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A CLEAN SLATE: GREEN SLATE PRODUCTION AND EXCHANGE IN THE MOJAVE DESERT

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A CLEAN SLATE: GREEN SLATE PRODUCTION

AND EXCHANGE IN THE MOJAVE DESERT

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Applied Archaeology

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by

Jamie Marie Nord

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Approved by:

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ABSTRACT

In this thesis, I examine the procurement, manufacturing process, and subsequent distribution of cultural greenstone artifacts, historically referred to as green slate, in the Mojave Desert of southeastern California from a landscape-level framework. The San Bernardino County Museum (museum) curates a collection of incised and blank green slate artifacts (n=51) from numerous archaeological sites in the study region. These cultural materials were uncovered together in a box during routine inventory. As part of this thesis, I catalogued, rehoused, and remarried the collection with each artifact’s respective site assemblage in consultation with San Manuel Band of Mission Indians (SMBMI) in order to accommodate and respect cultural protocols. I conducted X-ray fluorescence (XRF) analysis on the collection, and the results demonstrated that at least 92% of the collection was procured from the same quarry source. The other 8% of the collection contains significant differences in the principle and trace elements. Additionally, I produced a heat map of green slate distribution, which highlighted a north-south linear trend throughout the ancestral territories of the Serrano, Kawaiisu, Southern Paiute, and Western Shoshone. Four main concentrations are evident along the 150-mile green slate corridor in mountainous regions of the Mojave Desert. The geochemical and spatial analyses provide evidence for the movement of green slate through inter-community exchange of material goods. The green slate distribution illuminates a

precontact and ethnohistoric trade route, which followed the Mojave River and other water sources. I argue that green slate supported the extensive Mojave Desert trade network as a culturally significant material used for inter-community exchange. Additionally, I argue that Native American communities created a community of practice for green slate production, which contributed to its cultural significance.

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DEDICATION

I dedicate this thesis in loving memory of my grandma Marilee Nord.

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CHAPTER ONE

INTRODUCTION

Research Orientation

The San Bernardino County Museum (museum) in Redlands, CA curates a collection of cultural greenstone artifacts from numerous archaeological sites throughout southern California. The green-colored stones have historically been referred to as green slate. The materials were physically removed from their respective sites' curation boxes and compiled together at an unknown time, likely for the pursuit of research that was never published. The cultural artifacts were left compiled together in a small box with a few pages of research notes by the unidentified researcher without a digital record of their location. The box of artifacts, labeled "Green Slate Collection" (GSC), was detected by the current curator, Tamara Serrao-Leiva, during routine inventory in 2020 and identified as a curatorial problem and research opportunity. This sort of incident is not isolated to the San Bernardino County Museum. Collections management practices have evolved over time, but the 17th century precedent for organizing and ordering similar museum objects together persists at some institutions (Macdonald 2006). Today, many museums and repositories employ the site assemblage approach in order to preserve provenience for archaeological material (Childs and Sullivan 2003).

In this thesis, I examine the distribution of green slate artifacts across the landscape, using the museum's GSC as a microcosm from which to investigate the landscape-level research questions. A landscape approach has previously been applied to incised stone artifacts (Thomas 2019), but there has been a lack of focus on green slate materials. Little is known about the artifact type in terms of its raw material source, procurement, or how it traveled across the landscape for cultural use. Incised stone artifacts often found in southern California and the Great Basin have largely been associated with the Chumash, Western Shoshone and Southern Paiute (Bury et al. 2004; Lee 1981; Santini 1974; Thomas 2019). Mountain and Desert Serrano affiliations to incised stones have been largely ignored and overlooked in past archaeological research.

Research Objectives

The primary goal of this thesis is to catalog, accession, and rehouse the collection of artifacts in a culturally appropriate way. I have incorporated input from San Manuel Band of Mission Indians (SMBMI) regarding the treatment and care of the cultural materials, as well as the research design. SMBMI expressed that this research can help the living community learn information about Serrano ancestors and their material culture that has been lost to them. As part of the research, I have also produced an artifact catalog that can be merged into the museum's database, Argus, and the catalog serves as an appendix to this thesis (see Appendix A).

A second goal of this thesis is to rectify a literature gap regarding green slate artifacts, specifically in the study area of the Mojave Desert. The traditional lands of the Serrano cover a significant part of this area, in addition to the

Southern Paiute, Western Shoshone, and Kawaiisu lands to the north. Serrano populations were decimated between 1771–1886 due to the Mission system, forced displacement by settlers, and genocidal campaigns (Trafzer 2002). When the San Manuel Reservation was established in 1891, only 20-30 people remained of the Yuhaaviatam clan of Serrano (San Manuel Band of Mission Indians 2022; Trafzer 2002). Another Serrano clan lived at the Morongo Indian Reservation, established in 1865, along with Cahuilla and Cupeño (Morongo Band of Mission Indians 2022). As a result of the decimation, there is a general lack of ethnographic and archaeological research about Serrano culture, which may explain the overlooked Serrano affiliation to incised stones. Little research has been published about green slate artifacts (Gilreath 2007; Ritter 1980; Sutton 1982; Sutton and Schneider 1996), and this thesis can contribute to the understanding of ancestral communities of the Mojave Desert through an examination of this collection.

A third goal of this thesis is to disseminate information about the collection and this specific artifact type to the affiliated Indigenous communities. Some of the cultural information about green slate has been lost to the descendant communities, such as SMBMI. The severe decline of Native American populations in the Mojave Desert within a short time span may have prevented or affected the oral transmission of this cultural knowledge. Additionally, past archaeological practices of removing artifacts from their place of origin were detrimental to Native American communities traditionally affiliated with the

Mojave Desert, in addition to being taboo for some cultures, like the Serrano. The removal of artifacts from the landscape created a discontinuity of knowledge for some traditional practices by causing a physical separation of Mojave Desert communities from their material culture. However, agencies now consult with Federally-Recognized Tribes on the treatment of cultural resources through a government-to-government relationship, and some academic research in archaeology is led by Indigenous archaeologists or incorporates a collaborative approach (Atalay 2012; Bruchac et al. 2010; Watkins 2001).

Research Questions

In this thesis, I address several research questions about green slate artifacts from the Mojave Desert. Specifically, I focus on the distribution and exchange of green slates, and I use the rediscovered Green Slate Collection at the San Bernardino County Museum as a microcosm from which to explore these questions.

I approach this research from the landscape level with a focus on rehousing the collection. While these cultural materials were physically removed from their place of origin, Indigenous knowledge indicates that cultural resources can be significantly tied to their place (Laluk 2017) and assemblage (Zedeño 2008, 2009). This is part of the reason why archaeological collection and curation can still be controversial today for some Native American communities affiliated with the Mojave Desert. Native American tribes in Southern California may advocate for complete preservation of archaeological sites (Caple 2016; Loewe

2016; Middleton 2012; Watkins 2003), which can be achieved through preservation, research, and outreach, also known as preservation archaeology (Mayro and Doelle 2018). Additionally, tribal communities may choose to rebury cultural resources on site when they are inadvertently discovered during ground disturbing projects, as opposed to curating them in perpetuity (Nicholas 2008). In order to restore some of the spatial ties to the cultural material, this research explores contextual information and spatial distribution, in addition to remarrying the collections.

1. In what cultural context are green slates recovered in the Mojave Desert?
2. Where are incised green slates and blanks reported in the Mojave Desert?
3. Can spatial patterns be derived from the green slate distributions across the landscape?
4. If so, what do these landscape patterns suggest about: (1) procurement locations, (2) manufacturing practices, and (3) exchange between traditionally associated communities?

Green Slate Collection

There are 94 artifacts and fragments in the GSC at the San Bernardino County Museum from 43 archaeological sites in the greater Mojave Desert region. Interestingly, the collection mostly contains incision motifs with no discernible pattern, which is somewhat unusual for a collection of incised stones in the Great Basin. Past research on other collections has demonstrated that discernible geometric motifs are prevalent in the California coast and Great Basin

(Klimowicz 1988; Ottenhoff 2015). However, there may have been regional styles in design elements across the Great Basin (see Thomas 2019), which may explain the relative absence of discernible design in Mojave Desert incised stones.

Many of the green slate artifacts in the collection possess drilled perforations, suggesting that the cultural materials were suspended and perhaps worn on the body. Personal property, including adornment items, are potentially sensitive in nature for traditionally associated Native American communities, like the Serrano (Bean 2017; Ramon and Elliott 2000; Strong 1972). With this in mind, the cultural artifacts were handled and treated with care, sensitivity, and respect.

Many samples in the collection are also fragmented. It is possible that this damage occurred during exposure to the open elements, field recovery, or curation. In light of the documented collections management issues with the GSC, damage could have occurred to the collection at some point during their curation. However, the abundance of fragmentation also suggests a possibility of fragmentation occurring closer to the time of use or discard. In the American Southwest region, some stone artifacts have been interpreted as “killed,” or intentionally fragmented, such as ritual stone palettes, manos, metates, and crystal or polished stone cruciforms (Adams 2008). Additionally, incised stones in coastal California have been interpreted as intentionally broken (Bury et al. 2004).

Of the GSC's 94 cultural artifacts, 51 are green slate artifacts. A few of the other 43 artifacts within the museum's GSC are actually gray slate, making the name of the collection a bit of a misnomer. Since the box of cultural artifacts was labeled "Green Slate Collection," I continue to refer to the collective materials in this way. These outlier gray slate artifacts are not the focus of this research, but they were included in the rehousing and collections management effort. Generally, slate appears in shades of gray, but it also appears in other colors, such as green, red, black, brown, and purple. The color of slate is usually determined by its iron and organic material content. Slate appears green due to a high chlorite content. Gray slate artifacts are more common in the archaeological record, but I am only focusing on green slate artifacts for three reasons. First, the color green may have cultural significance or cosmological value, as argued by archaeologists for the Mojave Desert (Garfinkel et al. 2016) and for other regions around the world (Bar-Yosef Mayer and Porat 2008; Brumm 2010; Plog 2003; Taube 2005; Weiner 2015). Secondly, the largest lithic category in the GSC is green slate, and thus provides the greatest sample size for archaeological study. Lastly, since chemical composition can affect the different colors of slate, I need to focus on one color to accurately conduct XRF analysis and discuss procurement sources.

The lawful ownership of the GSC presents an added collections management issue. Some of the cultural materials are lawfully owned by a mixture of public agencies, while curated at the museum. However, of the sites that produced the GSC artifacts, 34.9% are located on private land, and the museum lawfully owns those artifacts. The San Bernardino County Museum's site numbering system is referred to as SBCM numbers, and it predates the state trinomial system. For this reason, many of the archaeological sites and subsequent collections discussed in this research are referred to using their SBCM number (e.g., SBCM 13). Several federal agencies represent the public ownership and include Bureau of Land Management, Forest Service, and National Park Service. California Department of Transportation (CalTrans) and the US Navy also lawfully own part of the Green Slate Collection. However, permission from each agency was not required to conduct this research since no destructive testing occurred. As a federally recognized repository, the museum was able to grant research approval for the entire collection because of each agency's memorandum of understanding (MOU) with San Bernardino County.

CHAPTER TWO

LITERATURE REVIEW OF INCISED STONES AND SLATE

Archaeology of Incised Stones

Incised stones have been recorded at archaeological sites around the world, including in southeastern California (Brumm et. al 2006; Cooper 1941; Keenan-Smith 1961; Lee 1981; Mock 2016; Stone and Balser 1965). Incised stones are a small, portable form of petroglyph with designs incised into one or both sides. Some incised stones have shaped edges, perforations, or ground surfaces. This artifact type varies widely across the world in its size, color, material, and incision motif. The cultural significance, use, or meaning of incised stones may depend largely on the cultural community, geographical region, and time period (Perry 2007; Thomas 2019; Wlodarski 1984). Therefore, numerous interpretations of incised stones exist in archaeological literature across the different regions, such as gaming, healing, sharpening tools, charms, pendants, and more (Cameron 1990; Gilreath 2007; Ottenhoff 2015; Thomas 2019). In the following sections, I focus on presenting an overview of incised stone literature specifically for California and the western Great Basin.

Coastal California Incised Stones

Much of the southern California coast, as well as part of interior California, is part the ancestral territory of the Chumash. Lee (1981) analyzed the relationship between Chumash cosmography and incised stones, by correlating 127 incised stone motifs to larger petroglyph panels. Lee reported that some motifs were repeated between the panels and stones, although their symbolism may not necessarily have equal meaning. She argued that an incised stone is a utilitarian object since it is handheld, and the motif was used on the incised stone due to cosmography and crisis art. Incised stones assisted with preserving motifs within Chumash culture by repeating the sacred motifs on small utilitarian objects for cultural continuity and safeguarding (Lee 1981:57). Lee’s analysis of incised stones focused on their utilitarian expression and may underrepresent their cultural significance. Community information and value was preserved and embedded in the stone, making the entire artifact cultural, social, artistic, and valued.

Also within Chumash territory, 36 incised stones were recorded at Vandenberg Air Force Base. The incised stones were recovered from middens within seasonal residential sites. Bury and colleagues (2004) suggested that larger numbers of incised stones at Late Prehistoric sites were correlated with an increase in manufacturing. According to Bury and colleagues, most of the artifacts do not display evidence of use as gaming pieces or items of adornment, since they lacked divots, wear and perforations. However, many of the incised stones were fragmentary, and Bury suggested that they were broken intentionally by ancestral Chumash. Bury and colleagues argued that, despite the portable nature of the artifacts, the incised stones remained part of the seasonally occupied sites, since most were associated with dwelling structures (Bury et al. 2004:7-55). In other words, the communities may not have transported the incised stones seasonally to other sites. This suggests that the artifacts were associated with occupation and that their cultural significance may be connected with location at the specific site.

The studies mentioned above focused on the incorporation of incised stones into everyday life for Chumash people in coastal and interior California. A few other archaeologists conducted studies of Chumash incised stones from the Channel Islands. These studies determined that incised stones were recovered in funerary or ceremonial contexts. Perry (2007) argued that the presence of incised stones alongside ceremonial items on Santa Cruz Island provided evidence that the Northern Channel Islands contained culturally significant spaces for Chumash people. Wlodarski (1984) reported incised stones on Santa Catalina Island with hundreds of burials and associated funerary objects. He determined that larger incised stones were incorporated into funerary practices while smaller incised stones were worn as pendants. His research demonstrated how the size and shape of the incised stone may affect its specific purpose or meaning for a community. However, it is important to note that each proposed interpretation corresponds to sensitive cultural practices, making these artifacts potentially eligible for repatriation under the Native American Graves Protection and Repatriation Act (NAGPRA). The difference between the results of the mainland California and Channel Islands studies further suggests that placement on the landscape can contribute to the cultural meaning of incised stones for communities like the Chumash.

Great Basin Incised Stones

Interior California and the Great Basin contain numerous archaeological sites that produced artifact assemblages upwards of 50 incised stones, as shown in Figure 1. This section focuses on discussing these larger assemblages (Zedeño 2008, 2009) and the general patterns of interpretation, distribution, and incision motif presented in the literature. It is interesting to note that many of these collections now reside in museums and have been relatively understudied. However, some tribal communities today are now using these collections to demonstrate their cultural continuity on the landscape to protest the enduring Numic spread argument (Kaibab Band of Paiute Indians 2020; Stoffle et al. 2021).

The Gatecliff Shelter in southern Nevada is one of the most notable incised stone sites in the Great Basin with an assemblage of 428 incised stones. Thomas (1983) noted that the rock art panels inside the rock shelter contain striking similarities to the motifs on the incised stones. She suggested that the incised stones served as landscape markers for annual pinyon harvesting and as a replacement for larger, permanent boulder petroglyph panels. In other words, the incised stones could be used as geographic points to navigate the landscape for community congregation during important seasonal activities or events. However, her analysis did not sufficiently explain why hundreds of landscape markers would be recovered in one site or evaluate the issue that incised stones are mobile, small, and impermanent points in space.

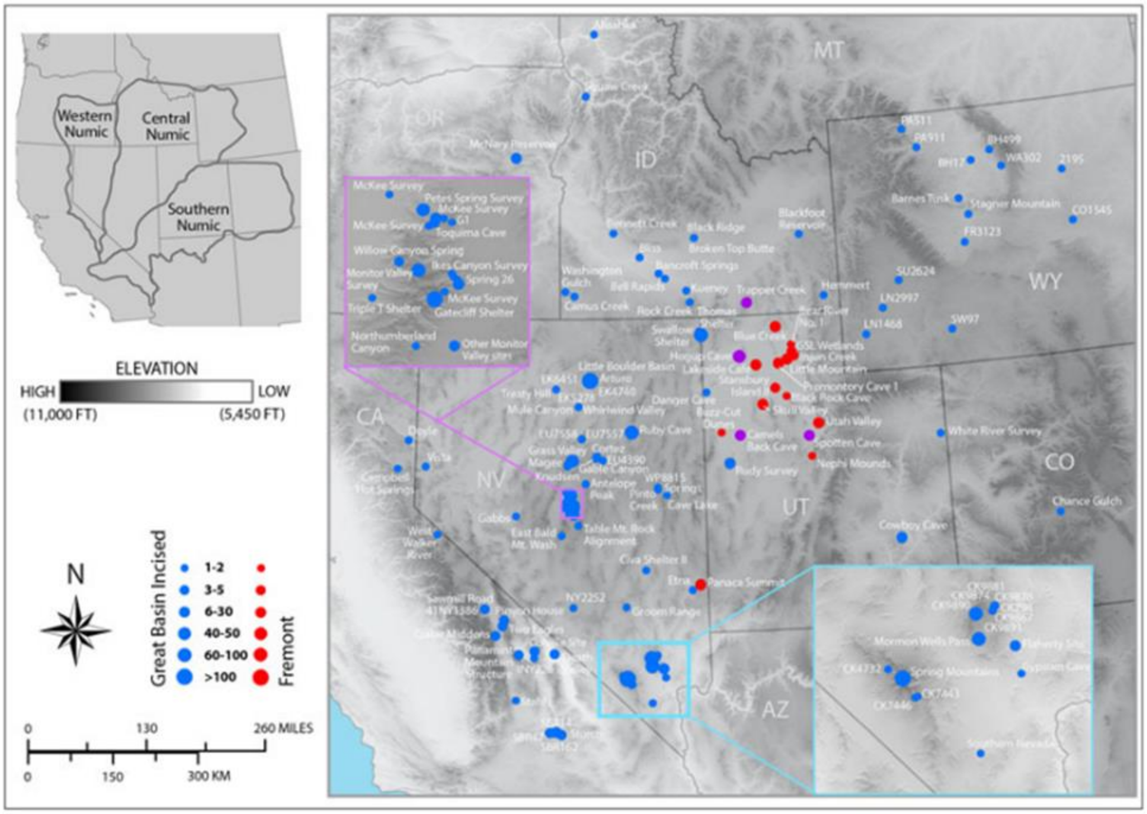

Figure 1. Distribution of Great Basin Incised Stones (from Thomas 2019).

Thomas (2019) addressed the issue of incised stone emplacement and abundance in the Great Basin, including at the Gatecliff Shelter. His prayerstone hypothesis postulated that incised artifacts were intentionally placed in spaces of power. He relied heavily on Shoshonean oral history to demonstrate that communities would repeatedly return to specific places of power for prayer. Incised stones and other materials were left as offerings or expressions of gratitude during prayer. Incised stones are rarely recorded as isolated artifacts in the Great Basin, so the archaeological record supports Thomas's hypothesis. His analysis included 3,500 incised stones from archaeological sites throughout the Great Basin, including part of the Mojave Desert. His map of incised stone frequencies in the Great Basin is extremely thorough and helps demonstrate the widespread distribution of incised stones among Numic speaking communities (see Figure 1).

Some collections of Great Basin incised stones were compiled from numerous sites, like the Santini Collection, in addition to the museum's GSC. Klimowicz (1988) analyzed 788 incised stones that comprise the Santini Collection from multiple sites across southern Nevada. She concluded that many incised stones likely served as items of group identity due to the repetition of design motifs. It is interesting to note how repeated motifs were recorded in both coastal California and the Great Basin. Most of the collection did not display any evidence of manual shaping (Santini 1974). She concluded that the stone selection process was central to production. Either a motif or a stone was chosen first and then the other was chosen to accommodate the size. Thomas (2019) also noted this during his analysis and suggested that the incising process may have been a more central part of the artifact production than shaping. Klimowicz classified the collection into eight design grammars; curvilinear, bisect, banded, circle, crosshatch, dendritic, anthropomorphic, or no discernible design. However, her analysis did not sufficiently address the fact that approximately 30% of the collection is fragmentary, and therefore could not be categorized into a design grammar.

Archaeologists have argued that Numic speaking communities (Paiutes, Shoshone, and Utes) arrived in the Great Basin around 1300 CE (Bettinger and

Baumhoff 1982; Sutton 1987; Young and Bettinger 1992). However, descendent communities assert that Numic-speaking people were created there (Kaibab Band of Paiute Indians 2020; Stoffle and Zedeño 2001; Stoffle et al. 2004, 2009, 2021). The Numic Spread argument has prevented tribal communities from participating in cultural resources management for sites or materials dated older than the argued time of arrival (Stoffle et al. 2021). Southern Paiute communities are using incised stone collections from the western Great Basin to prove the cultural continuity model of Numic people, reclaim their ancestral lands, and ensure their role in future government to government consultation on the stewardship and management of their cultural resources (Kaibab Band of Paiute Indians 2020; Stoffle et al. 2021). Stoffle and colleagues' analysis incorporated hundreds of ethnographic interviews with Southern Paiute representatives and specifically focused on incised stones with a feathered motif (Figure 2). The ethnographic findings revealed that Southern Paiute communities have used feathered incised stones as a form of prayer with intentional placement. Numerous feathered incised stones were recorded at their place of Creation and on many nearby trails. The oral histories and archaeological record demonstrate that the Southern Paiute feathered incised stone tradition has existed for at least thousands of years, surpassing the suggested date of the Numic Expansion (Kaibab Band of Paiute Indians 2020; Stoffle et al. 2021).

Figure 2. Feathered Incised Stone Motif (from Stoffle et al. 2021).

Incised Green Slates in the Mojave Desert

Incised green slates are a form of incised stone that are manufactured from green slate as the raw material. The majority of incised stones recovered from archaeological sites in the Mojave Desert are manufactured from slate, based on a review of the literature, and many are green slate with perforations and incisions like the GSC. The practice of incising green slate in the Mojave Desert appears later in the archaeological record than in other regions of California and the Great Basin (Sutton 1982). Blanks, or green slates lacking incisions, are frequently recorded at sites that also produced incised slates, according to site reports. The dual presence of incised and blank slates demonstrates ongoing manufacturing within communities. These data suggest that incising green slate was not an isolated activity nor one performed by a sole individual. Ritter (1980), who considered the practice of incising slates to be the “tail end of a long tradition,” noted that incised slates were recovered near “domestic” artifacts, and thus were part of daily life. Gilreath (2007) argued that since incised green slates are reported in “bits and pieces…among occasional debris”, they were likely a commonly used item, fragmented during everyday activities. However, in nearby coastal sites, Bury and colleagues (2004) suggested that Chumash incised stones were broken intentionally. The common recordation of fragmented incised green slates at Mojave Desert sites could also be due to intentional breaking.

Only a handful of published studies contain analysis of incised green slates from the Mojave Desert (Gilreath 2007; Sutton 1982; Sutton and Schneider 1996). Most records of incised stones in the region exist only in technical site reports from compliance with cultural resource management (CRM) preservation laws, which are generally inaccessible to the public. Many of these reports also lack in-depth descriptions and analysis of the artifacts. For example, Basgall and Hall (1994) noted that incised stones are a regular occurrence in Fort Irwin assemblages and can be associated with the Saratoga Springs complex. In other words, green slates and incised stones are noted in a Mojave Desert site assemblage, but the focus of analysis in an academic paper or CRM report resides with groundstone, flaked lithics, ceramics, and faunal materials (Allen 2007a; Simpson 1965; Sutton et al. 2009).

Based on a review of the literature and archaeological record, it is clear that communities have been incising stone materials in California and the western Great Basin for thousands of years. Within this region, there is significant variation in style and cultural value. The specific practice of incising green slate in the Mojave Desert may have appeared later than other traditions, although additional radiocarbon testing is needed to confirm this. Some communities may have formed centers of production for the artifact type since blanks were often recorded alongside incised materials. This may have been a community activity and an integral part of everyday life. Overall, the research demonstrates that the location and placement on the landscape likely contributed to the cultural significance of the artifacts for many communities traditionally associated with the Mojave Desert.

Geology and Archaeology of Slate

Slate has been economically valued as a resource in precontact, historic, and modern times due to its properties which allow it to be split, or cleaved, into thin sheets. The slaty cleavage, or splitting and thickness properties, impacts the economic value of slate. In the 18th and 19th century, slate was used as blackboards and individual writing surfaces in schools (Gwyn 2015). The phrases “clean slate” and “blank slate” are derived from the English and Roman traditions of recording information on a stone tablet with chalk. Slate is a fine-grained metamorphic rock, and its color is determined by the mineral composition. Slate usually appears dull, gray, and lackluster, but the presence of chlorite can cause slate to occur as a shade of green. Green slates may also contain high quantities of volcanic ash. The mineral forms when sedimentary rocks like shale and clay are pressurized and heated inside the earth for millions of years (Merriman et al. 2003).

The hardness of minerals can be measured on the Mohs scale with a range of 1–10, and slate ranges between 2.5–4, similarly to limestone (Merriman et al. 2003). The hardness of slate adds to its durability and desirability as a lithic resource. Despite its durability, slate can be easily scratched or incised on its surface with a sharp instrument since it contains soft clay materials in its composition, making it a suitable material for incised stones (Gwyn 2015; Merriman et al. 2003).

Green Slate Quarries

The unidentified researcher who compiled the GSC argued that three potential green slate quarries existed in southeastern California. Six pages of unpublished background research notes about the collection were located at the museum with no author listed. The researcher credited Gerald Smith for a proposed quarry site at Pilot Knob and Bob Reynolds for a second possible quarry located near the Clark Mountains. Finally, the researcher proposed a third quarry site in the western San Bernardino National Forest due to the abundance of archaeological sites in that area containing slate artifacts in the associated assemblages.

