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Richard L. Burger
Yale University, richard.burger@yale.eldu

Catherine M. Bencic
Binghamton University--SUNY, catherinebencic@gmail.com

Michael D. Glascock
University of Missouri Research Reactor Center, glascockm@missouri.edu

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Richard L. Burger
Yale University

Catherine M. Bencic
Binghamton University

Michael D. Glascock
University of Missouri Research Reactor

INTRODUCTION

Efforts to determine the sources of obsidian artifacts from Peru and Bolivia began in the 1970s (Burger and Asaro 1977, 1979; Burger *et al.* 2000:271-272). In a multi-year pilot study at the Lawrence Berkeley Laboratory (LBL) in Berkeley, California, the existence in Peru of three major and five minor obsidian source deposits was posited on the basis of their chemical signatures. These eight types of obsidian comprised 97 percent of the 871 artifacts analyzed by neutron activation (INAA) and X-ray fluorescence (XRF). It was not until 2003 that the geological sources for all of the major and all but one of the minor chemical signatures were finally discovered. This progress has made it possible to identify the geological source for almost all of the archaeological obsidian subsequently studied from Peru. After the original pilot study of Central Andean obsidian four decades ago, only a small number of new chemical signatures such as Acangagua and Chumbivilcas have been encountered, and their use in prehistoric times appears to have been modest in scale and of mainly local significance (Burger *et al.* 2000; Glascock *et al.* 2007).

The successful identification of the geological sources of Central Andean obsidian utilized in antiquity has encouraged studies of obsidian exchange at different scales of analysis, including pan-regional surveys (Burger 2006, 2009), regional surveys (Burger *et al.* 2000; Burger *et al.* 2006b; Eerkens *et al.* 2010), and valley surveys (DeLeonardis and Glascock 2013). In addition, intensive investigations at the largest of the Peruvian obsidian source areas were initiated. These have largely focused on extraction technology and compositional variability (Jennings and Glascock 2002; Rademaker *et al.* 2013; Tripcevich and Contreras 2011; Tripcevich and Mackay 2011).

Another type of study with great promise is the in-depth study of obsidian procurement and use at individual sites. Such studies have the potential to track changes in obsidian utilization as the nature and economy of the site and the region in question evolved. To be done well, such in-depth studies require the analysis of a large sample of obsidian artifacts from controlled contexts that span the history of the site under study. Studies of this kind also require an understanding of the cultural context in which obsidian was consumed at the site. A study following such an approach was published for Marcaya in the Nasca drainage (Vaughn and Glascock 2005) and an even more extensive application of this approach exists for the Olmec site of San

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Lorenzo in Veracruz, Mexico (Hirth *et al.* 2013). The present study of Conchopata, a Huari site in the Department of Ayacucho, provides another example of this approach.

For this investigation, a large sample of obsidian artifacts (n=93) from the Middle Horizon site of Conchopata was analyzed to determine the source of the volcanic glass by using INAA at the University of Missouri Research Reactor (MURR). Prior to this, Catherine Bencic carried out lithic analysis of the obsidian and the other stone artifacts from the site (see Bencic 2016, this volume). Obsidian from Conchopata was of particular interest because of the complex patterning of obsidian exchange that occurred through much of the Central Andes in conjunction with the expansion of the Huari state. In many Middle Horizon sites, such as Pikillaqta, the pattern of obsidian acquisition during the Middle Horizon differed both from the earlier and later regional patterns of obsidian procurement (Burger 2006; Burger *et al.* 2000; Burger and Glascock 2000). The increased interregional interaction that characterizes the Middle Horizon in Peru had a clear impact on the large-scale movement of obsidian, as did the close association of the Huari state with Quispisisa, a massive obsidian source near the modern towns of Sacsamarca and Huanca Sancos in the Ayacucho Region (Burger and Glascock 2000, 2002; Figure 1).

