OBSIDIAN AND POLITICAL ECONOMY IN THE WARI EMPIRE: A PORTABLE X-RAY FLUORESCENCE STUDY OF THE PATIPAMPA SECTOR OF HUARI

BY

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Abstract

During 2017 and 2018, the Huari Urban Prehistory Project conducted excavations in the non-elite Patipampa sector of Huari in Ayacucho, Peru. Quotidian resource acquisition, distribution, and use are not well understood in Huari as previous excavations have focused on monumental architecture and mortuary centers. This thesis presents research on the Patipampa obsidian artifact assemblage and its relation to Wari political economy in a non-elite context. I conducted portable X-ray fluorescence and lithic attribute analyses on 446 obsidian artifacts in order to understand obsidian's role at Patipampa. My research supports the idea that the people of Patipampa had unrestricted access to Quispisisa obsidian and did not need to conserve material. It appears that the Wari provided Quispisisa obsidian via a redistributive economic system. The presence of additional types brings into question other forms of resource acquisition at Huari and ties to the local Puzolana obsidian source.

Dedicated to the dogs of Ayacucho.

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PXRF – portable X-ray fluorescence

HE – *hallazgo especial* (special find)

EA – *espacio arquitectónico* (architectural space)

CM – *cabecero de muro* (wall trench)

Ctx – cortex

DT – debitage type

CD – condition

FT – flake termination

SZ – size

Wt (g) – weight (grams)

Introduction

Monumental architecture and surface scatters of pre-Hispanic artifacts carpet the landscape of the Andes. However, surface architecture and artifacts can reveal only so much about pre-Hispanic Andean civilizations. Many scholars consider the Wari to be an empire that governed regions definitively marked by a distinct architectural tradition (Isbell 1991; Isbell and McEwan 1991b; Malpass 2001; Schreiber 1992, 2013). To understand the extent of control of quotidian resources in the capital city of Huari, archaeological data reflective of specific practices of the Wari state must be examined for social, political, and economic implications. Obsidian is a material integral to daily life at Huari that can tell archaeologists a great deal about the political economy of the Wari Empire at a residential or household level (Bencic 2015; Fortin 2015; Kaplan 2018; Stone 1983). I use geochemical sourcing of artifacts to argue that the obsidian assemblage from the Patipampa sector of Huari indicates a redistributive economy within the capital city.

The Wari are known for their standardization, be it in religious iconography, architectural styles, organization of space, ceramic production, or burial practices (Isbell 1991, 2004a; Isbell and Knobloch 2009; Groleau 2011; McEwan 2005; Menzel 1964; Nash 2002; Screiber 1992). Archaeologists are only beginning to address the control and distribution of quotidian resources used by the Wari, particularly with regard to stone tools. Obsidian is one of the most frequently encountered lithic materials in the Wari sphere of influence (Stone 1983) and deserves greater attention when studying the quotidian. Due to the unique geological conditions required for its formation and the relative scarcity of sources, researchers can determine the original provenance of obsidian artifacts using trace element analyses.

I analyzed obsidian artifacts recovered during the 2017 and 2018 excavations at the Patipampa sector of Huari by means of portable X-ray fluorescence (PXRF) to understand Wari obsidian acquisition and how the Wari distributed it within architectural compounds. I have identified obsidian from four known sources as well as three unknown sources, providing new information for interpreting the economic and political control of a valuable yet quotidian resource at the type-site of Huari.

Patipampa appears to have been a space for small-scale production of luxury goods such as shell and stone beads as well as other lapidary products. The absence of agricultural tools, the large proportion of specialized artisan production tools such as drills, and jewelry in all stages of production support this hypothesis (Burger 2013:328; Hastorf and D'Altroy 2001:13). I believe the residents of Patipampa may have been attached-craftspeople (Hastorf and D'Altroy 2001; Kovacevich 2013:256-7), producing fine jewelry for the Wari state. In turn, the state provided the residents abundant quotidian resources. Using ubiquity of obsidian source varieties across Patipampa, I test my data against models of centralized and independent acquisition to interpret aspects of the political economy of the Wari Empire at the domestic scale (Hirth 1996; Hirth and Pillsbury 2013a; Hirth et al. 2006; Goldstein 2013). I then compare my results to previous obsidian sourcing studies from the Wari sites of Vegachayuq Moqo (Kaplan 2018) and Conchopata (Burger et al. 2016).

In order to test models of provisioning and acquisition within an empire, I have chosen to use ubiquity, or relative presence, of obsidian types at Patipampa. Greater uniformity of sources within an assemblage indicates centralized and distributed acquisition while greater variation indicates independent types of acquisition (Hirth et al. 2006:116). A centralized form of acquisition, such as one directed by the state or a nonpolitical organization, is expected to focus attention on a single source of material for numerous reasons, including proximity, accessibility, quality, quantity, and/or cultural preference (Hirth et al. 2006). Archaeologically, an assemblage in which a single obsidian type is ubiquitous likely represents centralized acquisition and redistribution, fitting a command economy model for the empire (Hirth et al. 2006).

An assemblage where multiple obsidian types are ubiquitous likely represents independent forms of acquisition (Hirth et al. 2006). Access to certain sources may be limited for individuals or groups, possibly relying on indirect acquisition via trade (Asaro and Burger 1977; Goldstein 2013). Those utilizing the obsidian may have no preference for a source, obtaining whatever is available at the moment, or they may have a culturally-dictated preference, choosing to use a specific type. A market economy model is best fit for independent modes of acquisition (Hirth et al. 2006, Hirth and Pillsbury 2013b). However, command and market economy models are not mutually exclusive. Varying ubiquities of obsidian types may demonstrate a mixed economy, with less uniformity or significant spatiotemporal differences.

In chapter 2, I provide a background on excavations at Patipampa, obsidian sourcing in Peru, and a summary of archaeological use of the obsidian sources I have identified in the Patipampa assemblage. For over four decades, archaeologists have conducted geochemical research on archaeological obsidian in the Andes to understand resource exploitation and regional and temporal distributions spanning millennia.

Previous studies of Wari obsidian sourcing provide a useful baseline to compare to the Patipampa data.

In chapter 3, I describe my research design and methods of analysis. I primarily selected obsidian found within distinct architectural spaces in order to compare sources with architectural spatial and temporal context. I describe my criteria for lithic attribute analysis and their uses. I give an overview of PXRF operations and analysis for tracing obsidian artifacts to a geological source. By collecting elemental concentration data, a ‘fingerprint’ can be created for each geological source, which can be compared to elemental concentrations in archaeological obsidian.

Chapter 4 presents my lithic attribute analysis and the results of the geochemical analyses as they relate to the political economy in the city of Huari. For each of the two PXRF analyses, I list identified sources and provide bivariate plots of trace element concentrations. This chapter concludes with a summary of obsidian type ubiquities across Patipampa.

Chapter 5 presents my discussion on the identified sources and some of the representative artifacts. I then compare my results to prior obsidian provenance studies at Huari and Conchopata. These data conform to previous Wari sourcing studies (Burger and Asaro 1977; Burger et al. 2016; Kaplan 2018), as one type, Quispisisa, is overwhelmingly ubiquitous. I conclude that Patipampa’s obsidian assemblage is a result of centralized acquisition and redistribution by the state.

In chapter 6, I summarize the results of my analyses and the implications they have for Wari scholarship. I conclude with suggestions for future research at Patipampa and other Wari sites.

Background

Located in the Ayacucho Valley of Peru, the site of Huari was once the capital of the Wari Empire and is estimated to have housed 20,000 - 40,000 inhabitants in its 2.5km^2 architectural core (Isbell 2004b:202, 2008:750).

Patipampa

Patipampa is a sector of Huari located in the western portion of the city, adjacent to the current visitor's center and site museum. Carbon dating of 2017 and 2018 materials has placed occupation at Patipampa between AD 638 and AD 988 (Table 1). The Keck Carbon Cycle AMS Facility in the Earth System Science Department, University of California, Irvine conducted the C14 analyses of Patipampa materials. I calibrated the dates using Calib Rev 7.0.4 and the SHCal13 calibration curve. 2 sigma median probability dates are presented in Table 1. These dates fit the accepted range for the Middle Horizon in Ayacucho.

Patipampa C14 Dates (2 Sigma Median Probability)				
Lab Code	**Locus**	**Unit**	**EA**	**Cal. AD**
198139	480	35	1	**822**
198140	95	21		**933**
198141	62	21		**966**
198142	480	35	1	**933**
198143	346	42		**826**
198144	511	43	8	**651**
198145	531	44	9	**719**
198146	485	41	6A	**675**
198147	379	47	11	**935**
198148	545	41	6A	**734**
216083	1055	60	13B	**727**
216084	929	75	15	**661**
216085	921	70	6	**641**
216086	1001	75	15	**710**
216087	981	67	1	**804**
216088	1081	71	14B	**649**
216089	1085	80		**932**
216090	802	74		**720**
216091	988	60	13B	**643**
216092	668	35	1	**849**
216096	1039	76	17	**823**
216097	1020	61		**988**
216098	946	76	17	**820**
216099	264	39		**638**
216100	540	43		**660**
216101	523	47	11	**675**
216102	423	43	8	**664**
216103	532	39	5	**731**
216104	1009	77		**859**

Table 1. Calibrated Patipampa C14 dates (2 sigma median probability)

Excavation Methods

At the start of the 2017 field season, field directors established a grid of 10m by 10m squares. The total area of excavation, including Ismael Pérez Calderón's 1995 excavation, is approximately 1.2ha in size with a perimeter of 514m. Without surface architecture, excavators opened test units of varying sizes in order to locate walls and architectural spaces. Upon discovering walls, workers excavated trenches following each wall. This system quickly established the limits of walls and allowed crew chiefs to create units relative to walls. Units were excavated using a locus system with each level of a unit being assigned a unique locus number. After excavating the plow zone of a unit, excavators screened all soil through 0.5cm mesh. When an excavator discovered a particularly unique artifact or concentration of artifacts, either *in situ* or in the screen, a crew chief registered it as an *hallazgo especial* (HE), or special find, recording total station points and photographing the artifact. Criteria for HEs were not firm but generally included restorable, complete, or otherwise unique ceramics, cultural material concentrations, shell and stone jewelry, metal, burned textiles, and complete bifaces. However, this system was not consistent.

In order to maintain uniformity across the site, a locus system was used. The basic locus was defined as a volume of soil in an arbitrary 10cm level. Excavators also defined new loci by changes in stratigraphy or meaningful contexts, such as floors or ash concentrations. In addition to a locus number, excavators assigned layers to each locus. However, there is little consistency between recorded layers for loci due to differences in excavator interpretations and levels of expertise, depositional events, and taphonomic processes. Patipampa is located on a hill and stratigraphy varies considerably. Instead of solely relying upon the inconsistent layer designations, I try to relate my analysis to architectural spaces, occupation and construction phases, floors, and cultural features such as caches. I reference layers when clear stratigraphic differences are present.

Architectural Spaces

The 1995, 2017, and 2018 excavations have revealed 129 distinct walls. During the 2017 and 2018 seasons, crew chiefs and co-director William Isbell identified 19 distinct architectural spaces in the orthogonal cellular style prominently used by the Wari (Isbell 1991; Isbell and McEwan 1991b; Malpass 2001). These 19 architectural spaces compose one distinct patio group and undefined structures, as shown in Figure 1. Additionally, four stone canals are present. Crew chiefs registered architectural spaces using the prefix "EA" (*espacio arquitectónico*) and sequentially numbered them as discovered. I have labeled the EAs in Figure 2. Most excavated areas yielded intentional room fill used to close architectural spaces as the people of Patipampa abandoned spaces. Some architectural spaces returned *in situ* artifacts from floor contexts and caches. Looting occurred in much of the site, with evidence of ancient looting that likely occurred soon after the abandonment of the site or between occupational phases.

Figure 1. Composite image of 2017 and 2018 excavated walls and architectural spaces. 2017 drone image (background) courtesy of Steve Wernke and Justin Jennings. 2018 drone image (foreground) courtesy of Zachary Ahonen-Critchley.

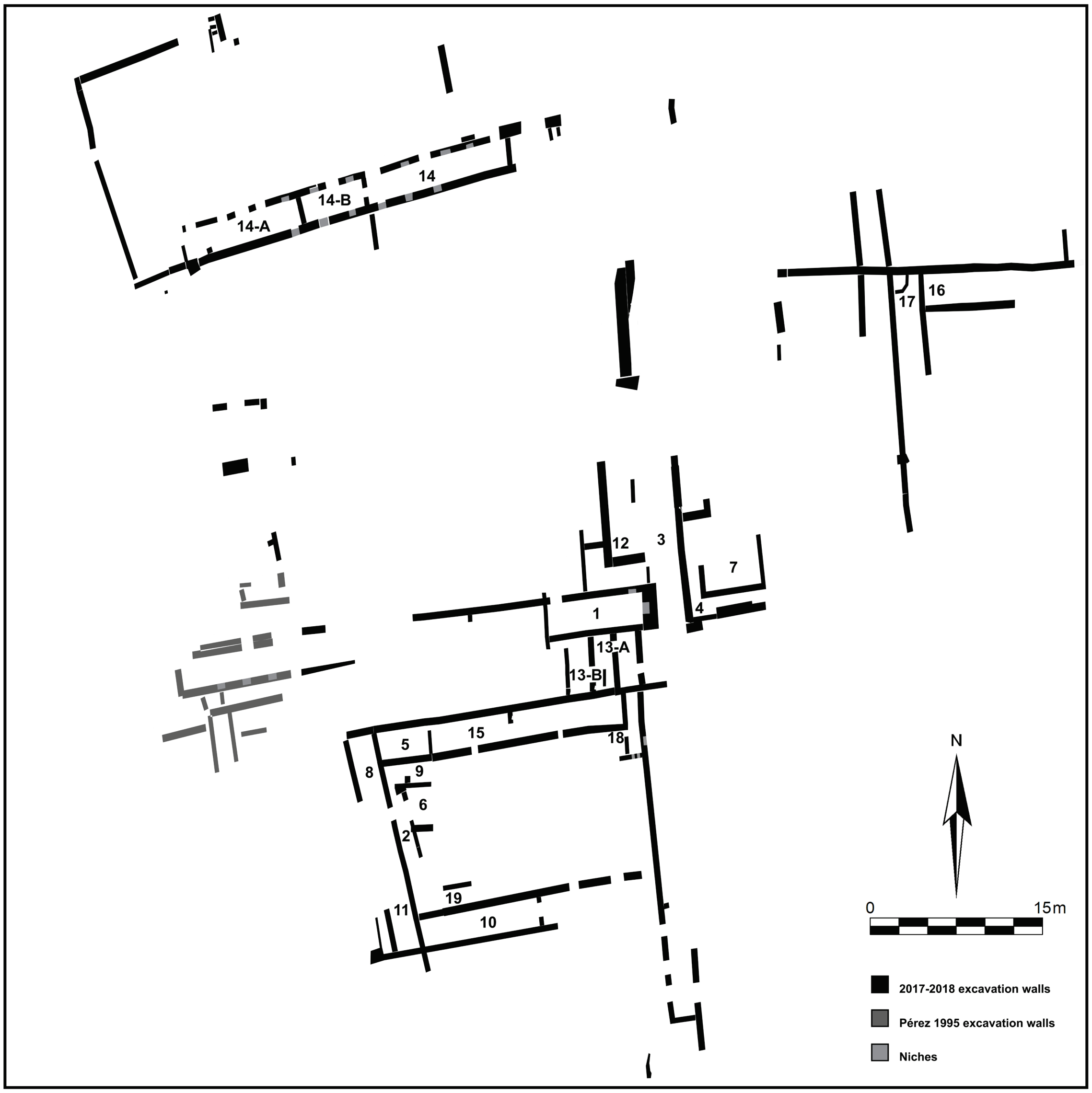

Figure 2. Map of Patipampa architecture with numbered EAs.

EA1

EA1 is a rectangular space north of Patio Group 1, approximately 11.50m x 3.70m in size. EA1 is divided into unit 29 to the west, unit 35 to the east, and unit 67 in the center. Two niches are present in unit 35, one to the north and one to the east. At the end of the 2018 season, excavators uncovered a closed doorway to the northwest.

EA1 contained the largest quantity of lithic artifacts compared to other architectural spaces. Of these, I identified 11 as chalcedony and chert drills likely used in the production of stone and shell beads. Additional artifacts related to lapidary activities include a fragment of a carved and polished chalcedony bracelet, polished and unworked dumortierite, worked and unworked chalcedony and opal, polished chert fragments, a sodalite bead, a caliche bead, worked and unworked marine shell such as *spondylus*, and a piece of chrysocolla with partial and complete drill holes. Similar to other architectural spaces within Patipampa, there is evidence of craft production; however, this does not suggest intense specialization.

In 2017, excavators discovered a cache in EA1 containing large quantities of bone, carbonized botanicals, fine ceramics, cinnabar and arsenic powders, and an unusual obsidian artifact (Figure 3). HU480-01 is pecked and ground flat on both faces with a ground, beveled edge. Based on its shape, it was likely originally circular. The beveled edge may have been for insetting the original artifact into a frame of some kind. The artifact was retouched on one side of one face after being broken. I was unable to identify any usewear on this retouched surface, likely indicating a brief period of use. The clean edge shows no signs of abrasion, supporting the idea of brief use. In 2018, excavators discovered human remains approximately 50cm away from locus 480, potentially linking this obsidian artifact and other offerings with the burial.

Figure 3. HU480-01. Potential obsidian mirror fragment with retouch.

I have yet to see mention of any similar obsidian artifacts in Middle Horizon publications or Andean lithic typologies (Engel 1980; MacNeish et al. 1980; Vining 2005). This artifact could have originally been an obsidian mirror. Archaeologists have found what they believe to be obsidian mirrors at other Wari sites, including a polished fragment at the Cheqo Wasi sector of Huari (Benavides 1991:64), a 0.4mm thick fragment from the temple site of Calpish (Browman 1970:86), and a complete mirror with a carved wooden hand from Huarmey (Lavalle 1984:185). The Huarmey mirror is the only published photograph of a Wari obsidian mirror, however it is more similar in appearance to Chavín and Moche anthracite mirrors than an obsidian one (Calvo and Enoch 2007).

Excavators found these objects in the only floor of EA1. However, excavation to reveal additional floors did not occur. The function of this space and its relation to adjacent spaces are presently unknown. Analyses of all artifact classes are underway and continued excavation is planned.

EA2

EA2 is a late occupation in the western portion of Patio Group 1, consisting of units 21, 30, 32, and 41. Excavators did not define the limits of this architectural space, as wall construction phases were not clear. It was later absorbed by EA6. Early levels contained two intrusions, though a floor was intact in the northeast half. Below this floor was an ashen deposit but no hearth. Within the ashen deposit was a polished marialite bead with two complete drill holes. A fragment of an identical bead was also found in the screen, though its association is unknown. Excavators found a medial fragment of an obsidian biface and a fragment of a ceramic instrument nearby. Cultural materials such as ceramic, bones, and lithics were evenly distributed throughout EA2. The function of EA2 is not apparent.

EA3

EA3 is a 2.00m x 4.80m space to the east of EA12. A wall running along its eastern edge as well as the northeast corner of EA1 defines its limit. There was a low concentration of artifacts on and above the floor of EA3. Of note are three chert drills and a lunate obsidian biface found on the floor. A floor intrusion approximately 1.40m x 0.90m in area and 30cm in depth was located on the eastern side of EA1, extending under the wall. Excavators found a chrysocolla bead, large concentrations of animal bones, primarily camelid, and carbon within this intrusion. The concentration of ceramics within the intrusion was higher than elsewhere in the locus, but did not indicate a cache. Stratigraphy within the intrusion revealed an earlier floor covered in approximately 13cm of compact soil, with the later floor being approximately 12cm thick. Excavation of EA3 did not continue and its function is not apparent.

EA4

EA4 is an L-shaped corridor east of EA1, approximately 7.56m x 3.94m on its longest axes, with a width varying between 100-80cm. Excavators found average quantities of lithic artifacts, including three medial fragments of obsidian bifaces and one medial fragment of an obsidian uniface. Few bone and shell artifacts were present, including one piece of worked *spondylus*. However, EA4 contained significant quantities of ceramics, particularly along walls. Along the northeast wall was a smashed ceramic offering containing darker soil. EA4 appears to have been an access corridor into EA7.

EA5

EA5 is a rectangular space in the western portion of Patio Group 1's north gallery. It is approximately 2.30m x 5.00m with a narrow opening into EA15, approximately 39cm wide. As excavation did not continue within this opening, its narrow size may be the result of collapse or intentional room closure. The fill above the floor contained an average quantity of lithic, ceramic, and bone artifacts. Notable artifacts included a worked fragment of *spondylus*, a bone with evidence of modification, a *mano de batán* (rocker grinder) fragment, a complete basalt biface, a chert drill, and a concentration of camelid remains.

After reaching the floor, excavators decided to concentrate on seven intrusions found at this level. These intrusions were likely the result of looting activity as they contained fragments of floor; however, it is not clear whether this looting was ancient or modern. Although possibly looted, intrusions included a diverse assemblage of artifacts, notably a sodalite bead, *spondylus* fragments, a complete copper *tupu* (pin), a fluted chalcedony biface, a chert drill preform, an unworked nodule of opal, a polished fragment of purple chert, a complete triangular obsidian biface, and multiple obsidian biface fragments. The seven intrusions and lack of continued excavation to find lower floors make interpretations of EA5's role within the north gallery difficult. The presence of raw materials, a drill preform, and completed fine goods implies some level of craft production, though minor.

EA6

EA6 absorbed EA2 and expanded in size as excavators discovered earlier phases of construction. EA6 is trapezoidal in shape, measuring approximately 5.54m x 4.80m on its longest axes, and is located east of the western gallery in Patio Group 1. Unlike other architectural spaces, complete wall perimeters do not define EA6. Instead, EA6 is defined by the limits of walls within units 21, 30, 32, 33, 41, and 70. Excavators completed digging four layers during the 2017 season.

Crew chiefs first defined EA6 by two walls running parallel to the northern gallery. The first layer below the plowzone contained average artifact concentrations of ceramics, faunal remains, lithics, shell, and carbonized botanicals. A large cache of plainware ceramic sherds was found at this layer, though the architectural association was not apparent. HEs from this layer included one complete *mortero* (mortar), one *mortero* fragment, and a *mano* (pestle). Excavators discovered a deteriorated floor throughout EA6 at the end of this layer. Following the limits of this floor, excavation revealed additional walls running parallel to the western gallery. The walls running parallel to the north and west galleries are from the latest construction phase in EA6 and correspond to the floor found in EA2. At this point, crew chiefs divided EA6 into EA6A and EA6B.

EA6A

EA6A was the space between the walls running parallel to the north gallery. Excavators encountered three intrusions in the northeast portion of EA6, now EA6A, and excavated each individually. Within the northwest intrusion, excavators found a large quantity of undecorated ceramics and carbonized botanicals as well as small quantities of lithics and faunal remains. Excavators noted that the concentrations of burned ceramics and carbonized botanicals increased with depth. A copper *tupu* fragment was the only HE from this intrusion. Excavators recovered few artifacts from the northeast intrusion, noting small quantities of ceramics, faunal remains, and carbonized botanicals. The southeast intrusion contained an average concentration of artifacts and concentrations of ceramics and carbonized botanicals increased with depth. Excavators noted many large, undecorated sherds in the profile of this intrusion acting as fill between floors.

Towards the center of EA6A, excavators found a large, round stone with a hole through the center. This was initially identified as a capstone to a tomb. Upon excavation, crew chiefs identified this as the cover to a drainage canal running under the floor of EA6A. The stone-lined canal contained deteriorated ceramics and faunal remains, carbonized botanicals, and the distal portion of a chert projectile point.

After initial excavation of the canal, excavators removed the southernmost wall of EA6A, absorbing EA6B. This allowed for the removal of the floor. The wall contained some ceramics and faunal remains, carbonized botanicals, one shell bead, and one fluted chert projectile point. Additional excavation of EA6A was limited to the area south of the removed wall. The floor at this level was 2-3cm thick, followed by a compact layer of clayey soil approximately 5-8cm thick. The concentration of cultural materials in this layer was quite low. Excavators found large ceramic sherds, faunal remains, carbonized botanicals, and one piece of obsidian debitage. In the subsequent layer, excavators noted an increase in cultural materials. Ceramics, faunal remains, and carbonized botanicals were the most prevalent. Few lithics were present. Notable artifacts include two obsidian biface fragments, a triangular shell bead, and a modeled ceramic face. Excavators encountered floor two at the end of this layer.

Excavated during both field seasons, the fill below floor two contained a large cache of ceramics. Excavators also found average quantities of faunal remains and carbonized botanicals throughout the fill, with few lithics or shell. Lic. Luz Antonio Vargas identified 315 sherds from 2017 that are likely restorable and analyzed 183 due to their unique forms and styles (Antonio 2018). Excavators found a similar quantity of ceramics in 2018. The total number of restorable sherds and vessels is unknown as analysis is ongoing. Chakipampa, Cruz Pata, Huarpa, and Nieveria styles are most prominent. Some vessels are Nasca in form, such as a tri-globular vessel, but demonstrate Huarpa and Chakipampa imagery associated with Ayacucho. Antonio argues for a new assessment of Nasca influence at Huari and in the Ayacucho region at whole (Antonio 2018). Three obsidian biface fragments, a large obsidian uniface fragment, a burned textile, and a copper fragment were the only non-ceramic HEs from within the ceramic cache. Lithic debitage was nearly absent within the cache. Considering the size of the cache, the lack of other cultural materials makes this fill stand apart from other room closures at Patipampa.

EA6B

South of EA6A, this area contained two floor intrusions. The first intrusion excavated was in the center-east of EA6B. It contained a high concentration of large ceramic sherds and faunal remains, carbonized botanicals, lithic debitage, and the distal fragment of a denticulated chalcedony projectile point. Due to its depth, excavation of this intrusion was paused until excavators removed the surrounding floor. The southern intrusion also contained large ceramic sherds, faunal remains, two pieces of lithic debitage, and carbonized botanicals. As in EA6A, large sherds were embedded in the fill profile of this intrusion.

Excavators have interpreted the earliest phase of EA6 as a likely patio space. Few cultural materials indicative of domestic or craft activities came from this space and it is in the interior of Patio Group 1. The later function of the space, after the construction of gallery-parallel walls, is unclear. Aside from the ceramic cache, the most significant difference in cultural materials between late and early phases is the extreme drop in lithic concentration from floor one to floor two.

EA7

EA7 is a rectangular space approximately 5.42m x 2.93m in size, located north and east of EA4. EA4 likely acted as a/the point of entry to EA7. Excavators found few artifacts in the initial levels of EA7, with the lithic assemblage only consisting of six pieces of obsidian debitage and a fragment of an obsidian biface. The quantity and diversity of artifacts increased as excavators came upon a floor, including a chert hand drill, three marine shell beads, and a number of Wari Negro style sherds. Excavators found three intrusions in the northern portion of EA7, each containing Wari Negro ceramics, bone, obsidian debitage, and carbonized botanicals. The quantity of lithics remained low throughout EA7; however, excavators found five fragments of obsidian bifaces and a rhyolite bead below the floor. Below the floor was a level of fill and then bedrock, proposed by excavators to have been repurposed as a natural floor. The quantity of bone and carbonized botanicals increased at this level and a fragment of a bone *tupu* was found. The overall low concentration of artifacts and features makes interpretation of this locus difficult.

EA8

EA8 is a rectangular space in the northwest corner of the western gallery in Patio Group 1. It is 4.00m x 2.26m in size, though the 4.00m length is an arbitrary limit. The total interior length of the western gallery is 17.81m. Excavators did not find any dividing walls within the western gallery, though this does not mean they are absent from the unexcavated portion. Camelid bones, carbonized botanicals, and ceramics composed most of the artifact assemblage in EA8, with low concentrations of lithics and marine shell. HEs registered in the field include a mostly-complete Viñaque style cup, a triangular green chert bead, a stone “anvil” with a circular depression, and a triangular obsidian biface with a concave base. Other notable artifacts include an unfinished chrysocolla bead, a broken *mano* (pestle), two obsidian biface fragments, and two pieces of worked *spondylus*.

Excavators found a hearth in the northwest corner of EA8 associated with a concentration of camelid bones and the base of a large ceramic serving vessel, similar to a platter. This is the only definitive hearth excavated at Patipampa and thus one of the few characteristic features of domestic life found in the sector. The *mano* fragment, serving vessel base, concentrations of carbonized botanicals and camelid remains, and hearth suggest that EA8 was a domestic space or at least related to meal preparation.

EA9

EA9 is a rectangular space in the northwest corner of the interior of Patio Group 1, north of EA6. It is approximately 5.00m x 1.60m in size, though the 5.00m length is an arbitrary limit and not defined by walls. Excavators found small rock fill evenly distributed below the plowzone, interpreting this as a result of abandonment of the space. Ceramics, lithics, shell, and carbonized botanicals were evenly distributed throughout this level. However, excavators found a large cache of broken ceramics, some of which contain partial or complete drill holes. Located nearby were two stone beads – one tubular basalt bead and one triangular chrysocolla bead.

Below this level was a 2cm thick floor with four intrusions, likely from looting activities, which crew chiefs registered as separate loci. All of the intrusions contained diverse mixtures of ceramic sherds, lithics, faunal remains, and carbonized botanicals. The southern intrusion contained a fluted bifacial point made of white chert, similar to others found across the site. The northwest intrusion also contained a *spondylus* bead and a large bead made of burned puzolana. The fill between floors 1 and 2 and floors 2 and 3 was also comprised of small rock fill with a homogenous mix of ceramic, lithic, faunal, and botanical artifacts. Locus 531 was a small space between floor 3 and a prepared bedrock floor, containing numerous ceramic sherds, a concentration of articulated young camelid remains, and few lithic artifacts. Excavators have interpreted this as a possible offering related to the construction of floor 3. The function of EA9 is not clear, though domestic refuse is present along with at least one potential construction offering.

