, and Village Aggregation: Compositional Analyses of Pre-Classic Pottery from Taos, New Mexico* (Fowles et al. 2007:129).

used sand for its temper and can be recognized from its thicker slip (Fowles et al. 2007). However, Fowles and his colleagues (2007) feel that there is so much interaction between and within regions of the Northern Rio Grande that these hard topologies are too blurred to be valid.

The mineral paint allowed this pottery to be fired in a hotter kiln than would the carbon-based paint of the later Santa Fe B/W (Fowles et al. 2007). As the Kwahe'e B/W faded from use, Santa Fe B/W and its variations took its place (Snead 2017).

The later Santa Fe B/W pottery can be identified through its use of organic (carbon based) paint on a blue-gray paste (Duwe 2011; Mera 1934). The designs are in the "Sosi style" exhibiting "solid geometric shapes and thick line work" (Fowles et al. 2007:131). But Fowles et al. (2007:146) point out an interesting characteristic of the bowls of this local Santa Fe B/W that have survived in the Taos region, namely that the organic paint has often burned off, but in its absence, leaving the evidence of original designs. Although it comes later, the Santa Fe B/W does not seem to be more developed than the Kwahe'e B/W in any aspect; "many morphological and technological aspects of the Santa Fe Black-on-white pottery at T'aitöna appear *less* standardized than their Kwahe'e predecessors" (Fowles et al. 2007:146). These regional differences among the Kwahe'e B/W and Santa Fe B/W may have something to do with who analyzed and catalogued the assemblages from different areas of the Northern Rio Grande. And after many years of working with the pottery of T'aitöna, Adler has voiced the opinion that it might be beneficial in future studies to identify the samples as "organic paint" or "mineral paint" (personal communication, 2022).

4.2 The Constraints in Using a Database with Idiosyncrasies

Both Kwahe'e B/W and Santa Fe B/W pottery were found in large quantities at T'aitöna. In the master database, there are 9,257 records for ceramic types which contain "Kwahe'e" in the name and 18,984 records which contain "Santa Fe" in the name. The unfortunate reality of using

records compiled over 50 years under the leadership of various excavation directors is that record keeping was done according to different standards at different times. As Schiffer (1996:362–363) cautions fellow researchers, “The behavior of the archaeologist is the greatest source of variability in the archaeological record.” At T’aitöna some of the same features can be designated in different terms. Noted above in the obsidian discussion, Mound 1 is the equivalent of Room Block 1. But, of more significance is that “null” was recorded for the provenience location of roughly two-thirds of the pottery in the data base. Consequently, only 2,582 records of the Kwahe’e B/W could be used for the GIS analysis and a mere 6,445 records of the Santa Fe B/W.

With these limitations in mind, a GIS analysis was done for each of the pottery types. The count and percentage of each pottery type for each room was determined. This did not include the “null” room data records as described above.

4.3 The Analysis of the Two Pottery Types

If T’aitöna was the place of two different societies coming together in one settlement, it should be expected that the material culture would reflect this in multiple aspects including the pottery that was left behind and how it was left behind. The Tiwa group whose predecessors had lived in the area for generations may have had an association with the earlier Kwahe’e B/W pottery type that was found at T’aitöna (Fowles 2007:129). Using ArcGIS Pro the presence of Kwahe’e B/W pottery was visualized across the pueblo (Figure 15). The Kwahe’e B/W pottery was found in Room Blocks 1, 2, and 3 in the southern area of the pueblo, mostly in very low quantities, under 2%. Room Block 3 has five rooms with 2–4% and two rooms with

4–13%. In the central part of the pueblo the great kiva and Room Block 4 rooms contain mostly very low amounts except for three rooms with the slightly higher 2–4%. One of the most southern rooms in Room Block 4, Room 451, has the much higher 4–13%. Room Block 6, in the center of the settlement, and Room Block 5, in the north, have one room each with less than 2%.The highest amount, by far, was in the midden. This distribution is consistent with the theory that most of rooms at T'aitöna were being lived in up until the site was burned, and people would be using the midden for most of their discarded and broken pottery.