The site of Conchopata, which will be discussed in more detail below, offers an intriguing focus for study. It is located over eighty kilometers from the Quispisisa obsidian source, but only a few kilometers from a minor source of obsidian. The latter source, originally dubbed the Ayacucho Type in the LBL pilot study, is now known as the Puzolana Source, and it extends from the outskirts of the modern city of Ayacucho (Burger and Glascock 2000/2001) for at least 20 kilometers to the south of the city, and perhaps significantly farther. While the obsidian nodules at the Quispisisa source can be quite large, up to thirty centimeters in diameter, those from the Puzolana source are rarely larger than three to four centimeters. During Preceramic, Initial Period, and Early Horizon times, the people of the Ayacucho Basin used both the Quispisisa and the Puzolana obsidian sources and over eighteen percent of the pre-Huari obsidian analyzed came from the Puzolana source (Burger 1982; Burger and Asaro 1979; Burger and Glascock 2000/2001, 2002:362; Table 1). In contrast, previous analyses on artifacts from the site of Huari suggested that the Middle Horizon urban center ignored the Puzolana source in favor of the more distant quarries of obsidian at Quispisisa (Burger and Glascock 2000/2001).

One question that we hoped to address with this study was whether a pattern of obsidian procurement that focused almost exclusively on Quipisisa, typical of the site of Huari, was found elsewhere in the Huari heartland at sites such as Conchopata. A second question of interest is whether the procurement and utilization of obsidian changed during the occupation of the Conchopata site. The Conchopata obsidian sample was carefully excavated by the Conchopata Archaeological Project directed by William Isbell, Anita Cook, José Ochatoma Paravicino, and Martha Cabrera Romero and it was then subsequently studied by lithic analyst Catherine Bencic. Judging from the radiocarbon evidence, the site appears to have been occupied for no less than four or five centuries. The controlled provenience of the obsidian samples analyzed here makes it possible to evaluate whether there were shifts in obsidian procurement over time, and if so, to explore what socioeconomic factors were responsible. A third question of concern was the degree to which Conchopata could be considered a cosmopolitan community. This theme has been explored previously by William Isbell and Tiffiny Tung using other classes of archaeological material, and we believed that obsidian sourcing data could be a valuable tool in such a consideration.

Before presenting the results of the sourcing study and a discussion of its implications for these three questions, we will provide background information on the Conchopata site. A description of patterns of obsidian usage at Conchopata, designed to complement this article, is presented in a separate Research Report by Bencic (2016, this volume).

THE SITE OF CONCHOPATA

The site of Conchopata stands 2700 meters above sea level on the northern edge of the city of Ayacucho in the central Peruvian Andes. Although the site originally covered twenty hectares or more (Isbell and Cook 2002), the construction of an airport, an army base, and an extensive residential development have destroyed most of the archaeological site. The three and a half hectares that remain intact contain the site's architectural core. The surviving area of the site is bisected by a paved road known as Avenida del Ejército, a street that is dotted with modern buildings, construction walls, and trenches.

The first scientific excavations at Conchopata were conducted in 1942 by Julio C. Tello, who uncovered a group of elaborately decorated, oversized ceremonial urns in offering contexts that are unique to the site (Menzel 1964, 1968). These ceramic vessels, assigned by Dorothy Menzel to Middle Horizon Epoch 1A, depict religious icons that may have been introduced to Ayacucho from Tiwanaku. Of particular note are the representations on the ceramic vessels of the staff god best known from Tiwanaku's Gateway of the Sun (Isbell and Cook 2002: 256; Menzel 1964, 1977).

Later survey and excavations at Conchopata conducted by Luís Lumbreras in the 1960s and early 1970s revealed stratified refuse that dated from the earliest phases of the Huari culture (Lumbreras 1974; Ochatoma 2007; Pozzi-Escot 1991). A large midden containing pottery and production tools indicated specialized ceramic production, and Lumbreras proposed that Conchopata was primarily a settlement of ceramic specialists (Lumbreras 1974). In October 1977, workmen digging a trench for a new pipeline along Conchopata's main road uncovered a new ceremonial offering of ceramics in a pit containing thousands of fragments of finely decorated jars (Isbell 1987; Isbell and Cook 1987). An emergency salvage operation was carried out by the Huari Urban Prehistory Project directed by William Isbell and Abelardo Sandoval. The surrounding area was excavated and visible surface architectural remains in the area were mapped (Isbell 1987).