EA10

EA10 is a rectangular space in the western half of the southern gallery in Patio Group 1, approximately 12.00m x 2.31m in size, as delimited by the gallery walls and an internal access. Only the westernmost 4.00m of EA10 was excavated as unit 46. Two levels below the plowzone, excavators found a concentration of thick ceramic sherds, including the base of an urn. Excavators recorded ceramics, lithics, faunal remains, and carbonized botanicals, and *manos* throughout the EA with some metal and shell found in lower levels, including a *tupu* fragment and worked *spondylus*. Three HEs were found in a layer of fill above a floor from two loci, one from locus 512 in the eastern half of the unit and two from locus 536 in the western half. In locus 512, excavators found a circular sherd broken out of a large vessel, featuring a molded image of the Staff God's face. In locus 536, excavators found a copper *tupu* and a cache of over 2000 *spondylus* beads. These were deposited above a bedrock floor and may have been related to the closure of the space.

Considering the number of drills, drill fragments, and pieces of *spondylus* elsewhere in Patipampa, the cache of beads may have been manufactured in proximity to EA10. The high concentration of *manos* and *mano* fragments suggests domestic activity in the space, though a lack of *metates*, *batánes*, ash, or a hearth complicates this interpretation. However, only the western third of EA10 was excavated, with the remainder potentially containing additional evidence of domestic activities.

EA11

EA11 is a rectangular space in the southern half of the western gallery in Patio Group 1, approximately 7.86m x 3.56m in size. EA11 extends outside of the gallery to a small wall of later construction, making EA11 two distinct spaces – one inside the gallery and one abutting it to the west. In initial levels, the excavator did not record information regarding which of the two spaces were excavated. It is likely that both were excavated simultaneously, obscuring distinctions between the spaces when examining the artifacts. Later levels were excavated from within the gallery space, mostly in the southern half.

EA11 contained three floors. Floor 1 was 60cm below the surface, floor 2 was approximately 60cm lower, and floor 3 was approximately 100cm below that. Artifact densities throughout EA11 were consistently low aside from ceramics. Not only were ceramics the most prevalent artifact, but Cruz Pata style ceramics were at a significantly higher concentration in EA11 than elsewhere in Patipampa, increasing in concentration with depth of excavation (Nishizawa 2018). Excavators found three teardrop-shaped malachite ornaments on floor 1. Crew chiefs registered numerous HEs in the fill between floors 1 and 2, including a copper snuff spoon decorated with a seated figurine, three copper *tupu* fragments, a ceramic foot, and a ceramic face from a jar. Between floors 2 and 3 were additional ceramic figurine fragments, unworked malachite/chrysocolla conglomerate, and unworked chalcedony. There is little to suggest any specific functions within EA11, though the concentration of Cruz Pata ceramics is anomalous within Patipampa and Hide Nishizawa is investigating the style's presence.

EA12

EA12 is a rectangular space located west of EA3 and is approximately 4.07m x 2.10m in size. As with some other EAs, the limits of walls did not define the space's dimensions for excavation. The space is only surrounded by walls on the south and west sides. There appeared to be a collapsed wall on the eastern side, though excavators did not explore this thoroughly. First excavated in 2017 as unit 48, crew chiefs reopened excavations in EA12 during the 2018 season. This was due to the presence of Viñaque style ceramics, which suggests a later occupation.

In 2017, the first layer excavated after the plowzone yielded significant quantities of ceramics but few faunal and lithic materials. Aside from the few Viñaque sherds, the other HEs were incised sherds and a polished black stone ornament, likely intended to be inset. Excavations stopped once excavators reached the second layer, approximately 30cm below surface.

In 2018, crew chiefs opened unit 80 in the northern half of EA12 to explore to possibility of a late occupation, continuing from where 2017 excavations ceased. In unit 80, excavators used arbitrary 10cm levels until reaching distinct stratigraphic changes. In the first level of the second layer, excavators only found ceramics. The second level revealed ceramic, faunal, and botanical materials.

The third level contained ceramic, faunal, botanical, lithic, and shell artifacts. Viñaque sherds were also found. There was an increase in quantity and diversity of cultural materials in the third layer, including *spondylus*, cinnabar powder, and human remains. Several human bones were stained red with cinnabar and one was stained green, likely from powdered cuprite as found in EA1. This layer also contained a human phalange with a drill hole.

In the fourth layer, excavators found small quantities of ceramics, faunal remains, and carbonized botanicals as well as a puzolana *tapón* (a “cork” inserted into tomb capstones). The bottom of this layer was covered in a 10cm deposit of crushed puzolana, similar to the puzolana deposit found above the tomb in EA17. This puzolana deposit was at the same level as a deteriorated floor, likely broken to make the puzolana deposit. The floor is at approximately the same level as the western wall, likely representing a late reoccupation. Additionally, excavators believe the area was used for a burial after the late occupation. This is supported by the presence of human remains, cinnabar, puzolana *tapón, spondylus*, and the deposit of crushed puzolana. As unit 80 was excavated at the end of the 2018 season, exploration of earlier occupations could not occur.

EA13

EA13 is a rectangular space approximately 4.49m x 4.30m in size, bordering EA1 to the south. Excavation quickly revealed a dividing wall with a passageway. This caused crew chiefs to split the space into EA13A to the east and EA13B to the west. Artifact densities were low in the first layer before this division but included ceramics, bones, lithics, and shell artifacts.

EA13A

EA13A is a rectangular space approximately 4.20m x 1.68m in size and connected to the southern wall of EA1. It connects to EA13B via an access to the west, approximately 1.25m wide. Excavators also encountered a small wall running north south in the southern portion of EA13B. Compared to the first layer of EA13, layer two in EA13A demonstrated a significant increase in cultural material densities, particularly faunal remains, lithics, and shell artifacts. These include worked and unworked marine shell and *spondylus* fragments, marine shell beads, three chert drill preforms, one chert drill, one obsidian lunate biface, and an obsidian biface fragment. In the northeast corner was a compact semicircular feature of indeterminate function. Excavators found the first floor at the end of the second level. Three intrusions were present in this floor but yielded very few artifacts. Two of the intrusions only included ceramics and faunal remains. The third intrusion to the southwest also included lithic debitage, a retouched obsidian flake, and a *mano* fragment.

Excavators found one stone canal under the first floor, running along the northern wall and through the dividing wall. Fill within this section of the canal contained a small quantity of ceramics, faunal remains, lithic artifacts, carbonized botanicals, marine shell beads, and worked and unworked *spondylus*. A second canal is located in the southern portion of EA13A but was not excavated as its own locus. Excavators found very few artifacts in the layer of fill below the floor. They then encountered a prepared bedrock floor below this fill. Overall artifact concentrations in EA13A were low.

EA13B

EA13B is a rectangular space approximately 4.20m x 1.80m in size and connected to the southern wall of EA1. It connects to EA13A via an access to the east, approximately 1.25m wide. In the northwest corner of EA13B, there is a small access approximately 68cm wide. Excavators recovered few artifacts from the second layer, including ceramics, faunal remains, lithics, a *mano*, and a *batán* fragment. Layer three included the greatest diversity and quantity of artifacts found within EA13B. Excavators found ceramics, faunal remains, lithics, shell artifacts, copper fragments, and carbonized botanicals. Notable artifacts include two chalcedony projectile points, two chalcedony hand drills, a chert hand drill, a fragment of polished chert, a half-sphere of polished blue fluorite, a turquoise bead, cuprite, an obsidian biface fragment, multiple *spondylus* fragments, and six small pieces of copper. Layer four revealed the first floor in EA13B. This floor is in the same layer as the floor found in EA13A, but excavators recorded these layers differently. As in EA13A, excavators found very few artifacts in the fill below this floor, excluding the canal areas.

Excavators also recorded the canals as existing in different layers, though this was due to excavator interpretations. The northern canal only contained ceramics, burned bones, and carbonized botanicals, all in low concentrations. The southern canal, however, contained a greater concentration of artifacts located within and around it. Excavators found ceramics, *mano* fragments, camelid and other faunal remains, carbonized botanicals, and few lithic artifacts. Only three notable artifacts came from this context: a shell bead, a chalcedony projectile point, and an unmodified nodule of Puzolana obsidian.

The functions of EA13A and EA13B are unclear. The unusual form and relatively low artifact concentrations suggest a passageway between other spaces, though excavation did not occur in these adjacent spaces. Puzolana obsidian within the fill of the southern canal suggests ritual significance as demonstrated by the association between obsidian and canals elsewhere in the Andes (Fortin 2010:71; Kolata 1993).

EA14

Like EA13, crew chiefs divided EA14 into EA14a and EA14b after excavators defined dividing walls and passageways. EA14 is a long niched gallery in the northwest portion of Patipampa. In total, EA14 measures 33.21m x 2.19m. EA14's length, 12 niches, and eight known entrances are atypical within Patipampa and general Wari architecture (Isbell 1991; Isbell and McEwan 1991b; Malpass 2001). Crew chiefs had

EA14 excavated as six units, some extending outside of the architectural space. These units are 63, 69, 71, 72, 82, and 83. EA14A and EA14B were both entirely within unit 71.

The eastern half of EA14, delimited by a dividing access approximately 77cm wide, contained units 63, 72, 82, and 83. All walls within this portion of EA14 showed evidence of white plaster painted red. Excavators found very few artifacts in the first layer, limited to ceramics and faunal remains. The second layer yielded a larger quantity and diversity of cultural materials including ceramics, faunal remains, lithics, shell artifacts, burned textiles, copper, and carbonized botanicals. Some HEs from this layer include ceramic face fragments with incisions, a ceramic face fragment featuring a maize motif, a puzolana *maqueta* (miniature), a puzolana *tapón*, polished chert, and a fragment of an obsidian uniface. The third layer contained even higher concentrations of all cultural materials. Excavators found a large concentration of broken ceramics in unit 72. Three chalcedony projectile points, a lateral fragment of an obsidian biface, and a fragment of a large, circular obsidian biface were associated with this ceramic deposit. Other HEs from this layer include two obsidian biface fragments and what is believed to be a whale tooth.

Excavators found a floor approximately 3cm thick below layer three, containing no cultural materials. A second floor was below this, approximately 5cm thick and containing small quantities of ceramics and faunal remains. Below the second floor was a third, also approximately 5cm thick. Excavators found small quantities of ceramics and faunal remains as well as small canals. A semicircular cist tomb was located in the southwest of unit 63 but was disturbed and the body removed prior to the construction of floor 1. Fill within the tomb contained three ceramic sherds with Southern Andean

Iconographic Series (SAIS) (Isbell and Knobloch 2009) designs, four human teeth, and cinnabar residue. The six niches within this section of EA14 were not excavated as individual loci and thus the exact association to cultural materials is unclear. The presence of a *maqueta*, a large ceramic deposit associated with a unique obsidian biface, whale tooth, niches, and tomb suggest non-domestic functions within this section of EA14.

Crew chiefs did not divide EA14 into EA14A and EA14B until midway through the second layer of unit 71. Excavators found low concentrations of cultural materials throughout the first layer, but a diverse assemblage of material classes including ceramic fragments, faunal remains, lithics, shell, carbonized botanicals, and copper fragments. This layer also contained a chalcedony drill and a puzolana *maqueta*. This *maqueta* is in the form of a house with an angled roof. There are remnants of white and red plaster on its surface. Layer two produced an even larger concentration of materials. HEs from this layer include a chalcedony bifacial core, one turquoise bead and bead fragment, a fragment of a polished turquoise ornament, two pieces of chrysocolla with pilot drill holes, four chalcedony drill preforms, two chalcedony hand drills, one chert hand drill, one chalcedony projectile point, three obsidian biface fragments, two obsidian uniface fragments, one obsidian ovoid biface, one obsidian ovoid uniface, a complete nodule of Puzolana obsidian, four pieces of copper, and a fragment of burned textile. Excavators found an additional puzolana *maqueta* similar to the one found in the previous layer. Upon the discovery of a dividing wall in the second layer, crew chiefs split unit 71 into EA14A and EA14B.

EA14A

EA14A is a small area west of EA14B, approximately 2.19m x 1.98m in size, defined by a dividing wall to the east and the limit of unit 71 to the west. Two niches are located within this space. Both niches and all three walls were plastered white and then painted red. Some artifact densities were average within EA14A, including ceramics, faunal remains, copper, and carbonized botanicals. Lithic artifact density was quite high, however. The two HEs recorded within EA14A were a perforated ceramic disk and a chalcedony hand drill.

Crew chiefs assigned individual locus numbers to the two niches in EA14A. The northern niche contained ceramic fragments, a perforated ceramic disk, a puzolana *maqueta* fragment, and lithic debitage. The southern niche also contained ceramic fragments and lithic debitage as well as a distal fragment of a chalcedony projectile point. Both niches were plastered and painted red like the surrounding walls. Excavators closed EA14A upon completion of layer two in order to focus on EA14B. The lack of further excavation obscures interpretation of EA14A, though there are possible ritual associations considering the painted niches and *maqueta* fragment.

EA14B

EA14B is east of EA14A, approximately 6.03m x 2.16m in size. It contains two niches on the north side and two on the south side. There is an entrance along the north wall approximately 1.32m wide and an access on the west end approximately 77cm wide. Continuing layer two, excavators found increasing concentrations of artifacts. Some HEs registered in the field include a puzolana *tapón,* numerous textile fragments, a puzolana *maqueta* fragment, ceramic figurine fragments, and a fragment of a modeled ceramic face. Lab HEs include numerous ceramic spoons and spoon fragments, a fragment of a basalt bowl, one turquoise bead, a 28-piece refit of chalcedony, a chalcedony hand drill, a bifacial chert core, a fragment of Puzolana obsidian, and three obsidian biface fragments.

Excavators found a floor below layer two, between 3 and 8cm thick. The fill below this floor contained a lower concentration of cultural materials, including ceramic fragments, faunal remains, lithics, copper, shell, and carbonized botanicals. The three HEs found in this layer are a fragment of an obsidian biface, a ceramic spoon fragment, and a piece of burned textile. Excavators found a second floor below this level, approximately 3cm thick, marking the end of excavation in EA14B.

Crew chiefs assigned individual locus numbers to the four niches in EA14b. The northeast niche contained few ceramic sherds and a puzolana *maqueta* fragment. The northwest niche contained only one ceramic sherd. The southeast niche contained one obsidian flake and few ceramic sherds. The southwest niche contained ceramic fragments and four pieces of lithic debitage. All four niches were plastered and painted red like the surrounding walls.

This gallery space likely held ritual significance. The *maqueta* fragments, painted niches, Puzolana obsidian, basalt bowl, and *tapón* are not indicative of any domestic activities. While EA14 was not excavated to completion, evidence points to ritual rather than residential function within this long niched gallery.

EA15

EA15 is a large space in the center and west portion in Patio Group 1's north gallery, directly east of EA5 and approximately 19.37m x 2.13m in size. This portion of the gallery contains a dividing access wall slightly east of center with an opening approximately 1.17m wide. Additionally, there are two accesses into the central patio.

The western access is approximately 67cm wide and the eastern access is approximately 49cm wide. Crew chiefs opened a unit in the west-central portion of EA15, unit 75. Unit 75 is approximately 5.27m x 4.28m, extending outside the gallery's north and south walls by approximately 50cm.

As one of the deepest excavations, EA15 contained diverse stratigraphy with 14 distinct layers. The first layer contained low quantities of ceramics and faunal remains. The second layer also contained low quantities of ceramics and faunal remains as well as shell fragments and four pieces of obsidian debitage. The third layer continued with this trend of low artifact densities, adding carbonized botanicals. Field HEs from layer three included two sherds in the Chakipampa style depicting the Ayacucho serpent, a carbonized textile fragment, a *mano* and *batán*, and a copper *tupu* or needle. Layer four included ceramic fragments, a large quantity of faunal remains, and carbonized botanicals. In layer five, excavators found ceramic fragments, faunal remains, a *mano*, very few lithics, and multiple copper needles. One obsidian biface fragment was in layer five.

Excavators encountered the first floor in layer six, approximately 3cm thick, along with a deposit of cuy bones. Layer seven included ceramic fragments, faunal remains, carbonized botanicals, and a shell bead. In layer eight, excavators encountered ceramic fragments and a small quantity of lithics and carbonized botanicals. Layer nine contained small quantities of lithics and carbonized botanicals but significant quantities of ceramics and faunal remains. Faunal remains were concentrated in the center of the EA. One obsidian biface fragment was found in layer nine. Excavators interpreted layer nine as intentional fill deposited prior to the construction of floor 1. In layer ten, excavators found ceramic fragments, faunal remains, few lithics, and abundant carbonized botanicals. This was the largest concentration of botanicals in EA15. Layer 11 contained no cultural material. However, it revealed floor 2, approximately 6cm thick. Layer 12 contained a large quantity of ceramic fragments and faunal remains. Layer 13 contained a small quantity of camelid remains and carbonized botanicals. Layer 14 did not contain cultural material and ended at bedrock. Excavators encountered very few lithic, metal, or shell artifacts throughout EA15; however, concentrations of ceramics, faunal remains, and carbonized botanicals were comparable to other areas of Patipampa. The presence of these artifact classes as well as groundstone implements suggests some domestic activity, but this is not conclusive.

EA16

EA16 is a rectangular space in the northeast portion of Patipampa. EA16 is approximately 3.60m x 2.53m. The north wall of the gallery is at least 15.33m long but excavators could not continue following this wall due to a steep terrace. This EA changed excavators midway through excavation. The first excavators may have encountered a dividing wall but had destroyed it before it could be recorded. In the first layer below the plowzone, excavators found a large quantity of ceramics and few lithic, faunal, or shell artifacts. One denticulated chalcedony projectile point was also found – a form unlike most others at Patipampa. Excavators found a greater diversity and quantity of artifacts in layer two, including many decorated sherds, the largest concentrations of lithic artifacts within EA16, and carbonized maize. Crew chiefs registered many field HEs including a fragment of a Viñaque lyre cup with a Rayed Head, a concentration of large ceramic sherds, a *tupu* fragment, a *spondylus* fragment, a large lateral fragment of an obsidian biface, a denticulated chalcedony projectile point similar to the one found in the first layer, and a marine shell pendant with six circular divots – a design found on silver pectorals (Giersz 2014). Excavators also found a bone pendant featuring this design on both faces. I registered additional lab HEs, including five obsidian biface fragments and two obsidian uniface fragments.

In layer three, excavators found a fragmented floor approximately 20cm thick. Material types and distributions maintained similarity to those of layer two but with a drastic decrease in lithic artifact density. Field HEs included a Chakipampa style two-toned pan flute, two ceramic plate sherds with vitrified slip, sherds from three distinct polychrome cups, a large black bone bead, and a fragment of a convex base obsidian biface. Other notable objects include two fragments of a similar black bone bead, an unworked piece of dumortierite, and an amber marialite crystal. The density of artifacts continued to decrease in layer four, including the number of HEs. Excavators found four fragments of burned textile, a polychrome cup fragment with a post-fire incision of a bird on the base, a proximal fragment of an obsidian biface, a complete nodule of chalcedony, and a circular bone pendant featuring an image of a Rayed Head. This bone pendant contained cuprite and cinnabar powders within the carving. Excavators found a second floor at the end of layer four. Layer five was a test unit following an intrusion in this floor, reaching bedrock. Within this layer were fragments of a human mandible, burned textile, a complete nodule of chalcedony, and a fragment of Puzolana obsidian.

Excavators do not believe there is evidence of long-term domestic occupation in EA16 and that it was likely a public space consistent with its gallery form. There is strong evidence for a disturbed burial including human remains, a fine shell pendant, a

Rayed Head bone pendant, two black bone beads, extremely fine ceramics, and Puzolana obsidian. As excavations did not expand further east in the gallery, it is not known where the original burial may have been located. Due to the fill and floor above the layer that included human remains, there is no evidence to suggest this was a modern disturbance.

EA17

EA17 is a small rectangular space located in the north portion in the western gallery of a likely second patio group. EA17 is approximately 2.78m x 2.62m. The size of the gallery is approximately 20.65m x 2.62m. A wall trench completely revealed the western wall of this gallery. The wall trench used to expose part of the eastern wall was not continued. Like EA16, EA17 changed excavators midway through excavation.

In the first layer, excavators found some ceramics and low concentrations of faunal, shell, and lithic artifacts. Some notable artifacts include a Cajamarca rim sherd, a fragment of an ocarina, a *batán* fragment, a chrysocolla bead, and an obsidian biface of an unusual form. The second layer demonstrated an increase in all cultural materials, including the appearance of carbonized botanicals. Notable artifacts include a human tooth, a mostly complete vessel containing cinnabar, additional Cajamarca ceramics, a bone awl, a fragment of a lyre cup featuring a Rayed Head, two copper *tupu* fragments, a burned textile fragment, a straight-based obsidian projectile point, a chalcedony drill preform, a sulfate mineral crystal, and a turquoise figurine fragment composed of planerite and faustite. The third layer continued the artifact concentrations present in the previous layer. Additional finds included *spondylus* beads, 83 stone beads of chrysocolla, malachite, and turquoise, a large piece of polished green fluorite, a gilded metal bead, three copper *tupus,* two obsidian biface fragments, a miniature spouted vessel, ceramic sherds coated in a calcium powder, cuprite powder, an ash deposit, a partial tomb capstone, and human remains.

Locus 946 was excavated as a burial. The removal of the capstone and scattering of human remains indicate a disturbed burial. Not all bones were present, but excavators determined the individual to be an adult. Cinnabar staining is present, primarily on the cranium. The tomb was located within the floor in the northwest corner of the EA, defined by a semi-circle wall. All walls within EA17 showed evidence of being coated in a white plaster and then painted red. Excavators also encountered a layer of crushed puzolana outside of the walls of the tomb, approximately 20cm thick. This layer contained very few cultural materials, though a polished piece of turquoise incised around its circumference, a polished turquoise cylinder, and a polished trapezoidal piece of malachite were present. Excavators continued below the puzolana to layer five, which contained even fewer cultural materials. Excavation of EA17 ceased after walls began to collapse. Aside from the burial, the function of EA17 is not evident.

EA18

EA18 is a narrow rectangular room located in the northeast corner of Patio Group 1. It is approximately 4.97m x 1.17m in size. There is a narrow doorway located in the southwest approximately 52cm wide. The southern wall contains two niches. There was one floor recorded. EA18 began as unit 61, extending from the eastern wall west towards the patio interior. Excavation of this area was very poor as the excavator refused to screen most soil or properly document findings, removing context from the few artifacts recovered from the EA. As such, there is no way to interpret the function or contents of this space.

EA19

EA19 is a narrow space in the southwest patio of Patio Group 1. Crew chiefs created unit 78 as a 3m x 6m unit to explore the interior of the patio. After discovering a second interior wall, the southern portion of unit 78 became EA19. Due to the arbitrary nature of the original unit, EA19 is approximately 3.00m x 1.32m in size.

The first two layers contained ceramics, lithics, faunal remains, and carbonized botanicals, all increasing in density with depth of excavation. Excavators found that artifact density continued to decrease in the third layer. Notable artifacts from layer three include a *spondylus* bead, a worked marine shell with scalloped edge, a large Cruz Pata urn sherd, a Viñaque cup sherd featuring the Staff God, a concentration of 15 pieces of worked and unworked marialite, and three fragments of obsidian bifaces. Excavators found all of these artifacts within the patio space, not the architectural space. In layer four, excavators discovered the second wall that would define EA19. Cultural materials continued to decrease. Excavators designated a burning event within the patio as layer five. The only artifact within this layer was a large rectangular marialite bead with two drill holes, identical to the one found in an ash deposit in EA2. Excavators interpret this burning event and bead deposition as the ritual closing of the final occupation floor. Groleau (2011) interprets similar ash deposits in Conchopata as part of ritual room closure.

Layer six was a thin floor, approximately 2cm thick, and subfloor located above the walls. Excavators found few ceramic, bone, or lithic artifacts in this layer, but carbonized botanicals were found throughout. Artifact densities increased in layer seven, which was entirely within EA19. Notable artifacts include a polychrome ceramic fragment of a figurine holding a panpipe, two obsidian biface fragments, a chalcedony hand drill, a laurel-shaped malachite bead, a copper *tupu* fragment, a long copper bead, and large carbonized tubers. Layer eight showed evidence of a deteriorated floor with very few cultural materials. Layer nine contained few cultural materials but many inclusions of carbonized botanicals. Excavators found a greater but still low concentration of ceramic, bone, and lithic artifacts in layer ten. A large two-piece refit of polished marialite came from this layer. Excavators found very few artifacts in layer 11. This also marked the end of excavation of EA19 as the field season had ended.

Based on the extent of excavation, excavators have interpreted three sequences of occupation within this space. The first is defined by the construction of the southern wall, followed by the construction of the northern wall, and then the construction of the floor between the walls. Large concentrations of carbonized botanicals and faunal remains suggest domestic activities within EA19. The quantity of worked and unworked marialite suggests some level of craft production in this space. The burning event and bead deposition similar to EA2 may have occurred on the same level floor and possibly contemporaneously. Further excavation of the patio is needed to understand the relationship between these spaces and events.

Site Function

Patipampa appears to be a production area for fine goods as opposed to the initial assumption that the spaces were strictly residential in function. Evidence for craft production is most evident in the lithic and shell assemblages. Chalcedony, chert, and opal drills are found across the site and demonstrate usewear consistent with bidirectional drilling. *Spondylus* beads and stone beads in various stages of manufacture are present in significant quantities, including a cache of over 4000 *spondylus* beads in EA10. Stone beads are made of marialite, chrysocolla, turquoise, malachite, and sodalite. Other jewelry includes polished and incised turquoise, malachite, chert spindle whorls, a polished piece of green fluorite, shell and bone pendants similar in design to the silver pectorals found in elite Wari burials (Giersz 2014), and worked shell typically found in mosaics (Lavalle 1984). Long, thin pieces of fine andesite and basalt with beveled edges may have been used as cutting implements for *spondylus* craft production. Additional fine goods include polished pieces of turquoise and dumortierite – a rare and vibrant blue mineral frequently misidentified as lapis lazuli. Using X-ray Diffraction, I confirmed the presence of marialite, turquoise, and dumortierite. All of these materials also occur in their raw, unworked states.

While the project uncovered over 100 complete and fragmented projectile points, excavators found no evidence for flaked stone manufacture. Few cores exist, none of which are obsidian, and there are no hammerstones present. Most lithic artifacts are debitage and most are angular shatter. Some lithic materials, such as black onyx, are represented by three or four flakes – hardly the quantity expected in a manufacturing area.

The residents of Patipampa may have manufactured textiles and other items of clothing. Spindle whorls, extremely fine carbonized textiles, *tupus*, and mineral powders possibly for dyes are some pieces of evidence in support of this hypothesis.

Copper and/or bronze artifacts are infrequent, and excavations revealed no evidence of metallurgy. Additionally, no evidence exists for ceramic production. The people of Patipampa likely processed some food within architectural spaces as evidenced by *batánes, manos,* and *metates*, though minimal in quantity. Despite the large quantity of carbonized botanicals, excavators only found a single hearth in EA11. These are evidence for domestic activity, but the relative absence of grinding stones and hearths does not justify identifying Patipampa as a strictly residential sector.

The inhabitants of Patipampa appear to have been attached craftspeople of some type, producing fine goods possibly for elite individuals. Archaeologists frequently define attached craft specialization by proximity to elite spaces such as palaces (Kovacevich 2013:256-7). This specialization may occur at a small scale in domestic rather than royal spaces, however (Kovacevich 2013:261). The Wari state likely provided necessary resources (i.e. food and obsidian) for this specialized labor. It is unclear if Patipampa's inhabitants resided permanently in the sector or even if these architectural spaces fit accepted notions of "households" in the Middle Horizon. The 2018 excavations uncovered two burials, one of which was looted shortly after the abandonment of the site. This is not unusual for a residential context as the Wari frequently placed burials below floors to domesticate space (Groleau 2011; Isbell 2004; Nash 2002). Patipampa may have functioned as a workspace sector with non-permanent residents. The abundance of botanical remains and utilitarian goods such as obsidian suggest a higher but non-elite status role for these individuals.

Obsidian

Obsidian is abundant in the Andean archaeological record, from some of the earliest Preceramic sites to terminal Inca contexts, and remained a trade good valued for its appearance and workability. When free of phenocrysts and/or air bubbles, obsidian fractures isotropically – or without a preferred direction of fracture – allowing for predictable reduction via percussion (Shackley 1998:10). Geologically, obsidian is rare and unstable, eventually hydrating over millions of years and weakening to the point of becoming unsuitable for lithic manufacture (Shackley 1998). The geologically young, volcanic, Andes are home to over a dozen unique sources of obsidian, many of which were utilized in pre-Hispanic times for a multitude of purposes. Figure 4 is a map of Wari sites and commonly exploited obsidian sources. Andean peoples fashioned obsidian into knives, blades, scrapers, perforators, projectile points, and even mirrors, with uses ranging from the domestic to the ritual (Bencic 2015; Fortin 2015; Kaplan 2018). The utility and geographic isolation of obsidian positioned it as a valuable resource in developing and maintaining political and economic control in the Peruvian Andes. Archaeological sites, such as the Wari imperial facility of Willkaya, were sometimes constructed to control obsidian sources (Schreiber 1992:156).