Figure 15. The distribution of Kwahe'e Black-on-white pottery across T'aitöna Pueblo. The percentage is calculated from the total amount of the Kwahe'e B/W excavated which was identified as coming from a specific room, kiva, or the midden. There is no data for the areas that are in gray. (Map by author)

The Kwahe'e B/W pottery was found in Room Blocks 1, 2, and 3 in the southern area of the pueblo, mostly in very low quantities, under 2%. Room Block 3 has five rooms with 2–4% and two rooms with 4–13%. In the central part of the pueblo the great kiva and Room Block 4 rooms contain mostly very low amounts except for three rooms with the slightly higher 2–4%. One of the most southern rooms in Room Block 4, Room 451, has the much higher 4–13%. Room Block 6, in the center of the settlement, and Room Block 5, in the north, have one room each with less than 2%. The highest amount, by far, was in the midden. This distribution is consistent with the theory that most of rooms at T'aitöna were being lived in up until the site was burned, and everyone would be using the midden for most of their discarded pottery.

In looking at the distribution of the Santa Fe B/W a slightly different, but similar, pattern is observed (Figure 16). Once again the midden contains the greatest amount of this pottery type. Most of the rooms for which we have data for pottery are in the south and central part of the settlement. These rooms have 2% or less of the total amount that has been recorded. It is important to note that there is no data for the complex made up of Room Blocks 7, 8, and 9 in the northwestern area of the pueblo. The walls of the rooms for Room Block 10, connected to the northwestern rooms of Room Block 4, are still being excavated and there are no sherds for the Kwahe'e B/W or the Santa Fe B/W.

Santa Fe B/W pottery was found in 68 rooms compared to 59 rooms with Kwahe'e B/W. There are roughly the same number of rooms with pottery from each type, and both are in low frequencies. At this point in the analysis of the two assemblages, the similar distributions of Kwahe'e B/W and Santa Fe B/W do not point to one cultural group using one type of pottery and another group preferring a different pottery type. If the people at T'aitöna exhibited the same pottery usage patterns as at other Northern Rio Grande pueblos then they would have gradually

Figure 16. The distribution of Santa Fe Black-on-white pottery across T'aitöna Pueblo. The percentage is calculated from the total amount of the Santa Fe B/W excavated which was identified as coming from a specific room, kiva, or the midden. There is no data for the areas that are in gray. (Map by author)

tapered off using the Kwahe'e B/W as they increasingly began adopting the Santa Fe B/W (Fowles et al. 2007). It does appear that all the people living at T'aitöna were using the midden for their discarded pottery. There do not appear to be "empty rooms" that were used as nearby locations for trash. This pattern not only reinforces the likelihood that all the rooms were being used for living and attendant activities such as storage up until the end of occupation it shows a strong similarity in everyone in the settlement using both types of pottery.

To examine the possibility that either Kwahe'e B/W or Santa Fe B/W was the preferred pottery by the people living in certain room blocks I performed a Chi-square test (Table 5). The H_0 being tested is: the type of pottery is not independent of the room block in which it is found.

The calculated χ^2 is 225.63 which is larger than the critical value (0.05, 5) of 11.07. So, the null hypothesis is rejected. The type of pottery found in a room is independent of which room block it was found in. This strengthens the argument that the people at T'aitöna were engaging in lifeways commonly embraced across the pueblo.

Table 5. Summary of the Chi-square calculation to test for the independence of pottery type to room block location where the artifact was found. The null hypothesis was rejected.