After the 1977 salvage project, no additional work was conducted at the site until June of 1982, when area excavations were undertaken at Conchopata by Denise Pozzi-Escot as part of an evaluation of Ayacucho's archaeological and colonial monuments (Pozzi-Escot 1991; Pozzi-Escot *et al.* 1998). These excavations, more extensive than previous work at the site, were carried out with a goal of evaluating Conchopata's role within the Huari state. Dense concentrations of buildings and large numbers of pottery production tools were recovered, confirming that ceramic manufacture was a major activity at Conchopata. The variability in architecture at the site was believed to indicate that no formal urban plan had been followed (Pozzi-Escot 1991).

In the early 1990s, José Ochatoma Paravicino and Ismael Pérez Calderón carried out additional salvage excavations in the northern part of the site. These revealed more architectural spaces associated with pottery production (Ochatoma 2007; Ochatoma and Cabrera 2001; Pérez 1998; Pérez and Ochatoma 1998). In response to increased construction within Conchopata's architectural core by local landowners, Ochatoma and Martha Cabrera Romero began new excavations in August 1997. This project was oriented toward gaining new knowledge about the use of space, activity areas, and the manufacture, circulation, and consumption of ceramics (Ochatoma 2007; Ochatoma and Cabrera 2001). The most important goal, however, was to recover as much cultural material and information as possible before the site was totally destroyed. The continuing threat led to the formation of an international multi-year emergency excavation project that was directed by Isbell, Cook, Ochatoma, and Cabrera. From 1999 to 2003 the Conchopata Archaeological Project excavated more than 200 architectural spaces, and an enormous volume of artifacts was recovered. The sample of obsidian discussed in this article comes from these excavations.

Analyses of the Conchopata materials from the 1999-2003 excavations have led to new insights into the occupation of Conchopata. It is currently one of the best dated Middle Horizon sites in the highlands of Peru, with radiocarbon dates indicating that its occupation was continuous from A.D. 400-500 to at least A.D. 900-1000, several centuries longer than previously thought (Isbell 2001; Ketteman 2002). The research also demonstrates that Conchopata's architecture was more carefully planned than previously believed and that the entire settlement had possibly been enclosed by perimeter walls. The offerings of large pottery vessels, used for brewing and serving, were interpreted as demonstrating that feasting was a major activity at Conchopata (Isbell 2001; Isbell and Cook 2002; Isbell and Groleau 2010). Studies of ceramic iconography and production have been central to understanding life at Conchopata and its role in Huari society (Cook and Benco 2001; Cook and Glowacki 2003; Isbell 2001, 2007, 2009a, 2009b; Isbell and Cook 2002; Knobloch 2000; Ochatoma 2007; Ochatoma and Cabrera 2002; Wolff 2012). Ongoing research has revealed a wealth of information about possible activity areas and ceremonial structures (Ochatoma 2007; Ochatoma and Cabrera 2001, 2002; Tung and Cook 2006), architecture (Blacker 2001; Isbell 2001; Isbell and Cook 2002; Ochatoma 2007; Ochatoma and Cabrera 2001, 2002), mortuary practices (Isbell 2004; Isbell and Cook 2002; Milliken 2006), warfare and trophy heads (Tung 2008, 2012; Tung and Knudson 2008), ritual and depositional practices (Groleau 2009, 2011) and diet (Finucane *et al.* 2006; Rosenfeld 2012).

Based on the newly unearthed architecture and its contents, Isbell and his colleagues have concluded that Conchopata featured palaces belonging to members of the Huari elite. According to this view, although ceramic production was important throughout the history of the site, Lumbreras was incorrect in believing that the site was a specialized village of potters (Tschauner and Isbell 2012). Given its large size and impressive architecture, Isbell considers it to have been "the second city" within the Huari heartland. He has emphasized the royal character of some of the residents, the presence of palaces where they resided, and the possible practice of polygamous marriage by these powerful figures (Isbell 2007). Furthermore, Cook and Glowacki (2003:186) argue that Conchopata was occupied by a cross-section of the Huari urban population that included elites of different rank, artisans, and religious specialists. Of special relevance to our study, these Conchopata residents utilized a wide range of stone tools that were manufactured from a variety of raw materials, of which obsidian was among the most important (Bencic 2001, 2016 this volume).

SOURCING RESULTS

A total of 93 artifacts from Conchopata were submitted to short-INAA at Missouri

University Research Reactor to measure the elements Al, Ba, Cl, Dy, K, Mn, and Na. The results are listed in Table 2. As shown in Figure 2, the artifacts from Conchopata were an excellent match for the ninety-five percent confidence ellipse on a bivariate plot of Mn versus Ba for Quispisisa with the exception of one artifact (RLB446 - field ID=3957A) which came closest to the ninety-five percent confidence ellipse for Puzolana.