Gerald Smith (N.D.) did argue that a green slate quarry site was located near Pilot Knob, the flat-topped mountain feature within the Mojave B Range located on Naval Air Weapons Station, China Lake (NAWS-CL) (Allen 2007b). Smith surmised that all of the green slate artifacts in the region are sourced from Pilot Knob. The landmark is part of the Miocene Eagle Crags Volcanic Field and contains natural deposits of colorful volcanic stone materials. A geologic map of the Pilot Knob Valley confirmed that a slate deposit of “greenish-gray color” with high levels of chlorite is located there (Andrew et al. 2014).

Other Green Slate Regions

The archaeological record demonstrates that Indigenous communities procured slate throughout the United States to manufacture a variety of cultural resources, such as celts, beads, projectile points, and pendants (Eberle 2010; Lauro and Lehmann 1982; Parks 1963). The widespread presence of incised green slates in the Mojave Desert was noted by archaeologists in passing (Gilreath 2007; Sutton 1982), but it has not been the focus of intensive archaeological investigations in California. However, enough research exists to establish that the Mojave Desert is not the only California region to contain green slates. A few minimal investigations in central and northern California demonstrate a presence of green slate, as well (McGuire and Hildebrandt 2019; Ritter 1980; Wallace and Lathrap 1952).

Despite the prevalence of incised slates in the Mojave Desert, one specific area in California contains an even larger assemblage: the upper Sacramento River in Shasta County. Four sites (SHA-475, SHA-1169, SHA-1175, and SHA-1176) contained over 1,500 incised slates and additional blanks, including some green slates (McGuire and Hildebrandt 2019). Interestingly, these sites are dated to 3,000–1,500 cal BCE through radiocarbon dating of associated materials, which is much earlier than the posited dates from Mojave Desert sites with green slate.

Sourcing and Distribution of Green Slate

As discussed above, green slate has been mentioned in past studies, but archaeologists have not focused on the sourcing or distribution of green slate artifacts in California. However, archaeologists examined long-distance and regional exchange of other lithic materials like rhyolite and obsidian in the Mojave Desert (Baugh and Ericson 1994; Hughes 2011; Scharlotta 2014). Investigations of lithic quarries in the Mojave Desert also focused on other materials, such as chert, basalt, and obsidian (Byrd et al. 2009). Additionally, Dinwiddie (2014) examined the distribution of gray slate points in the Pacific Northwest, but no green slate artifacts were included in the collection.

Previous Research by the San Bernardino County Museum

Two previous staff members of the museum conducted research that mention green slate, and their reports are on file in the museum's anthropology archives: Gerald Smith (N.D.) and Adella Schroth (Schroth and Laska 2002;

Schroth and Kearney 2006). Both archaeologists are possible candidates for the unidentified researcher who compiled the GSC, but the researcher could also be someone else who collaborated with them.

Importance of the Color Green

As mentioned in Chapter One, the color green has global significance and frequently serves as a symbol for economic transaction (Rodríguez-Rellán et al. 2020). Green colored stones have played a major role in the ritual and political economies of many societies, including in North America, Central America, and Western Europe, through their production and exchange.

At a global scale, green slate is usually overlooked in comparison to jade, turquoise, and other greenstones. In Mesoamerica, the production and trade of prestige goods, such as jadeite, affected the political economy, but an artifact could change or transform value or meaning during its use life (Andrieu et al. 2014). Larger greenstone ornaments were recovered in elite burials, while smaller greenstone beads had a wider distribution. This suggests that the wider Maya population was permitted some access to the prestige good. Similar to the Mojave Desert, greenstone debitage is rare in the archaeological record of the Maya lowlands, which indicates that greenstone artifacts may have been exchanged or gifted as finished objects (McAnany 2010). Lucero (2010) argued that the colors blue and green both produced associations with cosmology and the center of life for the Maya.

In the American Southwest, turquoise is the most common green or blue stone recorded at archaeological sites. The color and stone have carried many associations for the Zuni, Pueblo, and Navajo/Diné cultures related to water, sky, cosmology, and identity (Weiner 2015). For the traditional inhabitants of Chaco Canyon, the color turquoise symbolized participation in the Chaco system and acted as an identity marker (Plog 2003). Turquoise was used by Pueblo dancers as ornaments worn on the body for rain-making ceremonies (Museum of Indian Arts and Culture 2014). In Navajo/Diné culture, the turquoise color correlates to living water and rain (Whiteley 2012). Bodies of water, such as lakes and springs, are embedded with cosmological value (Weiner 2015), and water is essential for the sustainability of life in the desert. Green-blue stones have been central to Southwest communities and their identity, and the stones' visual similarity to bodies of water contributed to that significance.

There has been less examination of green symbolism or value in the Mojave Desert. Some investigations of green-colored stones focused on the ethnohistory, mining, and exchange of turquoise in Halloran Springs, San Bernardino County (Drover 1980). Laird (1976) noted that the Chemehuevi referred to the Providence-New York Mountains as the "Green Stone Mountains" due to their turquoise deposits. A Southern Paiute consultant for ethnographer Kelly (1934) stated that turquoise was used for personal adornment on the ears or nose (Fowler and Garey-Sage 2016). Another consultant informed her that a locally sourced green-blue stone was used to straighten arrows and that the material was traded amongst communities (Fowler and Garey-Sage 2016). Garfinkel and colleagues (2016) discussed the relative rarity of green-colored stones used culturally for the creation of rock art in the Mojave Desert. Serrano inhabitants of Newberry Cave used local green celadonite to create green pigment for numerous petroglyphs located inside the cave. Archaeologists argued that green represented life affirmation with associations of vegetation, growth, spring, or renewal for Western Shoshone and Southern Paiute peoples (Garfinkel et al. 2016; Vander 1997).

Summary of Literature Review

In conclusion, incised stones have been a topic of archaeological research in the western Great Basin and California for decades. Archaeological research recently shifted in focus from motif typologies and function (Klimowicz 1988; Lee 1981) to the inclusion of Native American oral histories and ethnography (Stoffle 2021; Thomas 2019). However, there is a general lack of distribution and sourcing analysis of incised green slate artifacts in the Mojave Desert, which can further contribute to Indigenous narratives and the cultural continuity model. Specifically, green slate spatial analysis can be incorporated into traditional knowledge of the landscape, oral histories of trading practices and ethnohistoric trail systems. Green slate and other greenstones may have associations with life, seasonality, and the natural environment for some communities traditionally associated with the Mojave Desert. Finally, I also infer from the literature review that incised stone traditions encompass an intentionality and confidence in the manufacturing and placement in the cultural and natural landscape. The Mojave Desert contains dynamic cultural spaces that contributed to the symbology, value, and significance of green slate artifacts.

CHAPTER THREE

CULTURAL AND NATURAL LANDSCAPE

Natural Landscape Overview

The Mojave Desert is located between the Sonoran Desert and Great Basin, and it can be divided into three segments: eastern, western, and central Mojave. The Mojave Desert covers most of modern-day southeastern California, as well as parts of Arizona and Nevada. It is the smallest of North America's deserts, and the area is characterized by its high temperatures, low humidity, and low elevation. The topography is similar to the rest of the Great Basin with isolated low elevation mountains. During the past eight million years, shifting tectonic plates have affected the geomorphology of the desert (Sutton et al. 2009). The exposed geologic landscape dates to roughly 2.7 billion years.

Flora and Fauna

Despite the arid and windy climate, the desert contains diverse wildlife, which can vary based on the elevation. Plant species include varieties of succulents, shrubs, trees, and grasses. Some of the most common Mojave flora are the Joshua tree (*Yucca brevifolia*), creosote bush (*Larrea tridentata*), Mojave yucca (*Yucca*), desert holly (*Atriplex hymenelytra*), and needlegrass (*Stipa speciosa*). Pinyon pine (*Pinus edulis*) and juniper (*Juniperus californica*) woodlands exist at higher elevations. The Mojave Desert also supports an abundance of animal species, including mammals, reptiles, birds, and amphibians. The most common mammals are small rodents like the ground squirrel (*Spermophilus sp.*) and kangaroo rat (*Dipodomys* spp.), while larger mammals include bighorn sheep (*Ovis canadensis*), jackrabbit (*Lepus californicus*), and coyote (*Canus latrans*). Bird species include the burrowing owl (*Athene cunicularia*), among others. Common reptiles and amphibians in the Mojave Desert are desert tortoises (*Gopherus agassizi*), lizards (*Crotaphytus* spp.), and snakes (*Crotalus* spp.). Many of the plants and animals are culturally significant to traditionally associated Native American communities from the Mojave Desert. The biodiversity of the region has provided medicine, food, clothing, and resources for Native American lifeways. Indigenous communities have maintained a strong relationship with the landscape by stewarding the cultural and natural resources, including plants and animals, in sustainable ways.

Cultural Landscape Overview

While Indigenous communities have stewarded the Mojave Desert since time immemorial, the archaeological record is limited in its data and only provides evidence of that occupation for the past several thousand years. Ethnographic data suggest that ancestral territories may have slightly changed over time, and some parts of the region also contain historically overlapped and shared spaces (Kelly 1934; Kroeber 1908, 1959; Strong 1972). As a result, multiple cultural groups may have utilized shared resources. Native American communities inhabited each region of the Mojave Desert and built extensive trade networks with other communities in California (Earle 2005; Hughes 2011; Kroeber 1925). The following sections outline the cultural background of the Mojave Desert through five chronological periods: Terminal Pleistocene, Early Holocene, Middle Holocene, Late Holocene, and Late Prehistoric.

Traditionally Associated Native American Communities

The Mojave Desert region has traditionally been inhabited by numerous cultural groups, including the Serrano, Kawaiisu, Southern Paiute, Western Shoshone, Cahuilla, and Mohave. Figure 2 provides a relative overview of the cultural spaces, but it does not portray definitive or legal boundaries. Most ethnographic maps of the Mojave Desert used by archaeologists are derived from Kroeber's (1925) map and are not entirely precise in comparison to how each community defines their territory or traditional use area. Additionally, some of the Native American communities were assigned these names by European settlers and explorers, but they maintain their own names for themselves (e.g., Maara'yam, Nuwuvi, and Newe). These Indigenous groups are part of the Takic and Numic branches of the larger Uto-Aztecan language family (Kroeber 1925). Sutton (1996) argued that occupation in the Mojave Desert was consistent from the Late Prehistoric period to the ethnographic present with the exception of the Chemehuevi, a southern group of Paiute. One of the first written European accounts of Indigenous communities in the Mojave Desert was recorded in 1776 by Fr. Francisco Garces of the Spanish Franciscan mission. He traveled westward in search of land routes and wrote in his diary about encounters with Native Americans (Earle 2005).

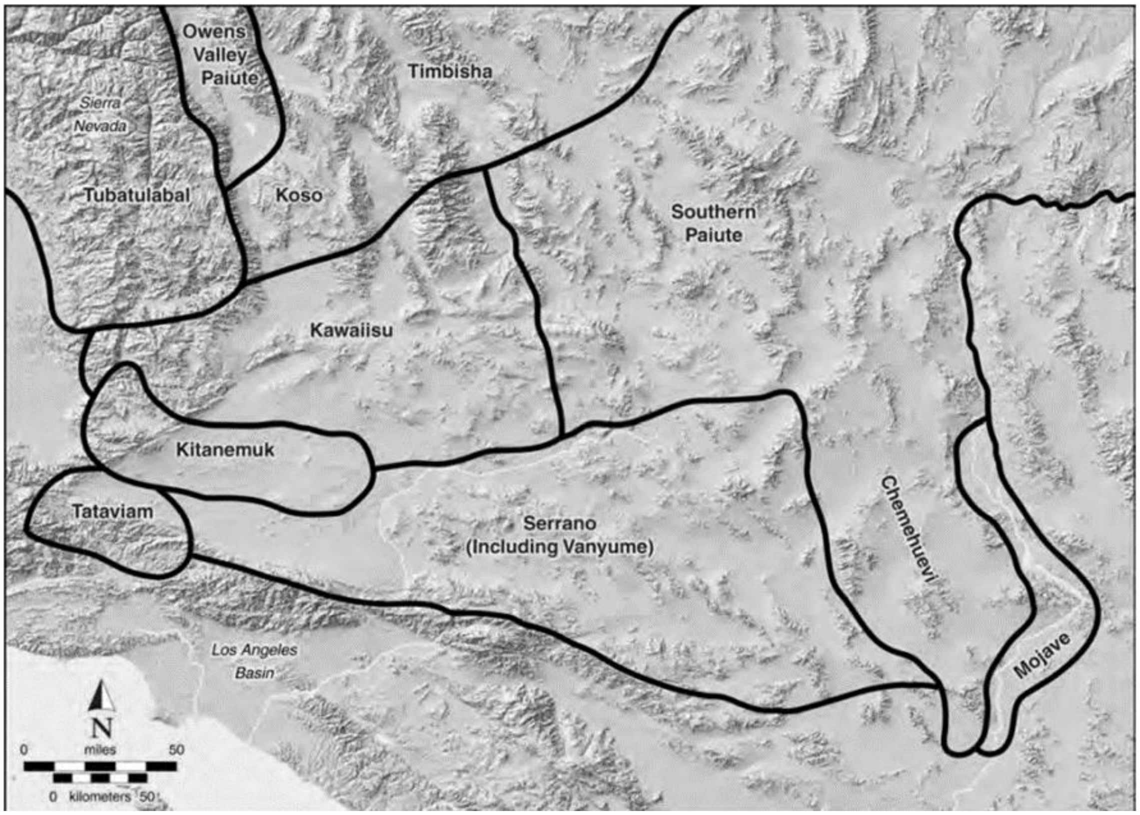

Figure 3. Ethnographic Map of the Mojave Desert (from Sutton 2017).

Archaeological Overview

The cultural framework most widely used to delineate the chronologies of the Mojave Desert was proposed by Warren (1980, 1984) with expansions by Sutton and colleagues (2007). Much of the Mojave Desert is managed by federal land management and military agencies. As a result, most of the archaeological investigations in the region resulted from cultural resource management (CRM) contracts as opposed to academic archaeology.

Late Pleistocene. The presence of Clovis Complex materials, such as at the China Lake sites, demonstrates that the Mojave Desert was occupied during the Late Pleistocene (10,050–8,050 BCE) (Giambastiani and Bullard 2007).

Clovis points suggest that big game hunting occurred, which was supplemented with gathering of local plants by Mojave Desert communities. The Pleistocene was characterized by a wetter and cooler climate, which allowed for several major lake and river systems to develop (Enzel et al. 2003). Evidence of Late Pleistocene occupation is spread out across the Mojave Desert in isolated artifacts, which are frequently dated typologically. Specifically, fluted points have been recovered near Pleistocene lake shores in the Mojave Desert, demonstrating Native communities' reliance on the lake systems during this time (Moratto et al. 2017).

Early Holocene. There was a cultural shift with the emergence of the Holocene epoch (8,050–2,050 BCE) (Sutton et al. 2007). The environment became increasingly arid, and the abundance of megafauna decreased, leading to adaptations in subsistence patterns by Indigenous communities. Pleistocene lakes gradually disappeared from the landscape. Recently, archaeologists defined the Early Holocene technologies in the archaeological record of the Mojave Desert as Lake Mojave (8,050–5,050 BCE) and Pinto (5,050–2,050 BCE), although the two complexes may have overlapped (Renteria 2020). Indigenous communities during the Lake Mojave Period transitioned to hunter-gatherer subsistence with Lake Mojave points characterizing the archaeological record at this time and place. Lake Mojave sites frequently contain stemmed projectile points, bifaces, unifaces, and groundstone tools in their assemblages. Pinto projectile points were first recorded in the Pinto Basin, demonstrating atlatl and dart technology, and this complex is widely expressed throughout the Mojave Desert. Millingstones were recorded at several Pinto sites, indicating that plant processing occurred. Faunal and human remains have also been recorded at some Pinto Complex Mojave Desert sites (Sutton 1996).

Middle Holocene. During the Gypsum Period (2,050 BCE–450 CE), several new projectile point types were manufactured and used by traditional inhabitants. Sites around Fort Irwin have been radiocarbon dated to this period and contain an abundance of faunal remains. Arguably, the most well-known Gypsum site in the Mojave Desert is Newberry Cave, which contains a large artifact assemblage and rock art (Davis et al. 1981). Rock art has also been dated to the Gypsum Period at sites in the Coso Range (Gilreath and Hildebrandt 2008). Archaeologists have argued that the Mojave Desert then experienced a population increase, and communities began forming large villages for residential stability at the end of this period (Byrd et al. 2009; Gardner 2006; Sutton 1996). Socioeconomical complexity and trade networks increased by the end of the Middle Holocene (Sutton 1996).

Late Holocene. A further increase in warming occurred during the Late Holocene. Bow and arrow technology marks the emergence of the Rose Spring Complex (450–950 CE) in the Mojave Desert. Numerous sites in the region date to this period and frequently contain small obsidian projectile points in their assemblages. Obsidian artifacts from this period are often sourced to the Coso Volcanic Field and other local sources. Research indicates that people were hunting smaller fauna, and there was dependence on a broader spectrum of plant communities as a result of environmental changes (Byers and Broughton 2004; Gardner 2006). Native American communities also began establishing more permanent settlements (Gardner 2006; Sutton 1996). Artifact assemblages continued to diversify and frequently included pipes, knives, drills, shells, awls, and obsidian tools, to name a few.

Late Prehistoric. The Mojave Desert experienced a continuity of culture, including during the Late Prehistoric period (950 CE – European contact). Although, archaeologists argued that the Chemehuevi entered the Mojave Desert in the southeast only several hundred years ago, possibly displacing Desert Mohave people (Kroeber 1959; Lerch 1985; Sutton 2017). Native American communities conducted agriculture during the Late Prehistoric period in the eastern Mojave Desert. People inhabited large, permanently occupied villages with associated activity areas, such as housepits, trash piles, funerary areas, food processing stations, and nearby camps for hunting and resource procurement (Sutton and Earle 2017; Sutton et al. 2007). By the time the Spanish arrived to the inland of California in 1760's–1770's, the desert encompassed many flourishing villages, each containing numerous family groups. Late Prehistoric sites contained artifact assemblages with Desert series projectile points (Cottonwood Triangular and Desert Side-notched), brownware and buffware ceramics, pendants, incised stones, and shell and steatite beads (Rogers 1931; Schneider 1988).

CHAPTER FOUR

COLLECTIONS MANAGEMENT AND RESEARCH METHODS

Methods Overview

In order to answer the research questions presented in this thesis, I conducted a landscape-level investigation to analyze how green slate artifacts were procured, manufactured, and exchanged across ancestral territories. I conducted spatial analysis of the green slates' locations at both the inter-site and intra-site level, relying heavily on site records, reports, and GIS mapping. Additionally, I cataloged and rehoused the Green Slate Collection at the San Bernardino County Museum to facilitate a more culturally appropriate method of curation. I consulted with San Manuel Band of Mission Indians (SMBMI) during the design and implementation of this research to facilitate discussions regarding research topics, the treatment of the materials, and any issues with confidentiality or sensitivity. SMBMI demonstrated interest in learning more about precontact trade conducted by Serrano ancestors, especially in the desert regions where entire Serrano communities were decimated. The Institutional Review Board (IRB) of California State University, San Bernardino determined this research to be Not Human Subjects Research (NHSR), so they did not require further review or approval.

Catalog

I cataloged the green slate artifacts using an Excel spreadsheet (see Appendix A). I recorded the artifact catalog number, SBCM number, site trinomial number, accession number, any additional number, site name, site location, ownership designation, new SBCM storage location, item count, object, material, description, condition, weight, dimensions, date cataloged, photo numbers, and notes. I assigned each artifact a new catalog number for this research using their SBCM number (e.g., SBCM13-1). Additionally, I captured overview and detail photographs as part of the cataloging efforts. I cast light from one side angle with a lamp, diffused through translucent material, to photograph the small incisions on the artifacts.

Curation

A priority of this research was to curate the GSC in a culturally appropriate way. After completing the data production, I remarried the artifacts with their respective SBCM collections in the Anthropology Storage curation facility at the museum to restore site and assemblage provenience.

The Code of Federal Regulations (36 CFR 79) outlines the minimum federal standards for the curation of federally owned museum collections. This is extremely relevant to the museum’s curation practices and to this research, since the GSC contains artifacts lawfully owned by numerous federal agencies. The museum follows the national and international standards in curation practices and adheres to 36 CFR 79. Along with archiving and updating site and provenience information, the San Bernardino County Museum records information regarding the relocation, condition, or conservation treatment of any artifact. A digital record is created in the museum's database every time a cultural artifact is accepted for curation, inventoried, and handled. I updated the digital records for the artifacts in the museum's database.

Part of the curation process involved rehousing the collection. I rehoused the artifacts in new polypropylene bags if the previous bag was deteriorated or damaged. I included an acid-free artifact tag with the catalog number in the bags. Many artifacts were previously bagged together. During the rehousing, I separated the green slate artifacts and bagged them individually. If an SBCM number contained more than one green slate, I put the multiple bags together in a larger bag with the SBCM number and trinomial listed on it. I physically remarried the artifacts with their respective SBCM collection, and put the artifacts at the top of the appropriate curation box.

Spatial Analysis

I compared the general locations of archaeological sites in relation to one another by conducting inter-site spatial analysis. Each site considered for this analysis produced at least one blank or incised green slate. This mapping effort included the site provenience of the GSC green slates, as well as the provenience for green slates currently housed in other collections. Gray slate artifacts were not included in this analysis. Some of the artifacts recorded in the map are fragmentary. It is possible that multiple fragments of the same artifact were listed in catalogs, which would cause the reported artifact counts to be higher than the actual counts. Using ArcGIS Pro software, I created a heat map of the archaeological sites' general locations in the Mojave Desert (see Figures 11a and 11b). To discourage future looting and the sharing of sensitive cultural information, this map does not contain precise site locations. I created this map with curator Tamara Serrao-Leiva by using significant site buffers to maintain the confidentiality of the specific site localities. The museum already maintains archaeological site GIS data restricted from public access, so we simply isolated the green slate sites. Next, we changed the symbology of the points to render them as a "heat map" in ArcGIS, which displayed the points as a dynamic, representative surface of relative density.

Since one research question focused on artifact distribution, the heat map was a main goal of this research. The map illustrated large-scale spatial patterns indicating where incised and blank green slates were recovered in the Mojave Desert. It also demonstrated which Native American communities have archaeological evidence of manufacturing, trading, and using incised green slate when compared with maps of their ancestral territories. This analysis allowed me to visualize the generalized locations of green slate artifacts to demonstrate any clusters, gaps, or trails.

In order for the heat maps to be as accurate as possible, I investigated other reports of green slate in the archaeological record. The GSC at the museum does not contain all known samples of green slate artifacts in the

Mojave Desert. Since a significant portion of the Mojave Desert is military or public land, I contacted cultural resources staff at numerous agencies regarding potential green slate artifacts in their repositories. Additionally, I conducted a digital search through the Digital Archaeological Record (tDAR) for references of green slate in site reports. I reviewed copies of the site reports on file at the museum to confirm green slate locations and quantities. Finally, I reviewed the collections database of the San Bernardino County Museum to identify any isolated green slate artifacts that were not included in the GSC by the unidentified researcher.

For intra-site spatial analysis, I examined the locations and counts of green slate artifacts at the individual site level. I incorporated contextual information, site interpretation, and recovery level from the archaeological sites in order conduct this analysis (Simek 1984). Additionally, I reviewed the provenience of the green slates in relation to site features. The intra-site spatial data and context provided information about which types of sites produced green slate and where they were recovered within sites. Their context within the site provides information about how the green slate artifacts were manufactured and used.

Microscopic Analysis

I examined the collection of green slate artifacts under 50X, 100X, and 150X magnification with a portable USB microscope. I connected the magnified images to a computer with the USB and screen-grabbed the images to digitally capture them. Microscopic analysis enhanced the incision details so that I could analyze distinctions between incision width and depth to determine the incising method and tool.

XRF Analysis

I used non-destructive portable X-ray fluorescence (pXRF) technology to geochemically analyze the composition of the cultural artifacts in the museum's GSC. As a non-destructive method, the cultural materials were not degraded or altered in any way. XRF technology has been previously used to analyze slate distributions in other parts of the world (Wolff et al. 2014). An XRF device saturates each sample with short wavelength X-rays. These X-rays knock inner electrons in the target material from their electron orbitals. This permits outer electrons to fall in to take their place and gives off a characteristic but faint fluorescence "light." The pXRF unit measures this signal and correlates the distinctive fluorescence spectra to that signal which is known to be associated with specific elements. The intensity of the signal correlates with the abundance of that element which was detected. Dr. Erik Melchiorre from the Geology Department at California State University, San Bernardino loaned me a Thermo Scientific Niton FXL Field X-ray Lab XRF for this analysis. He calibrated the device prior to the data collection, and we conducted two test analyses on geological lab samples. I set the pXRF unit to the Mining Cu/Zn setting for a total of 180 seconds per measurement. The data collection occurred at the museum so that the cultural materials were not removed from the museum's curation facility. No green slate artifacts from other institutions or collections were incorporated into this analysis due to constraints with timing, access, and COVID-19 restrictions.

I analyzed every green slate artifact in the GSC (n=51) with the pXRF unit for 180 seconds, even if an archaeological site contained more than one sample. This accounted for the possibility that slate artifacts from more than one procurement source could reside in a single archaeological site as result of exchange between communities. The GSC contains an abundance of fragments, but every fragment was analyzed even if two fragments appeared visually similar. The pXRF device scanned through “Heavy” and “Light” traces of metals in the samples and converted the traces into parts per million (ppm) (Campbell and Healy 2016; Forster and Grave 2012; Frahm and Doonan 2013).

CHAPTER FIVE

RESULTS

Results Overview

In this chapter, I present the results of the collections management efforts and analysis. The results are organized into methodology sections, as consistent with Chapter Four. The key results of this research demonstrate that the majority (92%) of the GSC is sourced to one quarry location, and the green slate sites are spatially distributed across the central Mojave Desert, spanning 150 miles.