Site	Type of Pottery	Observed	Expected	Chi-square values
RB 1	Kwahe'e	22	16.35	1.95
	Santa Fe	17	22.65	1.41
RB 2	Kwahe'e	25	80.25	37.88
	Santa Fe	166	110.92	27.35
RB 3	Kwahe'e	1085	876.26	49.73
	Santa Fe	1005	1213.74	35.9
RB 4	Kwahe'e	575	724.06	30.69
	Santa Fe	1152	1002.94	22.15
RB 5	Kwahe'e	10	14.25	1.27
	Santa Fe	24	19.75	0.91
RB 6	Kwahe'e	20	25.99	15.39
	Santa Fe	42	36.01	1
Chi-Square value - 225.63				
Critical value (0.05, 5) = 11.07				

Room 451 in the string of rooms between Room Blocks 2 and 4 shows up in the second highest category for both Santa Fe B/W and Kwahe'e B/W. One simple explanation might be

that Room 451 was used for trash after its occupants left. However, that is not the case. Room 451 is part of a group of three rooms which were built later than the two attached room blocks (2 and 4) to wall off the open area to the great kiva (Michael Adler, personal communication, 2022). These three rooms are not as well built as the others near them, and they sit on top of an extra-mural trash deposit. To a lesser extent, Room 323, two from the left in the second row of Room Block 3, also has a higher frequency of pottery.

These rooms containing slightly higher frequencies of pottery tie into a further consideration that needs to be part of the evaluation of locational data. In analyzing where pottery is found it is important to acknowledge that the place where a piece is found does not necessarily correspond with where that artifact was initially discarded (Lightfoot 1996:166; Schiffer 1983:676, 1996:21–22). In the excavation of room blocks at T'aitöna it became clear that two and three stories of rooms had collapsed down upon each other as part of the depositional process (Michael Adler, personal communication, 2022). Crown (1991) further cautions that the melted adobe of the walls contained pottery sherds, and it is difficult to distinguish between what was part of a wall and what was left behind in a room. However, trends seem to be present in the pottery data that also show up with the obsidian. That is, while there is evidence, from shrine styles for example, that two different cultures combined to form this settlement, the people living at T'aitöna do not appear to have segregated into clearly identifiable areas based on the distribution of particular artifact types. The assemblages of pottery show that both the older Kwahe'e B/W and the more contemporary Santa Fe B/W were being used during the 70 years of occupation at the pueblo. They are found in roughly the same areas suggesting that everyone was making use of the same two types of pottery. People were not using different pottery to distinguish themselves from their neighbors or the rest of the settlement.

Chapter 5: Discussion and Conclusion

The dynamic movement of large groups of people at the end of the Pueblo III and beginning of the Pueblo IV periods has often been studied from the perspective of those leaving the Mesa Verde region (Boyer et al. 2010; Glowacki 2015). Attention has increasingly turned towards the migration of these Puebloans as part of the greater trajectory of the Northern Rio Grande region because it was "not a nearly empty landscape available for use or colonization" (Boyer et al. 2010:286). Duwe and Cruz (2019:104–105) in piecing together the history of the Rio Grande region approach the subject by combining the Tewa viewpoint and cultural memory of events with archaeological scholarship:

> The Winter People, then, were possibly among the firstcomers. They likely shared cultural affinity with other contemporary Tiwa-speaking people in Rio Grande valley, such as people ancestral to Taos and Picuris (Fowles 2004), and may have produced the same Kwahe'e Black-on-white pottery (Schillaci and Lakatos 2016).

Those people who were the progenitors of Taos and Picuris are most probably the Puebloans of T'aitöna. While the debate continues as to the appropriate model for the extensive demographic changes that altered the Rio Grande valley, Duwe and Cruz (2019:98, 102) emphasize that each settlement reacted to the forces of change in their own unique ways. Across the landscape of what is now northern New Mexico and Arizona many different forms of negotiated aggregation were taking place in the twelfth and thirteen centuries. When groups from differing cultures come together they are forming a *coalescent society* (Clark et al. 2019:266). Duwe and Cruz (2019) see the transformation of the Rio Grande valley as happening through multiple episodes of coalescence. The question I am trying to answer at T'aitöna is if the peoples who built the settlement together did so through creating coalescence.