To confirm these results, two artifacts (*i.e.*, RLB446 and RLB495) were submitted to long irradiation where the measured elements were La, Lu, Nd, Sm, U, Yb, Ce, Co, Cs, Eu, Fe, Hf, Rb, Sb, Sc, Sr, Ta, Tb, Th, Zn, and Zr. Previous experience has shown that the long-lived elements are far more reliable than the short-lived elements for source determination. The long-INAA data for the two artifacts are listed in Table 3. As shown in the bivariate plot of Cs versus Th (Figure 3), the artifacts are excellent matches for the Puzolana and Quispisisa sources, respectively.

Obsidian Procurement and Use at Conchopata

As demonstrated by the INAA analysis summarized above, throughout its history, Conchopata residents had a strong preference for Quispisisa obsidian and they used material from this source almost exclusively. Roughly ninety-nine percent of the obsidian used for the tools and debitage analyzed from the Conchopata excavations came from the quarries at Quispisisa. Thus, the answer to the first question raised at the outset of this article is that the residents of Conchopata followed a pattern similar to the one adopted by the residents of Huari. They focused on exploiting obsidian from the Quipisisa source and almost ignored the obsidian available from the nearby Puzolana source. The deposits of volcanic glass at Quispisisa are located eighty-five kilometers to the south of Conchopata. This would imply a journey of at least five days, assuming that the obsidian was being moved by llama caravan (Flores 1968; Nicholas Tripcevich, personal communication 2014).

Yet, in spite of the distance and effort that must have been involved in procuring obsidian from the Quispisisa source, it was not carefully curated. As seen in Bencic's study (Bencic 2016, this volume), the obsidian assemblage at Conchopata includes some expedient tool types, such as retouched flakes and unifacial tools, and many large tool fragments were discarded rather than transformed into other tools. It is, therefore, clear that obsidian was not being utilized in a technologically or functionally efficient manner at Conchopata. From a functional standpoint, this is surprising, considering the high value placed on Quispisisa obsidian. Perhaps this pattern of technologically inefficient usage reflects a perception by the inhabitants of Conchopata that obsidian from Quispisisa was readily available, and that the supply chain provisioning it was reliable. Given the consistently heavy utilization of obsidian throughout the Conchopata community during its long history, this perception seems to have been justified.

These findings provide an unambiguous answer to the second question posed at the outset of this article regarding whether changes were observable in the patterns of source utilization during the four or five century history of the site. Quite simply, no changes through time were observable in obsidian source utilization in the sample analyzed. In all time periods, Quispisisa provided almost all of the obsidian that was utilized at the site. Bencic's analysis similarly documented that the pervasive presence of obsidian and its utilization in all sectors of the site studied likewise seem to have continued unchanged during the site's lengthy occupation.

The analysis of obsidian trace element composition using neutron activation (INAA) at MURR indicates that almost all of the obsidian used at Conchopata was obtained from the Quispisisa source and this pattern continues throughout the history of occupation at Conchopata. As we have noted, if the glass nodules were carried from Quispisisa by llamas to a production site at or near Conchopata, this would imply a journey of nearly a week in each direction. In contrast, the Puzolana obsidian source was only a short walk away from Conchopata and it would have taken no more than a few hours to acquire raw materials there. Despite this, Puzolana source obsidian accounted for only a single artifact in our sample, which is to say only about one percent of the samples tested.

Like the Quispisisa source deposits, the quality of the volcanic glass from the Puzolana source is excellent, so from a technological perspective, the principal advantage of the Quispisisa source compared to the Puzolana source is the large size of its nodules (Burger and Glascock 2000:293). With nodules rarely exceeding three to four centimeters in diameter, the raw material from the Puzolana source would not have been appropriate for producing many tool types, regardless of the skill of the knapper. On the other hand, the frequency with which the Puzolana source was exploited by stone workers in Preceramic and Initial Period/Early Horizon times demonstrates that Puzolana obsidian was transformed into some types of tools and utilized flakes (Table 1) for several millennia. At Conchopata, the presence of the sole obsidian artifact, a flake, made from Puzolana obsidian is significant. It demonstrates that this nearby deposit of high quality obsidian was known to the residents of Conchopata during the Middle Horizon and that it was occasionally used, although not to the degree that it was during the preceding millennia (Burger and Glascock 2001). Thus, the lack of exploitation of the nearby Puzolana source was a conscious choice rather than the result of ignorance.