Catalog

The Green Slate Collection contains 94 cultural artifacts, of which 51 are green slate artifacts. The rest of the collection contains incised stones made from other materials, slate artifacts of different colors, and other lithic artifacts. As previously mentioned, I catalogued the entire GSC, but I focused the analysis on the green slate artifacts. I catalogued each fragment separately unless multiple fragments could definitively be attributed to the same artifact. I updated the museum’s collection database, Argus, with pertinent artifact information as a result of the formal cataloging of the GSC. Table 1 demonstrates some of the key physical attributes of the 51 green slate artifacts. These artifacts were collected from 28 archaeological sites across the Mojave Desert. It is important to note that since many of the slates are small fragments, the actual quantities of green slate artifacts from these sites are likely inflated.

Table 1. Artifact Features

Color	
Greenish gray	40
Dark greenish gray	11
Perforations	
Perforated	11
Unperforated	40
Incisions	
Incised	34
Blank	17
Condition	
Complete	5
Fragment	46

As part of the cataloging work, I recorded numerous physical attributes of the artifacts, including color, since some of the artifacts in the collection were gray slate. However, I noted visual differences amongst the green slate artifacts from the GSC. I quantified variations in shades of green slate using the Munsell color system. I identified ten shades of “greenish gray” and “dark greenish gray” as shown in Table 2. The collection contains significantly more greenish gray slate artifacts than darkish green artifacts.

The GSC contains 11 green slate artifacts with perforations. All of the perforations on the tabular-shaped green slates are unifacially drilled (see Figure 4), but one cylindrical artifact is biconically drilled. However, the majority of the cultural materials in the GSC are unperforated. This suggests that green slate was a dynamic raw material and utilized by Indigenous communities for multiple reasons. It is important to note the amount of fragmentation in the collection, as well. The actual percentage of perforated materials could be higher, but they were catalogued based on the available information provided by the fragments' characteristics. There is also an apparent lack of usewear on the unifacially drilled artifacts (see Figure 4). If the materials were suspended and worn on the body, the lack of usewear could be explained by infrequent use and association with special occasions. However, Adams (2008) suggested that some Native American communities drilled holes into cultural materials as a form of discard, similar to intentional fragmentation.

Table 2. Artifact Colors

Munsell Color ID	Munsell Color	Count	Percentage
Gley 1 5/5G_/1	greenish gray	7	13.73
Gley 1 5/10Y	greenish gray	1	1.96
Gley 1 5/5GY	greenish gray	16	31.37
Gley 1 5/10GY	greenish gray	10	19.61
Gley 1 6/5GY	greenish gray	2	3.92
Gley 1 6/10Y	greenish gray	3	5.88
Gley 1 6/10GY	greenish gray	1	1.96
Gley 1 4/10Y	dark greenish gray	7	17.73
Gley 1 4/5GY	dark greenish gray	2	3.92
Gley 1 4/10GY	dark greenish gray	2	3.92

The majority of green slate artifacts are small fragments, which makes determining their shapes and full dimensions difficult. Interestingly, of the larger fragments and complete artifacts, a variety of artifact shapes can be discerned in the collection. The majority of recognizable shapes are elongated and tabular with a thin cleave (Figure 5). The thickness of the green slate cleaves ranges from 1.33 to 7.58 mm. Additionally, the collection contains several tear- shaped green slates with a pointed tip, such as SBCM 631-1 shown below in Figure 10. The final shape represented in the collection consists of three cylindrical green slate artifacts (Figure 6). The slate cleaves were beveled around the sides to create rounded and elongated artifacts. One of these artifacts, not shown, is the only bifacially drilled green slate artifact in the GSC. It is also the only artifact with evidence of usewear near the perforation.

The GSC contains 34 incised green slate artifacts. Variations exist in their incision motifs and incisions sizes. Most of the incision motifs are apparently abstract, parallel lines, or cross-hatched (Figure 7). There are no known anthropomorphic or zoomorphic motifs in the collection. Smith (N.D.) argued that the slate motifs resemble local petroglyph motifs. Some cultural artifacts are incised on both sides while others contain incisions limited to one face.

The incisions were likely created with a pointed lithic tool but not all the incisions are uniform. Two green slate artifacts in the collection contain a single, deep and wide incision on their surfaces (Figure 8). Incisions on the other green slate artifacts are much narrower and shallower with less visibility in photographs. Smaller incisions occur adjacent to the deep groove on both artifacts. Additionally, artifact SBCM 635-3 in Figure 8a contains a deep incision on both sides. These types of incisions are evidently rare. Based on a literature review, there is a lack of deep incisions on stone artifacts in the archaeological record of the Great Basin and California.

There is one artifact in the collection with a concentric circle motif, which also presents an apparent anomaly for the region based on the archaeological record (Figure 9). The incisions of concentric circles on SBCM130-1 demonstrate the ability and skill to create a curved incised line, as opposed to the straight and angular incisions in the rest of the collection.

The condition of the green slate artifacts ranges (Figure 10), and only 5 of the 51 artifacts are complete. Some of the complete and fragmented artifacts were reglued as part of previous curation efforts. During the cataloging effort for this thesis project, no artifacts were physically reconstructed. Sutton and Schneider argued that the fragmentation of green slate from Guapiabit (CA-SBR-1913) "occurred in antiquity" and not in recent times (1996:22).

I did not photograph any green slate artifacts with black or red staining during the cataloging of the collection. The discoloration could be caused by red ochre and burn marks, suggesting possible ceremonial use or funerary association. The museum's collections management policy states that it is prohibited to photograph human remains and funerary/sacred materials, unless special permission is granted from the affiliated community. These cultural materials were handled with respect and recognition of their potential sensitivity. I placed these green slates in artifact boxes to prevent damage and labeled them with alerts on the exterior of the boxes.

Figure 4a. Example of Perforated Artifact, SBCM 87-4 (CA-SBR-187). Photo by author.

Figure 4b. Example of Perforated Artifact, SBCM 635-2 (CA-SBR-2083). Photo by author.

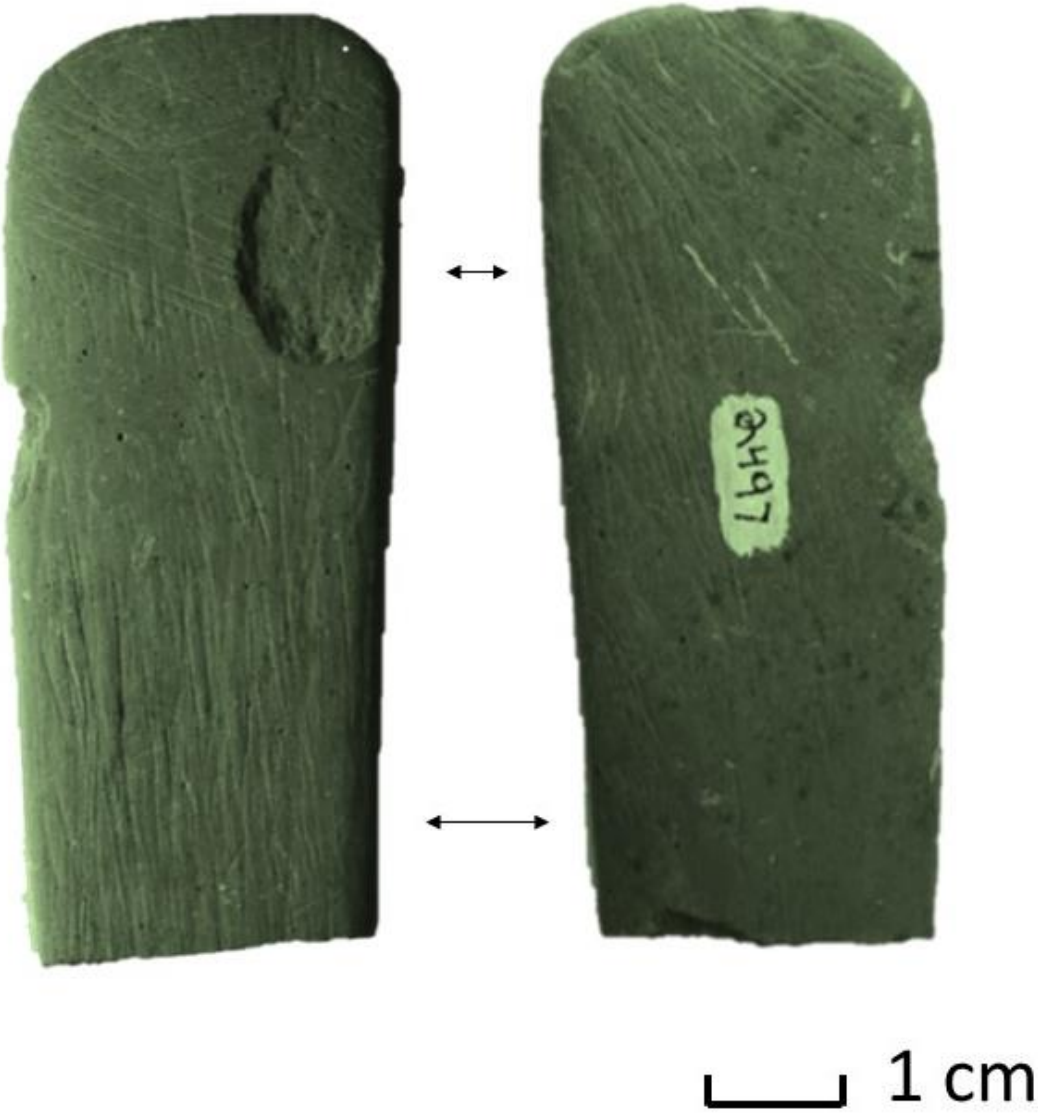

Figure 5a. Example of Tabular Artifact, SBCM 2497-1 (CA-SBR-4327). Photo by author.

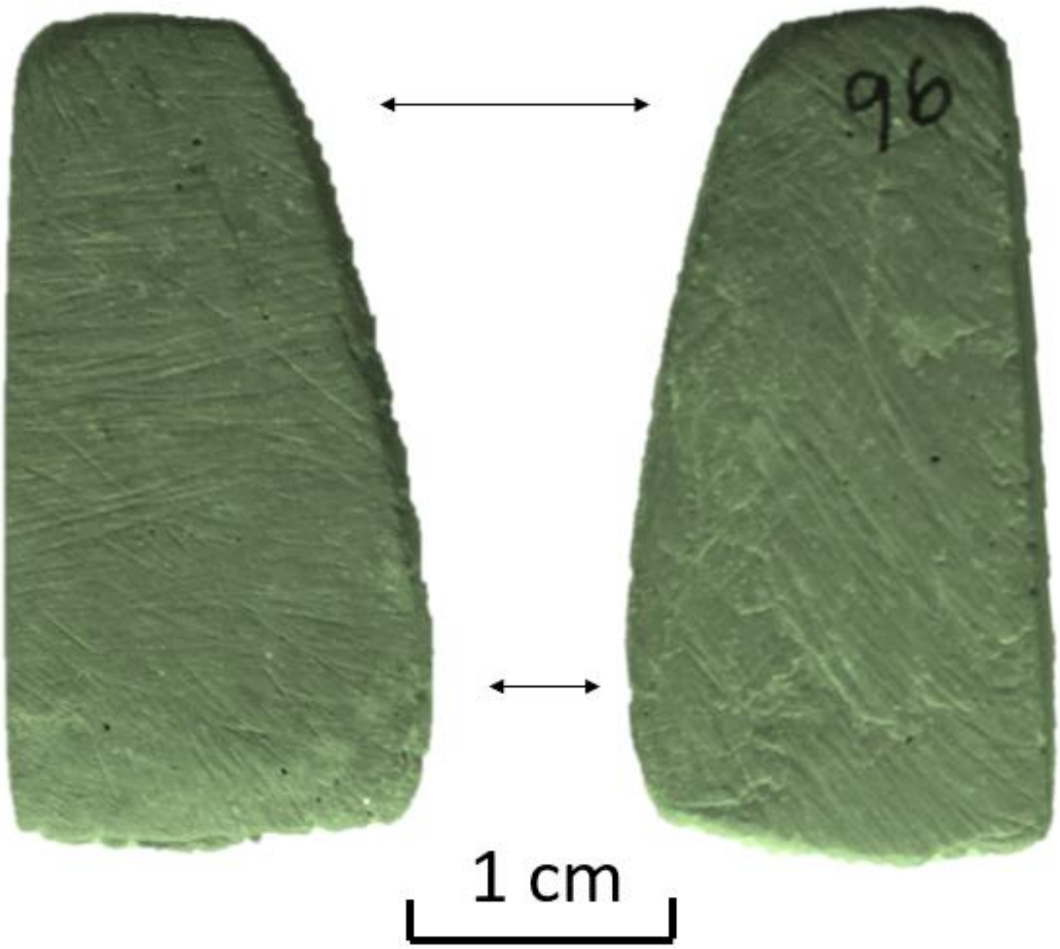

Figure 5b. Example of Tabular Artifact, SBCM 96-2 (CA-SBR-317). Photo by author.

Figure 6a. Example of Cylindrical Artifact, SBCM 87-1 (CA-SBR-187). Photo by author.

Figure 6b. Example of Cylindrical Artifact, SBCM 106-1 (CA-SBR-153). Photo by author.

Figure 7a. Example of Apparently Abstract Incision Motif. Photo by author under 100X magnification.

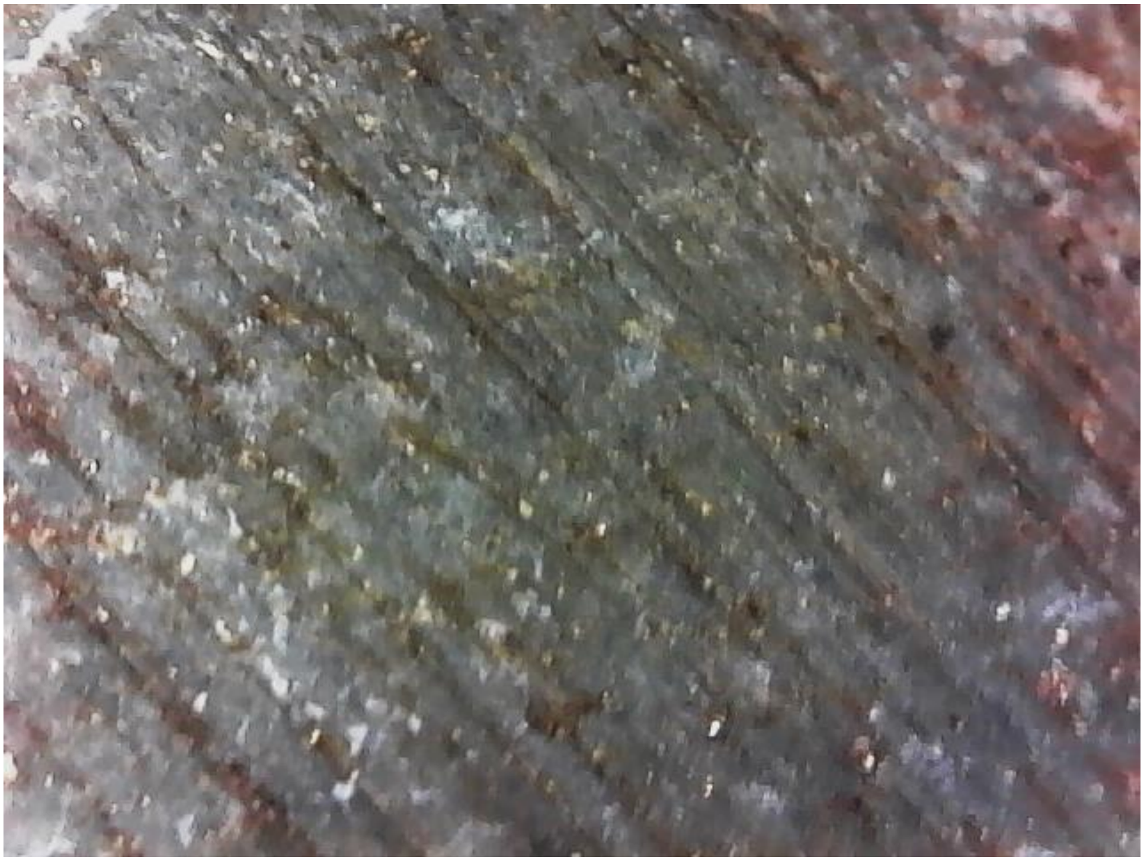

Figure 7b. Example of Apparently Parallel Incision Motif. Photo by author under 100X magnification.

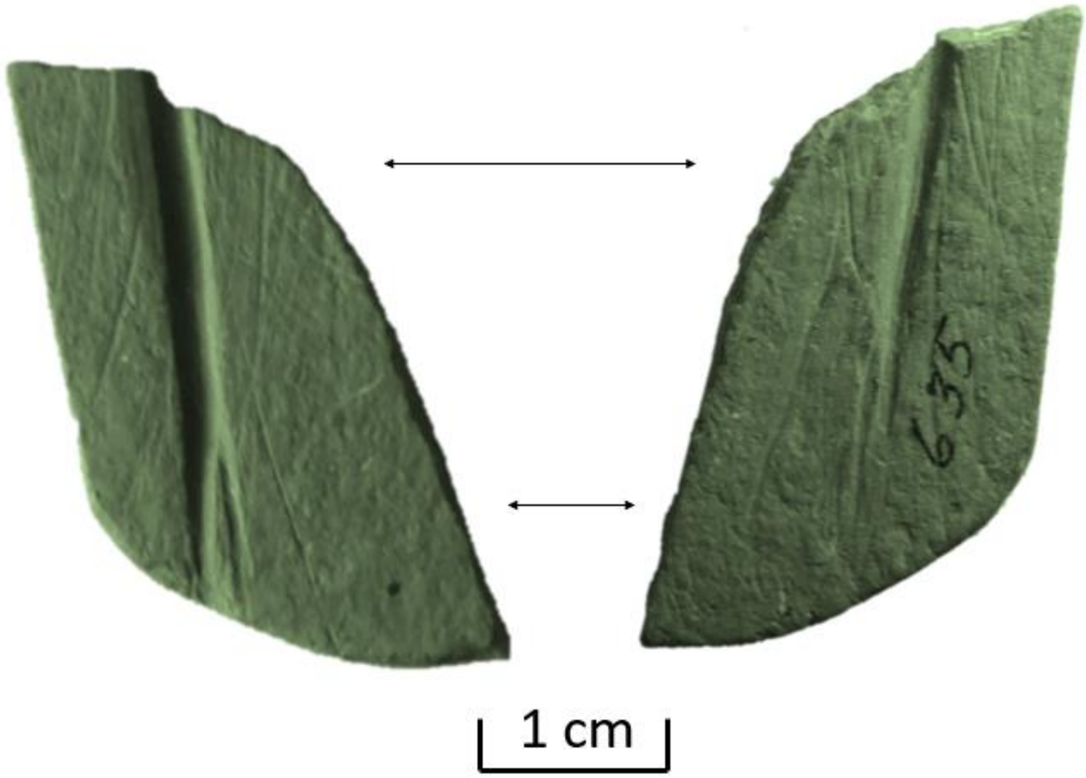

Figure 8a. Example of Deep Incision, SBCM 635-3 (CA-SBR-2083). Photo by author.

Figure 8b. Example of Deep Incision, SBCM 180-1 (CA-SBR-941). Photo by author.

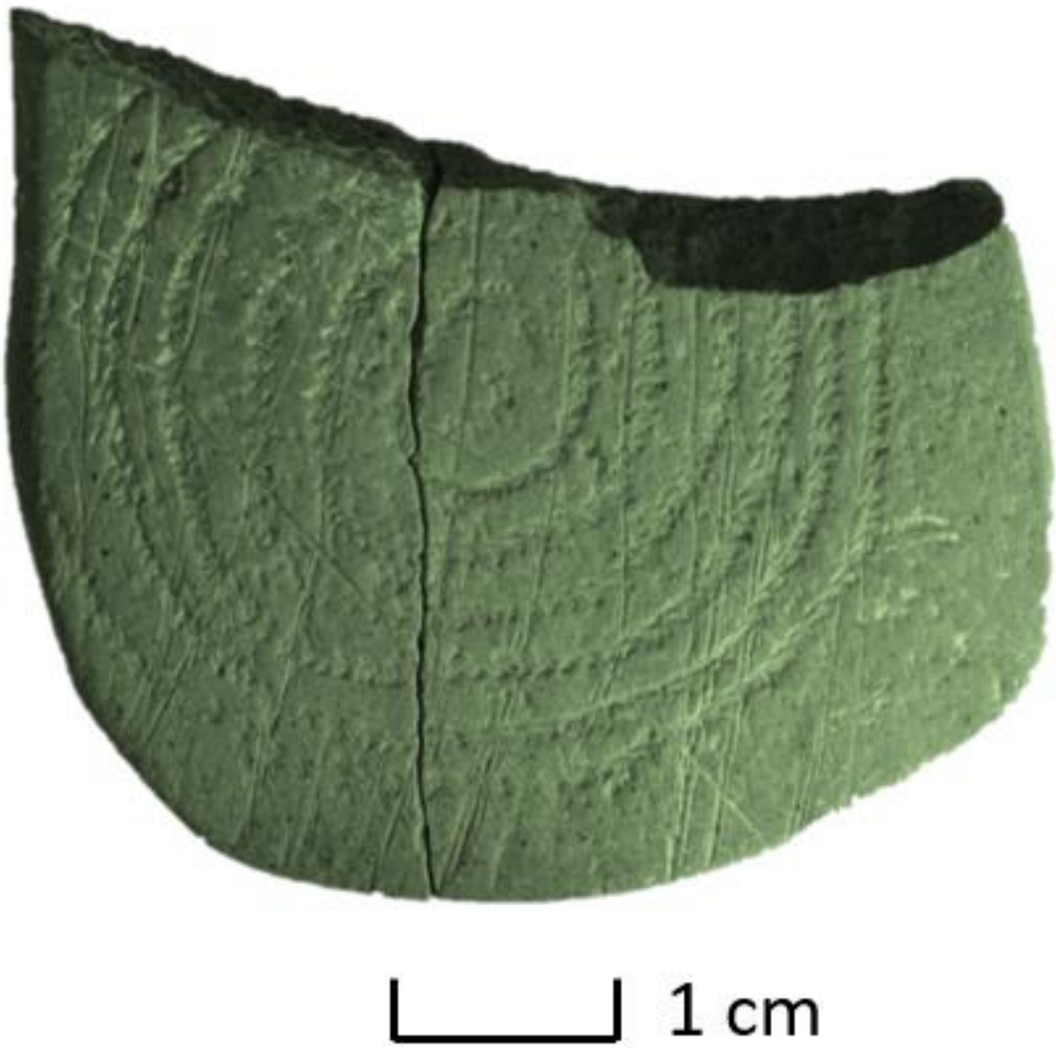

Figure 9. Example of Concentric Circle Motif, SBCM 130-1 (CA-SBR-115). Photo by author.

Figure 10a. Example of Fragmented Artifact, SBCM 302-2 (CA-SBR-306). Photo by author.

Figure 10b. Example of Complete Artifact, SBCM 631-1 (CA-SBR-2079). Photo by author.

Curation

I rehoused and remarried the Green Slate Collection with the artifacts' respective SBCM site collections. As a result of the curation methods, the artifacts are now stored in a culturally appropriate and respectful way that preserves provenience information. I also flagged records of the cultural materials for later review of eligibility for repatriation under NAGPRA or CalNAGPRA by the museum.

Additionally, I reviewed the associated archival materials in the museum. Archaeologists previously posited occupation dates for some of the sites containing green slate through the use of absolute and relative dating methods. This chronological information supports previous arguments that green slate artifacts are connected to Late Prehistoric occupation in the Mojave Desert. Through a review of the chronologies, I argue that green slate artifacts were manufactured and used from 950 CE through early European contact to about 1850.

Spatial Analysis

I identified numerous green slate artifacts outside of the GSC through a review of tDAR, reading site reports, discussions with federal agencies, and reviewing the museum's database. The results of this search are summarized in the fourth column of the table in Appendix B. I included these cultural artifacts in the spatial analysis to portray green slate distribution and concentration as accurately as possible. Unfortunately, I could not include these green slates in the XRF analysis. The museum curates some of these additional artifacts (n=8). It also curates a ninth green slate artifact, but the artifact does not have precise provenience, so it was not included in the spatial analysis. I identified additional green slates in site reports. Some artifacts listed in Appendix B are from the same sites as the GSC artifacts. For example, 16 fragments were recorded at CA-SBR-43/H based on the site reports, but only one fragment of green slate (SBCM-160) is located in the museum's GSC (Schroth and Kearney 2006). Appendix B includes a GSC artifact count and a total artifact count to reflect SBR-43/H, and other previously known green slate sites.

In total, I identified 150 green slates from 45 archaeological sites in the GSC, site reports, other repositories, and museum database for the Mojave Desert archaeological record. This assemblage consists of many small fragments, so the actual quantity of complete artifacts at each site may be lower. The green slate within the GSC at the museum represents 34% of this green slate artifact total. The results of the inter-site spatial analysis are presented in Figure 11 as a heat map showcasing the greater Mojave Desert area. The map displays the general distribution of all of the provenienced green slate artifacts across the Mojave landscape. Four medium-density clusters of green slate can be discerned from the heat map.