On the outskirts of the Rio Grande region of the northern Taos district lies T'aitöna Pueblo. There is ample evidence suggesting that during the thirteenth century a band of Tewa people from the Mesa Verde migration joined with a group of Tiwa people, who were living in small buildings built on top of their ancestors' pit houses, to create a new settlement (Adler and Hegmon 2022; Boulanger et al. in 2022; Crown 1991; Fowles 2004a; Lipe 2010). The presence of dual moieties at T'aitöna was argued by Fowles (2004a) in *The Making of Made People* based upon multiple lines of evidence, the strongest of which rests on the style of ritual constructions. However, archaeologists continue to explore the material culture of T'aitöna looking at how people from multiple backgrounds formed a unified community, one large enough to need 10 multistory room blocks, and then disbanded some 70 years later (Adler and Hegmon 2022; Boulanger et al. 2022; Fowles 2004a, 2004b, 2005, 2009).

Before evaluating how thoroughly the people of T'aitöna Pueblo may have created a coalescent society, it is important to look at a few factors that distinguish the Mesa Verde migration. Urged to relocate due to extreme stresses both in the environment and in society it appears that the Puebloans from Mesa Verde were disposed to let go of the hierarchical power structures which had proved unsuccessful in their primary culture (Clark et al. 2019:279). And, in the words of Lipe (2010:262), while the Mesa Verde Puebloans may have carried with them the practice of making extramural shrines and their Tewa language the more material signs of culture were "lost in transit" during their southward relocation. These aspects of the Mesa Verde migration may have contributed to their flexibility to blend into a new society despite outnumbering the indigenous Tiwa population (Clark et al. 2019:279).

One proxy used to approximate human patterns of behavior is how lithic material was obtained. Obsidian procurement is increasingly being used to investigate social networking

patterns and intra-pueblo activities (Boulanger et al. 2022; Mills et al. 2013; Shackley 1998, 2012). This approach is also valuable for looking at T'aitöna's history. T'aitöna Pueblo both adds to the understanding of the greater Northern Rio Grande region and raises some new questions. The Taos region is on the far northeastern edge of the Rio Grande area, and being such a distance away it isn't always included in the examination of exchange activities seen as centered on the Pajarito Plateau (Boulanger et al. 2022). Comparing the sources that the people of T'aitöna used for obsidian has the potential to highlight the alliances and hostilities among all Pueblos in the Northern Rio Grande region.

The data from the obsidian assemblage that is the subject of this thesis's GIS analysis was shared by Michael Adler, the director of the excavation at T'aitöna Pueblo, and Matthew Boulanger (both of Southern Methodist University). As part of their research, the obsidian was examined using XRF analysis to obtain the chemical signatures that would link them to the geological sources where each sample originated. Their research was the beginning point for this thesis' analysis. The purpose of the present work was to examine the obsidian data using spatial analysis methods and then to visualize those results in maps describing usage patterns across the pueblo to see if there were trends that could shed light on how the multiple cultural groups who came together coalesced as a unified settlement.

The first analysis, which centered on the three most abundant types of obsidian from the Jemez Mountains, showed that in all the room blocks in which samples were collected at T'aitöna Pueblo, El Rechuelos obsidian was found in close to 64% of the samples. In the midden that contained over half of all the samples (53%) it shows up at 59%. These percentages were displayed for each room block and the midden as proportional pie charts. The high percentage of El Rechuelos in the site's assemblage is clear. The visualization of the data also shows that the

Valles Grande obsidian was found in the second highest amount in all locations, accounting for 26% of the assemblage. The third highest amount was from Cerro Toledo. And while that type of obsidian was a little less than 10% of the overall amount found at the pueblo it does not show up in all locations. Cerro Toledo obsidian is absent from the samples for Room Blocks 4 and 6 but these two areas represent a mere 6% and 2% of the overall assemblage that was analyzed with XRF, and the absence may be due to the small samples.