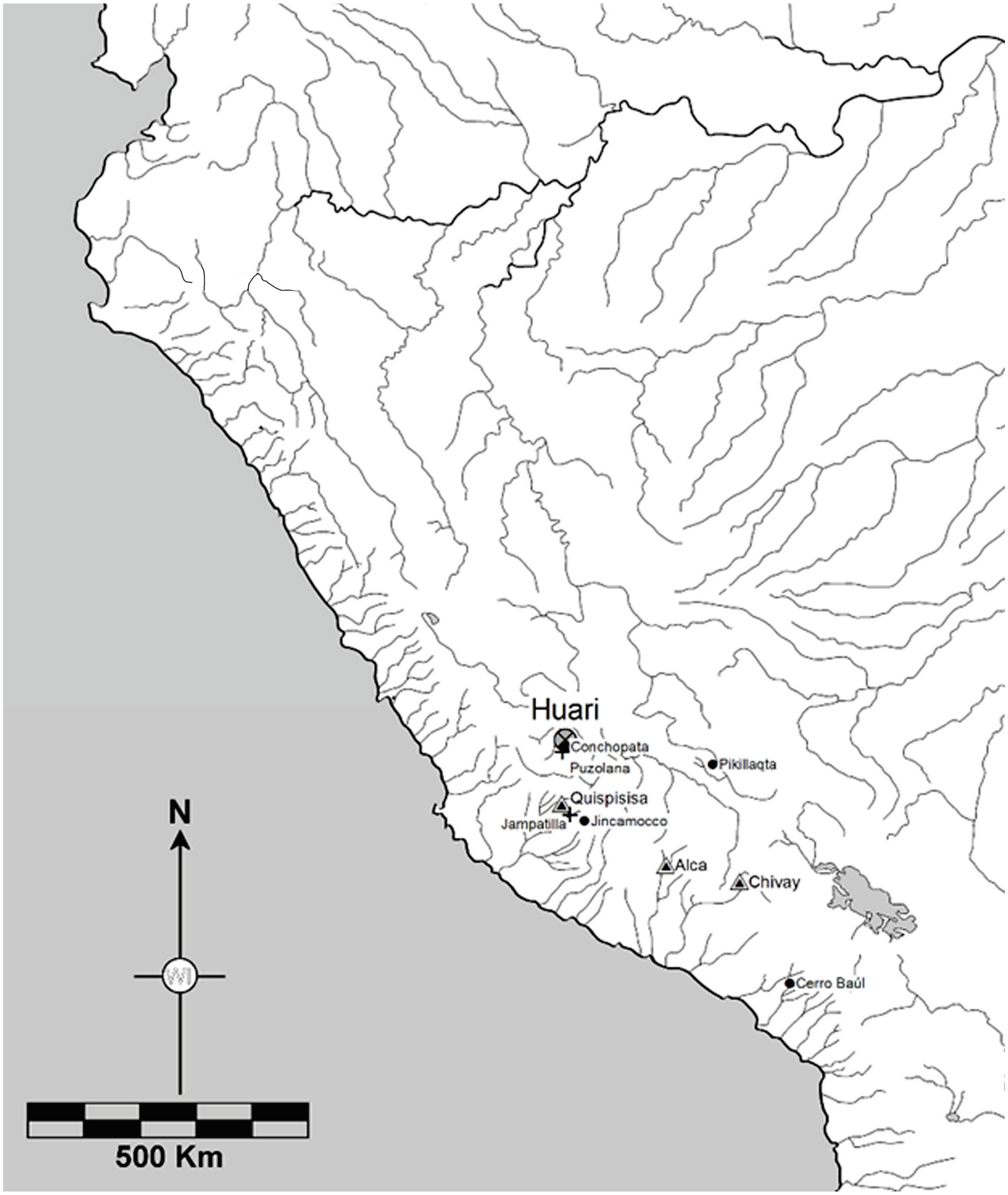

Figure 4. Map of Wari sites with major and minor obsidian sources (Original map courtesy of William H. Isbell).

Andean Chronologies

Before investigating the role and socioeconomic implications of obsidian at Huari, a brief explanation of its use through time in the Andes is necessary. The Wari were far from the first to control the procurement of obsidian and changes can be seen through the rise and fall of several Andean cultures.

Preceramic

Some of the earliest evidence of obsidian exploitation in the central Andes comes from Preceramic sites in the Ayacucho Basin. MacNeish's Ayacucho Archaeological-Botanical Project found obsidian in all Preceramic phases of the Ayacucho area, with the earliest dates associated with obsidian artifacts coming from Pikimachay (6900 ± 300 BC), Ayamachay (7250 ± 350 BC), Puente Cave (6950 ± 150 BC), and Jaywamachay (9000-8400 BC) (Burger and Glascock 2004:361). In the 1970s, Burger and Asaro geochemically analyzed 66 obsidian artifacts from MacNeish's Preceramic sites in Ayacucho, providing an interesting look into obsidian acquisition during some of the earliest occupations of the highlands. During the Puente phase (9000-7100 BC) at Jaywamachay, Quispisisa obsidian was the only type found. At other Preceramic sites, Burger and Asaro identified Puzolana Type obsidian, though only eight samples out of the 66 were identified as such. The Quispisisa Source is located approximately 83 km south of Jaywamachay while Puzolana outcrops can be found as close as 18 km to the northeast via straight line. Both types of obsidian are suitable for tool manufacture, though the small (<5 cm) Puzolana nodules are not adequate for large biface manufacture.

One explanation for the distribution of Quispisisa obsidian is a model of multiple exchanges, or down-the-line exchange, where the obsidian passes from group to group until used and discarded (Burger and Asaro 1978:68). This model may account for the fact that Quispisisa obsidian is not found at distant Preceramic sites. Two other theories put forth by Burger and Asaro are of direct procurement and long-distance trading expeditions where there is unrestricted access to an obsidian source or groups traveling great distances to exchange goods for obsidian, respectively. Direct procurement and unrestricted access to the Quispisisa Source would be hard to identify archaeologically with its long history of intensive exploitation. Vertical exchange and seasonality support the theory of long-distance trading expeditions, though we would expect to find Quispisisa obsidian much farther from the source. However, none of these can be supported without other contextual data.

Initial Period

A pattern for preference of Quispisisa over local obsidian continues through the Initial Period (ca. 1800-1200 BP) outside of the south highlands. Few data have been gathered regarding obsidian sourcing from Initial Period sites. Most analyses have focused on the south highlands in Cuzco, Puno, and Bolivia, with exceptions of Erizo in the Ica Department, Hacha in the Arequipa Department, and Waywaka in the Apurimac Department (Burger and Asaro 1977:23; Burger et al. 2000:289). The peoples of Erizo, Hacha, and Waywaka all used Quispisisa obsidian despite the availability of local obsidian types. Hacha demonstrates the furthest and most intensive obsidian exchange during this period, with 40 out of 64 tested obsidian artifacts traveling approximately 160 km south from Quispisisa, 7 artifacts traveling approximately 160 km south from

Jampatilla, and only 12 artifacts made from the presently unlocated Acarí Type (Burger and Asaro 1979:297; Burger et al. 2000:294). At Hacha, ceramic styles point to interaction with peoples of the south highlands without corroboration by the obsidian data, as the two major south highland sources, Chivay and Alca, are absent, likely indicating differential systems of exchange (Burger et al. 2000:294).

Early Horizon

The Early Horizon (ca. 1200-200 BC) originally demarcated the rise and fall of the Chavín culture centered in the Ancash Department (Pozorski and Pozorski 2008:622-624). The ceremonial pilgrimage site of Chavín de Huántar spread a religious ideology and iconographic pantheon that connected groups through much of western Peru (Burger 2008). The Chavín sphere of influence facilitated exchange across Peru on a scale not previously experienced. Numerous Early Horizon sites only yielded Quispisisa obsidian or were Quispisisa-dominant, such as Media Luna in the Ica Department and Chavín de Huántar in the Ancash Department (Burger et al. 2000:308). This pattern of Quispisisa obsidian distribution occurs throughout the Chavín sphere of influence. Campanayuq Rumi is a Chavín site in Vilcashuamán, Ayacucho, located 60 km north of both the Quispisisa and Jampatilla sources, and excavation has yielded 678 obsidian artifacts (Matsumoto et al. 2013:181). Out of 370 artifacts analyzed via PXRF, Matsumoto et al. identified 309 as belonging to the Quispisisa source (Matsumoto et al. 2018:54). It is possible that the function of Campanayoq Rumi was tied to control of the Quispisisa Source, marking the first major settlement associated with sociopolitical control of, or influence over, the obsidian source (Burger 2013:330). The presence of Alca obsidian at Chavín de Huántar may also tie Chavín to Cuzco (Burger et al. 2000:314).

Early Intermediate Period

The Early Intermediate Period (200 BC-AD 650) is marked by the decline of the expansive Chavín sphere of influence and the rise of local traditions such as Moche, Recuay, Huarpa, and Nazca (Jennings 2010:40). The Pucara polity of the Lake Titicaca Basin emerged slightly before the Early Intermediate Period, controlling most of the northern Lake Titicaca Basin and expanding its influence as far as Chumbivilcas in Cuzco (Burger et al. 2000:315). This political influence is reflected in obsidian acquisition, with 30% of obsidian at the site of Pucara coming from the Alca Source and 70% from Chivay (Burger at al. 2000:315). These ratios do not occur in other Pucara culture sites, such as Taraco and Qaluyu, however, with Chivay dominating most assemblages. The greater presence of Alca obsidian at Pucara, whose source is approximately 260 km west of the site, indicates more direct political and economic interactions with peoples in the Cuzco region than at other Pucara culture sites. Pucara's role as a sociopolitical center may explain greater ties to Cuzco and thus the Alca source, as other sites of distinct importance have shown similar patterns of higher-than-usual proportions of Alca obsidian (Burger et al. 2000:317).

Middle Horizon

The Middle Horizon (cal. AD 650-1050) is defined by the rise and fall of the Wari and Tiwanaku polities. The type-site of Tiwanaku sits on the southern edge of Lake Titicaca in Bolivia and was the locus for a religious tradition and set of iconographic images also seen in Wari materials. Research on obsidian found at Tiwanaku sites has revealed two key findings: obsidian occurs in low frequency and people prioritized local sources regardless of quality (Burger et al. 2000; Craig et al. 2007; Goldstein 2005, 2013). Goldstein argues that low quantities of obsidian at Tiwanaku sites in the Moquegua Valley indicate non-market acquisition by comparing them to obsidian found at the Wari settlement of Cerro Baúl (2013:377). A larger and more diverse obsidian assemblage would likely reflect market acquisition as the Tiwanaku had other goods suitable for trade. It is perhaps due to Wari control of obsidian sources and the lack of a market exchange system that limited Tiwanaku acquisition.

At the Moquegua Wari sites of Cerro Baúl, Cerro Mejía, and Mejía Ladera, occupants acquired obsidian from the Alca source, with lower quantities of Chivay and Quispisisa present (Williams et al. 2012). This suggests Wari control of obsidian acquisition and distribution typical of a redistributive economy rather than a market-based one. Similar patterns of source preference exist at other Wari or Wari-influenced sites such as Conchopata, Huari, Pikillaqta, Jincamocco, and Qasawirka. Jincamocco is perhaps the best example of Wari's redistributive economy. Although located approximately 30km from the Jampatilla Source, Burger and Asaro assigned only 22 of 51 artifacts to this source while 24 were assigned to the more distant Quispisisa Source (Burger and Asaro 1977).

In their study of artifacts from Huari, Burger and Asaro identified obsidian from three distinct sources: Alca, Lisahuacho, and Quispisisa (1977). They assigned 50 artifacts to the Quispisisa Source, one to Alca, and one to Lisahuacho. As these came from surface collection, along with many other early sourcing studies, spatial and temporal contexts do not exist. However, the prevalence of Quispisisa Type obsidian from Conchopata and Patipampa follows a similar pattern of dominance indicative of administrative acquisition and redistribution (Goldstein 2013; Hirth et al. 2006).

Andean Obsidian Sources

The first mention of Peruvian obsidian comes from missionary Fray Domingo de Santo Tomás' Quechua dictionary, published in 1560 (Petersen 2011:10). *Quispi rumi*, or transparent rock, is the definition given. While other missionaries published translations for obsidian in Quechua and Aymara, little to no attention was paid to the material until early 20th century archaeological investigations in Peru. The first description of Andean obsidian sources and their pre-colonial exploitation was published in Georg Petersen's 1970 text *Minería y Metalurgia en el Antiguo Perú*, though most information came from personal communications.

In 1975, Waldo Avila Salinas published the second geochemical analysis of Peruvian obsidian. Salinas utilized x-ray fluorescence (XRF) spectrography to analyze samples from Bolivia, Argentina, Peru, and Chile (1975). Soon after, Richard Burger and Frank Asaro published "Trace Element Analysis of Obsidian Artifacts from the Andes: New Perspective on Pre-Hispanic Economic Interaction in Peru and Bolivia," a defining text that chemically fingerprinted eight distinct obsidian sources in the Andes. Burger and Asaro used instrumental neutron activation analysis (INAA) and XRF to conduct their analyses and found "disturbing differences" between their results and Salinas', with Salinas' geochemical data holding no weight (Burger and Asaro 1977:6). A second collection of Peruvian obsidian was analyzed in 1977 and 1978 and resulted in the chemical identification of two additional sources of obsidian (Burger et al. 1998b:186).

During the Middle Horizon, "Not only was Quispisisa obsidian brought into areas which did not traditionally have access to obsidian… but also pieces of exotic obsidian are found in areas which used other types" (Burger and Asaro 1977:45-46). In the following year, Burger and Asaro published a paper with new data and an emphasis on theories of exchange during the preceramic period (Burger and Asaro 1978). Patterns of obsidian distribution in the preceramic are markedly different from in the Middle Horizon. “Ayacucho Type” obsidian was only found at preceramic sites in the Ayacucho region yet was absent from the much later Huari surface collection (Burger and Asaro 1978:69). The data produced by Burger and Asaro allowed for new assessments of exchange, verticality, and resource utilization in the Andes by revealing patterns of source utilization over space and time.

Jampatilla

One of Burger and Asaro’s ten obsidian types was dubbed the “Pampas Type” due to its frequency at sites located near the Rio Pampas drainage in southern Ayacucho (Burger and Asaro 1977:55). The geographic isolation of Pampas Type obsidian pointed to the geological source being located near the Carhuarazo Valley (Burger et al. 1998a:225). In 1981, archaeological survey conducted by Katharina Schreiber near Huaycahuacho resulted in the discovery of this source, approximately 130 km south of Huari (Burger et al. 1998a:226). In 1993, geological samples underwent INAA and matched the Pampas Type signature (Burger et al. 1998a:228). The source is located on the Jampatilla ridge in the Carhuarazo Valley; thus, the Pampas Type is now referred to as Jampatilla Type obsidian.

Jincamocco, a Wari administrative center in the Carhuarazo Valley, contained obsidian artifacts that were geochemically matched to the Jampatilla Type (Burger et al. 1998a:227). A small Wari imperial facility, Willkaya, is located directly to the northwest of the obsidian source (Schreiber 1992:156). Construction of a small imperial facility in such close proximity to the Jampatilla source may indicate state control of the resource (Schreiber 1992). Jampatilla obsidian was not found in Burger and Asaro's 52-piece surface collection from Huari (Burger and Asaro 1977), however I have identified one piece of the type from the Patipampa collection. This may support Schreiber's hypothesis that the Wari at Willkaya controlled the Jampatilla outcrop. During the Qasawirka/Wari phase at the site of Waywaka in Andahuaylas, approximately 110 km southeast from Huari, Jampatilla Type obsidian was found (Burger et al. 2006:112). Including Huari, these are the only sites where Jampatilla obsidian has been found.

During the 1980s and early 1990s, political conditions in Peru resulted in a hiatus of obsidian provenance studies with few papers published (Burger and Asaro 1982; Burger et al. 1984). Beginning in the 1990s, obsidian-sourcing efforts in the Andes continued.

Alca

The second source to be located from Burger and Asaro's ten distinct obsidian sources, originally referred to as the Cuzco Type, was heavily utilized in the Cuzco Valley and "rarely found in areas outside of the southern highlands of Peru" (Burger et al. 1998b:186). Frequency relative to location of this obsidian type in the archaeological record pointed to an origin in or around the Cuzco basin. In 1981, Burger analyzed a cobble of obsidian found on Cerro Santa Rosa in the Arequipa Department via XRF and tentatively matched it to the Cuzco Type (Burger et al. 1998b:186). In 1984, anthropologist Paul Trawick confirmed the location of the obsidian deposit and in 1994 Burger confirmed a match to the Cuzco Type via INAA. Due to its proximity to the village of Alca in the Arequipa Department, it is now known as the Alca Source.

A 1999 geoarchaeological survey set out to determine the extent of the Alca Source. Samples from six discrete locations as well as artifacts from the site of Quelcatani were analyzed via INAA (Rademaker et al. 2013:781; Jennings and Glascock 2002:110). Analysis revealed that the Alca Source contained a primary geochemical type (Alca-1) and six sub-groups (Jennings and Glascock 2002:112). Most obsidian deposits are fairly homogeneous in chemical composition, but Alca is an exception, stretching multiple kilometers along the slopes of Chococco River.

Alca obsidian is present at numerous Middle Horizon sites with evidence of Wari contact or control. These include Huari, Marca Huamachuco, Jincamocco, Cerro Baúl, Cerro Mejia, Mejia Ladera (Williams et al. 2012:75), and Wimpillay (Burger 2000:330-332). The presence of Alca Type obsidian at Marca Huamachuco, a site with evidence of Wari contact, is remarkable in that the source is over 1000km to the south. John and Theresa Topic believe there was little influence from the Wari and argue that the Wari copied the architectural style of Marca Huamachuco to use elsewhere (Topic 1991; Topic and Topic 2010). Burger argues that Wari interaction at Marca Huamachuco is responsible for the appearance of Alca obsidian (2000:337). Archaeologists have not found evidence of obsidian traveling this distance prior to the rise of the Wari and signals, at the least, an economic relationship between the Wari and people of Marca Huamachuco.

Quispisisa

It was originally believed that a major source of obsidian was located near the Quispisisa hamlet in San Genaro, Huancavelica Department, however this was found to be incorrect (Petersen 2011:11; Burger and Glascock 2002:344). Quispisisa Type obsidian was dominant in most of the site samples analyzed by Burger and Asaro in the 1970s, though its exact location remained unknown. Due to its prevalence, archaeologists prioritized finding this source and, in 1999, Burger and a team located the true Quispisisa source near Cerro Hatunrangra, Huanca Sancos Province, Ayacucho Department, approximately 110 km south of Huari (Burger and Glascock 2000, 2002:354). Geological samples were collected and analyzed via INAA, confirming that the Cerro Hatunrangra trace elements matched those of artifacts previously typed as Quispisisa in origin. Despite being located over 100 km from where scholars originally believed it to exist, this outcrop of obsidian defines the location of Quispisisa Type obsidian. Tripcevich and Contreras continued this work by surveying other Quispisisa outcrops across the Urabamba River from Cerro Hatunrangra, finding evidence of extensive prehispanic quarrying (Tripcevich and Contreras 2011).

Where obsidian sourcing has been conducted, Quispisisa Type has been identified at nearly every Wari site (Asaro and Burger 1977; Burger et al. 2000b). Nodules are large, sometimes exceeding 30 cm in size on one side, and can exhibit gray banding as well as red coloration. Tripcevich and Contreras found 34 quarrying pits and have estimated that at least 32,000 m^3 of obsidian has been quarried from Quispisisa (Tripcevich and Contreras 2011:128). Due to the difficulty in dating quarrying activity, archaeologists are unable to discern what quantity of Quispisisa obsidian the Wari extracted, though clearly they conducted intensive mining activities.

Puzolana

Originally named “Ayacucho Type” obsidian due to its frequency in the Ayacucho archaeological record, this type is now known as Puzolana as it occurs in layers of rhyolitic tuff locally known as *puzolana* (Burger and Asaro 1977:30). Outcrops appear around the city of Ayacucho at Cerro Campanayoq, the Chupas outcrop, and Ladera Ñawimpuquio at the south end of the city, and Cerro Buena Vista or "La Picota" further north (Burger et al. 2000:290; Huamán and Álvarez 2009). While exploited during the Preceramic in the Ayacucho Basin, Puzolana Type obsidian was overshadowed by Quispisisa Type despite the two being over 90 km apart. Researchers have identified Puzolana obsidian at only two Middle Horizon sites: Conchopata and the Vegachayuq Moqo sector of Huari (Burger et al. 2016; Kaplan 2018). Nodules of this obsidian rarely exceed 5cm on one face, making them mostly unsuitable for producing bifaces similar in size to those found at Huari. However, Puzolana Type obsidian exhibits color characteristics unlike the other types of Andean obsidian. Most nodules are either black or dark green and are frequently banded with gray; many also exhibit color change when tilted in the light. Other colors found in Puzolana nodules include red, purple, brown, silver, and gold. With color playing an important role in daily and ritual life for the Wari, the near total absence of this type may indicate that obsidian was primarily viewed as a functional resource of economic and political advantage rather than for aesthetic or cosmological purposes.

Methods

As the Patipampa excavation sought to reveal and investigate architectural spaces used in day-to-day life at Huari, I chose to focus on artifacts excavated from within clearly defined architectural spaces. Artifacts analyzed from outside of architectural spaces were from units later designated as EAs, from units adjacent to EAs, or were deemed ‘special finds’, such as bifaces. Analysis of the complete assemblage would have been ideal, but was outside of the scope of this study. Almost all artifacts came from deliberate room fill and most obsidian appears to have been purposefully broken for deposition.

In total, excavators found 2,708 obsidian artifacts at Patipampa (table X). Of these, I analyzed the lithic attributes and elemental compositions of 446 obsidian artifacts. I used two PXRF spectrometers to analyze the elemental compositions of 356 obsidian artifacts from the 2017 field season and 90 obsidian artifacts from the 2018 field season. Dr. Patrick Ryan Williams and the Field Museum of Chicago’s Elemental Analysis Facility provided the Niton XL3t GOLDD+ PXRF, which I operated under Dr. Williams’ instruction. I collected these data from June 26-29th, 2018 in Ayacucho, Huamanga Province, Ayacucho Region, Peru at an approximate altitude of 2,760 meters above sea level. I analyzed 356 artifacts from the 2017 season and 7 from the 2018 season using the Niton. At Binghamton University, I analyzed 24 artifacts from the 2017 season and 86 artifacts from the 2018 season using a Bruker Tracer III-SD PXRF on March 18th, 2019.

Lithic Attribute Analysis Methods

I analyzed lithic attributes of 446 obsidian artifacts in Ayacucho, Peru in June 2019. For each artifact, I recorded weight (g), presence/absence of cortex, debitage type (flake, angular shatter), condition (complete, proximal, medial, distal), flake termination (feather, step, hinge, plunging), type, and size grade, as applicable. My categories and recording processes were influenced by Bencic's (2015) analysis of the Conchopata lithic assemblage. One goal of the Patipampa excavations is comparison to Conchopata artifact analyses. I felt a similar process to Bencic's would facilitate future comparisons.

Cortex

The presence or absence of cortex on the dorsal surface of a flake or on shatter debitage can be used to discriminate between extremes of the lithic reduction process when compared against other attributes (Odell 1989). For instance, a piece of shatter debitage with cortex present is more indicative of early core reduction than a small flake with a feather termination (Kooyman 2000; Morrow 1997). In my analysis, I chose only to record presence and absence of cortex and not the quantity of cortex when present (i.e. 10%, 25%, 50% coverage). This is because percent cortex cover is not a reliable metric for gauging reduction stage or manufacturing processes (Odell 2004:127). Raw material type, material availability, technological trajectory, and cultural preference can affect the amount of cortex cover on an artifact (Andrefsky 1998:114; Bradbury and Carr 1995; Eerkens et al. 2010:829).

Debitage Type

I separated debitage into two categories: flakes and angular shatter. I categorized flakes as either complete, proximal fragments, medial fragments, or distal fragments.

Flakes demonstrated at least one of the following characteristics: evident flake termination, a striking platform, a ventral surface free of previous flake removal, and/or a bulb of percussion. I classified shatter as pieces that did not meet any of these criteria. Shatter is likely indicative of early stages of core reduction and, for a homogeneous material such as obsidian, reduced effort of material conservation as shatter creates undesirable, irregular core surfaces (Morrow 1997; Odell 2004).

Condition

For all non-shatter artifacts, I classified condition as complete, proximal fragment, medial fragment, or distal fragment. Fragment analysis facilitates understanding of intentional breakage and/or trampling damage (Jennings 2011; Pryor 1988; Root et al. 1999).

Fracture

I recorded radial, wedging, burin, and bipolar fractures when present on biface and uniface fragments. These characteristics may determine patterns of intentional breakage and deposition (Espinosa and Belardi 2019; Jennings 2011; Weitzel 2011). While Bencic did not analyze these fractures, she interprets debitage and other fragments of lithic artifacts as being intentionally broken and deposited at Conchopata (2015).

Flake Termination

I recorded termination when present on flakes and retouched flakes. The four classifications I used were feather, step, hinge, and plunging. Feather terminations are desirable in most stages of reduction as they create a regular surface and thus predictable flake removal (Odell 2004). Step, hinge, and plunging fractures create irregular surfaces and are generally undesirable. Irregular surfaces are often difficult or impossible to correct and lead to material waste (Odell 2004). Flake termination is an avenue to understanding skill level as well as material conservation, and thus implications for material availability.

All lithic attributes are presented in Appendix A.

<u>*Lab Methods*</u>

During the 2017 field season, I processed and cataloged all lithic materials off-site at our lab in Ayacucho. I washed all flaked stone artifacts using tap water and a toothbrush to remove soil. I then separated what I deemed to be special finds, typically whole implements or clearly retouched pieces. I photographed lithics from each locus as a group and then photographed special finds from within that locus. Special finds were cataloged with the preface HE. Photographing each locus expedited my initial sample selection for geochemical analysis, as I could readily determine loci lacking obsidian by viewing the lithics from each locus without the need to search though all bags.

2018

At the start of the 2018 field season, I selected artifacts for PXRF analysis. I chose artifacts based on size, ensuring each would fill a 10mm by 10mm square—more than enough to cover the aperture of the Niton. I applied the same selection criteria to the Bruker analysis as well. Obsidian diameter does have an effect on readings when the aperture is not completely covered (Davis et al. 2011:94). A 3mm small-spot collimator was available to use, but was unnecessary due to the size of artifacts chosen for analysis relative to the aperture. Thickness was not a deciding factor in sampling, with substantial distortion of mid-Z readings typically occurring at sub-1.5 mm thicknesses[1] (Davis et al.

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[1] This study was conducted on a desktop EDXRF, however results are expected to be similar when using a PXRF.

2011:94). I did not analyze any artifacts of sub-1.5mm thickness. The study by Davis et al. also determined that surface variability did not have a significant effect on readings, thus I did not choose a standard orientation of flaking or discriminate based on surface texture (2011:95). My 2017 assemblage sample size originally included 532 artifacts (selecting all artifacts >10mm) but I further narrowed it to 364 based on archaeological context, prioritizing artifacts found within architectural spaces. I selected 94 artifacts from the 2018 season, 84 of which were exported for analysis at Binghamton University. Selection criteria for the 2018 season artifacts was narrowed to special finds such as biface fragments, retouched flakes, and unique obsidian texture and form for ease of export processing. This creates a bias against debitage and shatter.

All measurements were collected while the Niton was positioned vertically, artifacts resting above the included aperture membrane cover, and controlled via USB connection and Thermo Scientific Niton Data Transfer software. I controlled the Bruker using a USB connection and Bruker's S1PXRF software. These processes reduce human error in positioning of the instrument and duration of readings. The stand for the Niton is too large for travel and was not brought to Peru. John Janusek, Patrick Williams, and I improvised a stand for the Niton. Using a shoebox, plastic cups, and foam, we created a stable apparatus for vertical positioning and hands-free operation. I used a conventional stand for Bruker operations, again positioned vertically so I could rest the artifacts on the aperture membrane cover.

Niton Operation

Prior to my analysis, calibration of the instrument occurred at the Field Museum. I used four standards as controls in order to verify readings. I ran two obsidian and two soil standards at the start and end of each day of analysis: El Chayal, Guatemala obsidian (ELC001); Snake River, Wyoming obsidian (CRB2005); NIST-2710 soil standard; and NIST-2711 soil standard, in that order. I ran each standard and each artifact twice. The first run was always Test All Geo (TAG) mode at 30 seconds each for the Main, Low, Light, and High filters. As Rb concentrations above 150ppm are imprecise in TAG, each sample was then run in Soils mode on the Main filter for 120 seconds to collect reliable Rb readings. For this analysis, the Niton collected reliable measurements of K, Ca, Ti, Mn, Fe, Zn, Rb, Sr, Y, Zr, Nb, Pb, Th, and U.

The Niton operates with a geometrically optimized large area drift detector and utilizes an Ag anode tube operating at 6-50 kV and 0-200 µA. Due to the large area drift detector and Ag anode tube, accurate measurement at high altitude is achievable. While the heaviest element used in characterizing the assemblage was only Zr, heavier elements give fewer counts in low-atmosphere conditions; the presence of air increases current requirements and thus counts, improving reading sensitivity of heavier elements (Shackley 2011a:56).

Bruker Operation

Bruker calibrates each instrument, creating a calibration coefficient specific to each Tracer PXRF along with recommended operating parameters. I used a geological sample taken from the Puzolana Source in Ayacucho as a control as I was unable to acquire a rhyolite standard in time for my analysis. After every 20 samples, I ran the Puzolana sample to check for reading drift. I operated the Bruker using the yellow filter, as lighter elements are not needed for source identification. This setting allows for reliable measurements of Fe, Co, Cu, Zn, Ga, As, Pb, Se, Th, Rb, U, Sr, Y, Zr, Nb, and

Mo. All measurements were taken at 40kV and 30μA for 60 seconds. Jeffrey Pietras, assistant professor of geology at Binghamton University, then calibrated the raw measurements, outputting values in weight percent for Fe and parts-per-million (ppm) for all other elements.

Elemental Analysis of Obsidian

Obsidian is a natural glass, beginning as silicic magma that undergoes fractional crystallization. Obsidian, like all other glasses, is an amorphous or non-crystalline solid. When formed, fractional crystallization separates trace elements based on their ability to crystalize with solids, leaving other trace elements to be absorbed by the liquid magma (Shackley 2005:10). Concentrations of trace elements "are affected by the initial amounts present in the melted rock, the temperature and pressure of the magma, and additional melting that takes place as the magma rises to the surface" (Glascock et al. 2007:527). As the liquid magma rapidly cools, crystallization does not take place and obsidian is formed, typically resulting in a chemically homogeneous source that can be fingerprinted.