The findings also suggest that the procurement of obsidian tools and nodules of Quispisisa obsidian by the residents of Conchopata was sufficiently reliable that the exploitation of the large neighboring Puzolana obsidian deposit with its tiny nodules was neither necessary nor attractive. It is likely, of course, that the actual selection of the obsidian source to be exploited may have been made by lithic crafters rather than the Conchopata consumers.

But how was the obsidian acquired from the Quispisisa source, and who prepared the tools, cores, and crude bifaces? If the people quarrying and working the obsidian were mainly outsiders, as they appear to be, judging from the lithic analysis, what was their relationship to those living in the center of Conchopata? These questions remain unresolved and should be the focus of future investigations in the field.

Debitage analysis by Bencic (2016, this volume) revealed a great deal about lithic production technologies at Conchopata. All production technologies, from expedient flake production to highly formalized technologies such as blade and biface production, produce a dominance of small-size debitage (Ahler 1989; Magne 1989; Maudlin and Amick 1989). The rarity of this small-size debitage at Conchopata is a compelling reason to conclude that almost all production took place elsewhere. If so, this implies a degree of specialization in the production of obsidian tools linked to the high level of organization that characterized Huari state society.

Bencic has concluded that the manufacture of most obsidian tools did not take place at Conchopata itself, or at least not in the sectors sampled by archaeologists (2016, this volume).

Tool makers were either producing tools off-site, or in parts of the site that remain to be sampled, and it is likely that most obsidian bifaces were imported as finished tools. There are several formal tool types represented at the site, but as demonstrated by the debitage analysis, production of these standardized tool types did not occur at the household level.

There is evidence for a range of different technologies that were utilized in the manufacture of the obsidian tools recovered at Conchopata. Bifacial thinning flakes and flakes with abraded platforms were recovered, although these are very rare. It is possible that some, or all, standardized types were imported as finished tools and that biface production was carried out by skilled knappers. The evidence that blanks and crude bifaces were occasionally imported is consistent with research at the obsidian source where evidence of early stages of tool production and the production of preforms has been found (Burger and Glascock 2000; Tripcevich and Contreras 2011). However, the production of large bifaces such as those found at Conchopata would have required very large blanks, much larger than any in the Conchopata lithic assemblage. Furthermore, the debitage analysis and lack of in-situ obsidian concentrations indicate that biface production definitely did not occur in the site center. This pattern of obsidian use is similar to that found at the capital site of Huari. Jane Stone's analysis of surface collections from Huari demonstrated that, based on a lack of primary manufacturing debitage, formal obsidian tools were not produced in sampled areas (Stone 1983).

Expedient obsidian tools, in contrast, may have been created at Conchopata by non-specialists at the household level, with each household and/or individuals possibly having cores on hand for opportunistic production. The presence of cores, and flakes with dorsal cortex and cortical platforms, indicates that obsidian was not imported only as finished tools. Some core reduction and expedient flake production took place at the site, and the high proportion of flawed flake terminations indicates that the debitage in the site center was produced by people who were not particularly skilled in tool production. While almost anyone can create an unmodified flake tool, the production of bifaces and other formal tool types require much more skill and talent, and it is unlikely that most Conchopata residents possessed this knowledge.

The abundance and dependability of the movement of obsidian into Conchopata can be explained by the existence of the Huari state and its ability to sustain a stable economic environment and infrastructure in its heartland. It maintained a road system that would have facilitated the safe movement of bulk goods such as obsidian (Edwards and Schreiber 2014:229-230; Schreiber 1991, 1992). Nonetheless, it would be unjustified to postulate the direct involvement of the Huari state in either the quarrying of the obsidian or its transformation into tools. Research at the Quispisisa obsidian deposits has confirmed that the volcanic glass deposits are vast, far too large to control by coercive means. Moreover, surface explorations at the Quispisisa source area have yet to find evidence of a formal Middle Horizon administrative presence in or around the geological source (Burger and Glascock 2002; Tripcevich and Contreras 2011).