Room Blocks 4 and 6 have very small sample sizes, (n=18) and (n=6), however they are the only two locations at T'aitöna where obsidian from Canovas Canyon was found. One sample was found in each of the two room blocks. This is interesting because the Canovas Canyon obsidian is from alluvial deposits located south of present-day Albuquerque (Boulanger et al. 2022). Boulanger and his colleagues (2022:124) postulate that these two Canovas Canyon obsidian samples found at T'aitöna Pueblo may indicate that the settlement was involved in trade networks that reached out to the most southern areas of the Rio Grande Valley.

When the tools are separated from the debitage and two spatial analyses are made to visualize where the obsidian for each group came from it is quite clear that, across the settlement, El Rechuelos obsidian is the most commonly found type whether the artifact is a tool or debitage. For the tools (Figure 12) El Rechuelos is present in all room blocks and the midden. And, although it is found in a slightly different percentage at each location, it accounts for well over half of the sample set from each area. Tools made from the second most abundant obsidian, Valles Grande, are found in four of the five room blocks, where tools were recovered in the study's assemblage, and in the midden. For the tools, both El Rechuelos and Valles Grande obsidians show up in most of the locations. Room Block 1 has tools made exclusively of El Rechuelos obsidian. This is a striking similarity across the pueblo. This obsidian tool data

supports the view of T'aitöna Pueblo as a coalescent society where the various cultural groups in the settlement were participating in shared lifeways by using tools made from the same obsidian sources.

There are five main obsidian sources for the part of the Southwest where T'aitöna is situated (Boulanger et al. 2022; Shackley 2005). Actually, Cerro Toledo is the most abundant type of obsidian in the Northern Rio Grande (Boulanger et al. 2022). However, at T'aitöna it was just third most represented in the assemblage. When Boulanger and his colleagues (2022) did a least cost path analysis for the alluvial deposits that were the sources for the El Rechuelos, Valles Grande, and Cerro Toledo they determined that the distances were roughly similar. This suggests that there were other considerations than distance such as not wanting to interact with other groups who might be encountered in the territory around or on the way to collecting the Cerro Toledo obsidian (Boulanger et al. 2022). Across the pueblo Cerro Toledo is the least represented of the three main obsidian sources from the Jemez Mountains.

When the data for the distribution of obsidian sources for the debitage is visualized in a map (Figure 13) it shows patterns congruent to the tools' map. Room Blocks 1, 3, and 8 and the midden have debitage from the same four sources in roughly the same proportion. Once again, El Rechuelos is represented in the highest frequency, followed by Valles Grande, Cerro Toledo, and No Agua Peaks West. The last type of obsidian is found in New Mexico, northwest of T'aitöna while the other three obsidian types are southwest of the pueblo. The debitage in Room Blocks 2 and 6 are 50% El Rechuelos followed by Valles Grande. The debitage obsidian source patterns point to the people at T'aitöna following similar practices in obsidian procurement. There is no demarcation that shows people living in one area of the settlement using obsidian from a different area or even in a strikingly unique proportion. The debitage data adds support to the

view that the inhabitants of T'aitöna were deliberately following similar obsidian procurement practices no matter where in the settlement they were living. The data was tested for independence using a Chi-square analysis. The result confirmed that the room block where an obsidian sample was found in no way determined from what source it was obtained. From the obsidian data there is no indication of where in the pueblo each of the cultural groups was living.