Green Slate Sites Overview Map

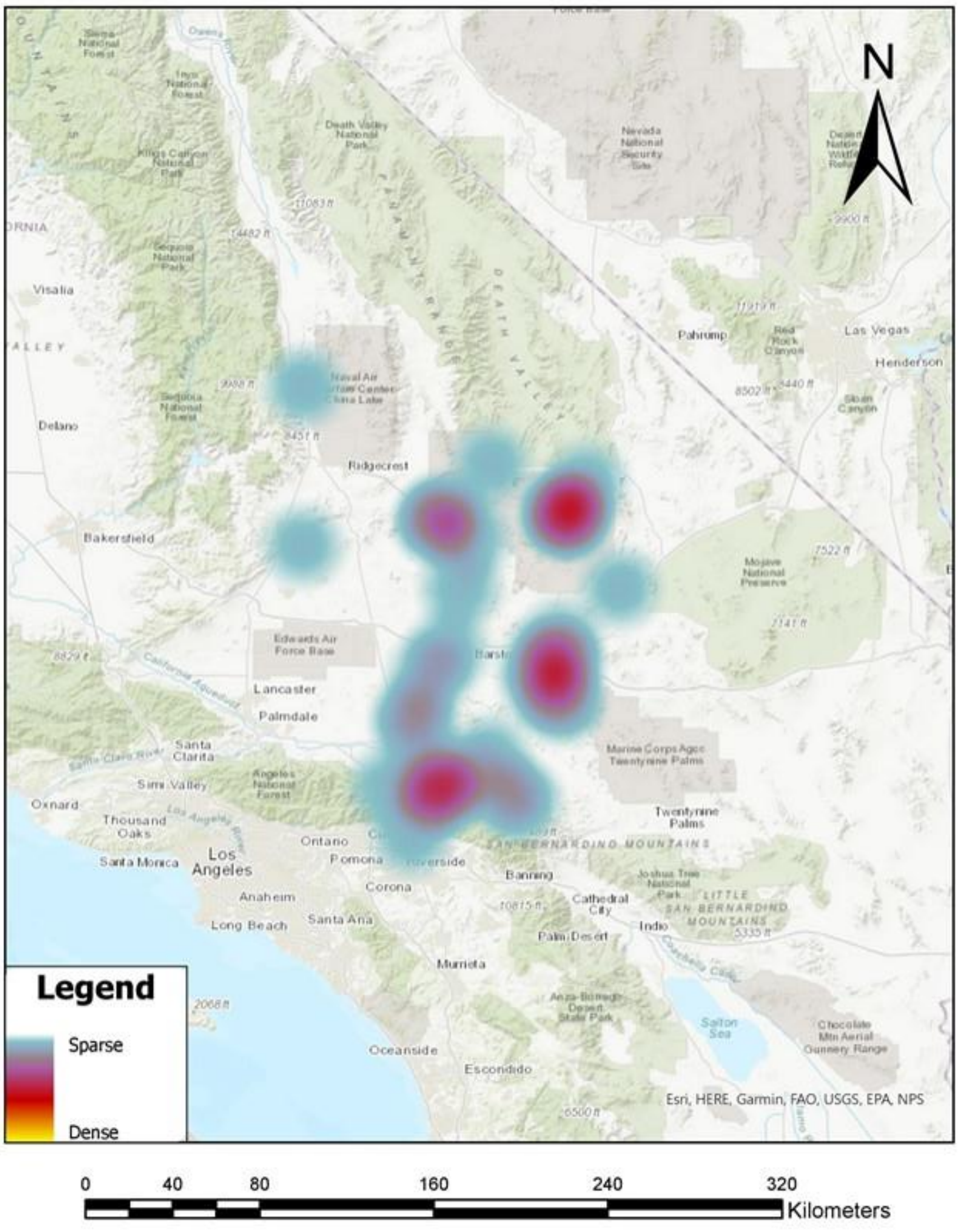

Figure 11a. Heat Map Distribution Overview of Green Slate Sites in the Mojave Desert.

Green Slate Sites Detail Map

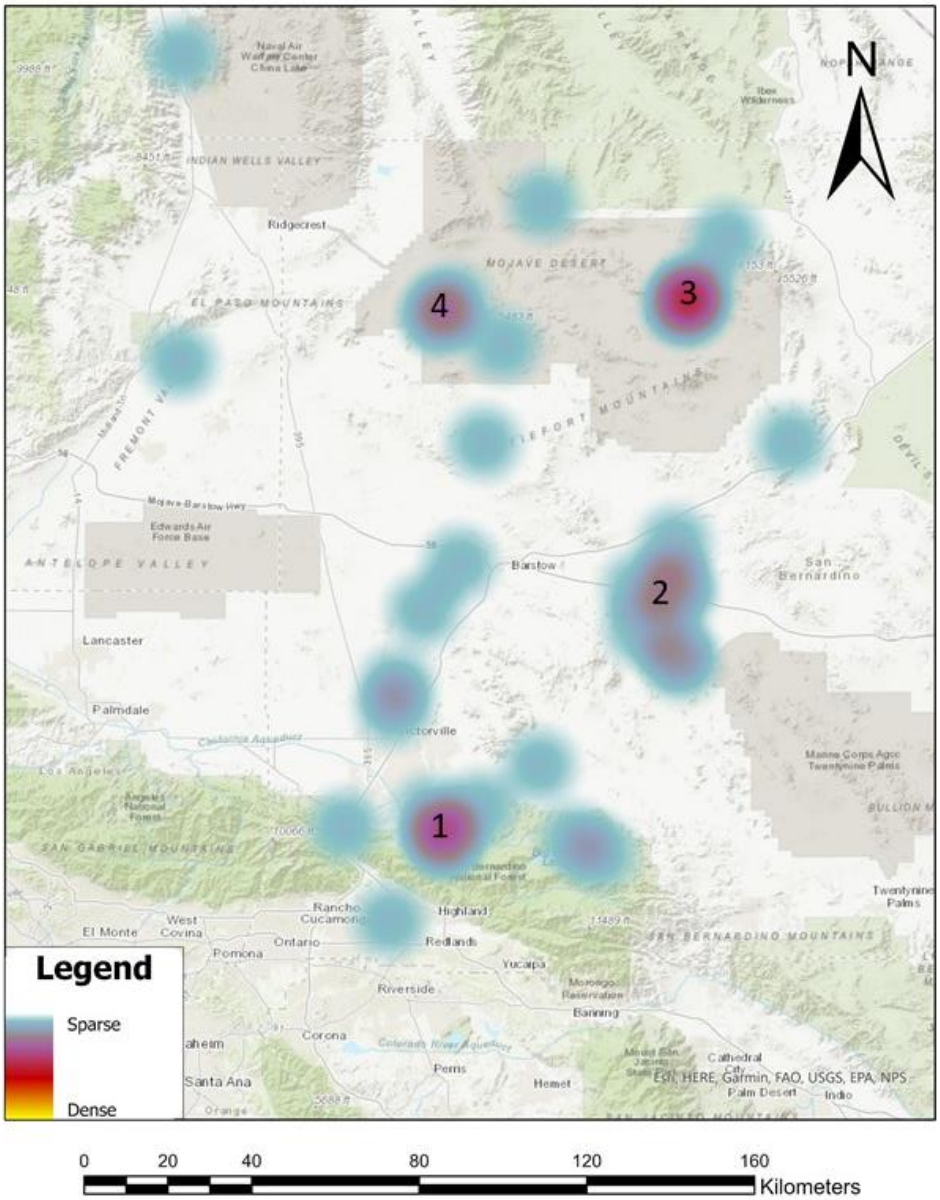

Figure 11b. Heat Map Distribution Detail of Green Slate Sites in the Mojave Desert.

The four clusters are focused in mountainous regions of the Mojave Desert. The first cluster of green slate is focused on the western San Bernardino Mountains and also includes sites in the Cajon Pass. There are additional green slate sites on each side of this cluster, as shown in the blue peripheries. Specifically, several sites are located throughout the rest of the San Bernardino Mountains, in the Summit Valley area, and in the San Bernardino Valley. This cluster contains the widest distribution of additional sites in its peripheries in comparison to the other three clusters, which have more centralized concentrations of sites. This cluster is located in the ancestral territory of the Mountain Serrano. The second cluster of green slate sites is located in the Rodman Mountains, southeast of modern-day Barstow. The second cluster also resides in the ancestral territory of the Desert Serrano. The third cluster consists of the highest known density of green slate sites and is located in the Granite Mountains, also known as the northern and central corridors of Fort Irwin. This cluster represents a concentration of sites within the ancestral territories of the Kawaiisu, Southern Paiute, and Western Shoshone. The fourth cluster is located in the Robbers Mountain area on the southwestern corner of NAWS-CL South Range in Kawaiisu and Western Shoshone ancestral territory.

Overall, the distribution of green slate sites in Southern California translates to a general linear north-south trend. Specifically, the distribution is confined to western San Bernardino County, beginning in the northern Mojave Desert and ending in the San Bernardino Valley. It is important to note that eastern San Bernardino County contains an apparent lack of recorded green slate sites. Two semi-linear trails are evident in the distribution with both trails consisting of the same start and end points, creating a cyclical distribution (Figure 12). However, one trail is located more westerly and follows the Mojave River and continues north to Robbers Mountain at NAWS-CL South Range. The second trail mostly consists of three clusters with fewer connecting sites. Figure 12 represents an interpretation of the green slate distribution to demonstrate the cyclical north-south trend.

I also examined the spatial distribution of green slate artifact characteristics. Specifically, I mapped the distribution of perforated and incised green slate artifacts. This analysis was limited to the GSC, due to lack of access to other collections for detailed cataloging. Incised green slates from the GSC (n=34) were collected from sites throughout the entire green slate corridor. However, perforated green slates (n=11) were only recovered from sites in the southern half of the study area, south of modern-day Barstow. Green slates that contained both characteristics (n=5) were distributed between modern-day Victorville and Barstow. I did not include heat maps for this analysis due to the small sample sizes.

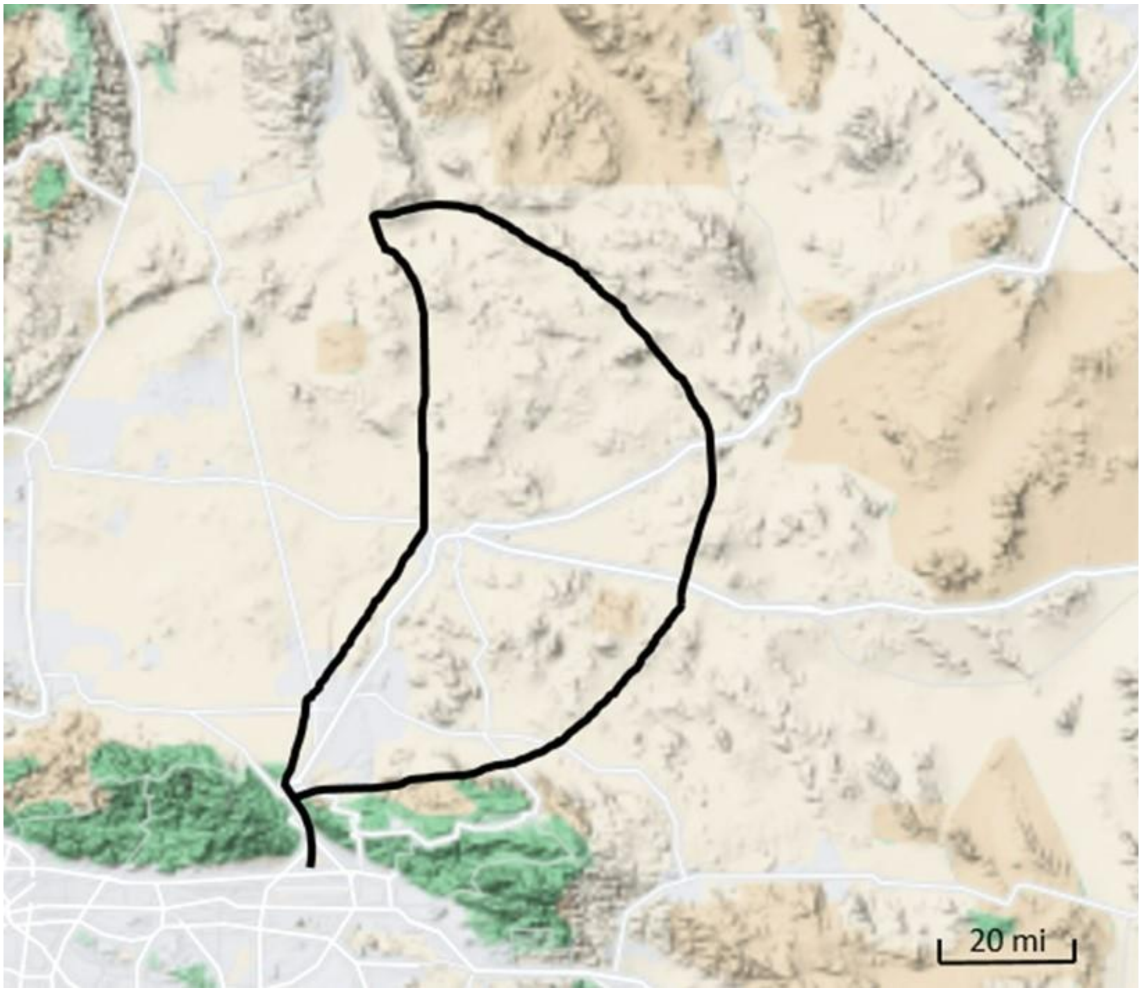

Figure 12. Interpretation of Green Slate Cyclical Distribution.

Table 3 describes the stratigraphy from which green slates were recovered at the site level, including the artifacts outside of the Green Slate Collection. Unfortunately, the stratigraphic levels of many green slate artifacts were not included in the original site forms and are unknown. However, of the known contexts, the majority of sites (n=13) were surface collected for green slate artifacts. No green slate artifacts were recorded below depths of 30-40 cm.

At several sites (n=4) green slate artifacts were recorded at both surface and subsurface levels.

Table 3. Artifact Recovery Levels for Green Slate Sites

Surface	Subsurface	Both	Unrecorded
13	2	4	26

Some of these reports presented site interpretations, including village, campsite, processing station, and isolate. Most of the green slate artifacts were recorded at sites interpreted as complex villages or permanently occupied sites. Seasonal campsites were dispersed throughout the Mojave Desert at various elevations. One artifact, 2497-1 from CA-SBR-4327 presents an anomaly in the collection as an isolate. This is the only known green slate isolate in the Mojave Desert.

Throughout the Great Basin, incised stones were occasionally recovered near firepit or hearth features, suggesting intentional placement (Figure 13) (Santini 1974; Stoffle et al. 2021). It is possible that some of the artifacts in the Green Slate Collection were intentionally placed, as well, since many were recovered from the surface. In regard to the sites included in this study, unfortunately, little information was recorded in site forms about the specific placement or distance of green slate artifacts from other artifacts or features. However, data exist about the general presence of features and artifact types. For example, several green slate artifacts were recorded at sites that contain rock shelters, pictographs, petroglyphs, and known traded materials, such as obsidian, shell, and beads.

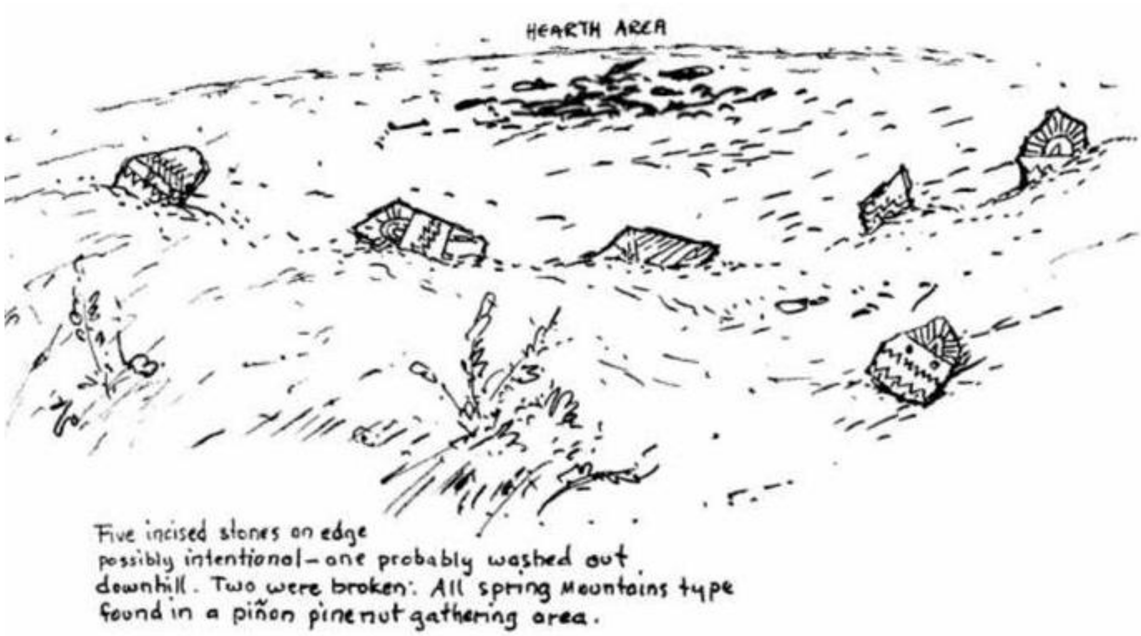

Figure 13. Five Incised Stones Around a Hearth (from Santini 1974).

<u>Microscopic Analysis</u>

I used a portable USB microscope to examine the artifacts' incisions and surfaces. I observed inclusions of mica or quartz on many artifacts. Incising may have been conducted with a fine lithic flake or a similar sharp incising instrument. Ritter (1980) suggested that the four incised green slates from the Panamint Mountains were modified using a stone flake. However, it is possible that incising tools were not uniform across the various affiliated communities of the Mojave Desert. Microscopic analysis at 100x magnification revealed variations among incisions in depth and width. Sutton (1982) also observed variation in the incision sizes on green slates from the Denning Springs Site (CA-SBR-3829). Further, the microscopic analysis in this thesis revealed that a line in a motif is typically achieved with a single incision, suggesting confidence by the crafter. In other words, repeated strokes on the slate are not required to incise the surface with a fine line. Additionally, it corresponds with the geochemical properties of slate. The raw material is durable but easily incised due to a soft clay composition. It is important to note that variations can occur on a single artifact, as shown in Figure 13. If a lithic flake was used to incise a slate artifact, it would likely create varied incisions due to the asymmetrical and uneven shape of the flake. Artifact SBCM 46-1 demonstrates differences in incision sizes on one of its sides. However, there are also microscopic and macroscopic differences in the incisions throughout the GSC. As mentioned above, two artifacts contained single, large incisions, which can be easily viewed without the aid of a microscope (Figure 8). Those incisions required numerous strokes of the lithic tool to create a deep depression on the surface of the slate, demonstrating a concentrated effort by the crafter.

Figure 14. Example of Incision Variations. Photo by author under 100x magnification.

XRF Analysis

The results of the pXRF readings (Appendix C) demonstrated that 92% of the collection was sourced to one quarry, and a few outliers may consist of a different material than slate. The purpose of utilizing portable X-ray fluorescence (pXRF) technology in this thesis was to determine compositional differences in green slate from archaeological sites across the Mojave Desert. It provided information on how many sources of green slate were actively quarried by Indigenous communities. This research incorporated analysis of the smaller trace elements as parts per million (ppm) in the slate material. Lithic sources contain trace element signatures, so this analysis illustrated how many different sources were represented. The main components in green slate are extremely common elements, like iron (Fe), and would be represented in high levels across every green slate source. In this case, the trace components of the green slate chosen for analysis were zirconium, chromium, rubidium, and vanadium, respectively. I graphed the quantities for each sample in a scatter plot to group the slates by similar composition, and thus by their source group. This illustrated any clusters or patterns across the samples. Based on these results, I present probable locations of green slate sources in Chapter Six.

Figures 14a and 14b portray the quantities of zirconium (Zr) and chromium (Cr) ppm in the Green Slate Collection. Figure 14a displays one large cluster with a few (n=5) outlying points. Additionally, two samples (160-1 and 345-5) are not represented on the graph due to their limit of detection (LOD). A limit of detection means that the quantity of the element, if any, is lower than the detection error for the pXRF unit. I chose trace elements for this analysis that minimally experienced detection limits across the samples. While some elements had detection limits across the collection, many elements were still detectable for the analysis. Since the two samples had an LOD measurement for either Zr or Cr, they cannot be graphed. The figure contains a 95% confidence ellipsis, and the cluster signifies that 44 of the 51 samples are behaving extremely similar in terms of their geologic properties, specifically for their trace levels of Zr and Cr. In

Figure 14b, the five outliers are removed to portray the strong similarity in the trace amounts of zirconium and chromium for the remaining data.

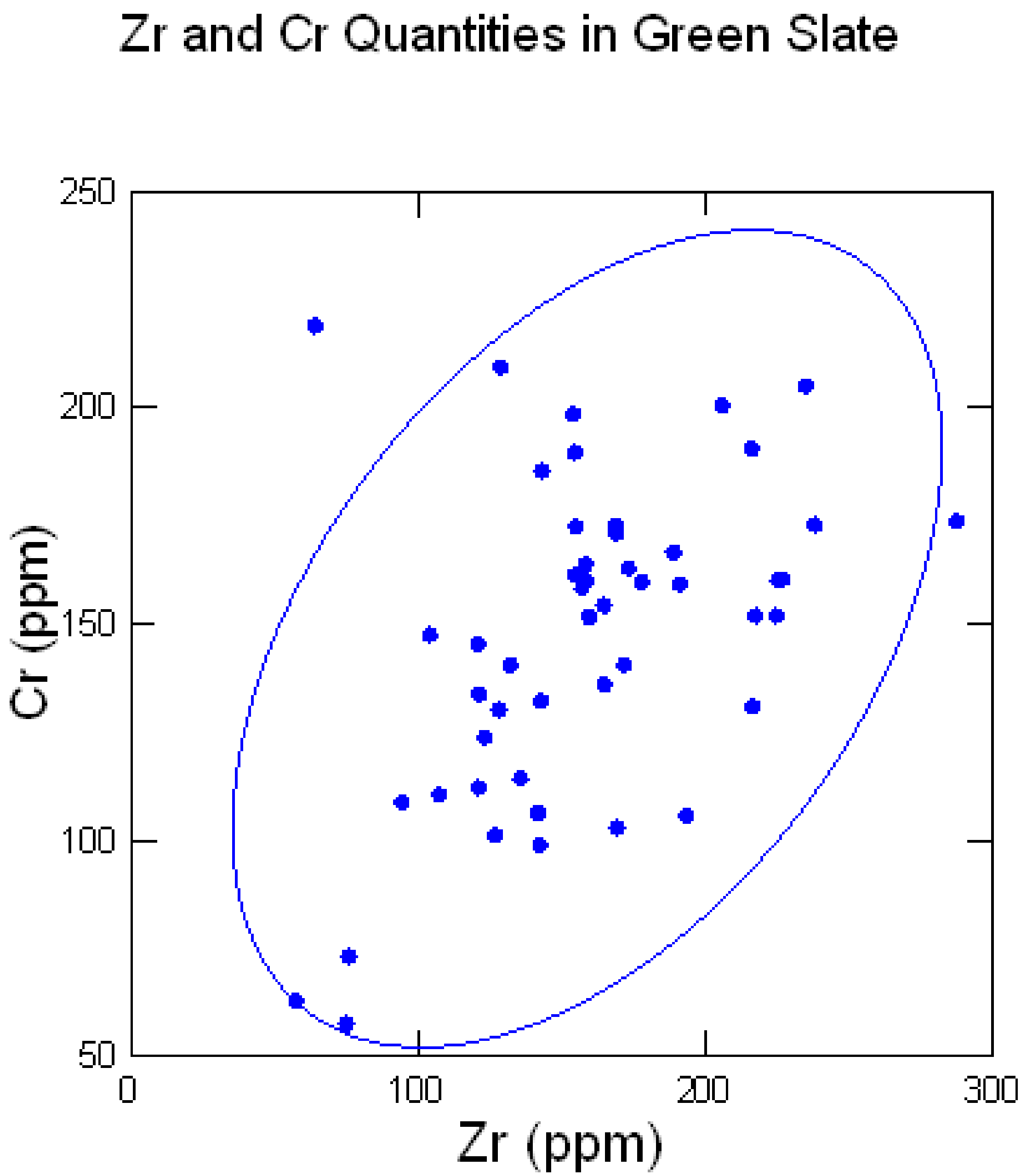

Figure 15a. Zirconium and Chromium Quantities (ppm) in the Green Slate Collection. Ellipse is drawn as 95% confidence ellipse by Systat.

Zr and Cr Quantities in Green Slate

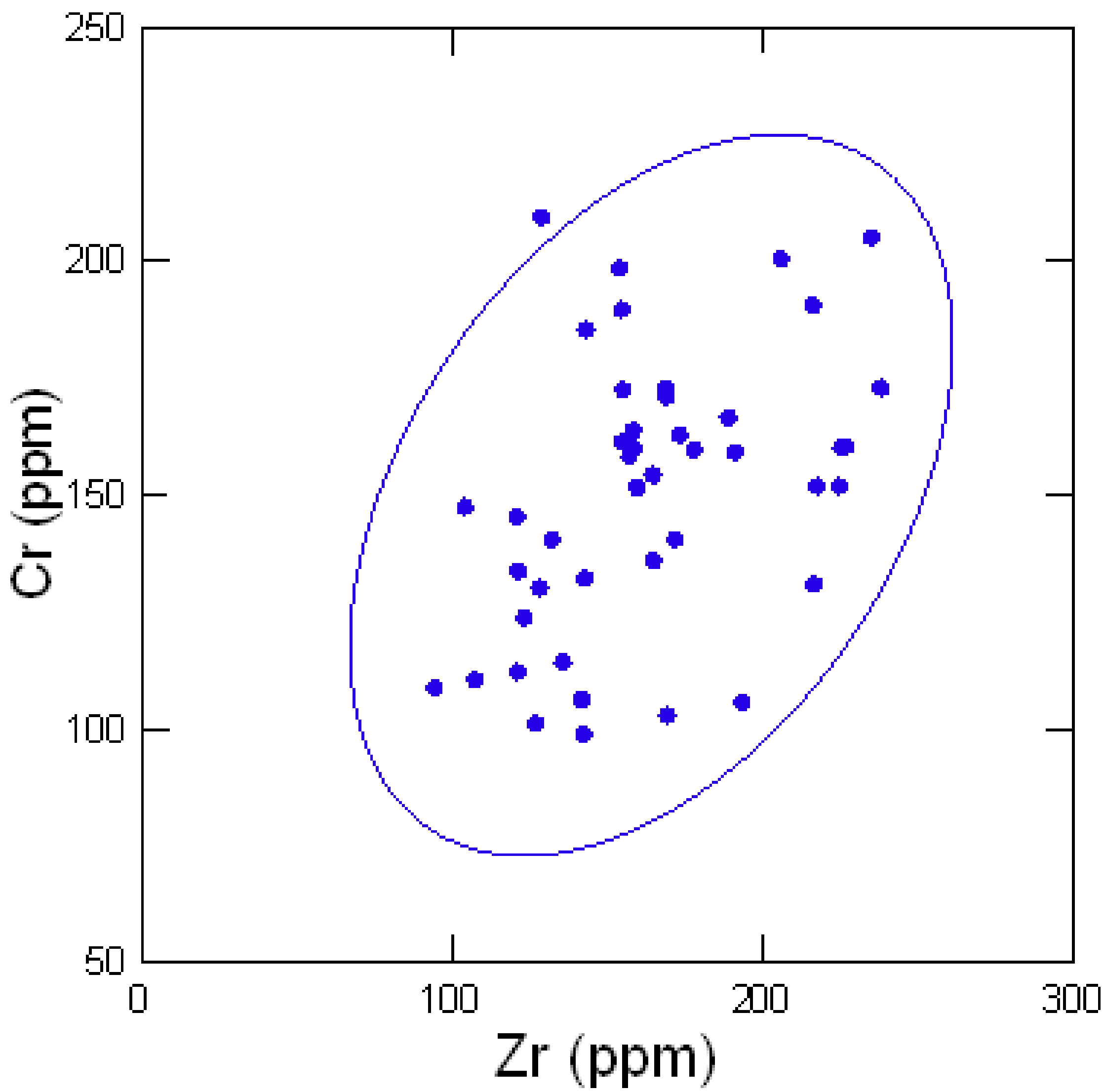

Figure 15b. Zirconium and Chromium Quantities (ppm) in the Green Slate Collection. Ellipse is drawn as 95% confidence ellipse by Systat.