The main elements used to source Andean obsidian via PXRF are as follows: Ti, Fe, Rb, Sr, and Zr. I did not collect Ti data using the Bruker as changing operation modes and filters was not in the scope of my analysis. Scientists often measure other trace elements for analyses conducted by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) and instrumental neutron activation analysis (INAA), but most are not measured confidently via PXRF. By comparing the calibrated PXRF data to source standards produced by Michael Glascock et al., I have assigned the artifacts analyzed to specific obsidian sources, though some remain anomalous (Glascock et al. 2007).

Analysis

I conducted attribute and PXRF analyses on 446 obsidian artifacts from Patipampa. Attribute analysis reveals information on production, consumption, and depositional practices of the Patipampa obsidian. A complete description of lithic attributes is presented in Appendix A. Using PXRF analysis, I identified source locations of the obsidian.

Lithic Attribute Analysis

Due to size restrictions in PXRF analyses, my attribute analysis and assemblage are biased against sub-10mm artifacts. This becomes problematic when examining end-stages of manufacture and retouch practices. However, >10mm debitage and fragments still provide useful data on general early-stage reduction, consumption, and depositional practices at Patipampa.

Debitage

270 of the 446 artifacts I analyzed are debitage, including 136 pieces of angular shatter and 134 flakes. Percentages are presented in Table 2. This high proportion of angular shatter may indicate little need or desire for the people of Patipampa to conserve obsidian (Morrow 1997; Odell 2004).

Obsidian Debitage Counts		
	n=	**Percentage**
Flakes	134	49.6%
Shatter	136	50.4%
Total	**270**	**100%**

Table 2. Obsidian debitage counts and percentages.

The proportion of complete to fragmented flakes is nearly equal, as shown in Table 3. The complete flakes and distal fragments allowed me to record flake termination, an avenue for interpreting manufacture skill level.

Obsidian Flake Condition		
	n=	**Percentage**
Complete	65	48.5%
Proximal Fragment	26	19.4%
Medial Fragment	21	15.7%
Distal Fragment	22	16.4%
Total	**134**	**100%**

Table 3. Obsidian debitage condition counts and percentages.

I was able to record flake termination types on 87 flakes, with 59.8% being "undesirable" rather than feather terminations (Table 4). The high proportion of step, hinge, and plunging fractures suggests the people working the obsidian were not highly skilled and/or not concerned with material conservation. However, my analysis does not include sub-10mm debitage from field screening or debitage from heavy fraction contexts.

Obsidian Flake Termination		
	n=	**Percentage**
Feather	35	40.2%
Step	5	5.8%
Hinge	38	43.7%
Plunging	9	10.3%
Total	**87**	**100%**

Table 4. Obsidian flake termination counts and percentages.

75 pieces of debitage exhibit cortex, 27.8% of the analyzed debitage assemblage (Table 5). Of these, 45 pieces are angular shatter. The percentage of cortex present on flakes at Patipampa is comparable to the Vegachayuq Moqo assemblage (22.7%), but greater than the Conchopata assemblage (13.4%) (Bencic 2015:54; Kaplan 2018:171). The percentage of shatter with cortex at Patipampa is also higher than at Conchopata

(22.4%) (Bencic 2015:54). This high percentage of cortical shatter may indicate early stages of reduction (Kooyman 2000; Morrow 1997). It is likely that the people of Patipampa had access to large quantities of raw material and were not relying upon preforms and blanks for production. However, excavators did not find any hammerstones or obsidian cores at Patipampa. Production may have occurred in unexcavated areas or debitage was brought in from other areas of Huari.

Obsidian Debitage Cortex						
	Flakes		**Shatter**		**Flakes and Shatter**	
Cortex	**n=**	**Percentage**	**n=**	**Percentage**	**n=**	**Percentage**
Absent	104	77.6%	91	66.9%	195	72.2%
Present	30	22.4%	45	33.1%	75	27.8%
Total	**134**	**100%**	**136**	**100%**	**270**	**100%**

Table 5. Obsidian debitage cortex counts and percentages.

Very few pieces of debitage exhibit retouch, evenly split between flakes and shatter debitage (Table 6). The presence of retouched flakes and shatter indicates expedient tool production, though minimal compared to formal biface and uniface production.

Retouched Obsidian Debitage						
	Flakes		**Shatter**		**Flakes and Shatter**	
Retouch	**n=**	**Percentage**	**n=**	**Percentage**	**n=**	**Percentage**
Unifacial	1	33.3%	2	33.3%	3	50%
Bifacial	2	66.6%	1	66.6%	3	50%
Total	**3**	**100%**	**3**	**100%**	**6**	**100%**

Table 6. Retouched debitage counts and percentages.

Formal Implements

I included 13 complete obsidian implements in my analysis (Table 7). Three of these are straight base lanceolate bifaces (Figure 5), or provisional type D in Vining's typology (Vining 2015:55). Two of the three are two-piece refits. Another straight base biface form is laurel rather than lanceolate in form (Figure 6) but is not present in the Cerro Baúl, Conchopata, or Vegachayuq Moqo assemblages. The most unusual obsidian implement from Patipampa is a biface in the form of an axe or possibly a *tumi* (Figure 7). Additionally, the analyzed assemblage includes one lunate biface, one ovoid biface, a bifacial "core tool", one ovoid uniface, and one lunate uniface, among others. This is not wholly representative of the obsidian bifaces at Patipampa due to sample limitations.

Complete Obsidian Implement Counts		
	n=	**Percentage**
Biface	11	84.6%
Uniface	2	15.4%
Total	**13**	**100%**

Table 7. Complete obsidian implement counts and percentages.

Figure 5. HU386-02. Straight base lanceolate biface refit.

Figure 6. HU293-03. Straight base laurel biface.

Figure 7. HU651-01. Axe or *tumi*-shaped biface.

Implement Fragments

I analyzed a total of 143 implement fragments discernable from retouched debitage, as displayed in Table 8. I identified proximal and distal fragments only when complete, and all others I categorized as medial fragments. There is a high proportion of implement fragments to debitage, though this is biased by not being able to analyze sub-10mm artifacts via PXRF. I also recorded fracture types on implement fragments, categorized as radial, wedging, burin, and bipolar (Table 9). Radial and wedging fractures make up 94.4% of analyzed fragments. While these fracture types are not absolute signs of intentional breakage, archaeological and experimental studies suggest they are likely indicative of deliberate fracture rather than from use or trampling (Espinosa and Belardi 2019; Jennings 2011; Weitzel 2011). Most fragments are medial, demonstrating radial or wedging fractures on multiple edges. The people of Patipampa may have broken bifaces into multiple fragments to distribute across spaces. A refit and spatial analysis is needed for further exploration of this hypothesis.

Obsidian Implement Fragments						
	Biface Fragments		**Uniface Fragments**		**Total Fragments**	
Fragment	**n=**	**Percentage**	**n=**	**Percentage**	**n=**	**Percentage**
Proximal	23	18.6%	1	5.3%	24	16.8%
Medial	84	67.7%	14	73.7%	98	68.5%
Distal	17	13.7%	4	21.0%	21	14.7%
Total	**124**	**100%**	**19**	**100%**	**143**	**100%**

Table 8. Obsidian implement fragment counts and percentages.

Obsidian Implement Fracture Types						
	Biface Fractures		**Uniface Fractures**		**Total Fractures**	
Fracture	**n=**	**Percentage**	**n=**	**Percentage**	**n=**	**Percentage**
Radial	103	83.1%	15	79.0%	118	82.5%
Wedging	15	12.1%	2	10.5%	17	11.9%
Burin	5	4.0%	0	0.0%	5	3.5%
Bipolar	1	0.8%	2	10.5%	3	2.1%
Total	**124**	**100%**	**19**	**100%**	**143**	**100%**

Table 9. Obsidian implement fragment fracture type counts and percentages.

My attribute analysis is not exhaustive nor does it include all obsidian macroartifacts from Patipampa. However, the absence of cores, preforms, and obsidian artifacts in intermediate stages of production is clear. The absence of these artifacts does not preclude other areas in Patipampa from being workshop spaces, but excavated EAs do not demonstrate obsidian workshop characteristics.

PXRF Analyses

The Niton and Bruker instruments require different methods of reading calibration. Ryan Williams provided a spreadsheet for the calibration of the Niton readings based on calibration at the Field Museum (Golitko 2015a, 2015b). Bruker provides a calibration program called S1CalProcess that operates as a Microsoft Excel plugin. Jeffery Pietras used this program and Bruker's calibration coefficient to convert the measurement counts from my analysis to weight percent for Fe and ppm for all other elements. Calibrated results for the Niton analysis are presented in Appendix B and calibrated results for the Bruker analysis are presented in Appendix C.

The ratio of Sr vs. Rb is distinct enough to characterize most of the obsidian I analyzed. However, the Sr/Fe ratio vs. Rb allowed for further distinction.

Niton Results

I analyzed 363 obsidian artifacts using the Niton PXRF and confidently assigned 360 to known obsidian sources (Table 10). I identified 355 of the 363 artifacts analyzed using the Niton as Quispisisa Type. I identified four artifacts as Alca-1 and one as Jampatilla Type. Two artifacts are from unknown sources and one is likely lechatelierite, or natural glass often created by lightning. Figures 8 and 9 are bivariate plots with labeled characterizations.

Niton Analysis Source Characterizations		
Source	**n=**	**Percentage**
Quispisisa	355	97.8%
Alca-1	4	1.1%
Jampatilla	1	0.25%
Unknown	2	0.6%
Lechatelierite	1	0.25%
Total	**363**	**100%**

Table 10. Source characterizations from Niton analysis.

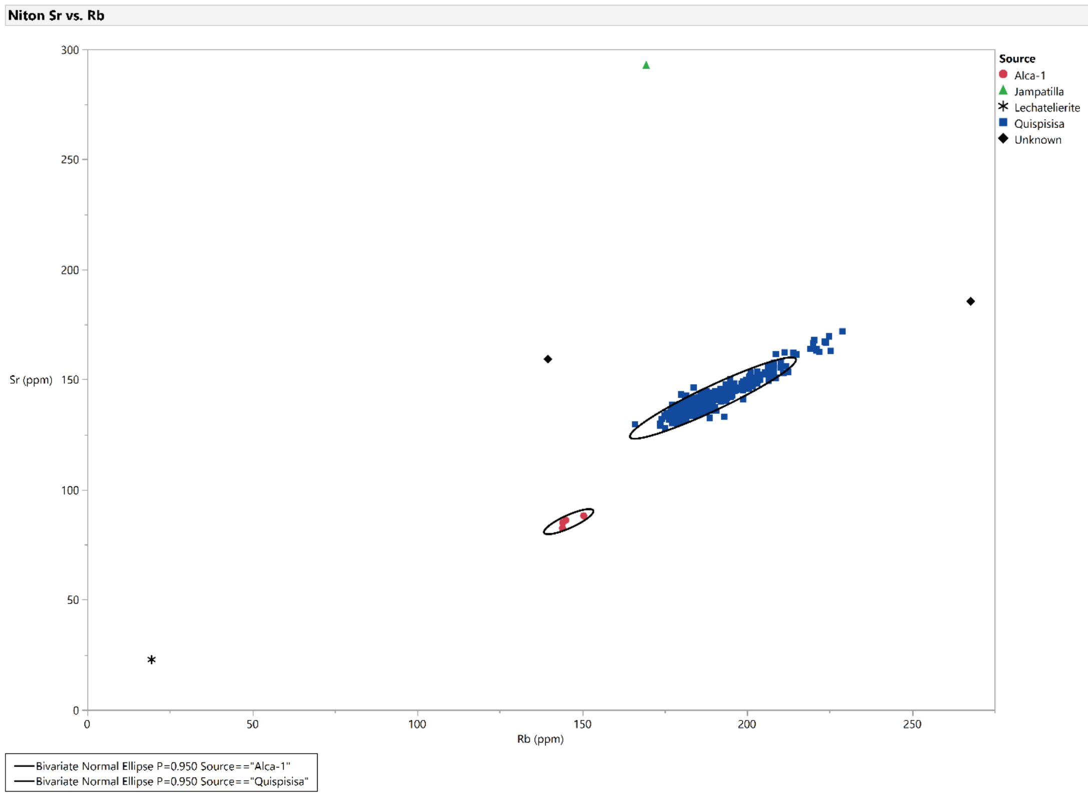

Figure 8. Bivariate plot of Niton Sr vs. Rb concentrations.

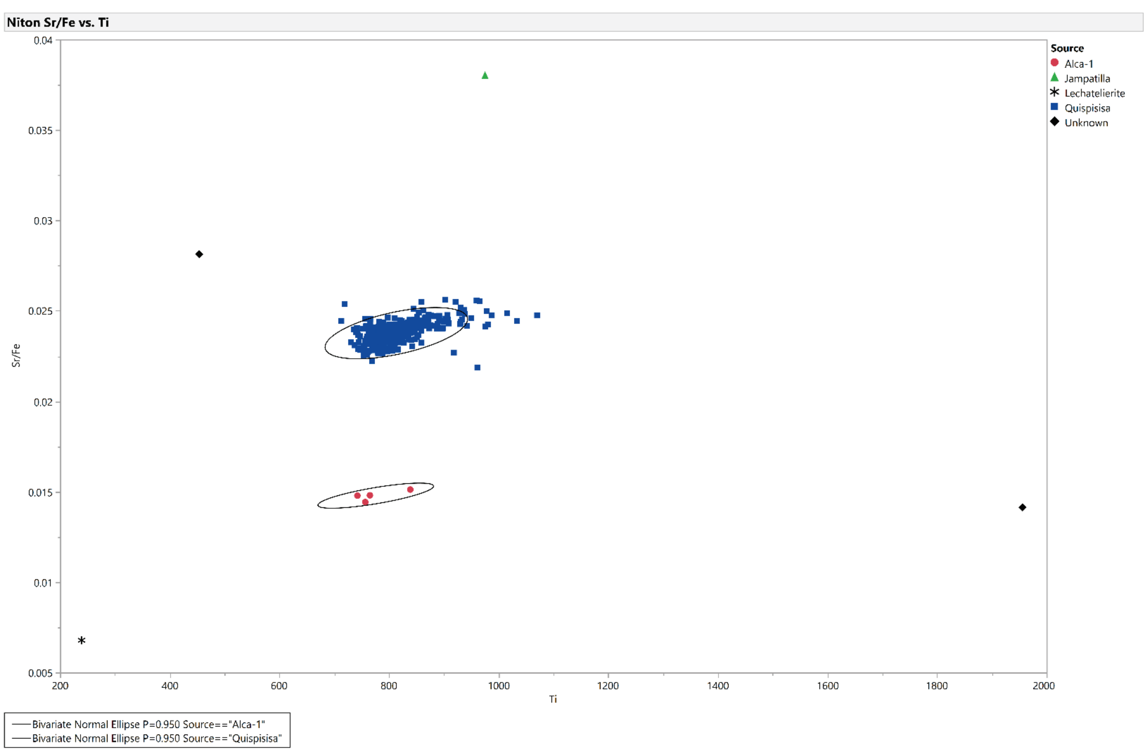

Figure 9. Bivariate plot of Niton Sr/Fe vs. Ti concentrations.

Bruker Results

Of the 110 artifacts I analyzed using the Bruker, 27 were artifacts that I had analyzed using the Niton in June of 2018. I chose to re-analyze these artifacts to compare results as shown above. Results below are of artifacts from the 2018 excavation at Patipampa. Of the 83 artifacts analyzed using the Bruker exclusively, I have characterized 76 as Quispisisa Type, three as Alca-1, four as Puzolana Type, and one from an unknown source (Table 11). The elements I used for characterizing this assemblage are Fe, Rb, Sr, and Zr (Figures 10 and 11).

Bruker Analysis Source Characterizations		
Source	**n=**	**Percentage**
Quispisisa	75	90.4%
Puzolana	4	4.8%
Alca-1	3	3.6%
Unknown	1	1.2%
Total	**83**	**100%**

Table 11. Source characterizations from Bruker analysis (artifacts from 2018).

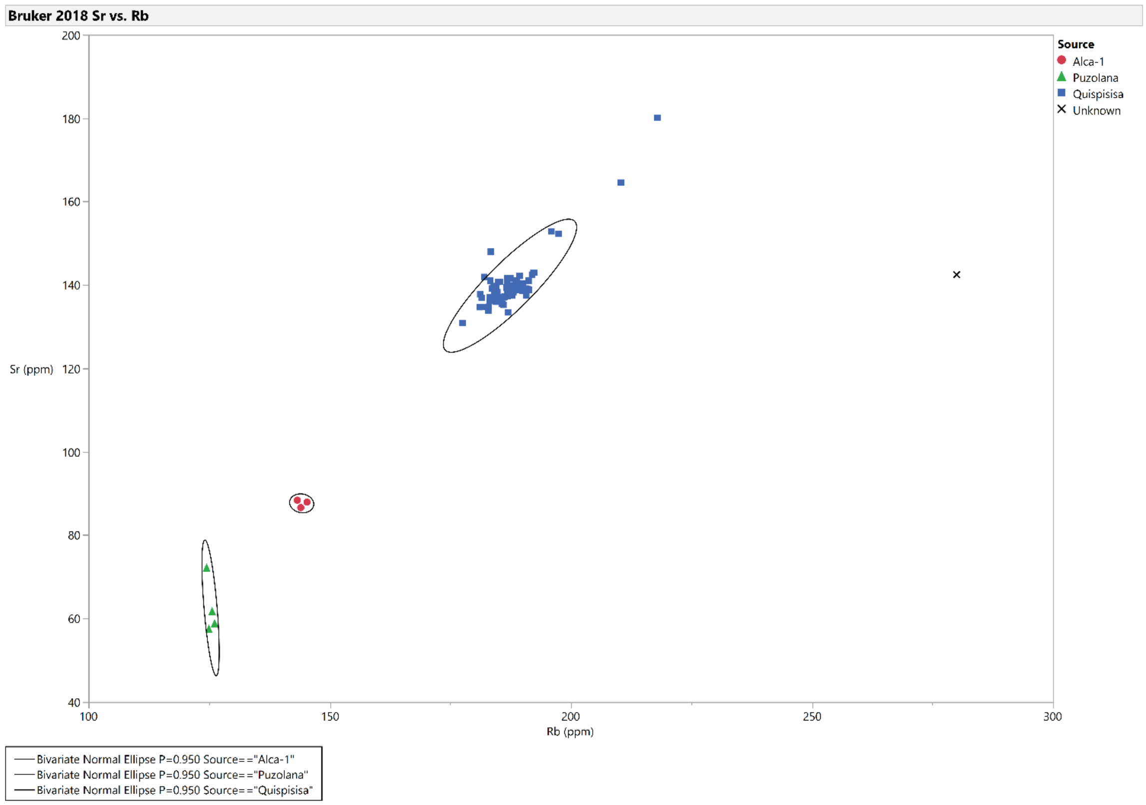

Figure 10. Bivariate plot of Bruker Sr vs. Rb concentrations.

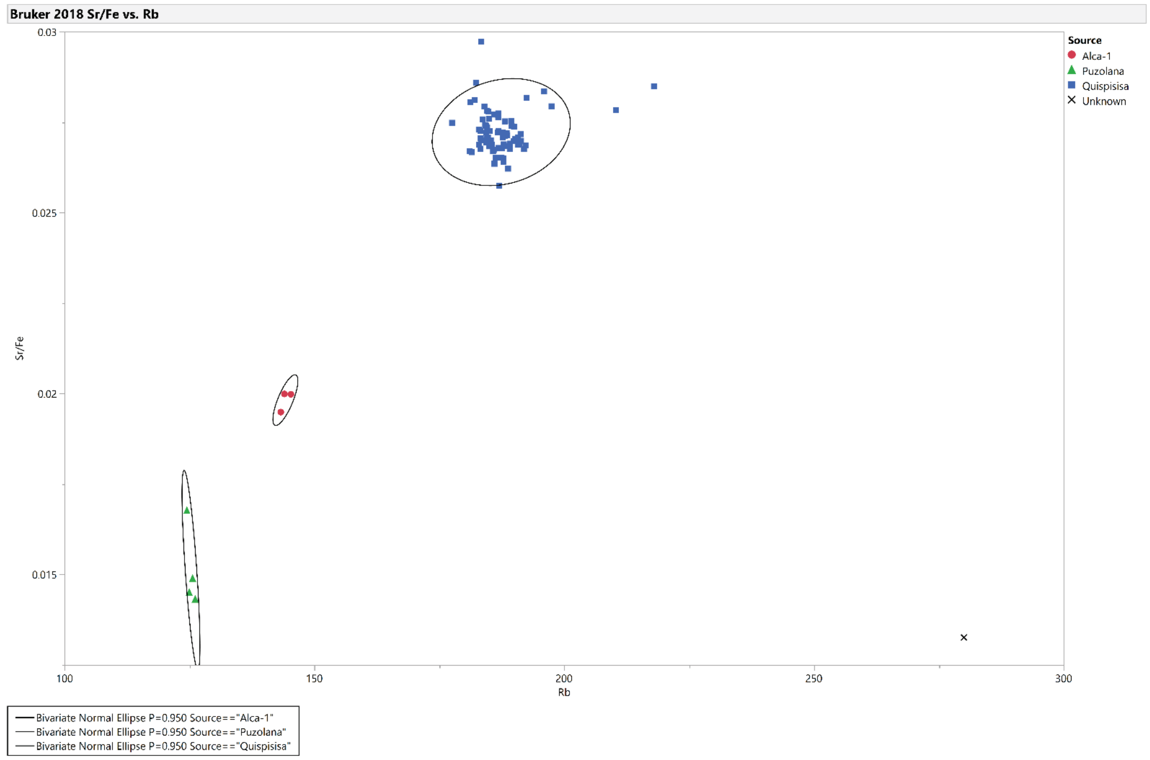

Figure 11. Bivariate plot of Bruker Sr/Fe vs. Rb concentrations.

Re-Analyzed Artifacts

I analyzed 27 artifacts using both the Niton and Bruker. Comparison across instruments and data sets can be problematic (Shackley 2011b). However, elemental concentrations fall within 95% confidence intervals for both instruments for these 27 artifacts (Figure 12). Drift is visible in comparing the analyses, but source characterizations are consistent.

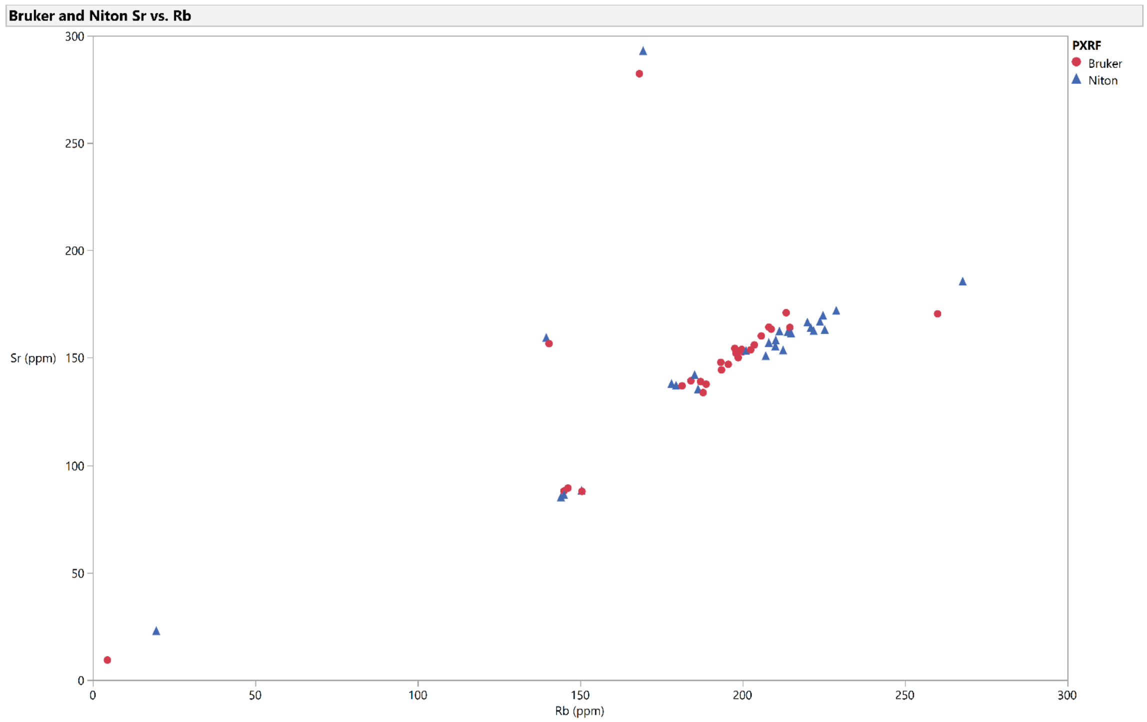

Figure 12. Sr vs Rb concentrations for artifacts analyzed using the Bruker and Niton.

Obsidian Ubiquity

In tested EA contexts at Patipampa, Quispisisa obsidian has 100% ubiquity (Table 12). Ubiquity for other obsidian types is low. This supports my hypothesis of centralized acquisition and redistribution (Hirth et al. 2006). EA18 is the only space excluded from my analytical assemblage due to lack of material context.

Obsidian Type Ubiquity in EA Contexts	
Source	**Percent Presence**
Quispisisa	100.0%
Puzolana	16.7%
Alca-1	22.2%
Jampatilla	5.6%
Unknown	16.7%

Table 12. Obsidian type ubiquity in EA contexts.

Discussion

The results of my obsidian analyses mostly correspond with previous studies (Williams et al. 2012; Bencic and Burger 2016; Kaplan 2018). That is, a clear majority of the assemblage originates from a single obsidian source. These results conform to a redistributive model of political economy with slight deviation (Hirth et al. 2006), possibly due to household or administrative acquisition (Kaplan 2018).

Quispisisa Assemblage

Quispisisa Type obsidian is ubiquitous spatially and temporally in excavated areas at Patipampa. The earliest associated date with Quispisisa artifacts is cal. AD 651 from locus 511 in EA8. The latest associated date with Quispisisa artifacts is cal. AD 935 from locus 379 in EA11.

Many obsidian artifacts from Patipampa conform to documented forms, but all exceptional or unusual pieces I analyzed are from the Quispisisa source. The location of the source may be significant with regard to these unusual artifacts; this should not be inferred and is outside the scope of this study.

A lack of source deviation supports the idea that Patipampa was a space for attached or state-sponsored craft production (Hirth et al. 2006). As the Wari government supported and supplied these craftspeople with daily resources, the craftspeople produced fine goods (jewelry) for the State.

Alca Assemblage

There is no significant patterning of Alca Type obsidian across Patipampa. However, I identified two pieces from Unit 40, the southernmost excavated area. Unit 40 may be a midden and has no associated architecture, obscuring interpretation. The only associated date with an Alca artifact is cal. AD 649 from locus 1081 in EA14B. This artifact, HU1081-01, is a biface fragment.

Puzolana Assemblage

Locations of Puzolana Type obsidian within Patipampa do seem significant. Excavators found two within EA14, the painted niched gallery. HU999-01 was located near the canal in EA13B. The fourth piece, found in EA16, was associated with human remains. I do not believe the acquisition of Puzolana obsidian was tied to the political economy of the Wari Empire, but instead was likely collected by the residents of Patipampa for ritual or non-utilitarian purposes. Nodules are visually distinct and the source is visible from the site of Huari.

Unknown Types

The presence of unknown types of obsidian may be a product of cosmopolitanism or Wari imperialism, entering the city as immigration occurred or as a byproduct of Wari activities elsewhere. HU532-03 is one of the few complete obsidian tools from Patipampa and was in an early floor intrusion. Unfortunately, this intrusion may have been a result of looting, ancient or modern, obscuring the primary context of the artifact.

I selected HU745-01 of EA16 due to its color and texture. Readings for this artifact do not match any known sources. An anomaly is visible under magnification and may be a result of vapor deposition during formation (Figure 13). Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) analysis can provide elemental analysis of isolated locations on artifacts and would determine if this anomaly affected my data (Williams et al. 2012).

Figure 13. HU745-01. Flake featuring potential vapor deposition.

HU531-01 is a unique artifact as it appears to be green obsidian, but its elemental composition does not match any known Andean obsidian. Concentrations of Ti, Fe, Rb, Sr, and Zr are much lower than expected for obsidian. The Niton could not detect concentrations for Mn, Zn, Y, Nb, Pb, Th, and U. Despite not being obsidian, I feel that this artifact's presence at Patipampa is significant enough to include in my results. Dr. Richard Naslund of Binghamton University helped to identify it as lechatelierite, a glass mineraloid that meteorites or lightning can create. Fulgurites are the variety of lechatelierite formed by lightning strikes. Meteorite impacts can produce tektites, natural glass objects with a high lechatelierite content. It is less likely that a meteorite impact created the mineraloid than a lightning strike considering their relative frequencies. If lightning formed this lechatelierite, someone removed pieces from the original fulgurite. Flake scars, prepared platforms, and crushed platforms are present on the artifact (Figure 14).