There are two pottery types associated with T'aitöna: Kwahe'e B/W and Santa Fe B/W. The older Kwahe'e B/W had been in use widely across the Northern Rio Grande but was starting to wane at the time that the settlement began. Small amounts were found in most of Room Blocks 2, 3, and 4. A few rooms in Room Blocks 1, 5, and 6 also contained low frequencies of the Kwahe'e B/W pottery. This pattern held true for the Santa Fe B/W. There is no data available at present for Room Blocks 7, 8, 9, and 10. At the time that both the pottery and the obsidian assemblages were collected, Room Blocks 7, 8, and 9 were not excavated beyond uncovering the walls at T'aitöna (Michael Adler, personal communication, 2022). The only exceptions were Room 822 that had been completely investigated and Room 901 that had been partially excavated, but the obsidian recovered from the walls of these two rooms cannot be compared to what was found in Room Blocks 1–6 (Michael Adler, personal communication, 2022). This explains why a small amount of obsidian is present in the obsidian spatial analysis, but none is in the pottery maps.

The pattern of low frequencies of pottery in the rooms and a very high frequency in the midden is consistent with the obsidian data. With both artifact assemblages it suggests that the discarded materials would be put into the midden because none of the excavated rooms were unoccupied at T'aitöna Pueblo. Perhaps of more consequence are the distribution trends observed in the two pottery maps for the room blocks. They present highly similar patterns of

where in the pueblo the two types of pottery were found and in what amounts. The pottery data was tested for independence using a Chi-square analysis. Again, the result confirmed that the room block where a pottery sample was found in no way determined what type of pottery it would be. In other words, people using Kwahe'e B/W were not living in certain room blocks while those having Santa Fe B/W were in others. There appears to be a settlement-wide pattern of where the two types of pottery were excavated. This adds support to the idea that there was a unified approach to the choice of pottery used, and perhaps made, at T'aitöna.

When examining the patterns of obsidian sources and the flake to tool percentages the underlying question being addressed is really what these analyses can contribute to the greater understanding about creating community. Whiteley (2004) points to the bifurcation of the population of T'aitöna into the settlements at Taos and Picuris as an indication that a unified identity had never been achieved at the pueblo. Fowles (2004a, 2004b, 2005) presents compelling evidence to the contrary. Citing the moiety organization (2005) and the existence of two styles of shrines existing in the same cosmic space (2004a, 2004b), Fowles contends that the people at T'aitöna came up with place making practices that honored each cultural tradition in their settlement. Beyond that, the people of T'aitöna were creating unique approaches to pueblo life such as their post-and-basin roof support system, which is only found at T'aitöna, and once the people of this settlement invented it, it was used exclusively from then on in their buildings (Fowles 2004a, 2004b). As highlighted by Clark et al. (2019:266), "cultural mixing may ultimately lead to ethnogenesis."

In this light, the similar distributions of Kwahe'e B/W and Santa Fe B/W in low frequencies across the rooms of the pueblo would indicate use patterns that were the same for both the indigenous Tiwa and the Tewa migrants from Mesa Verde in creating T'aitöna. Even in

1319, just a year before the people of T'aitöna ceremoniously burned their rooms to close them out, they built the great kiva in the plaza adjacent to Room Block 4. A year before they went to separate settlements they were still creating new structures for their Pueblo. Although the settlement began disbanding after 70 years, it is revealing to note that the contemporary Pueblos of Picuris and Taos both consider themselves to be Tiwa, and to be descendants of the small group of local Puebloans who co-founded T'aitöna. That seems to be a recognition of the two coalescing cultures finding one identity.

Questions about direct procurement and exchange networks in the Northern Rio Grande can begin to be answered more fully when the obsidian use and procurement practices in the Taos region are included in the larger analysis (Boulanger et al. 2022). This is where the research on the obsidian sources at T'aitöna fits into the larger analysis. Lines of inquiry about human interaction, however, can be explored with both sets of spatial analysis, the obsidian and the pottery. As greater amounts of obsidian data become available through further XRF analysis questions about the lifeways at T'aitöna can be answered with higher confidence. And it is possible to reevaluate the pottery records contained in the T'aitöna database to increase the number of records suitable for spatial analysis projects.