Two additional figures (Figure 15a and 15b) portray the values of rubidium (Rb) and vanadium (V) ppm in the GSC. Figure 15a contains a clear linear trend with one outlying point (635-4) and two points not included (128-2 and 345-5) due to LOD. In the second graph, the outlying sample is omitted to determine the trendline for the majority of the data. The trendline demonstrates that there is strong linear relationship between the trace elements across the remaining dataset of 48 of 51 samples. Specifically, it portrays the metamorphic grade of the Rb and V levels in the slate deposit at the source location. The dataset contains an R value of 0.7819. An R value is a correlation coefficient which measures the strength and direction of a linear relationship between two variables on a scatterplot. If the two variables are closely related, the correlation coefficient will occur closer to -1 or +1. Typically, anything above 0.7 is considered a “strong” relationship in statistical analysis. In this case, there is a strong relationship between the trace quantities of rubidium and vanadium.

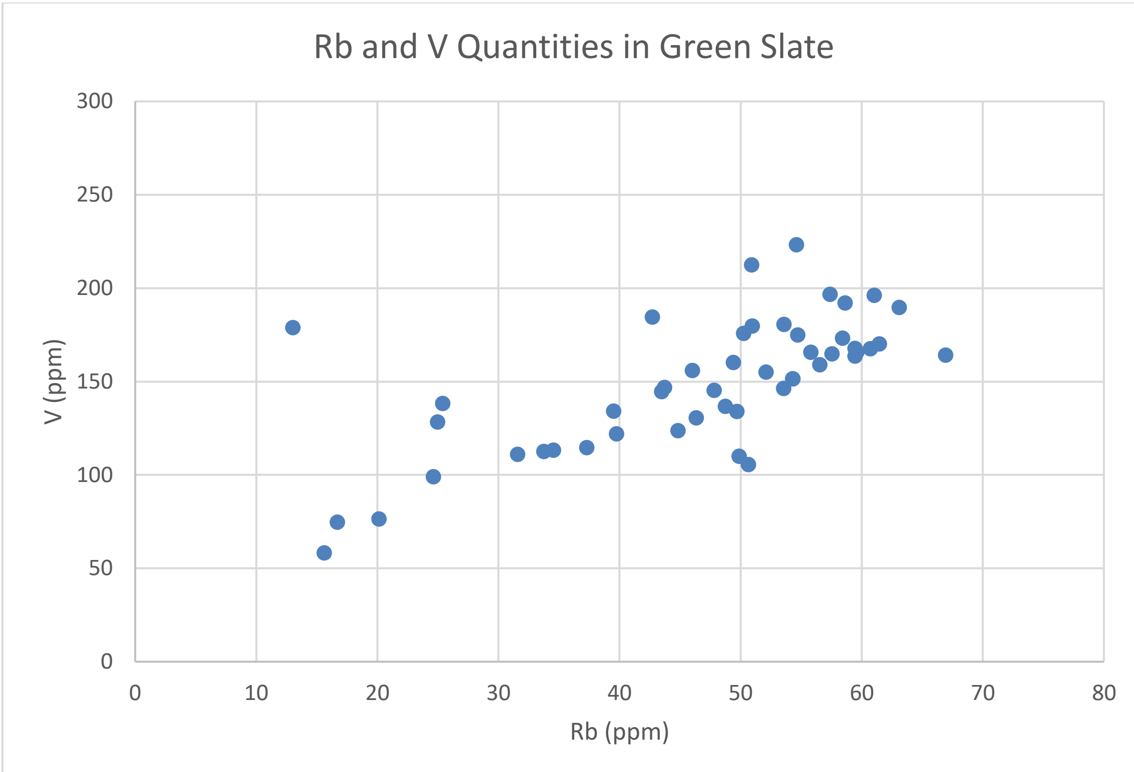

Figure 16a. Rubidium and Vanadium Quantities (ppm) in the Green Slate Collection.

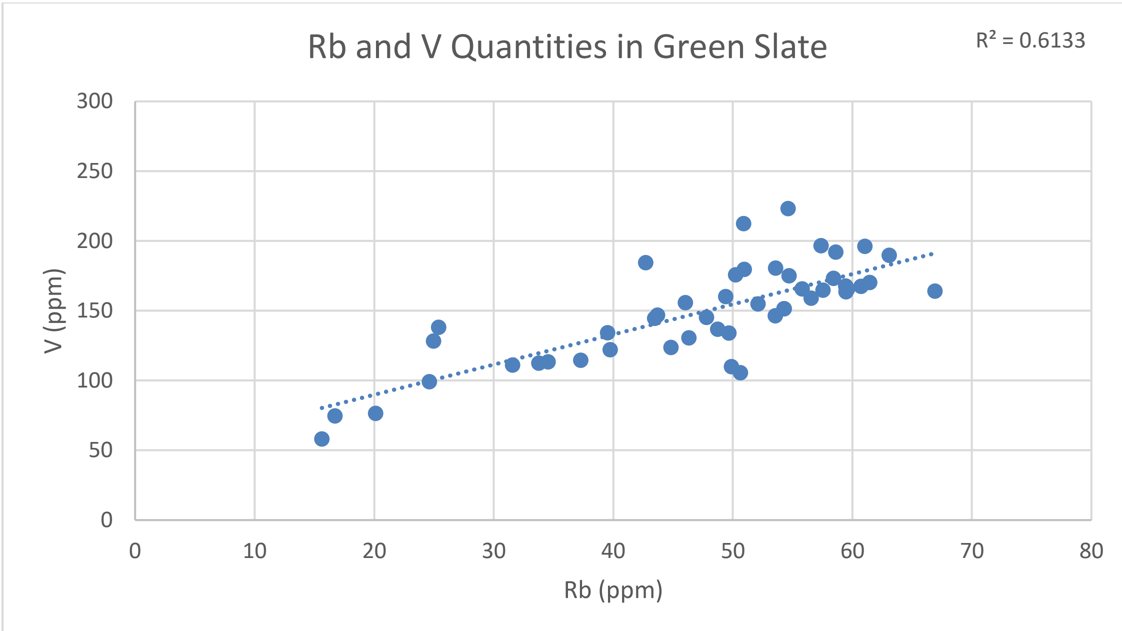

Figure 16b. Rubidium and Vanadium Quantities (ppm) in the Green Slate Collection.

Number of Sources. Analysis of the data strongly suggests that 47 of the 51 samples, or approximately 92%, originated from one large procurement source. In other words, the trace elements correspond so closely across the range of samples because the raw material was procured from one area. However, it was likely a large source area, perhaps roughly the size of a football field, as the linear grade of some of the trace elements (see Figure 16) suggests local variation of the same parent material.

Outliers. There are a few outlier points to the main trend. Assuming these points do not reflect analytical error or measurement of a surface inhomogeneity like a stain, these samples may represent different sources than that of the main trend. Future detailed work should be done on these particular samples to examine this possibility. The few outliers (n=4) have no apparent correlation between one another and were perhaps procured from separate regional locations. It is also possible that the outliers consist of a different raw material entirely that appears visually similar to green slate, since there are signficant differences in the major and trace elements. Another possibility is that the extremely small size of some of the outlying fragments may have affected the accuracy of the data due to an error during data collection. For example, the width of sample SBCM 345-5 is 10.73 mm, which is approximately the same size at the X-ray source on the pXRF unit. If this is the case, the percentage of green slate from the main source may be even higher.

The most common outliers across the pXRF results are the artifacts 160-1, 632-7, 345-5, and 128-2 (see Appendix C). Most of the collection experienced detection limits for minerals such as antimony (Sb), tin (Sn), cadmium (Cd), palladium (Pd), silver (Ag), and molybdenum (Mo). However, the outlier samples frequently contained detectable traces of these elements. Conversely, the majority of the collection contained detectable traces of strontium (Sr), rubidium (Rb), chromium (Cr), potassium (K), barium (Ba), aluminum (Al), phosphorus (P), chlorine (Cl), and magnesium (Mg), but the outlier slates experienced LOD. These samples even contain apparent differences in the major element quantities than the rest of the samples, supporting the hypothesis that they consist of an entirely different raw material or that an error occurred during data collection for the extremely small samples.

Data Comparison. In this thesis, I present the first published XRF data of green slate. Therefore, the GSC pXRF results cannot be compared to data from known quarries or other collections. However, any future studies can use this data for comparison, including for other green slate collections or for in-field pXRF analysis of quarries.

CHAPTER SIX

LANDSCAPE DISCUSSION

Green Slate Landscape

In this chapter, I present my analysis of inter-site spatial information for green slate artifacts within the cultural landscape of the Mojave Desert. Landscape archaeology can incorporate a broad array of lenses, including social memory and oral history, gender, phenomenology and sensory experiences, identity, and communities of practice (Bender et al. 2007; Joyce 2021; Kearney 2016; Knapp and Ashmore 1999; Rainbird 2016; Riley et al. 2005; Shackel 2003; Tilley 1994). I incorporate landscape-level analysis in this thesis to investigate spaces at each episode of life for the cultural artifacts, which collectively create a network of communities of practice in the desert landscape. By examining green slate places, I also explore and recreate how the lithic resource traveled through the Mojave Desert by means of local exchange and contributed to the socioeconomic systems of traditionally affiliated Native Americans.

Contexts

As demonstrated in the results, most of the green slate artifacts were recorded at large, complex sites and a few smaller, seasonal camps. Many of the larger sites were interpreted as villages at the time of their recording, which suggests that green slate artifacts are associated with permanent occupation. Additionally, the majority of the collection was recorded at the surface level at their respective sites across the Mojave Desert. These sites frequently also contained other ornamental materials, such as shell and stone beads (Gilreath et al. 1987). Archaeologists have connected green slate artifacts as a Late Prehistoric phenomenon (Schroth and Laska 2002; Sutton 1982). A review of chronological information for each site confirmed this statement but also suggested a Protohistoric association, as well. In other words, green slate production continued after initial European contact.

Manufacturing Process

Debitage from the manufacturing process of green slate artifacts is notably absent from the archaeological record. Out of the 45 sites with green slate represented in the GSC, only two sites contain evidence of the manufacturing process. This may suggest that the artifacts were manufactured at different locations than where they were utilized and later recorded by archaeologists, similar to Mesoamerican greenstone contexts (McAnany 2010). As previously mentioned, green slate artifacts were commonly recorded at large sites with other items of prestige or value. However, the green slate artifacts may have been manufactured in close proximity to their resource procurement locations. The manufacturing sites are generally unknown, except for CA-SBR-2677/H and CA-SBR-51.

The slate assemblage from site CA-SBR-2677/H (SBCM 761) provides the greatest insight into the connection between the procurement and manufacturing processes. Three green and gray slate fragments contained intact quarry matrix. This may suggest that the raw material was procured locally.

Additionally, two green slate fragments from SBR-2677/H were worked flakes, likely discarded during the manufacturing process (Schroth and Kearney 2006). A second site, CA-SBR-51 (SBCM 282), produced numerous unfinished green slate artifacts and associated debitage (Peck and Smith 1957).

Material

Cultural greenstone artifacts in the Mojave Desert have been referred to as green slate in archaeological site reports and literature. However, Gilreath (2007) suggested that not all green slate artifacts are truly green slate. She posited that some greenstones in Shasta County may actually be schist or siltstone (Gilreath 2007:274). The XRF data in this thesis suggests that most of the GSC consists of green slate with a few outliers. The outliers may have been misidentified in the field as green slate. If the artifacts are in fact a separate material, green andesite is one possible identification due to its visual similarity to green slate.

Geologically speaking, there are a few noteworthy differences between andesite and slate, mostly regarding their formation. Andesite is a fine-grained igneous rock that forms when magma is erupted onto the surface and is crystallized quickly. Slate is a low-grade metamorphic rock that is generally formed by metamorphosis of mudstone or shale, under relatively low pressure and temperature conditions.

There is no way to know if Native American communities traditionally associated with the Mojave Desert distinguished between slate, andesite, or other green-colored stones. Green slate and green andesite appear similar and share comparable qualities in their workability as a lithic resource. They are both fine-grained and durable, share similar levels of hardness, and both have a dull appearance in multiple shades, including green. The shades of green in andesite and slate artifacts closely correspond and both materials occur in geologic deposits in the western United States. However, a mineral resource can have other cultural considerations as a lithic resource for Native American crafters, such as the significance of its placement on the landscape. Distinguishing between the two materials generally does not assist in answering anthropological questions about resource procurement, tool manufacture, or exchange. I use the term “green slate” throughout this thesis in reference to the entire collection due to precedence and for continuity. “Slate” can also generally refer to the sheet-like, tabular shape of the artifact. I make the material distinction now in preparation for discussion of green slate sources. It is important to correctly identify the resource material for accurate geochemical analysis and raw material sourcing. In other parts of the world, such as Mesoamerica, archaeologists have rectified this identification issue by referring to artifacts as “cultural greenstones” (Healy et al. 2018). This term is a more accurate identification of the artifact type, and I propose that it can be used in future literature for “green slate.”

Green Slate Sources

The results of the XRF analysis in this thesis demonstrate that the green slate artifacts in the GSC are sourced to primarily one large green slate outcrop.

The outlier artifacts (n=4) may have been procured from small, isolated deposits throughout the Mojave Desert. While Native Americans have possessed intimate knowledge of the landscape, including locations for resource procurement, archaeologists and geologists do not have verification about the locations of many green slate quarries. There are several possible source locations for green slate across the Mojave Desert. It is important to note that green slate artifacts from other collections were not part of this XRF analysis. Therefore, additional pXRF analysis of other green slate collections may reveal another procurement source not represented in the GSC.

I contacted the cultural resources staff at Fort Irwin during this research, and they stated that a green slate outcrop is located on the military lands. They were unable to share further details regarding the site for this research. This also corresponds with the spatial distribution of the artifacts, since a cluster of green slates was recorded at Fort Irwin in the Granite Mountains (see Figure 11). This cluster is one of the main concentrations of green slate sites in the Mojave Desert. The Granite Mountains at northern Fort Irwin is the most probable location for the green slate source due to the presence of a cluster, the presence of green slate debitage, and confirmation that a green slate quarry is located in the area. However, additional in-field XRF analysis is required to confirm this quarry as the main procurement site.

There are two other less probable, unconfirmed locations for a green slate quarry. Gerald Smith reported a green slate quarry at Pilot Knob, which likely refers to the mountain feature in the NAWS-CL, South Range. He argued that all the green slate in the region could be sourced to this quarry (Smith N.D.). Based on the XRF results in this thesis, Smith was correct that the majority of green slate in the Mojave Desert came from one source. While geological maps of the area support the presence of a possible green slate layer, no archaeological reports of a quarry were identified. Additionally, cultural resources staff at NAWS-CL reported that they had no knowledge of a green slate quarry within the military installation. However, one of the only known green slate manufacturing sites, SBR-2677/H, is located in NAWS-CL, South Range. This supports Gerald Smith's statement that a quarry could be located in the area, but it remains unconfirmed at this time. Several other green slates were recorded in this area, creating the fourth cluster (Figure 11).

Numerous sites with green slate artifacts were recorded in the San Bernardino Mountains, distant from the other proposed green slate quarries. The unidentified researcher who compiled the GSC posited in their three pages of unpublished notes that a green slate source could be located in the mountains due to the sheer quantity of sites. The large concentration of sites is the only evidence that supports a nearby satellite quarry.

Landscape Analysis

Recent trends of landscape-level analysis in archaeological research examine the landscape as inherently cultural. The cultural landscape is not simply a natural environment or even a place of settlement. Rather, as Bender

(1993) stated, “landscapes are created by people – through their experience and engagement with the world around them.” Communities embed meaning, value, and identity into their socially constructed landscapes. Additionally, archaeologists argued that the landscape is contextualized and subjectively experienced (Johnson 2012; Kempf 2020; Knapp and Ashmore 1999; Tilley 1994). Cultures continuously develop, change, and evolve, and cultural landscapes are a product of cultural construction and influence. Therefore, landscapes also undergo changes and phases of development. Humans create a dynamic relationship with their surrounding landscape and thus transform a physical space into meaningful places. Current trends in landscape archaeology include phenomenology (Rainbird 2016; Tilley 2016) and animacy (Wallis 2009; Zedeño 2009), which emphasize the communication, sensory experience, power, and reciprocity between people and the landscape.

Landscape-level analysis provides a useful framework for investigating the Mojave Desert (Allen 2011; Thomas 2011). Many past studies in the Mojave Desert treated the region as an arid landscape in which communities procured the maximum number of calories possible through strategic subsistence practices. However, as noted by Tilley (1994), “the landscape is continually being encultured, bringing things into meaning as part of a symbolic process by which human consciousness makes the physical reality of the natural environment into an intelligible and socialized form.” Over time, Mojave Desert archaeologists shifted from a focus on subsistence strategies and settlement distribution

(Bamforth 1990; Eerkens and Rosenthal 2002; McGuire et al. 1986) to an examination of how communities interact with the landscape and dedicate significance to it (Fowler 2009; Liwosz 2017; Ocampo 2019; Stoffle et al. 2021).

Mobility in the Landscape

As portable artifacts, green slate blanks and incised stones have the ability to move across the landscape through the agency of their procurer, manufacturer, trader, or user. In this way, the cultural materials interacted with the landscape, in addition to the person. The artifacts gathered experiences and transformed through the stages of its cultural biography (procurement, manufacture, travel, cultural use, discard, recovery, and curation). Similar to the landscape, material culture is not static or devoid of meaning (Gosden and Marshall 1999; Halperin 2014; Joyce 2012a). Further, green slate artifacts construct and contribute to the cultural landscape just as people do (Hendon 2012). The life of a green slate artifact and its crafter or user are interwoven and dynamic (Hodder 2012). A crafter embeds animation, community identity, memory, knowledge, and agency into the portable artifact during the manufacture and incising processes (Gell 1998; Meskell 2004; Nelson 2006; Zedeño 2008, 2009). The artifact carries the crafter's contributions during its movement on the landscape and throughout its biography (Keane 2006; Meskell 2004; Mills and Ferguson 1998; Olsen 2010).

Lithic Landscape

The lithic landscape refers to the spatiotemporal behaviors involving the procurement, manufacture, transport, use, and discard of lithic materials (Barrientos et al. 2015). A landscape approach to lithic analysis allows for the inclusion of spatial data, such as the scatter areas and geologic sources (Ditchfield and Ward 2019). Therefore, a lithic landscape includes both human-modified and unmodified lithic materials. The archaeological record can provide context for human interaction with geographic spaces in terms of subjective and objective variables, namely distribution, availability, accessibility, quality, and exploitability. As a part of the landscape, lithic materials can be imbued with cultural importance or value. Native American communities in the Mojave Desert may have shared access to lithic sources or participated in regional exchange, based on their location and ancestral territories. Barrientos and colleagues (2015) described the nature of lithic landscapes as varied. In other words, green slates from different sources could theoretically accumulate at a single archaeological site, or green slate from one source could be distributed amongst numerous separated sites, as is the case with the GSC.

It is important to recognize that a lithic dataset may never be complete. Due to cultural and natural transformations (Schiffer 1975), some green slate may remain preserved subsurface *in situ*. Additionally, green slate artifacts from southern California may reside in other museums and repositories in similar circumstances as the GSC or worse; unaccessioned, uncatalogued or unprovenienced. Based on the distribution of green slate in the GSC, there could be additional green slate artifacts in the western Mojave Desert. Specifically, the gaps between the main concentrations on the heat map likely contain additional green slate artifacts, especially on the eastern trail. As mentioned above in the mapping results, the western trail of green slate is more uniform and consistent between the clusters. However, the east trail of green slate is sparser, specifically in the High Desert area between modern-day Lucerne Valley and Barstow and the region immediately west of the Mojave National Preserve.

Established Trade Routes and Networks

As part of their interaction with the landscape, Native American communities in the Mojave Desert established trade routes. An abundance and variety of natural and cultural resources were procured, manufactured, and exchanged for foreign materials, which created economic and social relationships between communities. In this way, physical and economic routes were formed and traversed by traditional inhabitants on the landscape. Native Americans utilized local materials that depended on their location and season in the Mojave Desert as commodities of trade, such as mesquite, juniper berries, mineral pigments, and willow shoots, in exchange for exotic materials (Sutton and Earle 2017).

The archaeological and ethnographic records contain expansive evidence of trade occurring around, through, and within the Mojave Desert. Previous research demonstrates that the Mojave River served as a trade route, which connected the Mojave Desert, San Joaquin Valley, Colorado River area, and Southwest (Sutton and Earle 2017). The Mojave River also served as a trade corridor between the Mountain and Desert Serrano in the immediate area. Many Serrano villages were built along the banks of the river, creating a natural link between the Serrano people from the San Bernardino Mountains to modern-day Barstow (Sutton and Earle 2017). Marine resources were abundantly traded eastward, specifically *Olivella* shell beads, clamshell disc beads, asphaltum, abalone, and *Haliotis* shell (Gamble 2020). For Native Californians, shell beads were items of prestige, and some marine resources served as a form of currency (Smith and Fauvelle 2015; Trubitt 2003). The frequent presence of shell artifacts at Mojave Desert sites illustrates archaeological evidence of trade between coastal and desert communities since marine shells are exotic to the desert (Hughes 2011). Southwest communities traded their textiles and ceramics westward in exchange for the exotic marine resources (Smith and Fauvelle 2015). Fitzgerald and colleagues (2005) used AMS radiocarbon dates of *Olivella biplicata* spire-lopped shell beads from Mojave Desert sites to argue that exchange between coastal and southwestern Great Basin desert communities occurred since at least 8,350–8,050 cal BCE. This demonstrates an ongoing practice of establishing and maintaining sociopolitical networks between numerous precontact Indigenous communities. In other words, Native Californians developed sophisticated trade systems to distribute resources over large areas for thousands of years, which generated a complex economic sphere in Indian Country. The Mojave Desert acted as a landlocked, central station of trade activities due to its strategic location.

Native American communities traded many lithic materials over long distances, in addition to green slate. As discussed above, the geologic variability and cultural significance of the Mojave Desert landscape encouraged resource procurement from specific locations. In other words, resources like obsidian had highly varied dispersal, and the sources could have cultural value tied to their place. The resource inconsistency of the Mojave Desert also encouraged inter-community exchange. Previous research (e.g., Baugh and Ericson 1994; Hughes 2011) has demonstrated the value of obsidian in California, which was abundantly recorded at archaeological sites distant from quarry sites like the Coso Volcanic Fields. This pattern suggests its prevalence as an item of exchange.

Exchange of material goods continued through European contact, and as discussed in Chapter Five, green slate artifacts were recorded at some Protohistoric sites. Ethnographic records, such as the diary of missionary explorer Francisco Garces (Coues 1900), report that long-distance trade occurred between Native American communities in the Mojave Desert and include information about the types of traded resources and the regularity of exchange. Ethnographic records provide descriptions of Native American travelers running through the night in order to avoid the desert heat and using white stones as markers (Fowler 2009). During his travels, Garces witnessed multiple groups of Native Americans out on trade excursions in the Santa Clarita Valley, Mission San Gabriel, and the Tehachapi Mountains (Coues 1900:237, 243, 268, 302). Some ethnographic records report that trading parties could cover as much as 100 miles a day (Fowler 2009). Some communities practiced the tradition of long-distance running, also at night, to send messages to other nearby communities. The prestigious runners sang songs during their travels to assist with remembering the trail systems (Laird 1976; Van Vlack 2015). Based on this account, green slate material was potentially mobilized by trading parties across the zone of distribution in as little as two days each way.