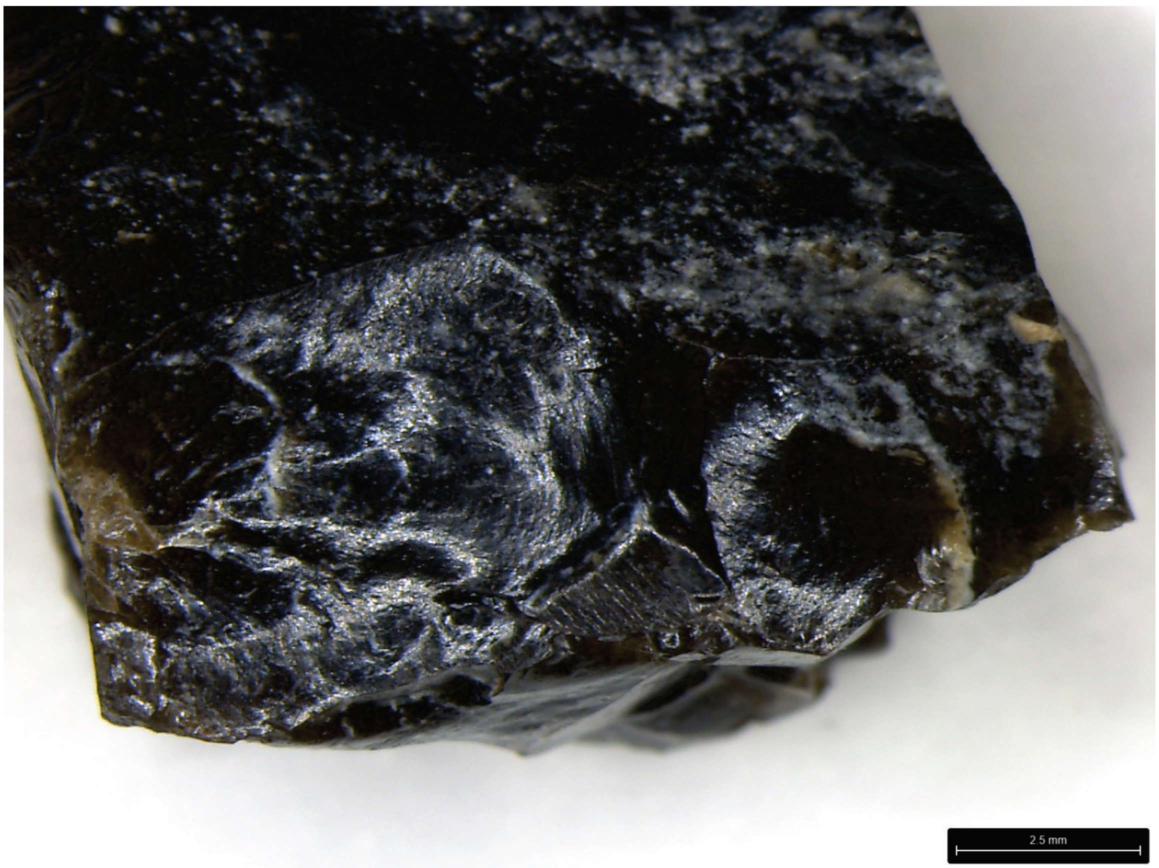

Figure 14. HU531-01. Lechatelierite.

As lechatelierite, HU531-01 has the most surprising and interesting provenance from the study, produced by lightning. Excavators also found a high density of camelid bones in locus 531, including an articulated cranium and vertebrae. This subfloor intrusion is possibly an offering or roomfill prior to the construction of a new floor. An associated carbon sample returned a date of cal. AD 719.

Comparison to Previous Sourcing Studies

In order to frame Patipampa within the larger Wari economy, I have compared my results to two previous obsidian sourcing studies at Conchopata and the Vegachayuq Moqo sector of Huari. Although all are located in the Ayacucho Valley, each site served a different function within the Wari Empire and had different resource requirements.

Conchopata

Conchopata was an urban settlement containing over 100 domestic architectural spaces primarily occupied by specialized ceramicists (Bencic 2015:19). Burger et al. (2016) analyzed the Conchopata obsidian assemblage and found that it was 99% Quispisisa Type and 1% Puzolana Type. Bencic and Glascock (2016) have suggested that the people of Conchopata had unrestricted access to Quispisisa obsidian considering its ubiquity and the prevalence of discarded tools at the site. 24.4% of the Conchopata obsidian assemblage is retouched (Bencic 2015:49), comparable to the 33.4% at Patipampa. Far less was excavated at Patipampa than Conchopata yet the Patipampa obsidian assemblage is over twice as large. Access to Quispisisa obsidian may have been truly unrestricted and unlimited for the residents of Patipampa. Conserving obsidian was not of apparent concern considering the low quantity of retouched flakes and high quantity of cortical shatter debitage.

The unmodified flake of Puzolana obsidian found at Conchopata was from an undisturbed elite tomb (Bencic 2015:50). Puzolana obsidian at Patipampa is associated with human remains and ritual contexts, but only as complete and shattered nodules.

The presence of Alca and Jampatilla obsidian at Patipampa also supports Bencic's theory that Conchopata was less cosmopolitan than other Wari sites (2015:320). The regular presence of Alca obsidian at Huari reflects the geographic extent of its trade networks. The same can be applied to Jampatilla obsidian, though less distant.

Vegachayuq Moqo

Kaplan's (2018) analysis of obsidian from the Vegachayuq Moqo sector of Huari, an elite ceremonial center containing D-shaped structures, demonstrates greater source variation than at Conchopata. A large data set, variation in sources, and proximity makes Vegachayuq Moqo an ideal comparison to my Patipampa data. Most of Kaplan's results refer to contexts prior to and during initial Wari settlement, placing a limitation on comparison. However, Ochatoma et al. interpret Vegachayuq Moqo's age based on Menzel's (1964) ceramic chronology rather than radiocarbon dating (Ochatoma et al. 2015). The presence of Alca obsidian at Vegachayuq Moqo is consistent with Burger and Asaro's (1977) analysis of Huari obsidian and my analysis of the Patipampa assemblage.

Kaplan also identified an unmodified nodule of Puzolana obsidian. Kaplan interprets the limited presence of Puzolana obsidian at Vegachayuq Moqo and Conchopata being caused by "an unprecedented influx of Quispisisa obsidian" (Kaplan 2018:198). The whole context of the Vegachayuq Moqo nodule is not mentioned, though the sector is an elite ceremonial center, and Puzolana obsidian may have only served ritual functions for the Wari.

At Vegachayuq Moqo, Alca obsidian increases in frequency during the transition to the Middle Horizon (Kaplan 2018:201). Kaplan (2018) interprets the presence of Alca in the assemblage as "more a byproduct of increased interregional interaction" than a product of demand (246). I believe my data support this idea. Alca obsidian at Patipampa is associated with early Middle Horizon contexts and the source lies within the Wari cultural sphere of influence.

Conclusion

Excavations at Patipampa have produced vast quantities of lithic implements, debitage, and lapidary goods but no formal workshops. Originally believed to be a domestic sector, evidence suggests semi-attached craftspeople may have occupied the space and produced luxury goods. While evidence of obsidian tool production, such as hammerstones and cores, is absent from the assemblage, people at Patipampa had access to considerable amounts of the material. The Wari State may have provided obsidian and other daily goods in exchange for the crafts produced at Patipampa. The high quantity of angular shatter and lack of material conservation fits a centralized provisioning model where the people of Patipampa were provided large quantities of obsidian by the State (Carballo 2013:124; Schortman and Urban 2004).

The obsidian economy within Patipampa is reflective of a larger trend within the Wari Empire. Quispisisa obsidian is ubiquitous through space and time at Patipampa, just as at Conchopata and Vegachayuq Moqo. This confirms my hypothesis that the people at Patipampa participated in a centralized, redistributive economy rather than a market or independent economy. The presence of Alca and Jampatilla Types may be the result of non-local residents bringing personal quantities of obsidian to Huari or may be byproducts of state activities. However, this is difficult to assess without understanding if Wari settlements near obsidian sources were established to control the resource. This avenue of research would aid in understanding the acquisition and distribution of obsidian throughout the Andes.

Puzolana obsidian is the only local obsidian in the Ayacucho Valley and has only been identified as whole nodules, shattered nodules, and an unmodified flake in Wari contexts. I do not believe this local obsidian held the same functions for the Wari State or people as the Quispisisa source did. Instead, it seems to have held specific ritual purposes.

I hope to see analyses of complete obsidian assemblages from Wari sites, particularly microdebitage. While more costly than XRF analysis, LA-ICP-MS is an excellent technique for geochemical analysis of obsidian microdebitage. Combined with microdebitage attribute analysis, this would provide new insights into obsidian tool production and exchange in the Wari Empire.

Appendix A: Lithic Attribute Analysis

Lithic Attribute Analysis Codes							
Code	**Ctx**	**DT**	**CD**	**FT**	**SZ**	**Form**	**Fracture**
1	Absent	Flake	Complete	Feather	10-20mm	Debitage	Radial
2	Present	Shatter	Proximal Fragment	Step	20-40mm	Biface	Wedging
3			Medial Fragment	Hinge	40-60mm	Uniface	Burin
4			Distal Fragment	Plunging		Bifacial Retouch	Bipolar
5						Unifacial Retouch	
6						Biface Fragment	
7						Uniface Fragment	
8						Nodule	

Lithic Attribute Analysis Results

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU39-02	39		CM	0.91	1	1	1	3	1	1		Quispisisa	
HU39-01	39		CM	2.10	1	2			1	1		Quispisisa	
HU45-01	45		23	3.60	1		3		1	6	1	Quispisisa	Edges abraded
HU68-01	68	1	29	0.67	1	1	1	3	1	1		Quispisisa	
HU68-03	68	1	29	1.19	1	2			1	1		Quispisisa	
HU68-02	68	1	29	0.46	1		3		1	4		Quispisisa	
HU79-02	79	1	29	0.58	1	1	4	1	1	1		Quispisisa	
HU79-01	79	1	29	0.89	1	1	3	3	1	1		Quispisisa	
HU79-03	79	1	29	3.74	2	2			1	1		Quispisisa	
HU87-01	87	1	29	0.68	2	1	1	1	1	1		Quispisisa	
HU93-01	93		25	1.80	1	2			1	1		Quispisisa	
HU93-02	93		25	3.90	1		4		2	6	1	Quispisisa	
HU93-03	93		25	3.10	1		3		1	6	1	Quispisisa	
HU100-01	100		32	1.33	1	2			1	1		Quispisisa	
HU118-01	118		CM	6.87	1	2			2	1		Quispisisa	
HU118-02	118		CM	5.57	1	2			2	1		Quispisisa	
HU118-03	118		CM	3.99	1	2			1	1		Quispisisa	
HU123-01	123	1	29	1.06	1		3		1	6	2	Quispisisa	
HU123-02	123	1	29	4.50	1		2		1	6	1	Quispisisa	
HU134-01	134	1	29	0.41	1	1	1	1	1	1		Quispisisa	
HU134-04	134	1	29	1.81	2	1	1	1	1	1		Quispisisa	
HU134-03	134	1	29	1.08	1	2			1	1		Quispisisa	
HU134-02	134	1	29	0.33	1		2		1	6	1	Quispisisa	
HU134-05	134	1	29	4.40	1		2		2	6	1	Quispisisa	
HU134-06	134	1	29	4.80	1		3		1	7	1	Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU149-01	149		CM	0.61	1	1	2	1	1	1		Quispisisa	
HU149-02	149		CM	3.48	1	2			1	1		Quispisisa	
HU181-01	181		35	1.13	1	1	1	3	1	1		Quispisisa	
HU186-07	186	3	36	0.74	1	1	4	3	1	1		Quispisisa	
HU186-06	186	3	36	0.62	1	2			1	1		Quispisisa	
HU186-03	186	3	36	2.42	2	2			1	1		Quispisisa	
HU186-04	186	3	36	3.12	2	2			1	1		Quispisisa	
HU186-05	186	3	36	1.30	1	1	3		1	1		Quispisisa	
HU186-01	186	3	36	3.30	1		4		1	6	1	Quispisisa	
HU186-02	186	3	36	1.09	1		3		1	6	1	Quispisisa	
HU187-01	187	2	32	0.50	1	1	2		1	1		Quispisisa	
HU190-01	190	1	35	0.62	1	2			1	1		Quispisisa	
HU190-03	190	1	35	1.31	1	2			1	1		Quispisisa	
HU190-02	190	1	35	0.51	1	1	2		1	1		Quispisisa	
HU192-01	192	4	37	1.11	1	1	1	3	1	1		Quispisisa	
HU192-02	192	4	37	1.17	1	2			1	1		Quispisisa	
HU192-03	192	4	37	1.82	1	2			1	1		Quispisisa	
HU193-01	193	4	37	0.94	2	2			1	1		Quispisisa	
HU194-01	194	3	36	2.42	1		3		1	6	2	Quispisisa	
HU197-04	197	4	37	1.20	1	1	1	3	1	1		Quispisisa	
HU197-03	197	4	37	1.04	1	1	1	4	1	1		Quispisisa	Burin flake
HU197-07	197	4	37	0.90	1	1	1	4	1	1		Quispisisa	
HU197-06	197	4	37	2.16	1	2			1	1		Quispisisa	
HU197-02	197	4	37	1.09	2	2			1	1		Quispisisa	
HU197-08	197	4	37	2.23	2	2			1	1		Quispisisa	
HU197-09	197	4	37	2.17	2	2			1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU197-05	197	4	37	1.22	1	1	2		1	1		Quispisisa	
HU197-10	197	4	37	1.76	1	1	3		1	1		Quispisisa	
HU197-01	197	4	37	1.90	1		1		1	2		Quispisisa	Ovoid biface made from shatter
HU198-01	198	2	32	3.01	1	2			1	1		Quispisisa	
HU198-02	198	2	32	1.08	2	2			1	1		Quispisisa	
HU200-03	200	3	36	0.56	2	1	1	1	1	1		Quispisisa	
HU200-02	200	3	36	2.39	1	2			1	1		Quispisisa	
HU200-01	200	3	36	0.65	2	2			1	1		Quispisisa	
HU200-04	200	3	36	8.60	1		3		2	6	1	Quispisisa	Ovoid biface fragment
HU203-02	203	1	35	0.65	1	2			1	1		Quispisisa	
HU203-01	203	1	35	1.22	1		3	3	1	6	2	Quispisisa	
HU204-01	204	2	32	0.56	1	1	3		1	1		Quispisisa	
HU206-01	206	1	35	2.23	1	2			1	1		Quispisisa	
HU213-01	213	5	39	0.67	1	2			1	1		Quispisisa	
HU213-02	213	5	39	0.62	1	2			1	1		Quispisisa	
HU213-05	213	5	39	1.84	1	2			1	1		Quispisisa	
HU213-03	213	5	39	0.85	1		4		1	6	1	Alca-1	
HU213-06	213	5	39	2.70	1		3		1	6	1	Quispisisa	
HU213-04	213	5	39	0.91	1		3		1	7	1	Quispisisa	
HU218-01	218	2	30, 32, 33	0.42	1	1	1	1	1	1		Quispisisa	
HU218-02	218	2	30, 32, 33	2.40	1		3		1	6	1	Quispisisa	Triangular biface fragment
HU222-01	222		40	1.06	1	1	1	1	1	1		Quispisisa	
HU223-01	223	1	35	0.73	1	2			1	1		Quispisisa	
HU230-02	230	3	36	0.65	1	1	4	1	1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU230-03	230	3	36	0.37	1	1	1	1	1	1		Quispisisa	
HU230-04	230	3	36	0.92	1	1	4	4	1	1		Quispisisa	
HU230-01	230	3	36	7.01	1	2			2	1		Quispisisa	
HU230-06	230	3	36	0.88	1	2			1	1		Quispisisa	
HU230-07	230	3	36	1.93	1	2			1	1		Quispisisa	
HU230-08	230	3	36	2.90	1		1		1	2		Quispisisa	Complete lunate biface
HU230-05	230	3	36	1.53	1		3		1	6	3	Quispisisa	
HU233-07	233	5	39	4.14	2	1	1	2	2	1		Quispisisa	
HU233-01	233	5	39	1.31	1	2			1	1		Quispisisa	
HU233-02	233	5	39	1.13	1	2			1	1		Quispisisa	
HU233-03	233	5	39	0.81	1	2			1	1		Quispisisa	
HU233-04	233	5	39	1.06	1	2			1	1		Quispisisa	
HU233-05	233	5	39	2.40	1	2			1	1		Quispisisa	
HU233-06	233	5	39	0.93	2	2			1	1		Quispisisa	
HU234-01	234	5	39	22.20	2	1	1	1	2	1		Quispisisa	
HU237-02	237	4	37	0.54	1	1	1	3	1	1		Quispisisa	
HU237-08	237	4	37	2.16	1	1	1	3	1	1		Quispisisa	
HU237-04	237	4	37	2.12	2	1	4	3	1	1		Quispisisa	
HU237-05	237	4	37	2.28	1	2			1	1		Quispisisa	
HU237-07	237	4	37	1.11	1	2			1	1		Quispisisa	
HU237-03	237	4	37	0.73	1		1		1	4		Quispisisa	Retouch to T-shape
HU237-01	237	4	37	1.07	1		3		1	6	1	Quispisisa	
HU237-06	237	4	37	2.89	1		4		1	6	2	Quispisisa	
HU237-09	237	4	37	4.50	1		3		1	6	1	Quispisisa	
HU237-10	237	4	37	3.80	1		3		1	6	1	Quispisisa	Crushing on lateral edge
HU237-11	237	4	37	3.80	1		2		1	6	1	Quispisisa	Straight base biface fragment

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU242-01	242	6	41	0.75	1	2			1	1		Quispisisa	
HU242-02	242	6	41	4.00	1		2		1	6	1	Quispisisa	Ovoid biface fragment
HU244-01	244	6	41	6.80	1		3		1	6	1	Quispisisa	Edges abraded
HU251-02	251	4	37	2.37	1	2			1	1		Quispisisa	
HU251-03	251	4	37	3.33	1	2			1	1		Quispisisa	
HU251-01	251	4	37	0.29	1	1	2		1	1		Quispisisa	
HU251-04	251	4	37	2.70	1		3		1	6	1	Quispisisa	
HU254-02	254	4	37	0.45	1	1	4	1	1	1		Quispisisa	
HU254-05	254	4	37	2.81	1	2			1	1		Quispisisa	
HU254-03	254	4	37	0.76	1	1	2		1	1		Quispisisa	
HU254-01	254	4	37	0.81	1		3		1	6	2	Quispisisa	
HU254-04	254	4	37	2.22	1		3		1	6	1	Quispisisa	
HU254-06	254	4	37	4.00	1		3		1	6	1	Quispisisa	
HU258-01	258	6	41	0.53	1	1	1	3	1	1		Quispisisa	
HU258-02	258	6	41	4.64	1		3		2	6	1	Quispisisa	
HU259-01	259	6	41	3.37	1	1	1	1	2	1		Quispisisa	
HU259-02	259	6	41	1.01	1	2			1	1		Quispisisa	
HU260-02	260	8	43	3.52	2	1	1	3	1	1		Quispisisa	
HU260-01	260	8	43	3.51	1	2			2	1		Quispisisa	
HU261-02	261	1	35	0.62	1	1	4	1	1	1		Quispisisa	
HU261-06	261	1	35	0.49	1	1	4	3	1	1		Quispisisa	
HU261-07	261	1	35	0.39	1	1	1	3	1	1		Quispisisa	
HU261-05	261	1	35	4.10	1	2			1	1		Quispisisa	
HU261-10	261	1	35	0.74	1	2			1	1		Unknown	
HU261-04	261	1	35	7.65	2	2			2	1		Quispisisa	
HU261-08	261	1	35	7.41	2	2			2	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU261-01	261	1	35	0.70	1	1	3		1	1		Quispisisa	
HU261-03	261	1	35	0.76	1	1	2		1	1		Quispisisa	
HU261-09	261	1	35	3.70	1		3		1	6	1	Quispisisa	
HU263-02	263		40	2.77	1	2			1	1		Alca-1	
HU263-01	263		40	2.47	1		3		1	6	1	Quispisisa	
HU263-03	263		40	3.50	1		3		1	6	1	Quispisisa	
HU264-01	264	5	39	1.85	1	2			1	1		Quispisisa	
HU269-02	269	6	41	4.93	2	1	4	1	2	1		Quispisisa	
HU269-01	269	6	41	2.18	1	2			1	1		Quispisisa	
HU269-04	269	6	41	5.20	1		4		2	6	1	Quispisisa	
HU269-03	269	6	41	6.10	1		3		1	6	1	Quispisisa	
HU270-04	270	6	41	0.76	1	1	1	1	1	1		Quispisisa	
HU270-05	270	6	41	1.91	2	1	1	1	1	1		Quispisisa	
HU270-01	270	6	41	3.62	1	2			1	1		Quispisisa	
HU270-02	270	6	41	2.58	1	2			1	1		Quispisisa	
HU270-03	270	6	41	2.91	1	2			1	1		Quispisisa	
HU271-01	271	4	37	2.64	1		1		1	4		Quispisisa	
HU274-01	274		40	5.41	1	1	1	3	2	1		Quispisisa	
HU274-02	274		40	0.41	1	1	1	3	1	1		Quispisisa	
HU274-04	274		40	0.97	1	1	1	3	1	1		Quispisisa	
HU274-05	274		40	0.84	1	2			1	1		Quispisisa	
HU274-06	274		40	3.80	2		1		1	3		Quispisisa	Somewhat lunate in form. Unifacially worked on dorsal surface, meeting cortex
HU274-03	274		40	4.44	1		2		2	7	1	Quispisisa	
HU276-01	276	9	44	0.99	1		3		1	6	2	Quispisisa	
HU280-02	280	6	41	0.44	1		3	1	1	6	2	Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU280-01	280	6	41	6.24	1		3		2	6	1	Quispisisa	
HU282-02	282	1	35	0.98	2	1	1	1	1	1		Quispisisa	
HU282-01	282	1	35	2.35	2	2			1	1		Quispisisa	
HU283-02	283	1	35	0.60	1	1	2		1	1		Quispisisa	
HU283-04	283	1	35	0.36	1	1	2		1	1		Quispisisa	
HU283-01	283	1	35	4.41	1	2			2	5		Quispisisa	Unifacially retouched shatter
HU283-03	283	1	35	2.12	1		3		1	6	1	Quispisisa	
HU284-01	284	11	47	1.79	1		3		1	7	2	Quispisisa	
HU289-02	289	5	39	0.52	1	1	1	4	1	1		Quispisisa	
HU289-01	289	5	39	1.31	1	2			1	1		Quispisisa	
HU290-01	290	5	39	1.76	1	2			1	1		Quispisisa	
HU292-01	292	5	39	1.09	2	1	2		1	1		Quispisisa	
HU293-02	293	5	39	0.36	1	1	1	3	1	1		Quispisisa	
HU293-01	293	5	39	6.01	1	2			2	1		Quispisisa	
HU293-03	293	5	39	4.91	1		1		2	2		Quispisisa	Complete straight base laurel biface
HU294-01	294	5	39	0.36	1	1	1	3	1	1		Quispisisa	
HU294-03	294	5	39	0.66	1	1	2	3	1	1		Quispisisa	
HU294-02	294	5	39	0.50	1	2			1	1		Quispisisa	
HU294-05	294	5	39	2.59	1	2			1	1		Quispisisa	
HU294-07	294	5	39	5.50	1		1		1	2		Quispisisa	Straight base and sides, round distal edge
HU294-06	294	5	39	3.60	1		3		1	6	1	Quispisisa	
HU294-04	294	5	39	1.23	1		3		1	7	2	Quispisisa	
HU295-06	295	5	39	0.25	1	1	1	3	1	1		Quispisisa	
HU295-04	295	5	39	0.52	1	1	4	4	1	1		Quispisisa	
HU295-07	295	5	39	2.10	1	2			1	1		Quispisisa	
HU295-08	295	5	39	2.81	2	2			1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU295-01	295	5	39	0.25	1	1	2		1	1		Quispisisa	
HU295-03	295	5	39	2.17	2	1	3		2	1		Quispisisa	
HU295-05	295	5	39	1.53	2	1	3		1	1		Quispisisa	
HU295-02	295	5	39	9.35	2	2	1		2	4		Quispisisa	Bifacially retouched shatter
HU296-05	296	9	44	0.75	1	1	4	1	1	1		Quispisisa	
HU296-06	296	9	44	0.83	1	1	4	3	1	1		Quispisisa	
HU296-02	296	9	44	1.07	1	2			1	1		Quispisisa	
HU296-04	296	9	44	0.57	1	1	2		1	1		Quispisisa	
HU296-03	296	9	44	0.76	1		2		1	6	1	Quispisisa	
HU296-07	296	9	44	3.60	1		2		1	6	1	Quispisisa	Biface fragment with straight angular base
HU296-01	296	9	44	1.05	1		4		1	6	2	Quispisisa	
HU299-01	299	7	37	3.40	1		3		1	6	1	Quispisisa	
HU300-01	300		40	0.91	1	1	1	1	1	1		Quispisisa	
HU300-02	300		40	0.70	1	1	1	4	1	1		Alca-1	
HU303-01	303	6	41	0.97	1		2	3	1	4	2	Quispisisa	
HU310-01	310	12	48	0.86	1	2			1	1		Quispisisa	
HU310-02	310	12	48	1.22	1	2			1	1		Quispisisa	
HU310-03	310	12	48	2.17	1	2			1	1		Quispisisa	
HU311-02	311	1	35	0.47	1	1	1	1	1	1		Quispisisa	
HU311-08	311	1	35	0.41	1	1	1	1	1	1		Quispisisa	
HU311-05	311	1	35	1.25	1	2			1	1		Quispisisa	
HU311-06	311	1	35	1.60	1	2			1	1		Quispisisa	
HU311-03	311	1	35	2.53	2	2			1	1		Quispisisa	
HU311-04	311	1	35	1.53	2	2			1	1		Quispisisa	
HU311-01	311	1	35	0.59	1	1	2		1	1		Quispisisa	
HU311-07	311	1	35	1.55	1		3		1	7	1	Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU312-07	312	1	35	2.17	1	1	1	3	2	1		Quispisisa	
HU312-06	312	1	35	1.25	2	1	1	3	1	1		Quispisisa	
HU312-02	312	1	35	0.98	1	2			1	1		Quispisisa	
HU312-09	312	1	35	1.50	1	2			1	1		Quispisisa	
HU312-08	312	1	35	0.89	2	2			1	1		Quispisisa	
HU312-03	312	1	35	1.04	2	1	3		1	1		Quispisisa	
HU312-01	312	1	35	2.61	1		2		1	6	2	Quispisisa	
HU312-04	312	1	35	0.75	1		3		1	6	1	Quispisisa	
HU312-05	312	1	35	1.30	1		3		1	6	3	Quispisisa	
HU315-01	315	7	37	1.73	1		3		1	6	1	Quispisisa	
HU320-01	320	12	48	0.73	1	1			1	1		Quispisisa	
HU324-01	324	9	44	2.87	2	2			1	1		Quispisisa	
HU324-02	324	9	44	0.85	1	1	2		1	1		Quispisisa	
HU325-01	325	9	44	0.97	2	1	4	1	1	1		Quispisisa	
HU326-01	326	9	44	2.78	1	2			1	1		Quispisisa	
HU327-03	327	9	44	0.98	1	2			1	1		Quispisisa	
HU327-01	327	9	44	1.93	2	2			1	1		Quispisisa	
HU327-02	327	9	44	3.57	2	2			1	1		Quispisisa	
HU333-02	333		CM	3.19	1	2			1	1		Quispisisa	
HU333-04	333		CM	4.51	1	2			1	1		Quispisisa	
HU333-01	333		CM	1.56	2	2			1	1		Quispisisa	
HU333-03	333		CM	2.62	2	2			1	5		Quispisisa	Unifacially retouched shatter
HU338-01	338	5	39	1.73	1	1	2	3	1	1		Quispisisa	
HU340-02	340	6A	41	1.44	1		3		1	6	1	Quispisisa	
HU340-03	340	6A	41	1.84	1		2		1	6	1	Quispisisa	Crushing and step fractures on ventral face and retouch along broken edges.