The GIS analysis is heavily dependent on the amount of XRF data generated. Until all samples in the assemblage have been chemically characterized, patterns of where the obsidian was procured, and perhaps how, cannot be robustly explored. As more complex data is generated and the number of source areas is increased, the data will have to be conceptualized into additional spatial analyses. Choropleth maps and nearest neighbor analysis will allow the style of the spatial analysis to reflect more nuanced relationships among the data points. The next set of inquiries should separate the types of tools (projectile points, blades, etc.) to discern the

distribution across the settlement. Do there appear to be locations that are the loci of different types of activities? Can any of these be associated with contributions from the Tewa or Tiwa cultures? Or are they indicative of more communal activities that were shared across the settlement? The GIS analyses conducted for this thesis have provided preliminary answers to questions about the sources of obsidian material found at T'aitöna Pueblo. The pottery analyses have given basic support to the view that the pueblo was fully occupied, but more work needs to be done to discern shared patterns across the pueblo that indicate a unified approach for a suite of activities. T'aitöna may have been on the outskirts of the Northern Rio Grande region but it holds information key to understanding this period of great movement, aggregation, and networking with groups far beyond the Taos area.

One last note is that this research is important because it contributes knowledge to the local communities of Picuris and Taos about *their* people and *their* past; the audience for this work is not confined to academia. In this region, it is important that archaeological investigations are in concert with, and hopefully in service to, Indigenous explorations of history (Ferguson et al. 2015). One of the foundations upon which Fowles' insightful work is built upon are the oral traditions of the Taos community, as recorded by Matilda Coxe Stevenson (Adler et. al 2022; Fowles 2004a). The field school investigations conducted almost yearly through the collaboration of the Southern Methodist University at Taos campus and the University of Arizona with the people of Picuris Pueblo is part of this on-going effort at co-creating knowledge. In this light, it becomes clear that every aspect of daily life in the past had the potential of leaving a material culture record that is tied to identity, both past and present; it continues to be of value to explore these aspects.

Appendix A – Supplementary Data

A Chi-square test using adjusted residuals was conducted for the obsidian artifacts. (See p. 45, Table 4) These further steps were performed in the hopes of statistically determining which room block's tools or debitage have an observed frequency close to what we would expect. A traditional Chi-square value indicates if the null hypothesis applies to the entire group of artifacts. This calculation was taken from chapter 13 of *Quantitative Analysis in Archaeology* by Todd L. VanPool and Robert D. Leonard.

A traditional Chi-square analysis was performed for the tools and debitage excavated and tested for Room Blocks 1, 2, 3, 4, 6, and 8. From this a Chi-square value was obtained for tools and debitage in each room block. From these a residual value was calculated using,

$$e_{ij} = (O_{ij} - E_{ij}) / \sqrt{E_{ij}} \ .$$

where e_{ij} is the residual. The subscript ij indicates that this is the first cell in the matrix. O is the observed value (for the first cell), and E is the expected value for the same cell. A new matrix was made with all these values in which a value was obtained for each row and each column as in calculating a traditional Chi-square. Then an adjusted residual is calculated for each category (i.e., tools in Room Block 1) using the equation,

$$d_{ij} = \frac{e_{ij}}{\sqrt{\left(1 - \frac{CT}{GT}\right)\left(1 - \frac{RT}{GT}\right)}}$$

Where d_{ij} is the adjusted residual for the first cell in the matrix. The value e_{ij} is the residual, CT is the column total, RT is the row total, and GT is the grand total.

The resulting adjusted residual may then be evaluated against the significance level. For the calculations in this thesis the significance level was 0.05 which corresponds to 1.96. Those adjusted residuals that are not <1.96 or >1.96 indicate that the difference between the observed and the expected are not significant. Now, instead of testing a null hypothesis for the entire excavation, there is a calculation specific for the obsidian (tool or debitage) for each room block.

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