Fowler (2009) used ethnographic data recorded by Kelly (1934) to reconstruct traditional travel routes used by Southern Paiute and Chemehuevi people. She argued that two trail systems existed; one served as a physical trade network while a second encompassed sacred trails that existed partly in oral histories, song cycles, and cosmology. Fowler presented three main, physical trail routes: Chemehuevi Valley on the Colorado River to the New York Mountains, Chemehuevi Valley to modern-day Parker, and the Mojave Road. Fowler’s trail system (Figure 17) borders the Granite Mountains, the most probable green slate source location. Charlie Pete, a Chemehuevi collaborator with Kelly, narrated the logistics of desert travel:

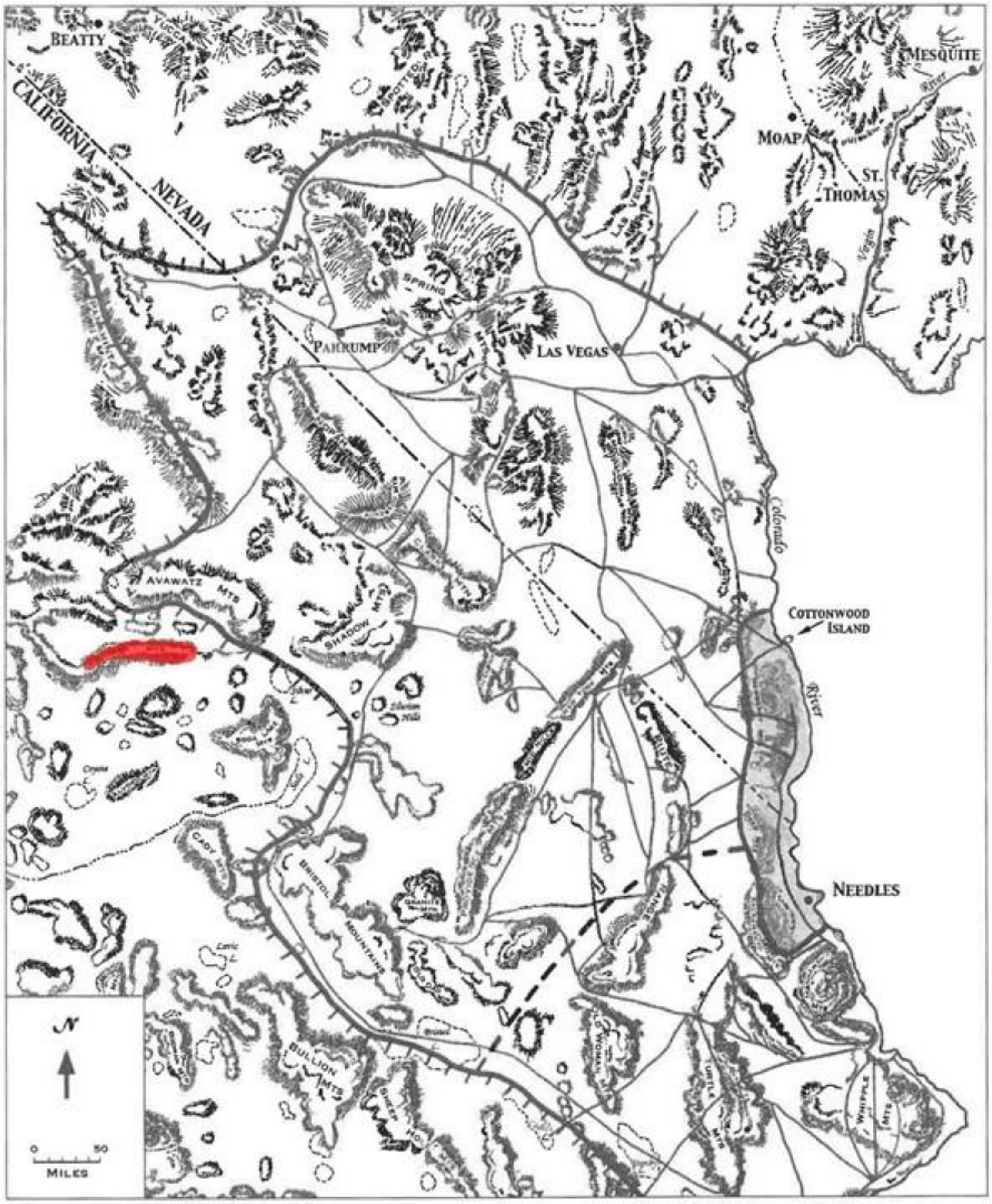

Figure 17. Southern Paiute Trails (reconstructed by Fowler and Garey-Sage 2016 from Kelly 1934). Granite Mountains highlighted in red by author.

"Travelers packed everything on their backs and wore any kind of footgear. Children always wore shoes; if the children were too small to walk, their parents took turns carrying them. They also took turns packing the water jar, which was carried in a burden basket or a net. Blankets, etc., were taken. Women took cooking utensils, including manos, but not metates. Men took weapons and walked ahead. Dogs accompanied the party. Children were given something to carry – perhaps a small skin sack, but not a burden basket or net. Travel along certain routes had to be timed so that people could be sure that there would be water available in drier sections. Timing was particularly important if some of these sources were tanks and sandstone potholes" (Kelly 1934:23:7).

Earle (2005) also mapped some of the major trade routes that were used during the 18th and 19th centuries by incorporating ethnographic data (Figure 18). The green slate artifacts may have followed some of these paths during their object biographies. Historic and modern travel paths, including modern freeways, frequently paralleled or covered precontact trail systems by exploiting Indigenous knowledge of the landscape, specifically of spring locations and other water sources. This settler exploitation likely disturbed or concealed some archaeological evidence of precontact trading parties (Earle 2005; Weber 2018).

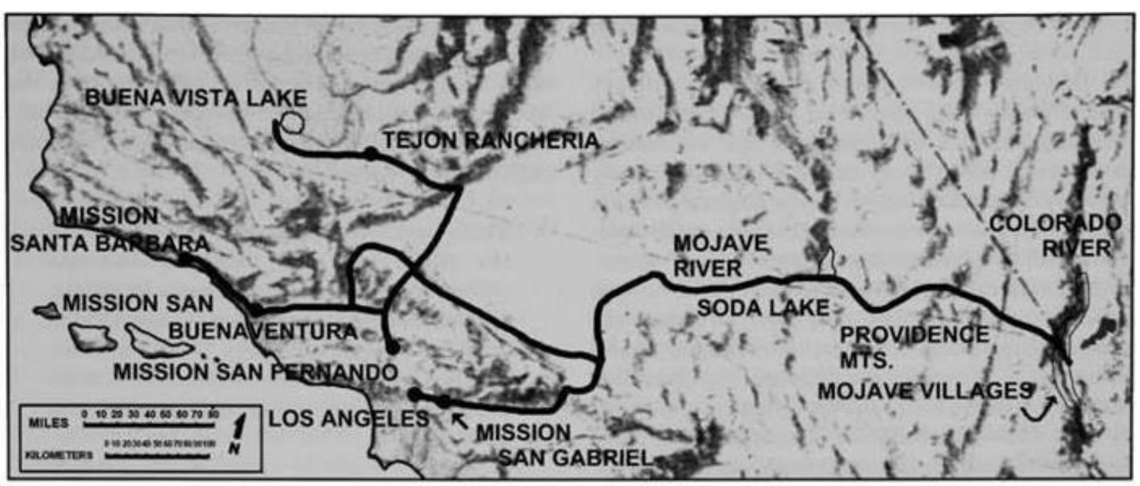

Figure 18. Late 18th and Early 19th Century Trade Routes (from Earle 2005).

A main trade route during the historic era, the Mojave Trail, followed the Mojave River in a northern and eastern direction, and acted as a corridor to the Colorado River. The Mojave River served as an important cultural resource by providing plant and animal resources for Serrano communities, in addition to providing water for trading parties. The southern portion of this trail corresponds with the green slate distribution. The other trails documented by Earle (2005) are located outside of the known distribution of green slate in the Mojave Desert documented in this thesis. However, these trails demonstrate how Mojave Desert communities connected with people of other regions through an economic network. Other routes followed the northern edge of the San Gabriel Mountains, providing access to communities in the Antelope Valley, San Gabriel Mountains, and Pacific Coast. A third section traversed the southern edge of the mountains and ran eastward from the San Gabriel Mission to the Cajon Pass. Both trade routes connected to the Mojave River and by extension, the Mojave Desert and its traditional inhabitants.

Green Slate Exchange

I conclude from the distribution mapping efforts in this thesis that green slate artifacts were recorded along a known trading corridor, the Mojave Desert, spanning approximately 240 kilometers (150 miles). Specifically, green slate artifacts were located at large village sites, following part of the Mojave River. This trade route spanned from the ancestral territory of the Mountain Serrano in the San Bernardino Mountains to the far reaches of the High Desert, crossing much of Desert Serrano territory (Kroeber 1925; San Manuel Band of Mission Indians 2022; Strong 1972). The green slate raw material was sourced primarily from one local quarry in the Mojave Desert and transported to numerous villages through exchange. Green slate can be associated with precontact and Protohistoric trading practices, since the long corridor of green slate sites is not entirely located near the primary source. In other words, I argue that the distance and wide distribution of green slate are evidence of trade and travel occurring throughout the Mojave Desert to distribute the material across the landscape. As shown in Figures 17 and 18, the green slate corridor is part of a larger existing trail system of inter-community exchange between coastal California and the Southwest. Sites with green slate artifacts produce contextual evidence of these trading systems through the artifact assemblages (e.g., obsidian, shell, and trade beads). As discussed above, Mojave Desert communities were ideally situated for the exchange and distribution of trade goods between two major sociopolitical regions. Regardless of its position in the trade network, green slate should be considered a significant material of value and prestige, due to its green color, incisions and perforations, and its somewhat uncommon appearance in the archaeological record. I limited the scope of this research to the Mojave Desert, but future research can evaluate the distribution of green slate throughout the Great Basin and California. This may reveal further extensions of the green slate trade.

As shown by the spatial analysis, the largest and densest cluster of incised green slate sites is located around the Granite Mountains, near the most probable green slate quarry, in the shared ancestral territory of the Western Shoshone, Southern Paiute, and Kawaiisu. Eerkens (1999) argued that Native American communities traditionally affiliated with Fort Irwin jointly stewarded some resources as “common pool resources.” These communities may have shared control and access over the natural resource of a green slate quarry. Since green slate artifacts were also recorded outside of the ancestral territories of these communities, green slate traveled across the landscape. Specifically, the map displays numerous locations of green slate artifacts around the Mojave River and San Bernardino Mountains in the ancestral territory of the Desert and Mountain Serrano. For this to occur, green slate must have traveled south through regional exchange.

Water Access on the Trade Routes

Native trading parties followed water sources on their trade excursions. Water is arguably the most precious resource for desert communities, and several water sources are located near the distribution of green slate in Figure 11. As discussed above, one trail follows the southern half of the Mojave River and deviates near modern-day Barstow, continuing north. Numerous springs, Pleistocene dry lakes, and tanks are located throughout the desert (Figure 19) (Earle 2005; Weber 2018).

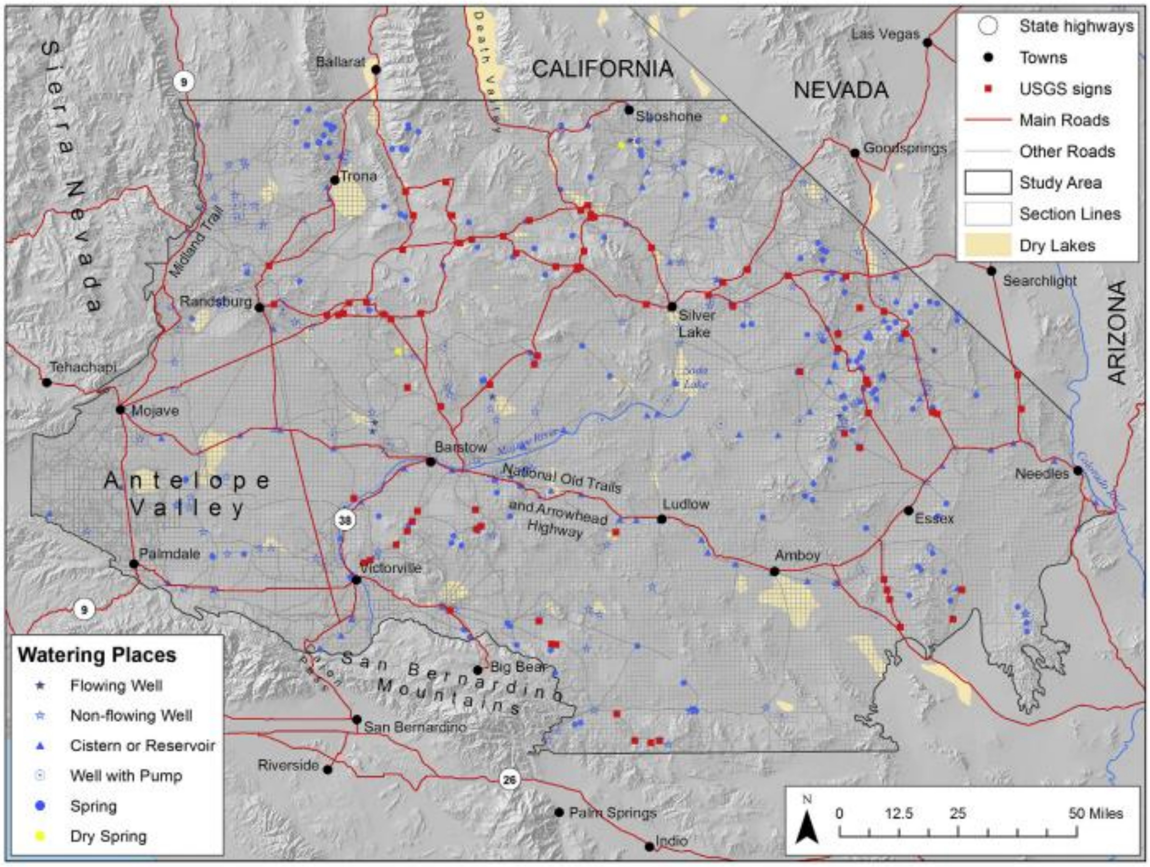

Figure 19. Locations of Mojave Desert Springs in 1917 (from Weber 2018).

Communities of Practice

While most incised green slates in the Great Basin date to the Late Prehistoric and Protohistoric periods, the larger practice of incising artifacts has continued for thousands of years. Thomas (1978) reported incised slates at the Gatecliff Shelter dating to 6,000 BCE. Previous analysis of reoccurring rock art motifs further suggested a continuity of cultural practices (Klimowicz 1988; Lee 1981), in addition to Paiute communities' research of incised stones (Kaibab Band of Paiute Indians 2020; Stoffle et al. 2021). This long-term practice of incising materials parallels the longevity of inter-community exchange occurring in the Mojave Desert (Earle 2005; Fitzgerald et al. 2005; Hughes 2012).

It is worth examining the larger production process and use of incised green slate at the inter-community level. I propose that Native American communities traditionally affiliated with the Mojave Desert created a community of practice for green slate manufacturing and incising. Communities of practice are a social system that reproduce and share a technological tradition (Antczak and Beaudry 2019; Eckert et al. 2015; Joyce 2012b; Stahl 2013; Vella Gregory 2018; Wenger 1998). Some recent research about communities of practice has focused on Mesoamerican ceramic production (Jordan et al. 2020; Joyce 2021). However, Thomas (2019) outlined that Great Basin cultural groups created a network of communities of practice surrounding the manufacture and cultural use of incised stones. In terms of incised green slate, the Mojave Desert tradition includes the resource procurement, design of incision motif, and act of incising. Variation exists within this community of practice, as demonstrated in the GSC. The range of green slate shapes, sizes, perforations, and incisions suggests that the reproduction of this technology was not exactly identical between the Mojave Desert communities. In other words, crafters likely had individual techniques. For example, the large, deep incisions on two artifacts (SBCM 635-3 and 180-1) were concentrated efforts for their crafters, whereas other crafters focused on circular incision motifs (SBCM 130-1) or rounded artifact shapes (SBCM 87-1, 106-1, and 128-2).

Incised and blank green slates have been reported in similar archaeological contexts across the Mojave Desert at sites within the ancestral territories of numerous Indigenous groups throughout the Late Prehistoric and Protohistoric periods (950–1850 CE). Specifically, the green slate artifacts were recovered from the ancestral territories of the Serrano, Kawaiisu, Southern Paiute, and Western Shoshone. The temporal and geographic repetition of the social technology suggests a transcultural phenomenon and community of practice for manufacturing incised slate artifacts in the Mojave Desert.

Visibility on the Landscape

After examining the dispersal of green slate, the continuity of its production, and its multicultural appeal, one cannot help but wonder, "how visible is green slate on the landscape?" As previously mentioned, the color of greenstones contains a cultural significance for communities traditionally associated with the Mojave Desert. However, perception of the greenstones' color is culturally contextual (Fahlander and Kjellström 2010; Hamilakis 2014; Hepp 2022; Houston and Taube 2000). While Indigenous communities perceived meaningful shades associated with springtime, life and vegetation (Garfinkel et al. 2016; Vander 1997), Western archaeologists may have perceived something else entirely (Colwell-Chanthaphonh 2004). Many of the artifacts in the GSC were surface collected in the 1960's and 1970's, and the uncommon green color of the artifacts may have influenced their early removal from archaeological sites. Since this period of hyper-recovery, green slate has had minimal visibility on the landscape. Most collected green slate artifacts remain in curation facilities without further analysis, and as a result, the next generation of archaeologists and descendant communities are relatively unaware of this artifact type.

CHAPTER SEVEN

COLLECTIONS MANAGEMENT DISCUSSION

Colonialism in Archaeology

European contact in California began in the 1500's and led to the development of the Spanish Mission system by the late 1700's. The oppression, forced assimilation, and displacement of Native Californians resulted in disrupted access to cultural resources, the ability to conduct traditional cultural practices, and the transmission of cultural knowledge (Bauer 2016; Hart and Chilton 2015). European and Euro-American collectors hoarded Indigenous cultural materials for centuries and viewed them as primitive arts or crafts. Historically, museums acted as custodians of Indigenous material culture for long-term preservation (Kreps 2003). Prior to Western colonization, Indigenous peoples successfully stewarded their own culture, history, and resources since time immemorial (Atalay 2006). Today, it is important for museum professionals and archaeologists to acknowledge this colonial legacy and incorporate Indigenous protocols into the care and treatment of artifacts to transform the field of archaeology (Atalay et al. 2014; De L'Estoile 2008). By treating artifacts with respect, efforts can be made to decolonize these spaces (Atalay 2006; Lonetree 2012).

It is necessary to emphasize that archaeological and curatorial practices have been destructive and harmful to Native American communities traditionally affiliated with the Mojave Desert and whose cultural materials reside in curation spaces. Cultural material has been viewed as a public resource to study the past, leading to institutions accumulating massive collections of Native American artifacts across the United States (Appiah 2005; Colwell-Chanthaphonh 2009; Meskell 2015). For some Native American communities, such as the Serrano, artifact preservation does not always equate to cultural preservation. Cultural preservation focuses on the future and the longevity of a people and emphasizes transmitting cultural practices to future generations through reconnection with preserved cultural spaces, which does not necessarily require the permanence of an artifact (Kreps 2003).

Legislation and Ownership

The concept of ownership is central to the issue of collections management and curation on a national level and for this thesis. For decades, scholars have posited "who owns the past," leading to debates in cultural affiliation, cultural and intellectual property, and repatriation (Brown 2014; Cuno 2012; Fagan 1999; Handler 2003; Mihesuah 2000; Putnam 2014; Watkins 2004). Even laws like ARPA and NAGPRA use property-centric language to discuss the status of artifacts. In the U.S., the land ownership of an archaeological site (e.g., public versus private) significantly impacts the lawful ownership of the artifacts contained within the site, as evidenced through the GSC. Two laws, 36 CFR 79 and NAGPRA, regulate agencies' responsibilities in their management of cultural material.

The introduction of regulation 36 Code of Federal Regulations Part 79 (36 CFR 79) in 1990 streamlined the minimum requirements for the curation of federally owned collections. 36 CFR 79 provided definitions, standards, and procedures for the curation of artifacts recovered under the authority of the Reservoir Salvage Act, Section 110 of the National Historic Preservation Act (NHPA), and the Archaeological Resources Protection Act (ARPA). However, there are several issues with 36 CFR 79 in its applicability to management of archaeological collections. First, there is a lack of enforcement for compliance with its stipulations. Second, there is a lack of consideration for the Indigenous perspective in collections management and a lack of an acknowledgment for the inherent sovereignty Indigenous people have over their own material culture.

Native American Graves and Repatriation Act (NAGPRA), also passed in 1990, introduced the repatriation of human remains, funerary objects, sacred objects, and objects of cultural patrimony to Federally-Recognized Tribes. Physical and legal stewardship of cultural material is transferred from the federal agency, university, or museum to the descendant community by means of repatriation. NAGPRA acts as a flagship legislation for Indigenous activism and archaeology by prioritizing the ownership of heritage for descendent communities (Chari and Lavallee 2013; Fine-Dare 2002). Native American communities were extremely limited in their ability to request the return of cultural material prior to the passing of NAGPRA. Archaeological collections from federal lands must be inventoried to identify artifacts eligible for repatriation under NAGPRA. This requirement is reinforced by compliance deadlines and supervision by the National Park Service NAGPRA Review Board. However, many institutions across the U.S. still struggle today with fulfilling compliance even after 30 years due to funding, time restrictions, conflicting priorities, staff shortages or turnover, and the sheer quantity of archaeological material. As a result of documented issues with the law, thousands of Native American ancestors continue to reside in repositories across the U.S. (Gould 2017; Hemenway 2010; Mountain 2017; Watkins 2004). There is a lingering apprehension amongst some archaeological professionals that returning artifacts to descendant communities will result in the loss of research (Putnam 2014). Although, the opposite proves to be true. NAGPRA inventories allow for the examination of collections which were minimally or never researched despite decades of curation. Fortunately, the San Bernardino County Museum, the holder of the GSC, is in compliance under NAGPRA and has placed a priority on maintaining mutually beneficial relationships with tribal partners.

Curation Crisis and Agency Stewardship

Poor collections management practices negatively impact the preservation of artifacts and hinder archaeologists' ability to conduct research (Friberg and Huvila 2019). There is an extreme shortage of physical space for curating archaeological materials in the U.S., making current practices unsustainable (Childs and Benden 2017; Kersel 2015). Artifacts may be improperly stored in deteriorating or overfilled boxes due to a lack of space, which can damage fragile archaeological materials (Childs and Sullivan 2003). Federal agencies must fund the curation of archaeological materials recovered from their lands (36 CFR 79), and this cost generally ranges from several hundred to a thousand dollars per box today. Thus, it is in their financial interest to limit the amount of future material excavated during archaeological projects on federal jurisdiction (Childs and Benden 2017).

As preservation laws were passed, attention was finally given by archaeologists in the 1970’s to the developing crisis, which they coined the “curation crisis” (Kersel 2015; Lipe 1974). Inappropriate care of archaeological collections hinders the main justification for their curation. Early whistleblowers of the curation crisis advocated for increased involvement from archaeologists in the management and curation of collections that they excavated and removed. These preservation activists questioned why more project funds are devoted to excavation cost rather than appropriate curation costs. Excavation is a single event while the responsibility for culturally appropriate curation of archaeological collections survives in perpetuity (Childs and Sullivan 2003).

The curation and archival aspect of this research illuminated issues with the long-term preservation of green slate artifacts. Green slates from one archaeological site were separated across multiple repositories over time. This reality became apparent for numerous sites during the research. The Green Slate Collection, while labeled, was left in the previous curator’s desk drawer with no written records of its location. Additionally, the green slate artifacts that remained in SBCM boxes also presented issues. As previously mentioned, one green slate artifact at the museum was unprovenienced. The only record attached to the artifact is the note “Great Basin.” Another green slate artifact was uncovered at the bottom of an SBCM curation box unprotected under heavy groundstone materials.

There are numerous methods to address the curation crisis for sustainable management of cultural materials, including the digital preservation of records, repatriation or deaccession of materials, and limiting future collections through intentional and selective field recovery (Benden and Taft 2019; Childs and Benden 2017; Williams 2011). New preservation laws help to minimize the amount of disturbance to archaeological sites, as well as the number of artifacts collected for curation (Middleton 2012). Collections can also be repatriated to tribal communities for the reburial of ancestors and funerary materials. Reburial enables Native American communities to honor, respect, and protect ancestors in a final resting place without future disturbance.

Historic Preservation and Traditional Stewardship

Archaeological excavation is an inherently destructive practice. In other words, an archaeologist only has one chance to record as much data as possible before an archaeological site loses its integrity and context. However, for some California tribes, the disturbance of archaeological sites is culturally taboo. Preservation *in situ* can be the preference of tribes, as opposed to complete data recovery of an archaeological site (Caple 2016; Gonzalez 2016; Middleton 2012;

Watkins 2003). Some traditionally associated communities, like the Serrano, contend that these resources need to stay on the landscape to live out their lifecycle. Additionally, tribes may approach site protection and preservation at the landscape level. California Native American tribes minimize site disturbance and preserve the landscape through numerous methods, including (1) consultation under state and federal historic preservation laws, (2) designation of sites under protected categories, (3) environmental activism, (4) community-based participatory research (CBPR), (5) tribal environmental agencies, (6) land acquisition, (7) outreach and education, and (8) traditional stewardship of the land, to name a few.

In California, Federally-Recognized Tribes consult on projects occurring on their ancestral lands through compliance with state and federal laws, such as National Historic Preservation Act (NHPA), California Environmental Quality Act (CEQA), and Senate Bill 18. Environmental laws were not created with Indigenous stewardship in mind, but they can provide a platform for site protection (Loewe 2016; Middleton 2012). As sovereign nations, Federally-Recognized Tribes consult on projects with local and federal agencies on a government-to-government basis. Tribes may advocate for data preservation when impacts to an archaeological site are deemed unavoidable.

Native American tribes in California are frequently forced to justify or prove that a site is culturally significant in order to fight for its preservation (Loewe 2016). Some of this knowledge is sensitive, confidential, or can be used to exploit tribal communities or their cultural spaces if widely communicated. However, providing information about sites to certain agencies or organizations can assist with designating special protections, such as listing them on the National Register of Historic Places (NRHP) or California Register of Historical Resources (CRHR), filing them as a Sacred Land File (SLF), or determining them to be a traditional cultural resource (TCR) or traditional cultural property (TCP). Consideration of significance for resources using these categories alerts permitting agencies to the sensitivity of the area, provides the opportunity for more robust consultation between agencies and tribes, and may provide protection for the resources.

Indigenous communities also fight for environmental justice and preservation of their ancestral lands through activism (Gilio-Whitaker 2019). Some development projects garnered widespread media attention and controversy, such as the Dakota Access Pipeline (DAPL), which was considered by many to be a failure in its compliance with historic preservation law. Native American tribes have spearheaded resistance movements and gained support of other activists, environmental organizations, media, celebrities, and the general public to create public, financial, and legal pressure on developers. In California, tribes have also worked towards environmental justice in order to combat climate change, prevent exploitation of the landscape, hold companies accountable, protect sacred sites, and maintain the health and wellbeing of tribal communities (Bass 2018; Ranco et al. 2011).

Community-based participatory research provides California tribes with a methodology for tribal involvement in archaeological research (Atalay 2012; Atalay and McCleary 2022). California tribes can identify research topics and questions that they want to investigate and facilitate academic research that aligns with their cultural protocols. CBPR allows for direct involvement regarding the treatment of cultural materials, methods of site investigation, and interpretation of the results.