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU340-01	340	6A	41	6.14	2		4		1	6	4	Quispisisa	
HU341-02	341	1	35	1.08	1	2			1	1		Quispisisa	
HU341-03	341	1	35	0.87	1	2			1	1		Quispisisa	
HU341-05	341	1	35	0.72	1	2			1	1		Quispisisa	
HU341-01	341	1	35	1.58	2	2			1	1		Quispisisa	
HU341-04	341	1	35	0.84	2	2			1	1		Quispisisa	
HU341-08	341	1	35	0.49	2	2			1	1		Quispisisa	
HU341-07	341	1	35	0.40	1	1	2		1	1		Quispisisa	
HU341-06	341	1	35	0.61	2	1	2		1	1		Quispisisa	
HU341-09	341	1	35	2.79	1		3		1	6	1	Quispisisa	
HU341-10	341	1	35	3.60	1		2		1	6	1	Quispisisa	
HU343-03	343	8	43	0.81	1	1	4	2	1	1		Quispisisa	
HU343-02	343	8	43	1.38	1	2			1	1		Quispisisa	
HU343-01	343	8	43	2.23	2	2			2	1		Quispisisa	
HU343-04	343	8	43	3.90	1		4		1	6	1	Quispisisa	
HU348-01	348	11	47	1.23	1	1	1	3	1	1		Quispisisa	
HU354-02	354	7	37	1.89	1	1	3	3	1	1		Quispisisa	
HU354-01	354	7	37	7.15	1	2			2	1		Quispisisa	
HU354-03	354	7	37	0.78	1	1	2		1	1		Quispisisa	
HU359-01	359	1	35	0.36	1	1	1	1	1	1		Quispisisa	
HU359-04	359	1	35	1.16	1	1	1	1	1	1		Quispisisa	
HU359-18	359	1	35	0.64	2	1	1	2	1	1		Quispisisa	
HU359-02	359	1	35	2.15	1	1	1	3	2	1		Quispisisa	
HU359-14	359	1	35	0.86	1	1	1	3	1	1		Quispisisa	
HU359-15	359	1	35	0.52	1	1	1	3	1	1		Quispisisa	
HU359-05	359	1	35	1.95	1	2			1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU359-12	359	1	35	2.35	1	2			1	1		Quispisisa	
HU359-19	359	1	35	1.41	1	2			1	1		Quispisisa	
HU359-03	359	1	35	1.19	2	2			1	1		Quispisisa	
HU359-07	359	1	35	0.79	2	2			1	1		Quispisisa	
HU359-08	359	1	35	1.11	2	2			1	1		Quispisisa	
HU359-16	359	1	35	1.13	2	2			1	1		Quispisisa	
HU359-06	359	1	35	0.56	1	1	2		1	1		Quispisisa	
HU359-09	359	1	35	2.37	1	1	2		1	1		Quispisisa	
HU359-10	359	1	35	0.56	1	1	2		1	1		Quispisisa	
HU359-13	359	1	35	0.21	1	1	2		1	1		Quispisisa	
HU359-17	359	1	35	1.15	1	1	3		1	1		Quispisisa	
HU359-21	359	1	35	6.80	1		2		2	6	1	Quispisisa	
HU359-11	359	1	35	2.01	1		3		1	7	1	Quispisisa	
HU359-20	359	1	35	5.60	1		4		1	7	1	Quispisisa	
HU379-02	379	11	47	0.46	1	1	1	1	1	1		Quispisisa	
HU379-01	379	11	47	2.89	1	2			1	1		Quispisisa	
HU379-03	379	11	47	1.08	1	2			1	1		Quispisisa	
HU379-04	379	11	47	4.15	1	2			1	1		Quispisisa	
HU384-03	384	1	35	0.51	2	1	4	1	1	1		Quispisisa	
HU384-01	384	1	35	0.94	1	1	1	4	1	1		Quispisisa	
HU384-02	384	1	35	0.59	1	2			1	1		Quispisisa	
HU384-04	384	1	35	1.48	1	2			1	1		Quispisisa	
HU384-05	384	1	35	1.21	2	2			1	1		Quispisisa	
HU384-07	384	1	35	2.48	2	2			1	1		Quispisisa	
HU384-06	384	1	35	1.04	1	1	3		1	1		Quispisisa	
HU384-08	384	1	35	4.90	1		1	3	2	4		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU420-01	420	1	35	0.46	1	1	2	3	1	1		Quispisisa	
HU422-01	422	9	44	3.51	1	1	1	3	1	1		Quispisisa	
HU422-02	422	9	44	0.57	2	1	2		1	1		Quispisisa	
HU423-01	423	8	43	4.16	1	1	1	3	2	1		Quispisisa	
HU430-01	430	6B	41	0.79	2	1	3		1	1		Quispisisa	
HU435-02	435		54	0.90	2	1	4	1	1	1		Quispisisa	
HU435-03	435		54	1.52	2	2			1	1		Quispisisa	
HU435-01	435		54	0.74	1	1	3		1	1		Quispisisa	
HU435-06	435		54	1.90	1		1		1	2		Quispisisa	Wear on proximal portion suggests hafting
HU435-05	435		54	0.70	1		3		1	4		Quispisisa	
HU435-04	435		54	2.67	1		1		1	5		Quispisisa	Unifacially retouched shatter
HU446-01	446	1	35	0.84	1	2			1	1		Quispisisa	
HU449-01	449	10	46	7.63	2	2			2	1		Quispisisa	Many hinge and step fractures
HU463-02	463	9	44	1.26	1	1	1	3	1	1		Quispisisa	
HU463-01	463	9	44	0.42	1	1	3		1	1		Quispisisa	
HU476-04	476	11	47	1.02	1	1	1	3	1	1		Quispisisa	
HU476-01	476	11	47	0.88	2	2			1	1		Quispisisa	
HU476-02	476	11	47	1.44	2	2			1	1		Quispisisa	
HU476-03	476	11	47	0.92	1	1	3		1	1		Quispisisa	
HU478-01	478	5	39	1.53	1	2			1	1		Quispisisa	
HU480-01	480	1	35	21.50	1		3		2	6	1	Quispisisa	Pecked and polished on both faces. Ground beveled edge. Unifacial retouch. Fragment of what may have been a mirror
HU481-06	481		CM	9.60	1		4		2	6	2	Quispisisa	Mostly-complete biface missing lateral portion of base. Ovoid with notched base
HU485-01	485	6A	41	3.60	1	2			1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU492-01	492	5	39	1.52	1	1	3		1	1		Jampatilla	
HU492-02	492	5	39	1.96	1		3		1	6	1	Quispisisa	
HU494-01	494	6A	41	0.69	1	1	1	1	1	1		Quispisisa	
HU494-02	494	6A	41	1.91	1		3		1	7	4	Quispisisa	
HU500-04	500	6A	41	0.79	2	1	1	1	1	1		Quispisisa	
HU500-03	500	6A	41	0.72	1	1	1	4	1	1		Quispisisa	
HU500-02	500	6A	41	0.57	1	1	2		1	1		Quispisisa	
HU500-01	500	6A	41	4.25	1		3		1	6	1	Quispisisa	
HU500-05	500	6A	41	3.80	1		4		1	6	1	Quispisisa	
HU502-01	502	7	37	1.33	1	1	1	4	1	1		Quispisisa	
HU511-02	511	8	43	4.12	2	2			1	1		Quispisisa	
HU511-01	511	8	43	3.40	1		3		1	6	1	Quispisisa	
HU517-01	517	5	39	1.07	1		3	1	1	6	2	Quispisisa	
HU530-01	530	6A	41	1.19	2	2			1	1		Quispisisa	
HU531-01	531	9	44	3.00	1		3		1	4		Lechatelierite	
HU532-01	532	5	39	4.31	1	2			2	1		Quispisisa	
HU532-02	532	5	39	3.02	1	2			1	1		Quispisisa	
HU532-04	532	5	39	0.87	1	2			1	1		Quispisisa	
HU532-03	532	5	39	1.06	2		1		1	5		Unknown	Retouched flake. Similar to concave-sided end scraper type ES18 (MacNeish et al. 1980:159)
HU532-05	532	5	39	1.37	1		3		1	6	1	Quispisisa	
HU536-01	536	10	46	3.66	1	2			1	1		Quispisisa	
HU536-02	536	10	46	1.21	2	2			1	1		Quispisisa	
HU540-01	540	8	43	0.85	2	2			1	1		Quispisisa	
HU540-02	540	8	43	4.96	1		3		1	6	1	Alca-1	
HU546-01	546	1	35	0.66	1	1	4	3	1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU636-01	636	14	72	2.87	2	1	1		1	5		Quispisisa	
HU641-01	641	6	70	2.30	2	2			1	1		Quispisisa	
HU651-01	651		74	6.17	1	1	1		2	2		Quispisisa	Axe or *tumi*-shaped
HU657-02	657	13	60	1.39	1	1	3		1	1		Quispisisa	
HU657-01	657	13	60	5.17	2	1	2		2	4		Quispisisa	
HU665-01	665	15	75	5.27	2	1	1	3	2	1		Quispisisa	
HU665-02	665	15	75	3.97	1	2			1	1		Quispisisa	
HU671-01	671	13	60	1.48	1		3		1	6	1	Quispisisa	
HU681-01	681	14	71	3.77	2		1		1	8		Puzolana	
HU690-02	690		74	3.91	1		4		1	6	1	Quispisisa	
HU690-03	690		74	1.36	1		3		1	6	1	Quispisisa	Significant crushing and hinge fractures
HU690-01	690		74	9.30	1		4		2	6	1	Quispisisa	Small portion of base missing. Many hinge and step fractures. Similar to 20040-02 (Plate 84, Engel 1983:124)
HU690-04	690		74	0.32	1		3		1	7	1	Quispisisa	
HU704-01	704	13	60	1.12	1		3		1	6	1	Quispisisa	
HU709-01	709	17	76	3.61	1		1		1	2		Quispisisa	Similar to 20040-02 (Plate 84, Engel 1983:124)
HU733-01	733	14	71	13.01	2		1		2	2		Quispisisa	Bifacial "core tool"
HU733-04	733	14	71	1.19	1		4		1	6	1	Quispisisa	
HU733-05	733	14	71	0.96	1		4		1	6	1	Quispisisa	
HU733-02	733	14	71	4.17	2		3		1	7	1	Quispisisa	
HU733-03	733	14	71	5.24	2		4		2	7	1	Quispisisa	Ovoid uniface fragment
HU745-01	745	16	77	0.34	1	1	3		1	1		Unknown	Many air bubbles. Area with vapor-deposited material
HU752-01	752		61	3.06	1		2		1	6	1	Quispisisa	Straight base biface fragment
HU758-02	758	16	77	1.03	1		3		1	6	1	Quispisisa	
HU758-01	758	16	77	2.03	1		3		1	6	1	Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU770-01	770		74	8.04	1		3		2	6	1	Quispisisa	
HU777-01	777	6	70	4.11	1		3		2	6	1	Quispisisa	
HU792-01	792	17	76	4.59	1		3		2	6	1	Quispisisa	
HU795-01	795		69	0.41	1	1	4	1	1	1		Quispisisa	
HU796-01	796	16	77	1.65	1		3		1	6	1	Quispisisa	
HU799-01	799	14	71	1.03	1		3		1	6	1	Quispisisa	
HU801-01	801	13B	60	2.51	1		3		1	6	1	Quispisisa	
HU802-03	802		74	0.80	1		2		1	6	1	Quispisisa	
HU802-02	802		74	2.97	1		3		1	6	3	Quispisisa	
HU802-01	802		74	2.06	1		3		1	6	3	Quispisisa	
HU803-01	803	6	70	15.65	2		4		2	7	4	Quispisisa	Very thick uniface fragment. Ventral face is flat with cortex and evidence of scraping
HU812-01	812	14	72	2.98	1		3		1	7	1	Quispisisa	
HU815-01	815	1	67	1.61	1		4		1	6	1	Quispisisa	
HU816-01	816		78	1.65	1		3		1	6	1	Quispisisa	
HU819-02	819		64	1.79	1		3	1	1	6	2	Alca-1	
HU819-01	819		64	7.15	1		3		2	6	1	Quispisisa	
HU821-01	821	16	77	6.80	1		3		2	6	1	Quispisisa	
HU827-01	827	6	70	4.70	1		3		1	6	1	Quispisisa	
HU828-01	828	1	67	13.73	1		2		2	6	1	Quispisisa	Biface fragment with straight edges. Unusual form
HU828-02	828	1	67	3.56	1		4		2	7	1	Quispisisa	
HU830-01	830		64	2.58	1		3		1	6	1	Quispisisa	
HU835-01	835	16	77	1.38	1		3		1	6	1	Quispisisa	
HU835-02	835	16	77	1.85	1		3		1	6	1	Quispisisa	
HU835-03	835	16	77	0.88	1		3		1	7	1	Quispisisa	
HU837-01	837	15	75	1.26	1		3	1	1	6	2	Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU838-01	838		78	1.09	1		3		1	6	1	Quispisisa	
HU850-01	850	14B	71	1.62	1		2		1	6	1	Quispisisa	
HU850-02	850	14B	71	0.90	2	2	3		1	8	4	Puzolana	Incomplete nodule - bipolar percussion
HU860-01	860		74	2.82	1		3		1	6	1	Quispisisa	Edges abraded
HU865-01	865		78	2.12	1		1		1	3		Quispisisa	Ovoid uniface worked on all edges
HU866-01	866		64	4.18	1		4		2	6	1	Quispisisa	
HU869-01	869	16	77	6.09	1	2			1	1		Alca-1	
HU883-02	883	17	76	1.84	1		3		1	6	1	Quispisisa	
HU900-01	900		78	6.05	1		3		2	6	1	Quispisisa	
HU903-01	903	14	72	40.04	1		4		3	6	1	Quispisisa	2/3 of circular biface. Broken edges are clean
HU903-02	903	14	72	2.07	1		3		1	6	1	Quispisisa	
HU906-01	906	1	29	3.65	1		3		1	6	1	Quispisisa	
HU907-01	907	6	70	1.52	1		3		1	6	1	Quispisisa	
HU908-01	908		74	2.12	2		2		1	6	3	Quispisisa	Cortex on dorsal face. Burin fracture along right doral edge, otherwise complete
HU917-02	917	14B	71	1.11	1		3		1	6	1	Quispisisa	
HU917-01	917	14B	71	2.88	1		2		2	6	1	Quispisisa	Straight base biface fragment
HU932-01	932	1	35/67	2.95	1		3	1	1	6	2	Quispisisa	
HU942-01	942		74	14.51	2		1		2	4		Quispisisa	Bifacially retouched shatter
HU949-02	949	14B	71	1.09	1		3		1	6	1	Quispisisa	
HU949-01	949	14B	71	2.15	1		3		1	7	1	Quispisisa	
HU950-01	950	15	75	0.78	1		4		1	6	1	Quispisisa	
HU965-01	965	14	72	2.55	1		3		1	6	1	Quispisisa	
HU965-02	965	14	72	3.99	1		3		1	6	1	Quispisisa	
HU978-01	978	16	77	7.33	1		4		2	6	1	Quispisisa	
HU992-01	992	14B	71	0.68	2	2			1	1		Quispisisa	

Sample	Locus	EA	Unit	Wt (g)	Ctx	DT	CD	FT	SZ	Form	Fracture	Source	Comments
HU999-01	999	13B	60	0.98	2		1		1	8		Puzolana	
HU1002-01	1002		80	2.02	1		3		1	6	1	Quispisisa	
HU1019-01	1019	14	63/72	9.93	2	1	1	1	2	1		Quispisisa	
HU1027-01	1027		80	2.07	1		3		1	7	1	Quispisisa	
HU1031-01	1031	19	78	2.02	1		4		1	6	1	Quispisisa	
HU1051-01	1051	19	78	2.19	1		1		1	4		Quispisisa	
HU1057-02	1057	16	77	0.14	1	1	1	1	1	1		Quispisisa	
HU1057-01	1057	16	77	3.94	1		4		1	6	1	Quispisisa	
HU1065-01	1065	17	76	3.64	1		3		2	6	1	Quispisisa	
HU1079-01	1079	16	77	0.78	2	2	3		1	8	4	Puzolana	Incomplete nodule - bipolar percussion with a burin fracture
HU1081-01	1081	14B	71	1.55	1		3		1	6	1	Alca-1	
HU1097-01	1097	7	73	3.59	1		3		2	6	1	Quispisisa	
HU1106-01	1106	7	73	15.32	1		4		2	6	1	Quispisisa	
HU1109-01	1109	7	73	3.97	1		3		1	6	1	Quispisisa	
HU1109-02	1109	7	73	1.61	1		3		1	6	1	Quispisisa	
HU1109-03	1109	7	73	0.86	1		3		1	6	1	Quispisisa	
HU185/6-01	185/6		36	0.98	1	2			1	1		Quispisisa	
HU185/6-02	185/6		36	1.05	1	1	3		1	1		Quispisisa	

Appendix B: Niton PXRF Analysis Results

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU39-01	39	CM		789.70	5879.29	29.76	186.25	142.09	12.04	71.09	10.81	26.44	18.62	9.49	Quispisisa
HU39-02	39	CM		980.40	6704.44	32.93	221.90	162.56	12.03	103.54	14.27	25.50	18.58	6.30	Quispisisa
HU45-01	45	23		803.47	5932.89	27.94	190.00	141.18	11.72	70.64	9.43	22.08	18.18	6.81	Quispisisa
HU68-01	68	29	1	883.09	6201.66	31.37	205.35	153.20	12.53	76.89	12.20	21.35	18.82	6.10	Quispisisa
HU68-02	68	29	1	921.34	6359.89	31.34	213.98	162.13	12.38	78.21	14.37	25.93	18.58	6.32	Quispisisa
HU68-03	68	29	1	853.98	5980.75	25.01	191.69	141.50	11.65	70.17	10.60	19.23	18.69	8.11	Quispisisa
HU79-01	79	29	1	868.95	5970.99	32.04	192.18	144.45	12.61	70.68	11.28	24.18	17.16	6.12	Quispisisa
HU79-02	79	29	1	830.49	6049.85	29.96	190.67	143.04	11.67	73.17	11.35	26.64	15.59	8.46	Quispisisa
HU79-03	79	29	1	744.54	5719.52	38.66	175.98	133.10	11.99	89.22	8.20	23.99	13.91	9.73	Quispisisa
HU87-01	87	29	1	811.09	5988.59	30.05	192.55	145.15	12.20	76.07	10.00	25.77	16.99	8.05	Quispisisa
HU93-01	93	25		832.37	6156.20	34.65	199.75	149.74	12.70	75.19	10.27	24.39	17.47	6.99	Quispisisa
HU93-02	93	25		866.75	6330.81	32.91	210.58	156.08	12.25	99.30	12.91	26.23	16.15	6.34	Quispisisa
HU93-03	93	25		837.32	6027.25	30.66	195.60	147.22	12.16	73.77	11.49	22.95	16.66	8.86	Quispisisa
HU100-01	100	32		796.97	5973.03	29.66	190.61	135.91	11.35	70.60	9.92	22.20	18.88	9.95	Quispisisa
HU118-01	118	CM		768.76	5870.82	36.49	183.89	139.94	10.89	68.48	10.10	23.96	18.08	13.47	Quispisisa
HU118-02	118	CM		737.19	5621.08	32.35	173.57	129.87	11.84	64.59	8.75	22.29	16.11	8.74	Quispisisa
HU118-03	118	CM		785.19	5813.62	33.59	185.07	137.83	10.80	69.11	10.46	24.17	15.97	12.19	Quispisisa
HU123-01	123	29	1	813.33	6023.10	27.35	188.34	141.01	12.21	72.55	10.28	21.59	15.50	7.72	Quispisisa
HU123-02	123	29	1	818.11	5893.99	32.51	182.92	137.50	12.97	70.31	8.56	25.77	18.05	10.76	Quispisisa
HU134-01	134	29	1	987.63	6741.04	30.34	223.84	166.84	13.13	80.65	14.11	24.39	19.49	7.97	Quispisisa
HU134-02	134	29	1	907.09	6263.51	25.07	206.57	153.55	11.02	79.13	12.83	23.38	19.96	8.61	Quispisisa
HU134-03	134	29	1	891.66	6125.31	29.49	200.90	151.49	10.66	95.09	11.71	20.96	16.54	8.59	Quispisisa
HU134-04	134	29	1	770.47	5893.92	35.69	182.18	138.43	11.50	68.40	9.66	24.95	15.87	9.58	Quispisisa
HU134-05	134	29	1	782.17	5830.79	32.51	188.22	138.79	10.50	69.28	10.35	22.92	15.98	10.41	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU134-06	134	29	1	786.55	5910.64	28.56	184.45	136.67	11.34	69.64	9.80	22.12	16.78	7.31	Quispisisa
HU149-01	149	CM		848.37	6033.19	31.54	198.75	145.15	11.85	73.60	11.60	23.21	16.66	6.65	Quispisisa
HU149-02	149	CM		785.56	5889.23	31.01	184.33	137.43	11.93	70.07	9.62	25.17	18.99	9.83	Quispisisa
HU181-01	181	35		820.94	6013.16	31.62	192.90	144.13	11.80	72.07	9.72	23.28	18.48	7.92	Quispisisa
HU185/6-01	185/6	36		809.77	6131.71	32.34	196.34	145.42	11.12	72.36	10.03	27.50	19.30	10.04	Quispisisa
HU185/6-02	185/6	36		807.63	5967.66	32.01	185.88	143.73	12.81	71.71	10.84	21.15	17.62	4.78	Quispisisa
HU186-01	186	36	3	753.56	5782.44	32.89	177.32	130.26	12.29	68.55	11.31	23.66	15.30	9.18	Quispisisa
HU186-02	186	36	3	764.34	5966.74	30.81	191.85	140.79	11.43	74.17	10.30	26.01	16.47	7.84	Quispisisa
HU186-03	186	36	3	746.61	5631.29	28.21	173.69	129.18	10.74	65.72	9.33	22.54	15.11	6.58	Quispisisa
HU186-04	186	36	3	753.01	5772.64	32.85	177.30	138.60	11.68	67.97	9.38	23.76	17.07	8.41	Quispisisa
HU186-05	186	36	3	759.88	5710.26	30.46	177.99	132.30	9.95	67.35	9.49	26.37	15.56	7.94	Quispisisa
HU186-06	186	36	3	782.07	5699.61	32.60	187.11	139.09	10.79	72.14	8.27	27.28	15.06	8.80	Quispisisa
HU186-07	186	36	3	827.21	5872.91	31.46	184.15	136.48	11.15	70.01	10.62	23.16	15.68	7.58	Quispisisa
HU187-01	187	32	2	851.40	6189.87	25.27	200.49	145.76	12.20	73.48	12.99	23.06	16.11	10.31	Quispisisa
HU190-01	190	35	1	765.82	5807.75	33.06	188.94	140.80	10.87	74.49	9.13	22.99	14.18	9.34	Quispisisa
HU190-02	190	35	1	855.45	6074.63	27.24	200.26	148.19	13.13	72.35	11.55	22.16	18.89	7.75	Quispisisa
HU190-03	190	35	1	756.19	5760.82	33.86	184.89	141.51	11.48	70.91	9.18	23.05	15.50	9.53	Quispisisa
HU192-01	192	37	4	741.98	5707.24	34.17	185.00	135.90	10.35	71.02	9.95	24.48	16.14	8.49	Quispisisa
HU192-02	192	37	4	806.30	5720.99	25.15	177.83	130.40	9.87	69.08	7.97	21.23	17.86	4.66	Quispisisa
HU192-03	192	37	4	767.78	5868.36	32.58	185.47	139.14	10.87	67.35	10.21	23.92	15.94	9.91	Quispisisa
HU193-01	193	37	4	840.05	5970.86	29.15	194.33	143.73	9.75	73.41	9.64	25.89	18.83	7.32	Quispisisa
HU194-01	194	36	3	814.74	5893.34	30.21	186.00	139.03	11.35	71.98	9.83	18.27	15.92	8.53	Quispisisa
HU197-01	197	37	4	842.52	5834.37	33.00	184.45	134.44	12.24	71.12	11.18	24.58	17.56	10.46	Quispisisa
HU197-02	197	37	4	809.80	5826.05	26.58	181.58	140.55	11.29	70.27	9.59	20.17	16.06	8.36	Quispisisa
HU197-03	197	37	4	821.76	5784.17	28.12	177.53	135.71	11.16	68.49	9.89	22.05	17.38	7.82	Quispisisa
HU197-04	197	37	4	764.17	5782.96	30.72	184.59	138.29	11.32	70.20	8.32	20.74	16.53	10.42	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU197-05	197	37	4	817.12	6018.62	33.63	191.92	145.74	12.77	72.34	11.37	23.09	15.91	7.71	Quispisisa
HU197-06	197	37	4	799.02	5828.10	34.39	184.36	137.92	10.87	71.13	10.18	22.93	17.34	7.03	Quispisisa
HU197-07	197	37	4	835.65	5986.84	34.94	193.98	141.89	11.83	72.12	11.94	23.03	18.08	9.40	Quispisisa
HU197-08	197	37	4	768.11	5706.15	30.15	176.93	135.32	12.29	69.59	8.41	21.79	19.21	6.80	Quispisisa
HU197-09	197	37	4	834.18	5891.46	36.64	187.55	140.09	10.40	71.09	9.41	22.01	19.05	9.49	Quispisisa
HU197-10	197	37	4	794.24	5725.15	26.84	179.03	135.87	10.50	70.94	9.52	24.70	14.67	8.18	Quispisisa
HU198-01	198	32	2	780.35	5894.48	34.54	185.91	140.36	12.85	69.16	10.22	22.95	16.77		Quispisisa
HU198-02	198	32	2	785.27	5851.46	26.61	185.86	140.70	12.40	72.44	9.71	24.23	17.27	8.26	Quispisisa
HU200-01	200	36	3	872.24	6357.21	37.50	208.06	157.58	10.26	74.94	11.98	24.22	19.51	8.50	Quispisisa
HU200-02	200	36	3	767.24	5824.46	37.06	180.68	135.09	11.30	68.35	9.04	27.00	19.15	9.33	Quispisisa
HU200-03	200	36	3	849.19	6320.57	33.54	207.99	152.02	11.59	74.36	12.68	23.75	16.66	8.20	Quispisisa
HU200-04	200	36	3	796.69	5869.94	33.90	186.74	138.22	11.36	69.43	9.86	24.12	16.42	12.13	Quispisisa
HU203-01	203	35	1	828.06	5937.62	34.69	186.86	139.96	11.81	71.27	9.09	24.76	15.20	9.00	Quispisisa
HU203-02	203	35	1	853.39	6031.01	30.79	194.01	145.37	11.63	71.87	11.35	26.52	16.62	6.76	Quispisisa
HU204-01	204	32	2	840.59	6021.70	28.25	198.80	140.92	11.51	71.41	10.55	23.14	16.01	8.59	Quispisisa
HU206-01	206	35	1	777.54	5830.41	35.57	183.59	135.53	11.50	69.52	9.93	23.58	18.90	11.79	Quispisisa
HU213-01	213	39	5	815.25	5896.95	27.45	188.75	141.11	10.27	70.47	10.90	23.63	17.68	6.60	Quispisisa
HU213-02	213	39	5	805.97	5998.55	29.64	189.59	141.76	11.02	69.07	9.22	23.87	16.45	10.25	Quispisisa
HU213-03	213	39	5	838.91	5829.69	45.70	150.45	88.15	11.24	91.14	9.39	18.27	9.80	3.01	Alca-1
HU213-04	213	39	5	873.50	5914.02	30.09	195.12	142.18	10.64	71.57	10.38	24.56	16.11	7.74	Quispisisa
HU213-05	213	39	5	761.14	5794.02	27.94	178.20	131.72	10.82	68.00	9.58	23.38	14.97	8.61	Quispisisa
HU213-06	213	39	5	862.33	6454.23	38.53	208.70	161.56	13.18	76.02	11.51	28.10	20.95	10.92	Quispisisa
HU218-01	218	30, 32, 33	2	942.33	6242.76	26.10	207.15	150.90	11.17	76.09	12.51	24.99	18.01	6.04	Quispisisa
HU218-02	218	30, 32, 33	2	838.48	5916.72	31.35	189.82	141.87	10.77	72.57	10.09	23.74	17.25	6.78	Quispisisa
HU222-01	222	40		843.85	5975.70	32.06	194.19	144.84	12.20	74.44	11.58	23.72	17.62	7.21	Quispisisa
HU223-01	223	35	1	844.58	5981.46	29.36	194.86	150.28	12.28	73.06	10.30	25.25	18.05	7.88	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU230-01	230	36	3	782.63	5851.43	39.97	185.03	137.93	13.13	69.34	9.72	27.25	16.03	8.57	Quispisisa
HU230-02	230	36	3	975.80	6752.59	34.17	225.32	163.05	11.99	103.66	13.58	28.84	18.98	6.66	Quispisisa
HU230-03	230	36	3	869.45	6233.46	30.78	203.10	153.63	12.01	75.04	12.83	23.09	19.19	6.05	Quispisisa
HU230-04	230	36	3	758.90	5660.85	30.62	178.71	136.87	13.31	68.64	9.83	25.26	16.32	7.90	Quispisisa
HU230-05	230	36	3	730.86	5751.35	35.73	174.89	133.78	10.53	66.65	8.58	22.03	15.02	8.92	Quispisisa
HU230-06	230	36	3	796.02	5823.73	31.60	184.82	139.92	10.92	69.60	10.93	19.21	15.08	9.93	Quispisisa
HU230-07	230	36	3	800.96	5819.08	32.28	184.59	133.41	11.61	69.97	10.35	24.50	18.71	8.23	Quispisisa
HU230-08	230	36	3	811.24	5970.18	25.91	186.76	138.81	13.55	71.80	10.48	23.30	15.91	7.29	Quispisisa
HU233-01	233	39	5	791.00	5811.71	34.27	185.98	135.65	10.99	70.55	10.61	23.42	18.40	8.83	Quispisisa
HU233-02	233	39	5	802.56	5868.63	34.64	184.33	139.42	11.72	69.79	9.91	22.84	17.09	9.93	Quispisisa
HU233-03	233	39	5	776.90	5744.40	32.06	177.37	134.68	11.45	69.04	9.83	19.66	17.41	8.11	Quispisisa
HU233-04	233	39	5	819.76	5917.12	31.11	186.53	140.73	12.20	71.62	10.43	25.03	16.97	7.52	Quispisisa
HU233-05	233	39	5	762.84	5825.27	35.07	188.38	135.78	11.52	70.05	9.84	22.19	18.95	8.35	Quispisisa
HU233-06	233	39	5	766.99	5738.35	31.11	176.79	134.96	11.07	68.02	8.67	24.44	15.26	6.34	Quispisisa
HU233-07	233	39	5	788.37	5751.52	30.83	178.94	130.20	12.08	68.00	9.80	22.02	17.54	9.05	Quispisisa
HU234-01	234	39	5	783.99	5875.95	36.53	184.01	136.34	11.79	70.24	8.66	30.54	17.12	8.56	Quispisisa
HU237-01	237	37	4	795.48	5845.30	28.74	179.94	138.07	11.72	71.46	9.83	21.54	17.07	6.74	Quispisisa
HU237-02	237	37	4	840.91	6019.18	28.28	194.68	144.73	10.99	71.67	11.32	22.17	16.11	9.61	Quispisisa
HU237-03	237	37	4	831.85	6035.91	31.30	196.58	145.21	11.03	74.57	10.60	20.98	19.51	7.52	Quispisisa
HU237-04	237	37	4	778.65	5638.60	34.55	174.10	132.01	11.24	67.90	9.10	24.95	15.69	6.22	Quispisisa
HU237-05	237	37	4	792.86	5888.76	30.75	188.75	140.53	11.87	71.03	9.96	21.03	15.29	10.69	Quispisisa
HU237-06	237	37	4	779.62	5841.69	32.35	182.74	137.27	12.26	70.32	9.36	25.22	18.44	6.57	Quispisisa
HU237-07	237	37	4	787.51	5887.50	27.58	183.31	135.92	12.29	69.95	8.91	26.10	15.41	6.95	Quispisisa
HU237-08	237	37	4	784.51	5890.89	27.65	184.26	139.55	11.26	70.86	11.85	25.56	16.42	6.46	Quispisisa
HU237-09	237	37	4	788.10	5852.94	31.78	183.08	138.37	11.92	70.63	9.40	23.95	18.83	9.94	Quispisisa
HU237-10	237	37	4	786.01	5872.03	34.72	184.15	138.28	11.51	70.16	9.68	26.39	16.48	8.16	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU237-11	237	37	4	809.51	5909.83	33.70	186.44	138.94	12.44	72.10	10.46	24.20	16.59	7.65	Quispisisa
HU242-01	242	41	6	801.84	5954.38	28.79	189.45	138.25	12.08	69.77	9.41	24.86	15.59	9.10	Quispisisa
HU242-02	242	41	6	769.78	5914.30	29.64	186.60	138.99	12.47	70.87	9.62	23.14	16.12	9.88	Quispisisa
HU244-01	244	41	6	800.63	6051.76	37.25	193.78	146.73	11.01	72.87	9.60	23.70	18.86	7.77	Quispisisa
HU251-01	251	37	4	902.73	6399.13	37.95	219.12	163.99	12.68	79.51	13.48	24.07	17.95	9.66	Quispisisa
HU251-02	251	37	4	743.52	5796.96	38.55	182.11	137.15	11.55	67.45	10.21	22.22	18.22	8.17	Quispisisa
HU251-03	251	37	4	771.09	5785.32	32.47	178.66	135.63	12.24	69.55	9.61	22.12	16.28	7.37	Quispisisa
HU251-04	251	37	4	866.73	6187.91	29.88	201.11	149.63	11.16	98.38	11.97	25.51	14.79	7.32	Quispisisa
HU254-01	254	37	4	828.34	5953.36	29.79	192.62	143.65	10.72	72.62	9.35	24.58	17.09	7.97	Quispisisa
HU254-02	254	37	4	872.08	6181.51	28.58	203.45	150.93	11.51	73.29	11.53	26.71	17.65	8.76	Quispisisa
HU254-03	254	37	4	803.94	5966.61	30.37	189.42	140.85	11.84	73.19	9.51	22.13	16.77	6.78	Quispisisa
HU254-04	254	37	4	755.43	5748.04	32.00	180.95	131.27	11.31	69.34	9.47	22.97	18.71	12.50	Quispisisa
HU254-05	254	37	4	784.27	5972.47	27.51	187.92	142.44	11.36	70.45	9.22	21.31	16.29	8.57	Quispisisa
HU254-06	254	37	4	794.95	5869.80	34.27	181.25	140.94	11.25	69.03	7.73	25.39	15.25	8.18	Quispisisa
HU258-01	258	41	6	791.41	5841.53	37.03	186.44	137.15	12.06	71.22	10.19	24.67	18.29	8.69	Quispisisa
HU258-02	258	41	6	771.08	5898.86	36.44	179.54	137.08	11.79	68.75	8.55	27.35	18.64	9.82	Quispisisa
HU259-01	259	41	6	786.97	5807.52	31.40	184.59	137.00	10.61	69.28	8.15	21.55	15.54	7.57	Quispisisa
HU259-02	259	41	6	937.00	6314.89	27.66	210.23	158.18	14.46	98.57	12.52	24.27	16.55	5.67	Quispisisa
HU260-01	260	43	8	762.46	5837.33	31.97	182.13	138.54	12.81	68.79	7.80	22.61	17.61	12.03	Quispisisa
HU260-02	260	43	8	775.09	5746.97	34.48	181.86	137.95	11.96	70.94	8.61	23.13	19.60	8.77	Quispisisa
HU261-01	261	35	1	815.62	5928.05	27.12	193.78	140.25	11.93	72.44	10.86	26.52	18.16	8.40	Quispisisa
HU261-02	261	35	1	854.30	6120.48	29.69	195.28	147.43	11.47	73.42	11.53	24.22	19.93	9.82	Quispisisa
HU261-03	261	35	1	888.19	6155.64	30.83	206.53	149.48	10.74	74.35	12.67	21.07	17.92	8.89	Unknown
HU261-04	261	35	1	783.99	5947.73	33.40	189.96	137.54	10.58	71.85	9.61	26.55	18.53	13.24	Quispisisa
HU261-05	261	35	1	770.17	5691.83	35.03	175.68	134.76	10.46	67.00	9.03	21.55	17.56	8.63	Quispisisa
HU261-06	261	35	1	837.78	6178.64	33.97	203.75	151.40	11.19	75.03	12.99	25.97	18.10	6.95	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU261-07	261	35	1	846.64	6079.19	25.78	199.89	148.99	11.47	76.73	11.62	26.79	17.01	7.90	Quispisisa
HU261-08	261	35	1	747.20	5679.26	28.90	166.03	129.69	11.90	67.27	9.47	27.49	16.57	7.22	Quispisisa
HU261-09	261	35	1	785.73	5903.02	37.83	187.16	141.13	11.43	70.50	10.66	26.07	17.94	6.38	Quispisisa
HU261-10	261	35	1	1955.89	13122.39	57.59	267.79	185.55	22.43	290.52	17.03	15.41	32.12	15.20	Quispisisa
HU263-01	263	40		770.73	5725.89	30.84	177.44	131.97	12.30	70.99	8.41	25.76	16.25	6.94	Quispisisa
HU263-02	263	40		765.18	5819.05	44.39	145.06	86.14	12.01	91.44	9.39	17.69	10.22		Alca-1
HU263-03	263	40		825.43	6001.33	32.91	194.89	145.27	13.16	75.00	11.55	22.28	17.58	7.70	Quispisisa
HU264-01	264	39	5	765.55	5852.87	26.51	186.60	138.04	10.83	69.67	8.37	22.75	15.56	6.93	Quispisisa
HU269-01	269	41	6	762.46	5817.49	31.88	182.62	134.74	10.49	68.62	8.96	22.82	17.83	12.40	Quispisisa
HU269-02	269	41	6	763.63	5860.78	31.65	187.57	141.06	11.60	71.54	10.29	20.23	18.88	6.85	Quispisisa
HU269-03	269	41	6	775.24	5849.58	31.08	186.99	135.52	11.56	72.16	9.57	27.07	14.65	8.48	Quispisisa
HU269-04	269	41	6	787.43	5810.67	32.10	182.90	137.66	11.16	68.91	9.30	26.79	17.19	7.80	Quispisisa
HU270-01	270	41	6	788.98	5875.75	36.62	181.88	137.71	11.13	70.98	8.48	23.97	18.09	10.74	Quispisisa
HU270-02	270	41	6	807.80	5836.04	32.80	183.73	137.87	13.38	70.02	11.16	23.74	15.70	8.21	Quispisisa
HU270-03	270	41	6	783.60	5878.68	34.39	185.77	138.01	13.90	70.95	10.63	23.15	19.94	10.14	Quispisisa
HU270-04	270	41	6	851.30	5941.24	31.07	190.17	140.54	11.14	73.42	10.46	24.64	15.84	5.87	Quispisisa
HU270-05	270	41	6	805.42	6048.82	34.81	193.73	140.28	12.24	70.76	10.38	24.63	18.44	8.90	Quispisisa
HU271-01	271	37	4	779.99	5746.88	27.03	181.23	133.74	11.51	69.06	9.54	21.69	15.90	6.95	Quispisisa
HU274-01	274	40		763.26	5820.01	30.10	181.58	132.64	10.41	88.63	10.40	23.50	15.20	9.75	Quispisisa
HU274-02	274	40		854.41	6233.06	28.91	206.34	155.22	11.39	77.71	12.23	26.26	17.46	8.77	Quispisisa
HU274-03	274	40		775.49	5842.67	34.60	186.86	139.91	11.33	69.13	9.91	24.33	18.71	8.28	Quispisisa
HU274-04	274	40		772.33	5905.39	29.35	190.44	141.84	11.62	70.67	8.53	20.55	16.11	9.23	Quispisisa
HU274-05	274	40		812.95	5948.25	31.87	189.31	139.93	11.92	70.36	10.37	19.66	16.78	6.75	Quispisisa
HU274-06	274	40		780.01	5857.17	31.08	183.45	138.22	11.98	70.52	10.28	22.92	15.69	8.40	Quispisisa
HU276-01	276	44	9	802.12	5861.96	29.71	187.90	138.88	10.48	69.96	9.57	23.36	17.19	6.69	Quispisisa
HU280-01	280	41	6	770.90	5838.83	33.41	186.32	135.37	10.26	70.81	10.19	24.06	19.43	6.09	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU280-02	280	41	6	864.44	6170.78	30.51	201.71	150.84	11.11	75.16	10.68	24.25	19.09	7.18	Quispisisa
HU282-01	282	35	1	785.27	5733.00	35.71	178.64	135.88	11.03	67.57	9.69	21.69	14.98	9.00	Quispisisa
HU282-02	282	35	1	764.08	5814.43	31.88	183.82	136.69	11.47	69.96	10.13	21.50	19.21	8.02	Quispisisa
HU283-01	283	35	1	809.66	5841.87	33.02	181.88	134.29	12.08	68.16	9.16	25.06	17.77	6.78	Quispisisa
HU283-02	283	35	1	837.71	6149.35	32.17	198.54	146.60	10.69	74.23	10.24	24.86	18.34	8.69	Quispisisa
HU283-03	283	35	1	787.26	5919.88	32.41	188.04	138.96	11.06	71.45	9.71	24.18	15.37	9.84	Quispisisa
HU283-04	283	35	1	892.34	6200.96	33.01	198.80	149.25	14.55	75.93	12.50	25.25	17.39	9.37	Quispisisa
HU284-01	284	47	11	803.71	5887.42	36.02	186.72	137.45	12.48	70.59	10.87	23.97	18.14	12.33	Quispisisa
HU289-01	289	39	5	756.55	5630.59	30.27	180.98	131.56	12.52	67.49	9.39	19.66	15.67	7.38	Quispisisa
HU289-02	289	39	5	857.19	6137.41	32.96	198.66	147.59	10.22	75.47	10.68	23.14	21.25	5.83	Quispisisa
HU290-01	290	39	5	810.54	5953.17	31.62	183.78	146.39	11.63	71.17	9.42	23.61	15.68	7.54	Quispisisa
HU292-01	292	39	5	803.26	5956.52	32.43	188.22	143.89	12.27	69.87	8.40	22.24	17.62	6.85	Quispisisa
HU293-01	293	39	5	774.23	5808.22	32.17	185.54	139.65	12.59	70.73	10.08	24.26	19.07	10.28	Quispisisa
HU293-02	293	39	5	857.94	6104.66	22.52	202.99	148.28	11.03	71.75	13.62	21.00	17.10	9.57	Quispisisa
HU293-03	293	39	5	799.21	5845.90	34.99	182.13	136.24	10.58	69.96	10.48	22.08	17.63	7.60	Quispisisa
HU294-01	294	39	5	877.87	6320.46	28.36	207.99	152.86	11.50	78.66	12.64	23.61	17.25	9.41	Quispisisa
HU294-02	294	39	5	785.76	5824.89	32.79	188.66	132.62	11.29	90.50	9.86	22.00	13.94	7.98	Quispisisa
HU294-03	294	39	5	876.78	6098.56	31.63	200.90	150.86	10.53	76.99	11.55	23.36	17.42	6.82	Quispisisa
HU294-04	294	39	5	794.95	5836.42	36.58	179.26	137.29	11.20	71.67	9.60	20.41	19.83	8.11	Quispisisa
HU294-05	294	39	5	753.48	5705.06	30.25	177.71	131.56	11.39	69.14	7.89	21.29	17.13	6.95	Quispisisa
HU294-06	294	39	5	792.77	5790.47	36.04	185.31	134.96	10.59	69.09	10.39	20.66	16.01	7.51	Quispisisa
HU294-07	294	39	5	781.41	5802.86	31.78	181.44	139.23	11.80	69.07	10.73	24.89	17.07	7.20	Quispisisa
HU295-01	295	39	5	909.21	6290.28	26.31	210.97	152.92	12.48	76.09	13.28	24.39	18.39	8.24	Quispisisa
HU295-02	295	39	5	793.93	5933.95	35.94	188.29	141.15	11.47	69.76	10.95	25.17	18.65	10.99	Quispisisa
HU295-03	295	39	5	813.86	5839.53	31.92	181.44	136.78	11.41	69.61	9.04	21.26	17.11	8.30	Quispisisa
HU295-04	295	39	5	949.98	6559.24	31.60	214.95	161.42	11.64	78.20	13.42	26.90	21.84	7.02	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU295-05	295	39	5	797.82	5800.09	21.20	195.47	142.83	9.88	73.55	10.13	20.61	18.56	5.90	Quispisisa
HU295-06	295	39	5	1015.39	6820.63	33.02	224.79	169.66	11.81	106.40	15.41	27.96	19.34	6.17	Quispisisa
HU295-07	295	39	5	772.18	5863.22	34.76	180.54	138.95	11.56	70.67	9.18	25.20	18.59	11.13	Quispisisa
HU295-08	295	39	5	773.22	5765.39	34.18	176.97	135.89	12.02	68.90	9.15	24.04	17.66	9.01	Quispisisa
HU296-01	296	44	9	835.63	5935.05	27.78	187.36	140.40	12.44	70.29	10.72	21.63	16.16	10.11	Quispisisa
HU296-02	296	44	9	842.27	5933.45	29.74	187.57	141.28	10.72	68.98	9.55	22.65	15.92	10.09	Quispisisa
HU296-03	296	44	9	819.76	5978.93	29.80	187.69	144.70	10.77	73.31	9.71	23.89	15.08	9.10	Quispisisa
HU296-04	296	44	9	927.83	6162.50	31.72	201.09	153.27	12.42	76.56	12.32	22.57	17.98	10.04	Quispisisa
HU296-05	296	44	9	821.29	5867.66	26.40	183.73	140.06	12.62	70.40	10.08	22.30	15.27	11.52	Quispisisa
HU296-06	296	44	9	800.37	5952.68	27.61	185.61	141.54	12.09	70.69	11.10	21.83	17.77	11.72	Quispisisa
HU296-07	296	44	9	819.93	5912.88	29.72	183.92	140.22	12.22	69.46	10.47	28.02	15.84	9.18	Quispisisa
HU299-01	299	37	7	836.61	6051.07	32.28	193.98	145.97	10.87	70.25	9.75	24.23	16.68	9.82	Quispisisa
HU300-01	300	40		814.88	5862.75	33.60	187.76	137.46	12.69	71.33	10.88	24.70	14.97	7.57	Quispisisa
HU300-02	300	40		756.70	5721.76	38.24	144.04	82.55	11.57	92.80	10.66	15.32	11.58	2.70	Alca-1
HU303-01	303	41	6	762.68	5722.66	28.05	183.64	137.55	12.06	70.91	9.06	24.99	15.55	7.01	Quispisisa
HU310-01	310	48	12	802.19	5982.22	28.39	187.85	136.84	11.73	70.62	9.98	24.53	15.70	12.69	Quispisisa
HU310-02	310	48	12	791.27	5973.75	28.03	192.64	140.79		72.81	10.57	24.34	17.01	13.03	Quispisisa
HU310-03	310	48	12	816.87	5802.12	33.21	177.48	135.90	14.11	69.20	10.47	22.50	19.83	12.99	Quispisisa
HU311-01	311	35	1	847.02	6037.07	29.04	196.23	144.84	13.33	73.23	11.82	22.05	18.26	10.48	Quispisisa
HU311-02	311	35	1	933.00	6398.40	35.48	208.10	156.98	10.90	99.64	13.28	24.34	16.60	7.55	Quispisisa
HU311-03	311	35	1	961.16	6308.17	33.79	178.15	137.91	12.79	70.70	9.54	25.16	20.19	11.44	Quispisisa
HU311-04	311	35	1	799.47	5832.81	33.88	184.03	139.30	11.64	68.89	9.26	24.22	17.35	7.98	Quispisisa
HU311-05	311	35	1	814.48	5890.00	28.69	179.57	138.94	11.58	71.16	10.21	22.95	18.69	6.11	Quispisisa
HU311-06	311	35	1	766.40	5731.79	28.75	184.40	136.53		70.47	9.63	25.41	14.57	11.32	Quispisisa
HU311-07	311	35	1	772.38	5870.56	38.72	183.20	137.87	10.37	70.28	9.26	24.69	17.53	8.27	Quispisisa
HU311-08	311	35	1	930.03	6401.96	34.80	210.12	155.41	11.43	74.53	12.71	25.53	16.54	6.98	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU312-01	312	35	1	802.80	5892.18	30.81	187.92	140.89	11.87	72.58	9.92	25.30	16.47	7.31	Quispisisa
HU312-02	312	35	1	771.17	5710.91	31.57	177.81	132.47	10.10	68.25	10.41	17.28	17.23	6.79	Quispisisa
HU312-03	312	35	1	903.19	6094.53	27.67	203.36	149.77	11.35	74.90	11.33	23.89	16.38	9.01	Quispisisa
HU312-04	312	35	1	805.07	5871.65	31.95	187.85	139.21	10.62	69.83	9.77	23.47	17.32	6.23	Quispisisa
HU312-05	312	35	1	778.38	5893.61	31.94	186.35	139.07	11.43	71.89	8.75	22.70	16.39	8.01	Quispisisa
HU312-06	312	35	1	819.38	5889.51	37.13	186.42	139.55	11.62	70.66	9.53	25.99	17.65	10.80	Quispisisa
HU312-07	312	35	1	799.28	5798.17	26.46	181.93	134.88	11.15	69.18	10.00	20.11	17.92	7.14	Quispisisa
HU312-08	312	35	1	837.60	5970.27	28.23	189.10	144.08	10.32	71.36	10.81	21.55	17.82	8.99	Quispisisa
HU312-09	312	35	1	786.87	5885.90	32.92	186.72	138.08	11.24	70.69	9.92	20.26	17.64	7.88	Quispisisa
HU315-01	315	37	7	789.57	5859.90	29.94	181.60	142.81	10.48	70.60	10.50	21.56	18.22	8.16	Quispisisa
HU320-01	320	48	12	803.31	5802.39	31.29	184.38	137.95	11.59	73.45	11.50	21.15	15.67	9.91	Quispisisa
HU324-01	324	44	9	755.94	5811.31	38.79	180.88	131.26	10.87	66.75	8.82	24.74	18.22	8.98	Quispisisa
HU324-02	324	44	9	839.23	5953.50	28.08	192.02	141.69	11.64	71.63	10.81	23.77	16.73	10.94	Quispisisa
HU325-01	325	44	9	807.45	5977.81	35.25	187.60	139.07	11.43	70.52	9.99	23.22	14.18	7.30	Quispisisa
HU326-01	326	44	9	780.02	5831.51	37.12	185.14	139.72	10.19	69.74	11.54	26.87	16.03	10.47	Quispisisa
HU327-01	327	44	9	798.64	5880.49	34.88	191.28	142.21	11.03	71.82	10.73	21.11	15.99	7.67	Quispisisa
HU327-02	327	44	9	770.78	5783.72	34.12	184.87	138.43	11.50	70.75	10.74	23.45	16.87	8.26	Quispisisa
HU327-03	327	44	9	719.29	5643.22	34.30	179.91	143.26	11.42	69.86	10.52	23.46	14.29	10.04	Quispisisa
HU333-01	333	CM		781.14	6024.65	37.19	189.42	143.52	11.78	71.07	9.44	25.37	15.80	10.54	Quispisisa
HU333-02	333	CM		789.52	5802.71	29.66	184.87	136.70	11.82	70.28	9.16	22.69	19.73	8.64	Quispisisa
HU333-03	333	CM		778.27	5879.24	33.55	182.67	139.29	10.08	70.70	10.17	21.27	16.08	7.42	Quispisisa
HU333-04	333	CM		801.21	5880.96	32.89	182.16	140.24	11.56	67.22	9.69	21.56	17.66	9.19	Quispisisa
HU338-01	338	39	5	810.81	5891.60	30.67	190.30	137.60	12.04	70.86	10.02	23.45	18.20	11.06	Quispisisa
HU340-01	340	41	6A	768.15	5888.55	36.56	183.11	137.43	12.32	69.83	10.43	20.09	17.23	12.16	Quispisisa
HU340-02	340	41	6A	780.29	5778.00	30.42	182.11	136.68	12.73	69.37	9.41	25.47	15.14	10.14	Quispisisa
HU340-03	340	41	6A	810.56	5888.30	34.38	188.61	135.89		72.94	10.13	26.40	17.86	8.62	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU341-01	341	35	1	780.17	5897.08	31.76	183.18	133.62	11.12	71.51	10.13	23.94	19.11	7.58	Quispisisa
HU341-02	341	35	1	808.62	5795.21	31.98	177.95	134.22	11.31	66.86	9.59	22.86	15.77	4.68	Quispisisa
HU341-03	341	35	1	844.51	5923.16	26.85	184.06	141.50	11.33	71.57	10.17	24.06	17.33	6.15	Quispisisa
HU341-04	341	35	1	806.55	6019.70	30.77	191.21	141.02	10.74	70.70	9.70	22.78	16.78	7.78	Quispisisa
HU341-05	341	35	1	816.46	5894.80	29.81	186.67	137.89	11.44	71.79	10.61	24.42	16.00	7.92	Quispisisa
HU341-06	341	35	1	820.09	6168.09	32.34	200.60	151.08	11.57	74.36	10.25	25.11	20.29	4.68	Quispisisa
HU341-07	341	35	1	1070.14	6947.79	34.92	228.86	171.95	12.88	80.71	14.62	26.89	20.54	6.29	Quispisisa
HU341-08	341	35	1	851.36	5958.79	32.90	194.96	146.96	11.60	73.92	11.08	24.16	17.50	6.03	Quispisisa
HU341-09	341	35	1	777.21	5987.46	35.23	188.24	143.54		72.27	11.16	22.38	20.03	7.95	Quispisisa
HU341-10	341	35	1	809.67	5963.65	34.41	186.37	137.82	10.20	69.47	11.46	21.57	17.12	8.31	Quispisisa
HU343-01	343	43	8	746.97	5841.84	30.42	182.81	133.87	11.16	69.17	11.21	23.20	17.51	9.93	Quispisisa
HU343-02	343	43	8	770.98	5820.64	31.21	186.55	139.54	12.37	69.72	10.05	24.83	18.23	11.35	Quispisisa
HU343-03	343	43	8	819.27	6057.59	28.85	193.82	143.83	11.72	73.96	9.84	21.27	17.62	8.02	Quispisisa
HU343-04	343	43	8	764.26	5821.91	34.08	180.98	138.59	12.64	68.48	9.33	26.26	15.92	10.84	Quispisisa
HU348-01	348	47	11	773.85	5937.94	32.98	191.28	143.06	11.68	71.04	10.06	24.26	17.91	9.86	Quispisisa
HU354-01	354	37	7	785.15	6018.56	38.34	187.46	138.34	12.45	71.31	9.78	26.01	19.36	10.00	Quispisisa
HU354-02	354	37	7	783.43	5868.07	36.00	188.04	141.48	11.95	71.87	9.41	21.61	18.89	7.93	Quispisisa
HU354-03	354	37	7	785.81	5921.65	31.76	191.07	141.29	11.07	70.92	10.96	26.67	16.15	7.13	Quispisisa
HU359-01	359	35	1	864.98	5988.28	22.91	198.47	147.36	12.34	76.38	11.88	25.43	18.49	9.30	Quispisisa
HU359-02	359	35	1	847.72	6029.15	28.62	189.22	141.34	10.84	72.94	10.48	21.83	19.31	8.95	Quispisisa
HU359-03	359	35	1	770.36	5878.56	30.50	184.84	134.20	11.41	68.92	8.81	19.39	16.89	9.57	Quispisisa
HU359-04	359	35	1	806.75	5869.41	31.36	187.27	141.83	10.79	68.65	10.40	23.21	14.52	9.49	Quispisisa
HU359-05	359	35	1	782.63	5929.73	31.28	183.85	137.89	11.01	70.69	9.61	25.77	18.14	6.00	Quispisisa
HU359-06	359	35	1	865.10	6092.30	30.57	203.03	149.69	11.83	74.60	10.57	22.21	16.31	8.56	Quispisisa
HU359-07	359	35	1	859.16	6116.71	25.22	196.81	146.28	11.48	75.24	10.70	24.97	16.31	9.05	Quispisisa
HU359-08	359	35	1	760.37	5668.13	25.48	175.12	127.97	11.06	69.08	8.63	22.59	18.76	8.40	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU359-09	359	35	1	779.96	5722.76	33.65	178.55	130.02		69.17	9.66	19.63	16.63	7.65	Quispisisa
HU359-10	359	35	1	860.00	6040.30	28.28	193.50	147.78	11.35	73.84	10.13	19.97	18.28	6.05	Quispisisa
HU359-11	359	35	1	809.98	5887.64	32.19	185.68	139.01		69.73	9.44	22.66	16.00	9.53	Quispisisa
HU359-12	359	35	1	790.68	6050.94	35.08	191.11	142.84	12.04	72.65	9.92	23.55	18.32	9.56	Quispisisa
HU359-13	359	35	1	965.71	6579.51	28.56	220.32	167.95	10.79	79.10	13.94	27.73	19.92	8.21	Quispisisa
HU359-14	359	35	1	830.70	5945.68	31.94	182.67	141.56	11.30	73.22	9.51	21.83	17.09	9.72	Quispisisa
HU359-15	359	35	1	827.89	6039.91	30.57	196.28	145.02	12.81	74.40	10.70	25.72	19.60	7.89	Quispisisa
HU359-16	359	35	1	769.25	5917.60	27.31	178.15	131.61	11.86	70.23	9.69	25.63	15.68	4.16	Quispisisa
HU359-17	359	35	1	813.41	5960.50	33.72	190.26	144.62	11.77	91.41	11.63	25.29	14.29	6.53	Quispisisa
HU359-18	359	35	1	853.36	6168.69	30.50	201.23	150.04	12.40	73.89	11.83	24.18	19.68	4.78	Quispisisa
HU359-19	359	35	1	747.58	5858.87	31.69	181.79	138.29	12.05	70.74	9.92	27.57	17.89	6.91	Quispisisa
HU359-20	359	35	1	743.40	5780.86	24.61	176.51	132.29	10.14	67.66	9.97	26.81	16.06	5.17	Quispisisa
HU359-21	359	35	1	768.21	5866.02	34.36	189.96	136.12	10.97	69.94	10.58	26.14	16.85	6.73	Quispisisa
HU379-01	379	47	11	765.39	5837.34	34.50	183.89	136.68		71.24	9.21	29.49	16.59	11.22	Quispisisa
HU379-02	379	47	11	852.58	5992.60	30.68	194.72	144.56	11.62	71.14	10.93	26.08	16.83	9.03	Quispisisa
HU379-03	379	47	11	799.12	5875.86	33.13	183.87	139.90	11.55	70.20	10.24	20.95	16.50	11.55	Quispisisa
HU379-04	379	47	11	779.49	5732.01	30.87	176.26	131.77	11.12	67.10	10.62	23.39	16.24	11.09	Quispisisa
HU384-01	384	35	1	798.51	6051.48	31.09	192.23	145.22	10.58	71.91	11.12	27.01	14.64	9.72	Quispisisa
HU384-02	384	35	1	899.53	6332.72	30.77	207.01	154.65	11.35	76.22	11.27	25.60	19.36	8.31	Quispisisa
HU384-03	384	35	1	859.29	6132.18	34.77	206.46	156.32	11.10	96.61	10.95	23.26	16.66	5.61	Quispisisa
HU384-04	384	35	1	713.06	6062.82	37.74	198.31	148.24	12.52	75.63	11.10	21.82	18.02	10.67	Quispisisa
HU384-05	384	35	1	769.27	5754.67	29.93	181.02	136.60	10.52	68.41	10.91	22.45	15.39	7.10	Quispisisa
HU384-06	384	35	1	897.87	6281.17	29.66	208.66	150.81	11.31	77.15	12.09	26.17	18.63	7.95	Quispisisa
HU384-07	384	35	1	795.04	5738.91	30.57	181.83	136.85	11.54	68.67	9.16	19.41	14.61	6.85	Quispisisa
HU384-08	384	35	1	759.89	5799.37	27.11	187.11	136.76	11.32	69.42	9.71	24.06	17.36	9.94	Quispisisa
HU385-01	385	35	1	1033.48	6708.26	29.50	221.02	163.95	12.80	102.73	15.66	24.33	17.88	7.71	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU385-02	385	35	1	741.49	5749.35	34.38	184.22	138.33	11.93	70.87	8.85	20.93	17.79	10.99	Quispisisa
HU385-03	385	35	1	800.76	5872.17	27.36	185.19	137.94	10.82	69.99	10.16	22.48	18.82	10.61	Quispisisa
HU385-04	385	35	1	898.95	6327.46	25.64	204.98	152.31	11.56	98.29	12.92	24.23	16.32	6.45	Quispisisa
HU385-05	385	35	1	777.16	5807.16	29.86	182.83	136.82	11.33	67.50	9.86	23.45	21.49	7.54	Quispisisa
HU385-06	385	35	1	788.38	5950.04	33.59	190.07	140.73	10.87	73.33	9.78	24.42	17.88	11.97	Quispisisa
HU385-07	385	35	1	978.24	6689.11	35.23	223.45	167.20	13.05	80.31	13.69	26.93	20.85	9.89	Quispisisa
HU386-01	386	35	1	816.47	6014.31	32.65	190.33	144.66	11.76	72.81	9.88	23.03	16.35	11.70	Quispisisa
HU386-02	386	35	1	820.48	5848.58	33.43	184.91	138.14	12.48	93.78	9.60	23.44	14.35	7.02	Quispisisa
HU391-01	391	43	8	796.94	5924.07	28.85	185.12	140.13	12.65	73.24	9.47	22.69	17.74	11.08	Quispisisa
HU391-02	391	43	8	793.51	5928.62	32.23	188.52	140.72	12.70	70.10	10.15	20.31	17.04	9.04	Quispisisa
HU391-03	391	43	8	906.72	6296.18	31.33	211.83	155.97	12.37	76.32	12.20	23.81	18.94	8.43	Quispisisa
HU391-04	391	43	8	769.87	5901.01	31.02	186.30	139.96	10.47	70.73	9.80	21.96	15.28	9.67	Quispisisa
HU391-05	391	43	8	938.20	6573.30	36.08	220.95	163.19	12.28	78.91	15.18	27.01	19.38	8.05	Quispisisa
HU397-01	397	42		788.60	5881.58	35.64	188.45	139.48	10.46	68.97	10.76	25.04	18.65	5.84	Quispisisa
HU397-02	397	42		805.81	5902.20	33.07	186.74	136.17	11.89	69.38	9.72	25.07	18.52	11.93	Quispisisa
HU405-01	405	35	1	823.43	6050.41	30.55	195.95	147.88	11.46	71.92	10.98	23.36	17.84	5.83	Quispisisa
HU417-01	417	42		790.27	5921.97	33.96	188.41	138.89	11.99	69.74	9.87	22.79	15.57	8.23	Quispisisa
HU417-02	417	42		806.36	5877.42	37.98	183.71	141.73	11.64	70.65	10.19	22.25	17.68	7.59	Quispisisa
HU417-03	417	42		735.75	5723.04	43.52	181.88	137.19	10.54	70.78	11.66	25.04	17.38	9.65	Quispisisa
HU417-04	417	42		777.53	5775.62	32.53	180.40	135.96	11.03	70.28	9.52	20.32	16.29	8.04	Quispisisa
HU419-01	419	35	1	855.38	6056.21	31.04	201.60	146.89	11.11	74.07	12.69	21.86	17.38	9.25	Quispisisa
HU419-02	419	35	1	788.51	5995.93	35.89	186.67	137.63	12.11	71.98	9.63	25.45	19.49	6.69	Quispisisa
HU419-03	419	35	1	788.39	5896.63	30.94	188.27	138.60	11.54	70.87	9.25	23.78	17.83	8.44	Quispisisa
HU419-04	419	35	1	765.87	5794.86	38.25	188.87	142.37	11.05	70.69	10.47	24.22	18.88	9.20	Quispisisa
HU420-01	420	35	1	832.08	5903.67	29.40	190.88	141.72	11.23	72.15	10.57	23.37	14.53	6.17	Quispisisa
HU422-01	422	44	9	757.45	5836.76	36.85	185.42	140.96	10.53	70.69	9.15	23.68	16.37	8.54	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU422-02	422	44	9	959.70	6510.09	35.68	219.97	166.50	12.41	101.86	12.45	27.82	16.94	6.19	Quispisisa
HU423-01	423	43	8	772.20	5888.81	30.89	186.49	139.97	11.46	70.80	11.46	22.55	18.05	9.17	Quispisisa
HU430-01	430	41	6B	843.29	6021.59	33.46	195.00	145.70	12.45	73.92	11.88	23.86	16.72	9.84	Quispisisa
HU435-01	435	54		788.35	5777.03	31.90	181.30	133.85	11.02	68.38	9.83	24.13	14.61	7.35	Quispisisa
HU435-02	435	54		859.23	6004.34	28.99	184.80	139.60	11.87	70.88	9.43	22.41	17.14	8.50	Quispisisa
HU435-03	435	54		789.72	5912.06	32.97	183.31	136.82	10.80	70.74	10.06	25.35	18.34	10.04	Quispisisa
HU435-04	435	54		801.07	5997.07	34.48	192.04	140.16	11.02	72.96	9.88	28.83	17.79	9.84	Quispisisa
HU435-05	435	54		930.81	6444.44	32.67	211.37	162.37	11.63	76.95	12.49	23.38	18.73	8.54	Quispisisa
HU435-06	435	54		825.17	5965.35	30.67	185.37	141.05	12.01	71.74	9.91	23.32	16.47	8.62	Quispisisa
HU446-01	446	35	1	784.60	5812.72	30.58	184.03	136.37	11.55	70.60	8.99	21.51	16.91	7.35	Quispisisa
HU449-01	449	46	10	781.08	5934.39	32.96	189.63	143.17	11.27	71.17	9.69	27.45	18.36	10.51	Quispisisa
HU463-01	463	44	9	891.09	6236.12	30.32	206.78	152.47	10.61	74.79	11.93	23.68	17.35	10.65	Quispisisa
HU463-02	463	44	9	823.83	5989.41	30.92	191.92	143.85	10.28	72.40	11.37	22.01	18.68	11.00	Quispisisa
HU476-01	476	47	11	821.88	6066.65	27.58	194.59	144.93	11.23	74.20	10.42	24.66	17.43	9.29	Quispisisa
HU476-02	476	47	11	918.44	6257.50	41.17	185.26	142.04	11.71	69.21	8.67	26.90	16.17	10.05	Quispisisa
HU476-03	476	47	11	824.41	6007.94	28.38	188.82	140.28	10.47	74.18	9.60	22.39	16.37	10.54	Quispisisa
HU476-04	476	47	11	835.52	6217.00	31.17	197.62	145.58	12.83	73.38	10.30	27.99	16.53	10.51	Quispisisa
HU478-01	478	39	5	789.06	5843.32	26.99	193.08	133.07	12.09	70.39	10.03	23.62	16.03	7.78	Quispisisa
HU480-01	480	35	1	821.94	5919.53	35.35	180.77	137.68		69.61	9.20	22.17	17.19	8.61	Quispisisa
HU481-06	481	CM		769.72	5812.81	30.94	182.32	135.55	12.07	69.69	8.87	24.30	17.20	8.67	Quispisisa
HU485-01	485	41	6A	816.54	5887.01	31.87	184.98	138.48	12.01	72.35	10.14	22.41	17.68	9.22	Quispisisa
HU492-01	492	39	5	975.15	7701.75	56.25	169.41	292.89	22.81	160.69	17.83	29.45	8.36		Jampatilla
HU492-02	492	39	5	768.26	5834.65	33.23	184.96	135.97	11.06	72.01	10.36	25.89	19.86	5.94	Quispisisa
HU494-01	494	41	6A	835.07	6091.21	31.44	196.07	148.30	12.08	74.95	10.69	21.97	15.75	8.05	Quispisisa
HU494-02	494	41	6A	791.19	5794.22	30.56	181.44	133.18	10.83	69.61	9.09	23.89	15.22	9.54	Quispisisa
HU500-01	500	41	6A	807.45	5817.94	36.71	186.32	137.26	12.35	70.01	10.08	23.05	19.90	10.65	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU500-02	500	41	6A	875.34	6186.41	27.77	203.87	149.86	11.55	74.90	12.18	24.31	17.54	9.18	Quispisisa
HU500-03	500	41	6A	799.24	5848.72	24.39	182.50	136.32	11.66	69.96	10.69	19.26	16.35	7.69	Quispisisa
HU500-04	500	41	6A	832.34	6005.27	30.81	192.85	144.34	10.46	73.38	9.95	22.31	17.91	8.33	Quispisisa
HU500-05	500	41	6A	791.99	5889.11	27.57	186.93	138.31	11.93	70.51	9.77	27.50	17.07	9.34	Quispisisa
HU502-01	502	37	7	788.49	5675.44	34.17	179.57	132.25	12.40	70.84	10.43	21.56	14.70	10.58	Quispisisa
HU511-01	511	43	8	827.14	5924.04	30.27	182.94	139.96	12.29	69.62	9.60	22.90	14.95	5.65	Quispisisa
HU511-02	511	43	8	758.62	5865.23	34.58	185.17	137.41	12.56	71.09	9.55	22.89	17.21	10.00	Quispisisa
HU517-01	517	39	5	762.86	5767.65	32.94	183.71	136.57	10.29	72.03	10.73	22.66	15.62	5.37	Quispisisa
HU530-01	530	41	6A	896.92	6357.65	26.49	207.99	155.41	11.67	77.41	11.93	22.77	17.32	8.31	Quispisisa
HU531-01	531	44	9	239.00	3360.95		19.52	22.81		10.10					Lechatelierite
HU532-01	532	39	5	739.92	5700.24	31.06	178.45	135.76	11.28	67.19	8.28	23.97	15.13	6.52	Quispisisa
HU532-02	532	39	5	816.10	5978.21	33.88	184.68	136.70	12.49	71.51	9.40	22.63	17.21	8.64	Quispisisa
HU532-03	532	39	5	453.86	5662.52	33.22	139.60	159.33	14.41	39.10	13.37	25.23	8.91		Unknown
HU532-04	532	39	5	813.53	5942.02	29.47	187.34	141.85	11.37	71.65	11.88	23.87	18.05	5.06	Quispisisa
HU532-05	532	39	5	781.81	5894.80	32.54	186.35	136.35	11.12	70.94	9.82	25.57	18.45	7.49	Quispisisa
HU536-01	536	46	10	759.54	5829.40	38.45	182.57	136.84	11.01	69.43	10.31	23.09	19.80	7.30	Quispisisa
HU536-02	536	46	10	800.35	5968.65	32.55	190.42	142.15	11.34	71.30	9.55	23.64	17.30	10.38	Quispisisa
HU540-01	540	43	8	815.80	5851.30	27.73	187.78	139.80	9.90	70.06	10.04	25.31	17.64	8.12	Quispisisa
HU540-02	540	43	8	742.27	5753.50	49.84	144.11	85.07	11.97	85.80	10.92	18.60	10.34	3.82	Alca-1
HU546-01	546	35	1	930.73	6294.79	30.22	212.50	153.52	11.69	77.96	13.82	25.96	17.73	9.61	Quispisisa
HU636-01	636	72	14	764.26	5843.67	34.22	183.68	136.74	11.76	70.10	10.55	18.88	19.24	8.08	Quispisisa
HU641-01	641	70	6	784.10	5818.02	30.37	178.99	135.23	12.43	70.10	8.88	26.43	16.67	7.61	Quispisisa
HU651-01	651	74		768.72	5877.47	33.02	184.38	135.98	12.20	70.21	9.26	20.73	15.85	7.21	Quispisisa
HU657-01	657	60	13	785.10	5786.05	32.52	178.25	133.68	11.83	69.42	9.75	22.24	17.15	6.38	Quispisisa
HU657-02	657	60	13	817.69	5957.77	28.49	188.78	141.13	10.91	70.08	9.09	22.01	17.44	6.20	Quispisisa
HU665-01	665	75	15	778.23	5927.58	34.39	188.04	136.57	11.12	70.85	9.53	25.33	16.63	8.24	Quispisisa