Today, some Native American tribes in California operate their own environmental protection departments through their tribal governments that mirror the federal Environmental Protection Agency (EPA) responsibility and National Environmental Policy Act (NEPA) process (Kapp 2019; Madrigal 2008; Sloan 2007; Stumpff 2006). Some California tribes have focused on resource sustainability and conservation in order to maintain their traditional and reciprocal relationship with the land. By creating and operating environmental protection departments or agencies, in addition to cultural resource protection, California tribes exercise their inherent sovereignty. Some of this agency programming may include native species preservation and rehabilitation, water quality testing and monitoring, air quality control, increasing access to traditional native foods, and investment in sustainable energies. However, tribal communities' environmental interests and concerns are not limited to their trust lands, which is why tribes consult with agencies on a government-to-government relationship regarding the natural and cultural resources throughout their traditional territories.

Some Native American tribes developed land acquisition strategies as a direct method of preserving their ancestral lands, including in California (Barcus and Smith 2016; Graves 2013; Manning and Reed 2019; Middleton 2011; Sizek 2014). Some tribal communities operate their own independent programs, while numerous other tribes have created intertribal land conservation organizations. In southern California, the mission of the Native American Land Conservancy (NALC) is to "acquire, preserve, and protect Native American sacred lands through protective land management, educational programs, and scientific study." Examples of land acquisition projects conducted by the intertribal nonprofit NALC include Coyote Hole and the 2,560-acre Old Woman Mountain Preserve. In northern California, the InterTribal Sinkyone Wilderness Council operates as "a consortium of ten tribes protecting tribal traditional lands and waters."

California tribes have developed internal and external outreach and education programming to provide accurate information about their cultural heritage, history, stewardship practices, traditional lands, cultural resources, and issues they continue to face. General public outreach helps tribes overcome stereotypes, provide awareness of their continuous existence, reclaim their often misrepresented history and culture, reconnect with lands that were taken, and garner support for the protection of their traditional lands (Talaugon 2017). Internally, California tribes work towards community-based efforts of revitalizing language, enhancing food sovereignty, and educating next generations of tribal members (Green 2013; Sowerwine et al. 2019).

Indigenous people are the traditional stewards of the land. California tribes have stewarded this land since time immemorial and continue to do so today. In recent years, agencies and the public have begun to acknowledge the Indigenous Traditional Ecological Knowledge (ITEK) and traditional stewardship of Indigenous peoples. Some examples of traditional stewardship include cultural burning for fuels reduction, sustainable harvesting of native plant resources, and management of animal and fish populations, such as salmon (Blackburn and Anderson 1993; Houck 2019; Marks-Block et al. 2021). Tribal communities may create a memorandum of understanding (MOU) with landowners in order to access traditional lands or enter into a legal partnership for co-management of lands. Stewardship is not limited to the natural landscape or *in situ* cultural resources. As part of their stewardship efforts, some California tribes also operate their own curation facilities for unprovenienced or repatriated collections in order to educate future generations and ensure the continuity of their cultural heritage.

CHAPTER EIGHT

CONCLUSION

Review of Research Orientation

In Chapter One, I presented four research questions and three research objectives that guided this thesis about green slate artifacts. The research objectives focused on incorporating traditional care practices into the collections management and curation of the Green Slate Collection at the San Bernardino County Museum. Collections-based research provides the opportunity for culturally appropriate and non-destructive methods. The research questions examined the Mojave Desert study area from the landscape level. For California tribes, the landscape is inherently cultural and contains a network of sites connected by trails.

Research Objectives

1. As part of this thesis, I successfully catalogued and rehoused the Green Slate Collection to remarry the cultural materials with each site assemblage.
2. This thesis contributed a new, landscape-level approach to green slate artifacts; a somewhat common artifact type at Mojave Desert village sites, which was minimally analyzed before this research.
3. This thesis incorporated input from San Manuel Band of Mission Indians through the research questions and objectives. Additionally, this thesis is a published study that will be accessible to all descendant communities. All

of the raw data will be on file with SMBMI, the museum, and in the care of the author. The XRF data, artifact catalog, and list of green slate sites are included in the following appendices.

Research Questions

1. In what cultural context are green slates recovered in the Mojave Desert?

Green slates were reported at large, complex villages and some seasonal camps in Late Prehistoric and Protohistoric sites in the Mojave Desert, dating from roughly 950–1850 CE. This time frame spans approximately 900 years, but the community of practice could easily be longer than this. The majority of sites are affiliated with the Mountain and Desert Serrano, while the northern tip of the green slate corridor is affiliated with the Kawaiisu, Western Shoshone and Southern Paiute communities. Green slates were mostly surface collected, but some were recovered to depths of 40 cm. Green slates were occasionally recorded at sites with immobile rock art features and within assemblages that included other known trade goods.

2. Where are incised green slates and blanks reported in the Mojave Desert?

Green slates were recovered from the central Mojave Desert. There is an apparent absence of green slate artifacts in eastern San Bernardino County. The known green slate sites in the Mojave Desert span 150 miles and contain four main clusters along the trail. The four concentrations are located in mountainous areas, specifically in the greater San Bernardino Mountains area, Rodman Mountains, Granite Mountains, and Robbers Mountain. The southern half of the trail follows the Mojave River, a known travel corridor and culturally significant area for the Desert Serrano.

3. Can spatial patterns be derived from the cultural artifact distributions across the landscape?

The distribution of green slate in the Mojave Desert portrays a generally linear trail system, running north-south through the central part of the desert. Specifically, two trails span the desert and connect at each endpoint, creating a crescent-shaped distribution. Geographically, this trail system connects the San Bernardino Valley to the San Joaquin Valley. It may continue in both directions and extend to coastal California and the inner Great Basin, but other regions of California are outside the focus of this research.

4. If so, what do these landscape patterns suggest about: (1) procurement locations, (2) manufacturing practices, and (3) exchange between traditionally associated communities?

XRF analysis demonstrated that the material is sourced to primarily one location. The Granite Mountain area at northern Fort Irwin is the most probable source for the collection due to the presence of a cluster of green slate sites, the presence of quarry matrix and debitage at nearby sites, and confirmation from Fort Irwin cultural resources staff that a green slate quarry is located on the installation. There is a lack of recorded green slate debitage at other sites, suggesting that green slate artifacts were manufactured at a separate location from where they were recovered. Additionally, the results suggest that green slate was exchanged between Native American communities, since it was reported across the Mojave Desert but procured from primarily one distant location.

Concluding Summary

In conclusion, the results of this landscape-level geochemical and spatial research demonstrate that green slate and other greenstone materials were exchanged between Native American communities in the Mojave Desert. Additionally, I completed a detailed analysis of the artifacts as part of the rehousing and collections management. The XRF analysis demonstrated that the majority of the GSC was sourced to one location, while the spatial analysis portrayed wide distribution of the materials throughout western San Bernardino County. The combination of these results strongly suggests the regular movement of the resource across the landscape through exchange. Additionally, the widespread practice of incising slate is evidence that the phenomenon was recognized as part of the Mojave Desert community lifeways. In other words, it was an appropriate, accepted, and socially understood practice and technology within the community, forming a community of practice. The fact that sites containing incised green slate are recorded within a 150-mile trade corridor of the Mojave Desert suggests that the technology transcended the languages, economies, and customs of different Native American communities. Vella Gregory (2018) argued that there can be geographical variation in the techniques for a community of practice, and I conclude that this is true for the social practice of incising stones. This thesis contributes to community of practice literature by addressing how resource procurement and economic interaction are intertwined with the social practice of green slate production and incising. As noted by Gilreath and colleagues (1987), green slate artifacts are as common in the Mojave Desert as other important ornamental artifacts and items of prestige. In comparison to shell beads, ceramics, and obsidian, green slate artifacts have previously received minimal in-depth analysis despite their presence in the Mojave Desert archaeological record.

Green slate can be considered a culturally significant trade item due to its association with village sites, wide distribution across the landscape, uncommon green color, and portability. Through intercommunity trade, green slate artifacts traveled around the landscape due to their portable nature. In this way, green slate artifacts were part of the landscape, with which Native American communities maintained a reciprocal relationship. Green slate experienced a transformation as an artifact that began as a raw material and led to the embodiment of cultural knowledge through incised motifs. Crafters may have also traveled across the landscape (Eckert et al. 2015) and transferred cultural knowledge about green slate production to nearby villages, influencing and spreading the local community of practice. The majority of green slate in the GSC originated from a large quarry site likely somewhere in the Granite Mountains of the northern Mojave Desert. It is important to note that the two known manufacturing sites (CA-SBR-2677/H and CA-SBR-51) are located in the vicinity.

However, samples from these sites were not included in the XRF analysis. Today, incised stones continue to be culturally significant and can help descendant communities demonstrate their continuous presence on the landscape (Kaibab Band of Paiute Indians 2020; Stoffle et al. 2021).

Generally, incision motif analysis and incised stone function have been the main focuses of previous archaeological research about this artifact type (Klimowicz 1988; Lee 1981; Thomas 1983). Very little research about incised stones exists beyond those themes. This thesis minimally intersected with these topics for two reasons: (1) to push the field of archaeology to develop new methods of analysis for incised stones, and (2) to avoid intersection with topics that are potentially sensitive for affiliated Native American communities in a publicly available thesis. In this thesis, I explored the general attributes of green slate artifacts as part of the contextualized social practice (Thomas 2019; Vella Gregory 2018), as opposed to categorizing them into static typologies.

Future Research

I strongly advocate for future collections-based, culturally appropriate research of archaeological materials with minimal previous analysis. I also encourage the application of new research methods to the massive incised stone collections that originated from the Great Basin. Advances in technologies and the development of relationships with tribal communities can contribute to innovative approaches in research on these large collections. I also encourage an evaluation of the curation conditions of these collections and an examination of their eligibility for repatriation under NAGPRA.

There are numerous unexplored avenues for future research regarding incised green slates. Researchers can conduct experimental archaeology studies, such as researching when fragmentation of incised slates occurs or how much pressure is required for incising. Residue analysis of Mojave Desert incised stones may reveal information about what materials were in contact with the artifacts, if any. Additionally, geochemical studies can be incorporated for other stone materials, and there are further opportunities to study the sourcing of incised stones in the Great Basin. Future XRF analysis of the green slate quarry at Fort Irwin can confirm this source as the primary GSC source. Finally, I advocate for XRF analysis of green slate artifacts from Shasta County, which would demonstrate if any other green slate sources exist or if green slate moved that far north through trade.

The Significance of Cross-Cultural Economies

Trade between Native American communities is evidence of their success on the landscape and their intimate knowledge of locally available resources. By procuring surplus material for exchange, traditionally affiliated communities developed intercultural economies with enterprising practices. Archaeologists have long held onto the colonialist narrative that ancestral communities, especially those in the desert, struggled to survive. However, the opposite is true. Indigenous communities thrived in their traditional lands and developed meaningful relationships with the landscape, its natural resources, and with other communities (Anderson 2005; Madrigal 2008). The struggle for continuity of culture began with European contact and subsequent forced displacement from cultural spaces, introduction of European disease, and genocidal campaigns (Atkinson 1998; Lightfoot 2004; Trafzer and Hyer 1999). In spite of these obstacles and historical trauma, descendent communities demonstrate resiliency, work towards healing, and rebuild connections to the spaces traditionally inhabited by their ancestors (Ramirez and Hammack 2014).

APPENDIX A

ARTIFACT CATALOG

Collection	SBCM #	Catalog #	Site Name	Trinomial
Green Slate Collection	2	SBCM2-1	Muscupiabit	CA-SBR-425
Green Slate Collection	13	SBCM13-3	Los Flores Ranch	CA-SBR-93, 1913
Green Slate Collection	14	SBCM14-1		CA-SBR-189
Green Slate Collection	39	SBCM39-1	Rialto Bench	CA-SBR-1457
Green Slate Collection	46	SBCM46-1		CA-SBR-176, 938
Green Slate Collection	71	SBCM71-1		CA-SBR-248-254
Green Slate Collection	87	SBCM87-1	Holcomb Ranch Site	CA-SBR-187
Green Slate Collection	87	SBCM87-2	Holcomb Ranch Site	CA-SBR-187
Green Slate Collection	87	SBCM87-3	Holcomb Ranch Site	CA-SBR-187
Green Slate Collection	87	SBCM87-4	Holcomb Ranch Site	CA-SBR-187
Green Slate Collection	88	SBCM88-1	Adelanto Springs	CA-SBR-66-68
Green Slate Collection	95	SBCM95-1	Camp Cady	CA-SBR-200
Green Slate Collection	96	SBCM96-1	Newberry Springs	CA-SBR-317
Green Slate Collection	96	SBCM96-2	Newberry Springs	CA-SBR-317
Green Slate Collection	96	SBCM96-3	Newberry Springs	CA-SBR-317
Green Slate Collection	106	SBCM106-1	Rabbit Springs	CA-SBR-153
Green Slate Collection	106	SBCM106-2	Rabbit Springs	CA-SBR-153
Green Slate Collection	106	SBCM106-3	Rabbit Springs	CA-SBR-153
Green Slate Collection	106	SBCM106-6	Rabbit Springs	CA-SBR-153
Green Slate Collection	128	SBCM128-1	Crowder Canyon Ridge Site #3	CA-SBR-713
Green Slate Collection	128	SBCM128-2	Crowder Canyon Ridge Site #3	CA-SBR-713
Green Slate Collection	130	SBCM130-1	Cut Bank	CA-SBR-115
Green Slate Collection	160	SBCM160-1	Shepard Cave	CA-SBR-43/H
Green Slate Collection	180	SBCM180-1	Oak Springs	CA-SBR-941
Green Slate Collection	182	SBCM182-1	Fossil Falls	CA-INY-1643
Green Slate Collection	301	SBCM301-1	Howe Tank	CA-SBR-2183-2185
Green Slate Collection	302	SBCM302-2	How Tank Cave	CA-SBR-306
Green Slate Collection	302	SBCM302-3	How Tank Cave	CA-SBR-306
Green Slate Collection	345	SBCM345-1	Koehn Lake	CA-KER-?
Green Slate Collection	345	SBCM345-2	Koehn Lake	CA-KER-?
Green Slate Collection	345	SBCM345-3	Koehn Lake	CA-KER-?
Green Slate Collection	345	SBCM345-4	Koehn Lake	CA-KER-?
Green Slate Collection	345	SBCM345-5	Koehn Lake	CA-KER-?
Green Slate Collection	600	SBCM600-1	Murphy Well	CA-SBR-131
Green Slate Collection	604	SBCM604-1		CA-SBR-2064
Green Slate Collection	631	SBCM631-1		CA-SBR-2079
Green Slate Collection	631	SBCM631-3		CA-SBR-2079
Green Slate Collection	631	SBCM631-4		CA-SBR-2079
Green Slate Collection	632	SBCM632-2	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-3	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-4	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-5	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-6	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-7	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	632	SBCM632-8	Troy Lake 13D	CA-SBR-2099
Green Slate Collection	635	SBCM635-1	Troy Lake 13A	CA-SBR-2083
Green Slate Collection	635	SBCM635-2	Troy Lake 13A	CA-SBR-2083
Green Slate Collection	635	SBCM635-3	Troy Lake 13A	CA-SBR-2083
Green Slate Collection	635	SBCM635-4	Troy Lake 13A	CA-SBR-2083
Green Slate Collection	2497	SBCM2497-1	Tanglewood #13	CA-SBR-4327
Green Slate Collection	4802	SBCM4802-1	Sparkhole Mountain	CA-SBR-4528

Catalog #	County	State	Agency	Count	Condition
SBCM2-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM13-3	San Bernardino	CA	San Bernardino County Museum	4	fragments
SBCM14-1	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM39-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM46-1	San Bernardino	CA	UDSA Forest Service	1	complete
SBCM71-1	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM87-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM87-2	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM87-3	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM87-4	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM88-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM95-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM96-1	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM96-2	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM96-3	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM106-1	San Bernardino	CA	San Bernardino County Museum	1	complete
SBCM106-2	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM106-3	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM106-6	San Bernardino	CA	San Bernardino County Museum	1	fragment
SBCM128-1	San Bernardino	CA	UDSA Forest Service	1	fragment
SBCM128-2	San Bernardino	CA	UDSA Forest Service	1	complete
SBCM130-1	San Bernardino	CA	CalTrans / USDA Forest Service	2	fragments
SBCM160-1	San Bernardino	CA	US Navy	1	fragment
SBCM180-1	San Bernardino	CA	US Navy	1	fragment
SBCM182-1	Inyo	CA	Bureau of Land Management	1	fragment
SBCM301-1	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM302-2	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM302-3	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM345-1	Kern	CA	Bureau of Land Management	1	fragment
SBCM345-2	Kern	CA	Bureau of Land Management	1	fragment
SBCM345-3	Kern	CA	Bureau of Land Management	1	fragment
SBCM345-4	Kern	CA	Bureau of Land Management	1	fragment
SBCM345-5	Kern	CA	Bureau of Land Management	1	fragment
SBCM600-1	San Bernardino	CA	UDSA Forest Service	1	fragment
SBCM604-1	San Bernardino	CA	UDSA Forest Service	1	fragment
SBCM631-1	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM631-3	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM631-4	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-2	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-3	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-4	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-5	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-6	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-7	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM632-8	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM635-1	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM635-2	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM635-3	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM635-4	San Bernardino	CA	Bureau of Land Management	1	fragment
SBCM2497-1	San Bernardino	CA	UDSA Forest Service	1	fragment
SBCM4802-1	San Bernardino	CA	San Bernardino County Museum	1	complete

Catalog #	Material	Color
SBCM2-1	slate	greenish gray (Gley 1 5/5G_/1)
SBCM13-3	slate	greenish gray (Gley 1 5/10Y)
SBCM14-1	slate	greenish gray (Gley 1 5/5GY)
SBCM39-1	slate	greenish gray (Gley 1 5/10GY
SBCM46-1	slate	greenish gray (Gley 1 5/10GY)
SBCM71-1	slate	dark greenish gray (Gley 1 4/10Y)
SBCM87-1	slate	greenish gray (Gley 1 5/10GY)
SBCM87-2	slate	greenish gray (Gley 1 5/10GY)
SBCM87-3	slate	greenish gray (Gley 1 5/10GY)
SBCM87-4	slate	greenish gray (Gley 1 5/10GY)
SBCM88-1	slate	greenish gray (Gley 1 5/5GY)
SBCM95-1	slate	greenish gray (Gley 1 5/10GY)
SBCM96-1	slate	greenish gray (Gley 1 5/10GY)
SBCM96-2	slate	greenish gray (Gley 1 5/5G_/1)
SBCM96-3	slate	dark greenish gray (Gley 1 4/5GY)
SBCM106-1	slate	dark greenish gray (Gley 1 4/10Y)
SBCM106-2	slate	greenish gray (Gley 1 5/5GY)
SBCM106-3	slate	greenish gray (Gley 1 5/5GY)
SBCM106-6	slate	dark greenish gray (Gley 1 4/10Y)
SBCM128-1	slate	greenish gray (Gley 1 5/5GY)
SBCM128-2	slate?	dark greenish gray (Gley 1 4/10GY)
SBCM130-1	slate	greenish gray (Gley 1 5/5GY)
SBCM160-1	slate	greenish gray (Gley 1 5/5GY)
SBCM180-1	slate	greenish gray (Gley 1 5/10GY)
SBCM182-1	slate	dark greenish gray (Gley 1 4/10Y)
SBCM301-1	slate	greenish gray (Gley 1 5/5GY)
SBCM302-2	slate	greenish gray (Gley 1 5/10Y)
SBCM302-3	slate	greenish gray (Gley 1 5/5GY)
SBCM345-1	slate	greenish gray (Gley 1 5/5G_/1)
SBCM345-2	slate	greenish gray (Gley 1 6/5GY)
SBCM345-3	slate	greenish gray (Gley 1 6/5GY)
SBCM345-4	slate	greenish gray (Gley 1 5/5GY)
SBCM345-5	slate	greenish gray (Gley 1 6/10Y)
SBCM600-1	slate	dark greenish gray (Gley 1 4/10GY)
SBCM604-1	slate	greenish gray (Gley 1 5/5GY)
SBCM631-1	slate	dark greenish gray (Gley 1 4/10Y)
SBCM631-3	slate	greenish gray (Gley 1 5/5G_/1)
SBCM631-4	slate	greenish gray (Gley 1 6/10Y)
SBCM632-2	slate	dark greenish gray (Gley 1 4/10Y)
SBCM632-3	slate	dark greenish gray (Gley 1 4/5GY)
SBCM632-4	slate	greenish gray (Gley 1 6/10Y)
SBCM632-5	slate	greenish gray (Gley 1 5/5GY)
SBCM632-6	slate	greenish gray (Gley 1 6/10GY)
SBCM632-7	slate	greenish gray (Gley 1 5/5GY)
SBCM632-8	slate	greenish gray (Gley 1 5/5GY)
SBCM635-1	slate	greenish gray (Gley 1 5/5G_/1)
SBCM635-2	slate	greenish gray (Gley 1 5/5G_/1)
SBCM635-3	slate	dark greenish gray (Gley 1 4/10Y)
SBCM635-4	slate?	greenish gray (Gley 1 5/5GY)
SBCM2497-1	slate	greenish gray (Gley 1 5/5GY)
SBCM4802-1	slate	greenish gray (Gley 1 5/5G_/1)

Catalog #	Description
SBCM2-1	1 fragment of incised green slate
SBCM13-3	4 fragments of incised and perforated green slate
SBCM14-1	1 fragment of green blank slate
SBCM39-1	1 fragment of perforated green blank slate
SBCM46-1	1 complete incised green slate with glue stains on 1 side
SBCM71-1	1 fragment of incised green slate
SBCM87-1	1 fragment of incised tubular green slate
SBCM87-2	1 fragment of incised green slate
SBCM87-3	1 fragment of incised green slate
SBCM87-4	1 fragment of incised and perforated green slate
SBCM88-1	1 fragment of incised green slate
SBCM95-1	1 fragment of incised green slate
SBCM96-1	1 fragment of incised green slate
SBCM96-2	1 fragment of incised green slate
SBCM96-3	1 fragment of perforated blank green slate
SBCM106-1	1 complete blank green slate
SBCM106-2	1 fragment of incised green slate
SBCM106-3	1 fragment of blank green slate
SBCM106-6	1 fragment of incised green slate with black discoloration
SBCM128-1	1 fragment of perforated blank green slate
SBCM128-2	1 complete perforated cylindrical green slate
SBCM130-1	2 fragments of incised green slate
SBCM160-1	1 fragment of incised green slate
SBCM180-1	1 fragment of incised green slate
SBCM182-1	1 fragment of incised green slate
SBCM301-1	1 fragment of incised green slate
SBCM302-2	1 fragment of incised green slate
SBCM302-3	2 fragments of incised green slate
SBCM345-1	1 fragment of blank green slate
SBCM345-2	1 fragment of incised green slate
SBCM345-3	1 fragment of incised green slate
SBCM345-4	1 fragment of blank green slate
SBCM345-5	1 fragment of incised green slate
SBCM600-1	1 fragment of blank green slate
SBCM604-1	1 fragment of blank green slate
SBCM631-1	1 fragment of perforated blank green slate
SBCM631-3	1 fragment of blank green slate
SBCM631-4	1 fragment of blank green slate
SBCM632-2	1 fragment of incised green slate with red staining on 1 side
SBCM632-3	1 fragment of blank green slate
SBCM632-4	1 fragment of perforated blank green slate
SBCM632-5	1 fragment of incised green slate with possible red staining and black discoloration on 1 side
SBCM632-6	1 fragment of incised green slate with possible red staining on 1 side
SBCM632-7	1 fragment of incised green slate with possible red staining on 1 side
SBCM632-8	1 fragment of incised green slate with possible red staining on 1 side
SBCM635-1	1 fragment of an incised green slate
SBCM635-2	1 fragment of incised and perforated green slate with glue stains on 1 side
SBCM635-3	1 fragment of incised green slate
SBCM635-4	1 fragment of blank green slate
SBCM2497-1	1 fragment of incised green slate
SBCM4802-1	1 complete incised green slate

Catalog #	Incisions	Perforations	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)
SBCM2-1	yes	no	0.63	15.81	13.2	2.27
SBCM13-3	yes	yes	46.71 (total)	Multiple	Multiple	Multiple
SBCM14-1	no	no	0.45	21.79	9.07	1.97
SBCM39-1	no	yes	5.89	46.58	23.69	2.75
SBCM46-1	yes	no	19.7	89.23	22.05	7.58
SBCM71-1	yes	no	2.85	41.83	16.23	2.94
SBCM87-1	yes	no	2.26	38.37	7.6	4.03
SBCM87-2	yes	no	1.42	23.16	17.39	2.05
SBCM87-3	yes	no	6.04	30.39	23.37	4.53
SBCM87-4	yes	yes	0.79	16.87	17.35	2.08
SBCM88-1	yes	no	84.91	172.89	69.03	3.98
SBCM95-1	yes	no	4.59	43.26	23.756	3.6
SBCM96-1	yes	no	7.45	36.96	30.7	3.92
SBCM96-2	yes	no	2.65	30.94	15.66	3.94
SBCM96-3	no	yes	2.62	48.01	23.99	1.7
SBCM106-1	no	no	1.51	21.69	9.47	5.48
SBCM106-2	yes	no	2.33	20.35	22.69	3.41
SBCM106-3	no	no	2.79	32.43	27.69	2.18
SBCM106-6	yes?	no	1.86	40.09	13.3	3.37
SBCM128-1	no	yes	1.02	21.89	26.67	1.44
SBCM128-2	no	yes	3.33	36.93	7.99	6.43
SBCM130-1	yes	no	8.75 (total)	Multiple	Multiple	Multiple
SBCM160-1	yes	no	4.31	36.11	26.09	3.13
SBCM180-1	yes	no	4.71	38.47	16.89	4.05
SBCM182-1	yes	no	3.66	29.91	18.49	4.88
SBCM301-1	yes	no	7.17	33.69	25.99	4.28
SBCM302-2	yes	no	1.25	30.79	12.04	1.85
SBCM302-3	yes	no	0.93	29.29	12.75	1.57
SBCM345-1	no	no	1.89	24.11	14.33	3.87
SBCM345-2	yes	no	10.91	51	28.09	4.07
SBCM345-3	yes	no	1.35	24.9	14.65	3.32
SBCM345-4	no	no	0.48	20.34	13.11	1.75
SBCM345-5	yes	no	0.19	10.5	10.73	1.8
SBCM600-1	no	no	10.63	62.46	33.94	2.4
SBCM604-1	no	no	1.24	21.67	15.39	1.89
SBCM631-1	no	yes	3.03	38.1	18.65	3.49
SBCM631-3	no	no	1.37	32.82	20.77	1.33
SBCM631-4	no	no	0.85	20.35	16.94	1.85
SBCM632-2	yes	no	1.67	22.95	20.64	1.81
SBCM632-3	no	no	0.57	19.89	13.16	1.69
SBCM632-4	no	yes	4.09	36.58	23.72	3.21
SBCM632-5	yes	yes	0.47	23.53	9.78	1.52
SBCM632-6	yes	no	0.31	17.49	5.51	1.78
SBCM632-7	yes	no	0.26	19.59	10.91	0.82
SBCM632-8	yes	no	0.23	11.42	6.96	2.18
SBCM635-1	yes	no	0.15	10.82	8.87	1.39
SBCM635-2	yes	yes	1.59	21.56	13.69	3.59
SBCM635-3	yes	no	3.17	34.89	19.46	2.54
SBCM635-4	no	no	2.37	28.97	22.18	2.27
SBCM2497-1	yes	no	16.16	65.88	28.58	4.27
SBCM4802-1	yes	yes	5.67	57.4	21.64	2