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU665-02	665	75	15	823.78	5985.66	28.29	191.18	142.46	12.41	72.80	10.42	20.47	15.45	7.90	Quispisisa
CRB2005				654.88	13186.68	222.82	269.41		191.54	414.83	231.87	75.76	23.25		
CRB2005				707.62	13070.05	221.99	265.34		189.50	408.65	233.36	67.38	23.34	12.82	
CRB2005				663.79	13180.54	226.21	266.49		193.74	404.37	235.68	71.08	25.97	11.71	
CRB2005				674.67	13261.62	224.78	272.91		197.14	434.68	239.07	74.82	20.93		
CRB2005				660.22	13197.06	220.94	264.27		190.69	428.25	233.05	75.50	24.63	10.72	
CRB2005				688.12	13338.34	232.08	272.28		195.88	411.61	239.00	71.38	23.19	9.16	
CRB2005				667.13	13356.17	214.96	266.98		186.80	403.99	234.21	75.10	24.69	13.56	
ELC001				769.09	6085.45	39.14	149.64	151.65	17.28	98.09	8.47	16.91	7.97		
ELC001				809.13	6071.34	32.82	152.07	155.49	16.49	97.11	10.17	16.88	7.42	3.26	
ELC001				832.74	6033.99	42.16	150.77	156.36	14.75	99.30	8.52	16.55	6.05	5.22	
ELC001				790.78	6101.19	39.02	148.99	156.72	17.31	101.67	8.59	18.18	7.62		
ELC001				833.27	6086.89	45.07	151.68	162.93	17.43	97.83	10.62	15.49	8.25	4.06	
ELC001				782.70	6030.70	41.48	147.14	154.85	16.89	100.37	8.08	13.82	7.15		
ELC001				823.40	6054.34	40.24	148.60	156.00	17.62	97.31	8.87	16.24	12.12	5.52	
ELC001				824.96	6094.34	39.97	148.02	156.85	16.48	100.27	8.75	14.89	7.69		
NIST 2710				2426.42	29188.06	7050.55	137.12	363.06	60.54	86.58	9.46	5234.11	16.65	11.79	
NIST 2710				2400.81	29371.51	6943.64	136.54	353.82	63.79	88.52	11.59	5191.35	47.07	18.29	
NIST 2710				2377.53	29442.73	7082.85	137.98	362.68	63.05	84.93	12.51	5264.95	29.88	16.74	
NIST 2710				2496.35	29707.57	7181.14	142.93	360.43	58.80	86.16	10.96	5304.88	44.04	16.76	
NIST 2710				2442.85	29830.40	7201.19	141.84	366.14	63.52	87.52	12.36	5378.65	30.74	15.46	
NIST 2710				2494.41	29930.92	7271.66	140.31	372.32	68.00	89.03	10.96	5348.49	54.21	17.40	
NIST 2711				2667.22	24855.65	327.88	123.49	264.70	37.22	261.69	16.57	1136.25	14.70		
NIST 2711				2561.50	24230.91	307.34	121.22	258.82	35.74	260.33	16.86	1096.22	16.71		
NIST 2711				2531.13	24840.61	318.75	123.97	267.34	38.02	256.80	16.20	1133.43	16.81		
NIST 2711				2553.79	24628.56	323.17	123.49	267.51	36.44	260.55	17.38	1150.44	8.07		

Sample	Locus	Unit	EA	Ti	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
NIST 2711				2594.93	24884.12	332.19	120.94	264.24	35.79	258.41	16.17	1129.54	12.35		
NIST 2711				2434.03	24673.77	316.00	121.98	262.96	39.18	260.28	16.46	1115.98	16.22		

Appendix C: Bruker PXRF Analysis Results

Sample	Locus	Unit	EA	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU39-02	39			5411.10	24.55	198.68	150.08	14.68	105.39	16.67	20.05	11.99	26.50	Quispisisa
HU68-02	68	29	1	5424.93	23.23	199.77	153.87	16.50	106.64	18.37	20.58	13.09	30.43	Quispisisa
HU134-01	134	29	1	5972.11	25.44	214.59	164.13	16.03	113.52	19.86	22.92	14.91	36.45	Quispisisa
HU213-03	213	39	5	4571.79	31.59	150.58	87.80	12.14	107.53	12.30	11.57	8.89	10.26	Alca-1
HU218-01	218	30, 32, 33	2	5199.35	20.77	193.32	147.89	13.00	99.95	14.96	20.59	11.69	18.68	Quispisisa
HU230-02	230	36	3	5645.95	25.17	203.63	155.99	15.80	109.81	20.05	21.20	13.78	38.28	Quispisisa
HU258-02	258	41	6	5218.08	23.00	187.89	133.80	9.59	98.70	10.68	19.53	11.17	19.79	Quispisisa
HU259-02	259	41	6	5187.89	22.90	187.10	138.92	13.26	97.81	10.74	19.31	11.22	17.72	Quispisisa
HU261-10	261	35	1	13237.15	43.60	260.05	170.49	22.84	309.74	14.99	17.03	15.85	23.69	Unknown
HU263-02	263	40		4445.45	33.81	146.26	89.33	12.22	99.29	13.43	11.56	8.38	6.68	Alca-1
HU280-01	280	41	6	4982.06	21.60	188.80	137.71	8.44	99.45	10.59	18.38	10.89	15.67	Quispisisa
HU295-04	295	39	5	5831.95	24.37	208.85	163.33	15.04	110.98	22.19	23.43	15.14	34.78	Quispisisa
HU295-06	295	39	5	5849.84	24.24	205.78	160.17	14.22	111.31	20.10	22.88	14.24	36.67	Quispisisa
HU296-04	296	44	9	5306.50	23.30	193.54	144.35	10.99	102.79	16.17	20.11	11.78	25.35	Quispisisa
HU311-02	311	35	1	5812.67	24.25	181.40	136.95	10.88	96.73	12.55	18.74	10.64	16.83	Quispisisa
HU311-03	311	35	1	5518.12	21.88	202.51	153.69	14.58	107.74	18.80	21.16	12.68	26.62	Quispisisa
HU311-08	311	35	1	5560.87	21.76	197.97	152.17	14.82	104.30	19.49	20.50	13.04	31.61	Quispisisa
HU341-07	341	35	1	6270.57	26.67	213.45	170.99	17.10	116.39	28.47	26.03	16.55	50.21	Quispisisa
HU385-01	385	35	1	5684.51	25.16	208.11	164.28	18.40	110.71	21.80	24.02	14.74	43.28	Quispisisa
HU422-02	422	44	9	5268.94	21.19	195.63	146.98	14.18	105.41	17.14	19.51	12.10	25.66	Quispisisa
HU435-05	435	54		5460.91	22.38	197.63	154.37	13.49	105.96	17.95	19.87	11.86	24.18	Quispisisa
HU476-02	476	47	11	5059.31	21.01	184.11	139.28	10.12	97.33	11.85	18.43	11.03	14.75	Quispisisa
HU492-01	492	39	5	7686.89	43.88	168.27	282.29	32.78	175.15	20.47	19.81	9.77	15.99	Jampatilla
HU531-01	531	44	9	1535.98	-1.72	4.49	9.26	0.41	6.00	0.53	10.41	3.26	2.00	Lechatelierite
HU532-03	532	39	5	4265.84	24.15	140.44	156.59	12.21	51.53	15.64	21.40	8.55	12.68	Unknown

Sample	Locus	Unit	EA	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU540-02	540	43	8	4465.22	33.71	145.04	87.94	12.56	102.31	13.91	11.49	8.26	7.27	Quispisisa
HU546-01	546	35	1	5449.69	22.96	200.10	152.87	14.85	104.48	18.38	20.93	12.78	26.45	Quispisisa
HU671-01	671	60	13	5140.81	20.73	187.93	138.22	12.55	97.76	12.63	18.60	10.74	10.57	Quispisisa
HU681-01	681	71	14	4142.96	29.82	125.64	61.73	10.98	88.78	30.69	13.93	7.67	5.52	Puzolana
HU690-01	690	74		5188.17	22.68	187.89	137.45	11.70	99.20	9.05	18.37	10.82	13.71	Quispisisa
HU690-02	690	74		5276.71	22.19	187.88	139.29	9.82	98.37	12.58	19.44	11.02	17.07	Quispisisa
HU690-03	690	74		5392.08	23.20	196.01	152.86	14.40	103.07	17.22	21.36	13.07	11.17	Quispisisa
HU690-04	690	74		4999.28	22.20	184.05	139.64	9.96	94.44	11.21	20.15	10.98	-2.04	Quispisisa
HU704-01	704	60	13	5073.84	22.18	185.79	135.47	9.64	97.89	12.95	18.26	10.90	9.67	Quispisisa
HU709-01	709	76	17	5046.29	21.39	183.68	139.17	8.93	96.23	12.48	18.89	11.17	16.82	Quispisisa
HU733-01	733	71	14	5092.18	21.10	183.24	136.30	10.98	95.91	12.78	18.18	10.73	15.51	Quispisisa
HU733-02	733	71	14	5174.75	22.23	186.29	137.21	9.94	98.29	11.31	19.19	10.64	14.81	Quispisisa
HU733-03	733	71	14	4763.24	20.57	177.57	130.91	9.39	91.96	8.81	17.83	9.86	10.02	Quispisisa
HU733-04	733	71	14	5013.81	22.84	182.99	134.77	11.47	98.80	10.65	18.50	10.45	17.85	Quispisisa
HU733-05	733	71	14	5097.38	19.38	185.52	137.03	10.00	98.13	10.30	18.56	10.79	13.64	Quispisisa
HU745-01	745	77	16	10742.02	45.35	280.04	142.49	25.41	369.93	21.82	20.79	17.70	30.33	Unknown
HU752-01	752	61		5048.74	21.44	182.06	141.92	10.93	95.31	11.81	20.50	11.51	-4.04	Quispisisa
HU758-01	758	77	16	5038.21	22.14	188.12	138.67	10.57	98.83	11.64	18.87	10.69	18.35	Quispisisa
HU758-02	758	77	16	5124.25	21.93	186.91	137.26	11.69	100.79	12.83	18.65	10.80	18.28	Quispisisa
HU770-01	770	76	17	5044.61	22.46	181.11	134.69	11.15	97.73	10.89	19.58	10.80	22.83	Quispisisa
HU777-01	777	70	6	4711.19	21.29	182.35	134.70	11.18	97.08	10.64	17.88	10.35	21.77	Quispisisa
HU792-01	792	76	17	5084.50	22.44	189.51	139.28	8.43	97.86	10.14	18.43	10.77	9.46	Quispisisa
HU795-01	795	69		5449.70	22.81	197.48	152.26	14.00	105.58	15.82	21.89	12.75	17.67	Quispisisa
HU796-01	796	77	16	5031.98	22.51	186.81	139.03	11.65	100.36	11.59	18.78	10.82	17.94	Quispisisa
HU799-01	799	71	14	5177.24	20.32	190.72	139.16	11.34	100.37	12.89	18.73	10.81	13.48	Quispisisa
HU801-01	801	60	13B	5048.33	23.84	184.40	135.98	10.24	96.80	12.71	18.50	10.81	13.73	Quispisisa

Sample	Locus	Unit	EA	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU802-01	802	74		5055.91	21.07	186.82	140.26	9.32	97.36	12.86	19.96	11.40	1.47	Quispisisa
HU802-02	802	74		4981.43	20.76	184.61	136.29	12.62	94.82	9.70	19.39	10.77	-15.33	Quispisisa
HU802-03	802	74		4912.49	22.73	181.23	137.79	12.50	94.86	10.98	18.87	10.50	-4.02	Quispisisa
HU803-01	803	70	6	5340.52	22.12	187.49	141.61	9.82	95.78	14.11	19.92	11.92	23.48	Quispisisa
HU812-01	812	72	14	5099.98	23.22	184.49	137.52	10.41	95.68	11.24	19.77	10.77	13.98	Quispisisa
HU815-01	815	67	1	5212.98	22.18	183.32	141.02	12.44	95.38	11.71	20.15	11.35	18.60	Quispisisa
HU816-01	816	78		5075.20	23.09	192.49	142.94	10.90	101.42	9.99	19.76	11.41	-12.89	Quispisisa
HU819-01	819	64		5111.08	22.76	186.80	141.58	13.46	99.23	10.46	19.00	10.86	-8.61	Alca-1
HU819-02	819	64		4535.13	34.10	143.30	88.39	12.24	97.47	13.80	11.85	8.74	15.19	Quispisisa
HU821-01	821	77	16	5023.24	21.23	184.58	139.73	8.81	99.20	12.05	19.22	11.26	15.49	Quispisisa
HU827-01	827	70	6	5029.19	21.73	183.26	137.11	9.33	96.87	11.01	19.57	10.81	21.36	Quispisisa
HU828-01	828	67	1	5026.91	22.46	185.13	137.02	11.00	96.60	9.24	19.20	10.61	16.59	Quispisisa
HU828-02	828	67	1	4905.32	20.57	182.92	133.87	9.78	96.92	12.77	19.21	10.71	21.06	Quispisisa
HU830-01	830	64		5064.41	23.48	184.37	138.77	10.11	94.08	10.19	19.24	10.93	0.92	Quispisisa
HU835-01	835	77	16	5137.13	21.49	189.95	138.61	10.91	98.05	10.66	18.27	10.65	15.67	Quispisisa
HU835-02	835	77	16	5099.55	23.22	188.11	138.29	10.90	101.84	12.08	18.05	10.92	14.70	Quispisisa
HU835-03	835	77	16	5132.41	23.18	181.54	136.88	11.53	98.66	12.85	19.58	10.98	14.27	Quispisisa
HU837-01	837	75	15	5191.65	19.95	191.29	141.04	10.29	101.39	11.26	19.25	11.29	14.26	Quispisisa
HU838-01	838	78		5169.42	21.12	191.01	139.01	9.77	98.82	10.84	18.85	11.11	0.85	Quispisisa
HU850-01	850	71	14B	5074.92	20.33	184.54	137.23	10.79	97.13	10.31	19.36	10.64	16.88	Quispisisa
HU850-02	850	71	14B	3960.46	28.80	124.97	57.48	10.62	86.58	32.01	13.94	7.64	6.09	Puzolana
HU860-01	860	74		5189.34	22.06	190.16	140.33	9.90	95.86	10.78	20.03	10.89	2.35	Quispisisa
HU865-01	865	78		5078.84	22.23	190.80	137.55	10.83	96.99	9.68	19.01	10.56	-0.07	Quispisisa
HU866-01	866	64		5163.31	22.64	189.40	142.17	10.49	96.41	10.45	19.60	11.31	1.45	Quispisisa
HU869-01	869	77	16	4399.99	33.84	145.32	87.92	12.21	97.28	13.41	12.15	8.75	5.39	Alca-1
HU883-02	883	76	17	5018.26	22.32	184.20	137.59	9.89	97.25	11.35	18.58	10.74	12.83	Quispisisa

Sample	Locus	Unit	EA	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU900-01	900	78		5247.20	22.21	188.65	140.81	11.91	94.95	12.15	19.48	11.06	8.13	Quispisisa
HU903-01	903	72	14	5131.95	21.71	186.07	135.23	9.58	98.58	12.40	18.87	10.85	19.54	Quispisisa
HU903-02	903	72	14	5099.17	19.96	184.93	140.72	9.96	95.62	12.69	19.70	11.32	18.04	Quispisisa
HU906-01	906	29	1	5057.43	20.16	184.76	136.92	10.76	94.79	10.03	18.80	10.67	14.84	Quispisisa
HU907-01	907	70	6	5170.03	20.34	187.73	139.97	9.51	96.79	13.44	20.14	11.25	15.88	Quispisisa
HU908-01	908	74		5121.94	22.78	186.72	139.40	12.40	96.68	10.49	18.87	10.90	9.29	Quispisisa
HU917-01	917	71	14B	5066.90	21.75	184.97	135.96	12.09	99.05	10.52	18.24	10.73	11.80	Quispisisa
HU917-02	917	74	14B	5069.26	22.24	183.35	136.86	10.41	96.63	12.24	18.61	11.04	18.23	Quispisisa
HU932-01	932	35/67	1	4975.38	21.65	184.80	138.27	10.52	96.97	10.97	19.28	10.87	16.55	Quispisisa
HU942-01	942	74		5087.27	21.26	184.20	139.50	10.55	95.83	14.45	19.41	10.94	12.75	Quispisisa
HU949-01	949	71	14B	5183.96	22.51	189.12	138.72	10.86	99.14	10.87	18.31	10.82	15.37	Quispisisa
HU949-02	949	71	14B	5140.55	23.79	187.69	139.90	11.44	97.45	11.32	19.07	11.01	15.47	Quispisisa
HU950-01	950	75	15	5384.07	21.54	188.80	141.13	9.83	99.54	13.44	19.05	11.15	17.22	Quispisisa
HU965-01	965	72	14	5144.92	21.02	191.39	138.83	10.12	97.97	11.35	19.06	10.83	13.72	Quispisisa
HU965-02	965	72	14	5166.36	20.71	189.19	139.01	9.55	98.47	11.13	19.04	10.89	18.91	Quispisisa
HU978-01	978	77	16	5138.73	20.83	188.52	139.75	11.65	99.31	10.41	18.89	11.02	11.06	Quispisisa
HU992-01	992	71	14B	5324.76	24.07	191.98	142.46	10.96	101.97	12.68	19.16	11.37	15.44	Quispisisa
HU999-01	999	60	13B	4106.97	29.61	126.16	58.83	12.90	90.39	32.68	14.87	8.01	12.70	Puzolana
HU1002-01	1002	80		4978.59	22.88	183.42	147.98	10.66	100.85	9.46	18.56	10.52	8.92	Quispisisa
HU1019-01	1019	63/72	14	5029.67	21.81	184.43	136.84	10.70	96.48	9.27	19.85	11.26	21.02	Quispisisa
HU1027-01	1027	80		5183.12	22.38	187.02	133.41	11.07	96.97	11.87	19.23	11.33	11.34	Quispisisa
HU1031-01	1031	78	19	5151.81	20.68	188.63	139.78	10.16	100.44	11.62	18.76	10.82	13.53	Quispisisa
HU1051-01	1051	78	19	5108.79	21.27	189.98	139.84	12.05	96.60	11.96	18.95	10.89	13.71	Quispisisa
HU1057-01	1057	77	16	5073.13	24.45	186.89	138.30	10.75	97.52	10.93	18.62	10.77	10.26	Quispisisa
HU1057-02	1057	77	16	6322.05	28.24	217.98	180.12	18.30	120.99	29.45	25.97	17.13	51.90	Quispisisa
HU1065-01	1065	76	17	5206.50	23.35	187.61	139.41	10.33	99.73	12.21	19.04	10.99	14.98	Quispisisa

Sample	Locus	Unit	EA	Fe	Zn	Rb	Sr	Y	Zr	Nb	Pb	Th	U	Source
HU1079-01	1079	77	16	4301.91	25.03	124.50	72.17	10.10	92.58	30.03	13.84	7.76	13.95	Puzolana
HU1081-01	1081	71	14B	4331.99	33.10	144.02	86.60	12.12	93.98	13.95	11.27	8.23	7.98	Alca-1
HU1097-01	1097	73	7	5126.45	20.26	185.93	137.08	12.21	98.30	11.85	19.46	11.08	15.51	Quispisisa
HU1106-01	1106	73	7	5214.44	20.09	185.34	140.75	10.33	98.24	11.30	19.96	11.24	19.10	Quispisisa
HU1109-01	1109	73	7	4945.89	20.57	186.06	137.04	10.53	98.62	11.51	19.08	10.91	10.93	Quispisisa
HU1109-02	1109	73	7	5324.32	24.81	192.28	142.98	12.54	101.90	12.63	19.43	11.04	23.06	Quispisisa
HU1109-03	1109	73	7	5913.08	24.30	210.40	164.59	16.03	113.31	23.58	21.99	14.60	40.26	Quispisisa
CC-001				4179.65	26.83	124.72	72.81	9.16	91.13	29.26	14.59	8.01	12.38	Puzolana
CC-001				4029.00	27.48	118.74	70.69	8.62	91.20	28.97	14.50	7.73	12.53	Puzolana
CC-001				4159.42	26.14	123.93	69.74	9.68	92.08	30.05	14.46	7.89	8.14	Puzolana
CC-001				4100.16	26.69	123.50	69.58	9.25	92.78	28.83	13.33	7.54	6.42	Puzolana
CC-001				4081.96	25.21	123.03	71.50	8.28	90.52	30.21	13.86	7.92	8.71	Puzolana
CC-001				4110.11	26.69	125.40	70.86	9.08	91.56	29.31	14.10	7.88	13.27	Puzolana
CC-001				4125.83	24.60	123.11	71.56	7.91	92.22	30.32	14.32	8.11	6.80	Puzolana

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