APPENDIX B

GREEN SLATE SITES

SBCM #	Trinomial	GSC Green Slate Count	Total Green Slate Count
2	CA-SBR-425	1	2
13	CA-SBR-93, 1913	1	27
14	CA-SBR-189	1	1
39	CA-SBR-1457	1	1
46	CA-SBR-176, 938	1	1
71	CA-SBR-248-254	1	1
87	CA-SBR-187	4	4
88	CA-SBR-66-68	1	1
95	CA-SBR-200	1	1
96	CA-SBR-317	3	4
106	CA-SBR-153	4	4
128	CA-SBR-713	2	2
130	CA-SBR-115	1	1
160	CA-SBR-43/H	1	16
164	CA-SBR-723	0	1
180	CA-SBR-941	1	1
182	CA-INY-1643	1	1
238	CA-SBR-211	0	6
282	CA-SBR-51	0	20
284	CA-SBR-53	0	1
301	CA-SBR-2183-2185	1	1
302	CA-SBR-306	2	2
345	CA-KER-?	5	5
600	CA-SBR-131	1	1

604	CA-SBR-2064	1	1
631	CA-SBR-2079	3	3
632	CA-SBR-2099	7	7
635	CA-SBR-2083	4	5
761	CA-SBR-2677/H	0	4
1602	CA-SBR-478	0	1
2497	CA-SBR-4327	1	1
4129	CA-SBR-3829/H	0	2
4612	CA-SBR-4170	0	1
4802	CA-SBR-4528	1	1
4839	CA-SBR-4449	0	1
4844	CA-SBR-4454	0	2
4847	CA-SBR-4457	0	1
4873	CA-SBR-4483	0	3
4882	CA-SBR-4492	0	2
N/A	CA-SBR-5251	0	1
N/A	CA-SBR-5266	0	3
N/A	CA-SBR-5384	0	1
N/A	CA-SBR-6219	0	3
N/A	CA-SBR-6237	0	1
N/A	CA-SBR-8301	0	1

APPENDIX C

XRF DATA

SAMPLE	Sb	Sn	Cd	Pd	Ag	Bal	Mo
13-3	<LOD	<LOD	<LOD	<LOD	<LOD	537670.1	2.4
301-1	<LOD	<LOD	<LOD	<LOD	<LOD	567405.1	<LOD
635-1	<LOD	<LOD	<LOD	<LOD	<LOD	693885.4	<LOD
635-2	<LOD	<LOD	<LOD	<LOD	<LOD	655948.5	<LOD
635-3	<LOD	<LOD	<LOD	<LOD	<LOD	558783.5	<LOD
635-4	<LOD	<LOD	<LOD	<LOD	<LOD	500348	<LOD
160-1	17.6	20.99	27.53	7.31	6.34	966028.1	2.48
96-1	<LOD	<LOD	<LOD	<LOD	<LOD	546689.8	<LOD
96-2	<LOD	<LOD	<LOD	<LOD	<LOD	535349.1	<LOD
96-3	<LOD	<LOD	<LOD	<LOD	<LOD	696301.6	<LOD
631-1	<LOD	<LOD	<LOD	<LOD	<LOD	703976.4	<LOD
631-3	<LOD	<LOD	<LOD	<LOD	<LOD	579645.7	<LOD
631-4	<LOD	<LOD	<LOD	<LOD	<LOD	518875.7	<LOD
106-1	<LOD	<LOD	<LOD	<LOD	<LOD	527065.4	<LOD
106-2	<LOD	<LOD	<LOD	<LOD	<LOD	530605.6	<LOD
106-3	<LOD	<LOD	<LOD	<LOD	<LOD	532286.6	<LOD
106-6	<LOD	<LOD	<LOD	<LOD	<LOD	505758.4	<LOD
88-1	<LOD	<LOD	<LOD	<LOD	<LOD	533964.3	<LOD
180-1	<LOD	<LOD	<LOD	<LOD	<LOD	597652.7	<LOD
2497-1	<LOD	<LOD	<LOD	<LOD	<LOD	509948.5	<LOD
302-2	<LOD	<LOD	<LOD	<LOD	<LOD	597157	<LOD
302-3	<LOD	<LOD	<LOD	<LOD	<LOD	562222.7	<LOD
604-1	<LOD	<LOD	<LOD	<LOD	<LOD	568522.6	<LOD
46-1	<LOD	<LOD	<LOD	<LOD	<LOD	554298.6	<LOD
4802-1	<LOD	<LOD	<LOD	<LOD	<LOD	518359.7	<LOD
2-1	<LOD	<LOD	<LOD	<LOD	<LOD	568741.5	<LOD
632-3	<LOD	<LOD	<LOD	<LOD	<LOD	593127.9	<LOD
632-4	<LOD	<LOD	<LOD	<LOD	<LOD	514652.6	<LOD
632-2	<LOD	<LOD	<LOD	<LOD	<LOD	574562.9	<LOD

SAMPLE	Sb	Sn	Cd	Pd	Ag	Bal	Mo
632-5	<LOD	<LOD	<LOD	<LOD	<LOD	764050.8	<LOD
632-6	<LOD	<LOD	<LOD	<LOD	<LOD	811154.6	<LOD
632-7	12.99	14.57	14.47	<LOD	3.49	784652.8	<LOD
632-8	<LOD	<LOD	<LOD	<LOD	<LOD	670445.2	<LOD
39-1	<LOD	<LOD	<LOD	<LOD	<LOD	615665	<LOD
600-1	<LOD	<LOD	<LOD	<LOD	<LOD	557324.9	<LOD
130-1	<LOD	<LOD	<LOD	<LOD	<LOD	493989.5	<LOD
14-1	<LOD	<LOD	<LOD	<LOD	<LOD	645363.6	<LOD
128-1	<LOD	<LOD	<LOD	<LOD	<LOD	586219.1	<LOD
128-2	<LOD	<LOD	<LOD	<LOD	<LOD	672861.5	3.33
71-1	<LOD	<LOD	<LOD	<LOD	<LOD	547084.1	<LOD
95-1	<LOD	<LOD	<LOD	<LOD	<LOD	574704.1	<LOD
345-1	<LOD	<LOD	<LOD	<LOD	<LOD	505397.2	<LOD
345-2	<LOD	<LOD	<LOD	<LOD	<LOD	510208.2	<LOD
345-3	<LOD	<LOD	<LOD	<LOD	<LOD	567042.4	<LOD
345-4	<LOD	<LOD	<LOD	<LOD	<LOD	551227.1	<LOD
345-5	10.63	<LOD	13.83	3.58	6.15	993383.3	4.51
87-1	<LOD	<LOD	<LOD	<LOD	<LOD	563953.4	<LOD
87-2	<LOD	<LOD	<LOD	<LOD	<LOD	514921.1	<LOD
87-3	<LOD	<LOD	<LOD	<LOD	<LOD	490729.4	<LOD
87-4	<LOD	<LOD	<LOD	<LOD	<LOD	586881.1	<LOD
182-1	<LOD	<LOD	<LOD	<LOD	<LOD	514201.7	<LOD

SAMPLE	Nb	Zr	Sr	Rb	Bi	As	Se
13-3	30.07	235.38	161.17	63.09	19.53	12.8	<LOD
301-1	20.38	169.6	130.06	49.88	12.63	<LOD	<LOD
635-1	10.72	107.96	68.33	31.59	<LOD	<LOD	<LOD
635-2	16.08	136.19	80.73	39.52	10.35	<LOD	<LOD
635-3	21.6	169.36	136.16	47.81	11.7	<LOD	<LOD
635-4	10.39	129.19	38.16	13.01	<LOD	29.36	<LOD
160-1	9.82	45.93	41.63	15.62	<LOD	<LOD	<LOD
96-1	22.32	158.75	137.24	66.92	10.55	8.37	<LOD
96-2	18.53	143.61	153.79	59.45	11.03	<LOD	<LOD
96-3	10.6	95.03	20.14	46.33	5.16	7.18	<LOD
631-1	13.83	142.74	22.07	24.96	<LOD	7.5	<LOD
631-3	11.97	128.68	105.77	44.83	6.7	<LOD	<LOD
631-4	7.27	104.64	78.93	50.91	5.95	36.99	<LOD
106-1	13.58	193.91	64.39	33.76	<LOD	11.56	<LOD
106-2	27.65	216.54	174.73	54.62	11.39	8.89	<LOD
106-3	20.25	173.65	124.14	53.59	12.7	<LOD	<LOD
106-6	16.62	127.45	83.36	50.64	14.86	9.03	<LOD
88-1	23.68	178.31	158.45	59.46	11.97	<LOD	<LOD
180-1	20.64	159.12	89.12	43.71	16.53	8.23	<LOD
2497-1	21.89	172.41	105.18	54.31	11.25	<LOD	<LOD
302-2	11.65	132.62	23.47	54.29	10.83	<LOD	<LOD
302-3	8.18	121.52	22.36	49.68	7.39	8.94	<LOD
604-1	16.11	155.23	92.78	56.55	11.39	<LOD	<LOD
46-1	25.2	191.57	165.76	57.55	12.37	<LOD	<LOD
4802-1	21.97	189.38	178.14	50.97	16.35	<LOD	<LOD
2-1	13.03	121.83	85.31	43.47	<LOD	<LOD	<LOD
632-3	17.39	154.45	93.75	46.02	<LOD	<LOD	<LOD
632-4	22.41	159.99	115.75	55.8	11.44	<LOD	<LOD
632-2	18.37	287.89	18.98	58.42	18.05	<LOD	<LOD

SAMPLE	Nb	Zr	Sr	Rb	Bi	As	Se
632-5	6.1	76.46	85.02	24.62	<LOD	<LOD	<LOD
632-6	9.47	75.57	47.59	20.13	<LOD	<LOD	<LOD
632-7	6.17	58.02	38.38	16.71	<LOD	<LOD	<LOD
632-8	18.78	142.25	87.98	37.29	4.95	<LOD	<LOD
39-1	19.81	169.34	140.02	39.75	<LOD	<LOD	<LOD
600-1	24.94	227.14	116.82	58.62	11.3	<LOD	<LOD
130-1	24.49	238.49	165.29	57.39	12.01	<LOD	<LOD
14-1	11.19	123.85	86.14	34.54	4.27	10.89	<LOD
128-1	16.62	155.52	150.47	42.71	8.08	<LOD	<LOD
128-2	18.44	64.62	19.14	<LOD	<LOD	<LOD	<LOD
71-1	15.5	121.32	34.07	59.6	12.12	17.32	<LOD
95-1	24.21	206.3	131.09	61.04	15.69	<LOD	<LOD
345-1	20.22	165.35	111.23	60.73	11.24	<LOD	<LOD
345-2	21.96	217.9	116.01	52.11	12.11	<LOD	<LOD
345-3	23.88	225.7	122.35	49.4	15.04	<LOD	<LOD
345-4	18.35	157.57	153.43	53.56	8.3	<LOD	<LOD
345-5	4.95	5.34	<LOD	<LOD	<LOD	<LOD	<LOD
87-1	14.58	155.03	93.63	54.71	16.17	<LOD	<LOD
87-2	19.47	165.1	132.37	50.24	12.72	<LOD	<LOD
87-3	26.91	217.03	133.26	61.45	9.94	<LOD	<LOD
87-4	15.24	143.26	116.3	48.74	6.36	<LOD	<LOD
182-1	20.87	225.12	42.03	25.39	<LOD	14.15	<LOD

SAMPLE	Au	Pb	W	Zn	Cu	Ni	Co
13-3	<LOD	9.26	<LOD	115.46	125.65	66.65	<LOD
301-1	<LOD	<LOD	<LOD	97.83	<LOD	<LOD	<LOD
635-1	<LOD	<LOD	<LOD	85.06	<LOD	<LOD	<LOD
635-2	<LOD	<LOD	<LOD	122.29	66.09	<LOD	<LOD
635-3	<LOD	7.63	<LOD	121	27.94	57.78	<LOD
635-4	<LOD	9.94	<LOD	318.59	<LOD	208.98	<LOD
160-1	<LOD	<LOD	<LOD	94.82	<LOD	<LOD	<LOD
96-1	<LOD	10.97	<LOD	109.53	43.36	42.26	<LOD
96-2	<LOD	14.49	<LOD	111.49	<LOD	58.9	<LOD
96-3	<LOD	<LOD	<LOD	64.47	<LOD	<LOD	<LOD
631-1	<LOD	<LOD	<LOD	114.99	<LOD	<LOD	<LOD
631-3	<LOD	4.88	<LOD	59.59	<LOD	<LOD	<LOD
631-4	<LOD	6.51	<LOD	59.39	<LOD	<LOD	<LOD
106-1	<LOD	23.35	<LOD	106.19	19.67	47.28	<LOD
106-2	<LOD	13.49	<LOD	135.7	<LOD	60.63	<LOD
106-3	<LOD	17.28	<LOD	105.24	<LOD	<LOD	<LOD
106-6	<LOD	16.48	<LOD	66.7	<LOD	<LOD	<LOD
88-1	<LOD	11.42	<LOD	101.01	<LOD	49.32	<LOD
180-1	<LOD	6.62	<LOD	147.52	<LOD	<LOD	<LOD
2497-1	<LOD	10.66	<LOD	95.21	<LOD	33.42	<LOD
302-2	<LOD	<LOD	<LOD	91.32	<LOD	<LOD	<LOD
302-3	<LOD	6.52	<LOD	69.93	<LOD	<LOD	<LOD
604-1	<LOD	<LOD	<LOD	116.24	<LOD	<LOD	<LOD
46-1	<LOD	12.12	<LOD	123.07	<LOD	48.85	<LOD
4802-1	<LOD	17.9	<LOD	123.04	<LOD	<LOD	<LOD
2-1	<LOD	5.5	<LOD	125.56	<LOD	<LOD	<LOD
632-3	<LOD	<LOD	<LOD	128.72	<LOD	<LOD	<LOD
632-4	<LOD	12.41	<LOD	108.28	<LOD	<LOD	<LOD
632-2	<LOD	<LOD	<LOD	95.6	<LOD	<LOD	<LOD

SAMPLE	Au	Pb	W	Zn	Cu	Ni	Co
632-5	<LOD	<LOD	<LOD	102.47	<LOD	<LOD	<LOD
632-6	<LOD	<LOD	<LOD	92.07	<LOD	<LOD	<LOD
632-7	<LOD	<LOD	<LOD	91.64	<LOD	<LOD	<LOD
632-8	<LOD	<LOD	<LOD	104.07	35.96	<LOD	<LOD
39-1	<LOD	<LOD	<LOD	162.89	<LOD	<LOD	<LOD
600-1	<LOD	<LOD	<LOD	114.77	<LOD	<LOD	<LOD
130-1	<LOD	31.6	<LOD	100.32	<LOD	44.69	<LOD
14-1	<LOD	<LOD	<LOD	104.38	<LOD	<LOD	<LOD
128-1	<LOD	6.86	<LOD	109.62	<LOD	<LOD	<LOD
128-2	<LOD	<LOD	58.72	107.86	149.03	<LOD	<LOD
71-1	<LOD	<LOD	<LOD	73.15	<LOD	<LOD	<LOD
95-1	<LOD	7.85	<LOD	153.72	50.22	38.41	<LOD
345-1	<LOD	<LOD	<LOD	104.84	<LOD	41.52	<LOD
345-2	<LOD	6.93	<LOD	75.84	22.06	<LOD	<LOD
345-3	<LOD	<LOD	<LOD	70.26	25.96	<LOD	<LOD
345-4	<LOD	<LOD	<LOD	74.76	23.85	<LOD	<LOD
345-5	<LOD	<LOD	<LOD	83.2	<LOD	<LOD	<LOD
87-1	<LOD	<LOD	<LOD	128.73	29.01	81.99	<LOD
87-2	<LOD	5.45	<LOD	127.74	58.84	36.55	<LOD
87-3	<LOD	8.9	<LOD	84.63	<LOD	45.28	<LOD
87-4	<LOD	<LOD	<LOD	83.47	<LOD	<LOD	<LOD
182-1	<LOD	14.56	<LOD	138	40.01	76.78	<LOD

SAMPLE	Fe	Mn	Cr	V	Ti	Ca	K
13-3	53301.63	259.02	204.68	189.63	5042.45	3016.74	37148.19
301-1	41103.78	100.78	102.58	109.97	3946.85	2348.17	22192.44
635-1	30654.96	<LOD	110.08	110.99	3104.55	3204.76	22498.8
635-2	36177.44	<LOD	113.93	134.17	4038.05	1737.64	23335.45
635-3	54727.17	263.4	170.67	145.21	4535.57	2105.36	30886.61
635-4	162880.3	842.3	209.09	178.8	4068.28	1049.83	10229.76
160-1	18256.13	<LOD	<LOD	58.2	2732.37	2239.66	3278.56
96-1	42124.17	161.38	163.42	164.09	4574.52	1781.97	38108.55
96-2	54144.5	144.65	185.08	167.69	4234.52	1286.96	36422.77
96-3	36813.64	<LOD	108.44	130.54	3430.58	2065.2	35661.04
631-1	36307.36	67.74	98.51	128.36	4352.34	1861.39	18278.8
631-3	34876.48	<LOD	129.82	123.62	2959.88	1069.62	30135.88
631-4	41591.99	<LOD	147.13	212.42	3968.8	2608.53	49773.65
106-1	46746.42	346.84	105.34	112.52	3434.43	6514.5	21344.85
106-2	61431.39	191.61	190.15	223.17	5116.9	2406.43	33173.66
106-3	52970.86	131.84	162.48	180.63	5011.45	2135.88	34487.96
106-6	27563.16	414.22	100.69	105.6	2684.35	7697.5	75162.4
88-1	46132.04	156.34	159.33	163.57	3430.84	13724.75	35042.54
180-1	53004.36	93.03	159.6	146.76	4578.57	1442.8	27543.22
2497-1	41056.58	99.94	140.25	151.45	4155.84	1608.6	31428.35
302-2	40874.73	138.76	140.08	151.47	3007.79	4138.36	34795.77
302-3	39310.42	<LOD	111.85	133.97	2838.28	2909.75	32682.14
604-1	45598.04	<LOD	160.9	158.98	4553.12	3363.85	33179.48
46-1	54406.91	130.84	158.83	164.81	4530.55	2704.09	35277.97
4802-1	52405.55	201.53	166.11	179.68	4307.77	1725.82	27610.87
2-1	50788.93	<LOD	133.44	144.65	3708.75	2288.83	27082.19
632-3	59435.84	155.6	198.23	155.89	4283.97	9944.27	30089.98
632-4	45372.69	<LOD	151.23	165.64	4892.2	1297.61	34892.85
632-2	45999.47	124.25	173.34	173.29	7000.62	9048.51	49647.66

SAMPLE	Fe	Mn	Cr	V	Ti	Ca	K
632-5	31555.69	<LOD	72.74	99.11	2993.09	2895.55	18327.26
632-6	23260.16	<LOD	57.17	76.47	2841.27	3421.51	29642.34
632-7	20126.62	<LOD	62.46	74.68	2927.05	3790.47	13537.66
632-8	38494.31	<LOD	105.95	114.59	3706.59	5144.24	20608.61
39-1	63760.41	191.44	172.36	121.98	4578.77	2093.6	22716.8
600-1	53194.51	470.97	159.93	192.12	4891.69	2421.78	37695.41
130-1	49283.16	230.77	172.58	196.72	6502.77	1366.87	36976.71
14-1	42961.73	<LOD	123.43	113.32	3792.34	2011.67	22554.33
128-1	54605.25	163.18	172.15	184.47	5292.12	2728	27352.4
128-2	81418.97	979.67	218.5	280.97	5172.67	6113.28	2982.69
71-1	55458.01	328.86	145.02	165.77	3795.63	2309.4	35705.1
95-1	61686.37	187.15	200.12	196.13	5056.47	1220.49	35653
345-1	58507.55	191.97	135.65	167.55	4068.45	1435.42	31305.1
345-2	40950.27	130.37	151.51	154.98	4948.58	847.45	29611.34
345-3	41318.55	165.7	159.83	160.19	6037.65	16920.26	28382
345-4	41050.95	<LOD	157.91	146.29	4709.73	1603.58	35295.3
345-5	192.27	<LOD	<LOD	33.43	1518.02	1123.73	<LOD
87-1	54471.86	209.56	189.26	175.01	3954.61	2760.07	34603.81
87-2	51459.37	110.59	153.86	175.83	4693.2	1738.97	30988.78
87-3	41986.78	158.36	130.58	170.16	4090.65	2044.16	34000.09
87-4	40238.36	<LOD	131.83	136.77	3705.93	2087.1	30322.63
182-1	57327.53	507.34	151.52	138.23	4864.81	7472.12	18272.45

SAMPLE	Ba	Al	P	Si	Cl	S	Mg
13-3	733.26	96884.12	1596.58	255161.1	<LOD	<LOD	7950.98
301-1	526.2	79345.6	1098.22	270361.6	293.59	131.98	10448.72
635-1	91.81	60859.98	953.28	176182.8	310.13	283.85	7445.08
635-2	323.96	65657.64	948.77	203281.3	359.79	702.23	6761.69
635-3	400.53	85654.95	1215.24	247661.4	1055.15	201.03	11593.29
635-4	435.58	87077.98	615.86	201708.6	1178.29	<LOD	28400.39
160-1	<LOD	391.78	<LOD	3037.98	325.1	204.63	3153.54
96-1	674.02	97139.1	800.11	250502.6	913.74	1184.83	14407.41
96-2	664.23	96938.82	764.42	263162.1	99.88	1178.51	4685.4
96-3	72.95	43228.66	605.45	177306.4	315.93	388.42	3306.51
631-1	163.84	41542.19	865.05	185740.7	448.42	109.11	5729.75
631-3	170.95	81513.15	670.7	262615.3	1240.34	<LOD	4485.98
631-4	257.91	86157.27	813.64	284394.8	1111.3	<LOD	9736.29
106-1	551.13	53664.32	1814.26	318129.2	1948.28	3987.38	13718.27
106-2	659.09	97514.64	898.78	250007.5	1444.7	1254.29	14178.33
106-3	457.97	97412.98	1070.91	262103.6	390.72	1411.83	9251.56
106-6	344.78	66255.89	1146.35	291735	678.95	1636.43	18331.05
88-1	664.39	86551.17	1218.95	263790.2	120.32	3683.21	10598.44
180-1	487.14	84774.3	1267.22	214748.8	421.7	1236.65	11951.74
2497-1	599.27	92891.71	1020.18	306470.2	<LOD	<LOD	9924.67
302-2	380.4	60995.59	1356.19	242089.6	1610.25	1531.24	11287.25
302-3	239.76	72624.54	1184.82	274686.2	1500.22	1069.25	8181.7
604-1	419.3	89936.77	1177.5	234953	512.04	<LOD	16968.74
46-1	797.88	90183.34	1338.73	244928.1	1216.71	1407.94	7810.2
4802-1	489.31	92073.87	1045.29	290375.6	489.15	<LOD	9934.23
2-1	291.43	83567.55	1592.86	248404.9	875.55	<LOD	11984.74
632-3	348.36	75561.2	2034.28	209666.3	963.61	577.15	12976.4
632-4	569.24	92485.91	978.26	294219.3	1497.63	<LOD	8255.97
632-2	501.79	81739.58	1768.96	210188.8	1381.93	3180.6	14005.17

SAMPLE	Ba	Al	P	Si	Cl	S	Mg
632-5	48.91	40301.68	726.39	135401.9	398.27	172.56	2661.39
632-6	100.71	28364.91	594.47	95539.84	242.1	443.99	4002.36
632-7	<LOD	40510.66	761.03	128743.3	433.3	197.98	3923.36
632-8	236.17	66928.24	1300.33	182236.8	449.48	422.83	9338.51
39-1	255.39	79202.64	946.01	198200.4	1021.04	<LOD	10458.18
600-1	979.52	73860.84	1208.38	256854.3	267.93	<LOD	9892.74
130-1	540.65	118106.1	1295.27	283439.8	268.57	<LOD	6956.23
14-1	199.29	64977.11	697.71	209045.6	606.54	<LOD	7165.1
128-1	205.64	89928.09	1256.91	216380.1	1103.16	423.87	13490.15
128-2	230.5	52808.07	3831.78	123051.3	1812.14	574.37	47236.39
71-1	214.24	81507.16	968.72	262090.6	212.61	2613.68	7068.11
95-1	599.25	89760.73	656.2	223519.5	152.98	<LOD	5711.4
345-1	662.46	116004.2	970.21	269387	343.74	<LOD	10896.16
345-2	566.67	85658.06	832.93	321190.8	<LOD	<LOD	4218.22
345-3	378.89	78141.52	1290.09	250902.8	728.83	1040.42	6793.31
345-4	248.51	101009.7	799.55	252448.1	169.39	577.06	10067.07
345-5	<LOD	<LOD	<LOD	3470.87	<LOD	97.25	<LOD
87-1	710.17	95107.07	486.23	233314	350.71	1401.6	7733.45
87-2	366.24	97122.59	1016.95	284805.5	855.53	509.09	10473.93
87-3	604.8	102071.3	939.61	315144.7	131.77	<LOD	7210.33
87-4	221.55	82027.24	869.97	239964.3	739.3	660.76	11595.16
182-1	500.71	65337.93	2593.3	304825.6	2547.93	1308.59	19353.3

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