As detailed by Bencic (2016, this volume), obsidian was the preferred raw material for several different tool types. Obsidian was used for a variety of tasks, including cutting, drilling, scraping, and as tips of projectiles for hunting or war. Indeed, obsidian must have permeated everyday life at Conchopata. Furthermore, obsidian tools and debitage at Conchopata are frequently found in ritual deposits at the site, suggesting that obsidian was valued as a symbol. Obsidian artifacts probably carried multiple levels of meaning, both religious and political, and the preference at Conchopata for obsidian from the Quispisisa source may have reflected the quarry's special role in the Huari state (see Bradley 2000 for a discussion of how Neolithic artifacts carried special associations with quarries and production sites).

The symbolic value of obsidian is also attested at other Middle Horizon sites throughout the Central Andes, where it is often an important component of elaborate burials and ritual offerings. Its inclusion in the elite Middle Horizon burials at Espíritu Pampa in Cusco and San José de Morro in the Jequetepeque Valley, as well as the ritual offerings at Cerro Amaru in Huamachuco are some notable examples of this pattern (Castillo 2001; Ministerio de Cultura 2011; Topic and Topic 2010:201-204).

In summary, based on the pervasive distribution of obsidian artifacts throughout the different built environments of Conchopata, it can be concluded that tools of Quispisisa obsidian seem to have been accessible to all members of the community, regardless of their economic and social status. Similarly, the relatively high and constant frequency of obsidian utilization during some four to five centuries of occupation at Conchopata confirms that the provisioning of the site was reliable and shows no evidence of having been disrupted during the site's lifespan.

The analysis of the obsidian data considered up to this point has shed some light on some of the everyday economic decisions made by the residents of Conchopata as they acquired, used, modified, and discarded the stone tools necessary for daily life. This has implications for the organization of production within Conchopata and it also provides an empirical basis for positing the existence of specialized knappers responsible for manufacturing many of Conchopata's tools. The sourcing analysis has revealed an enduring link between Conchopata and the geological source of obsidian some eighty-five kilometers to the south. These themes resonate with the issues of political and socioeconomic organization that have traditionally dominated research on the Middle Horizon. It is worth asking whether the obsidian evidence can illuminate other aspects of life at Conchopata during the Middle Horizon.

COSMOPOLITANISM AND CONCHOPATA

In recent years, there has been increasing interest in the concept of cosmopolitanism in archaeology (Gosden 2012; Meskell 2011) and scholars working in the Central Andes have drawn attention to its value for understanding daily life in Huari times. This interest can be seen as a logical outgrowth of the long-standing concern with economic and cultural interaction in the Middle Horizon (Lau 2005; Shady 1988). The latter concerns have sometimes been framed within a world systems framework or, more recently, in relation to notions of globalization that are popular in journalism and contemporary social science analysis (Jennings 2011). While these approaches have provided useful insights into the Middle Horizon economics and sociopolitical structure, the concern with cosmopolitanism offers a somewhat different focus by drawing attention to other aspects of quotidian experience, aspects that are as closely linked to individual identity and values as they are to material exchange.

The term *cosmopolitanism* is an old one, going back to the Greek Stoics of the fourth century B.C. It has been applied to the culture of those societies in which groups with different histories and values live side-by-side with each other despite their differences. Inevitably, the members of these groups enter into what philosopher Kwame Anthony Appiah (2007) refers to as "conversations." These "conversations" do not produce a homogenous society, but they do generate a world-view and cultural environment that transcend the narrow loyalty of the local city or *polis* that traditionally characterized many societies.

For the central Andes, scholars have argued that some prehispanic urban settlements, such as Chavín de Huántar (Burger 2012) and Tiwanaku (Janusek 2002, 2008) should be considered as cosmopolitan centers. Certainly Teotihuacan in Central Mexico with its Oaxacan and Guatemalan neighborhoods (Cowgill 2004; Manzanilla 1997) and imperial Cusco, with its population drawn from throughout Tawantinsuyu, are likewise examples of cosmopolitan cities (Bauer 2004; Farrington 2013; Rowe 1968). Huari, the capital of the state that included Conchopata, has been viewed as a cosmopolitan center by William Isbell (2009b: 213) and he has written the following:

> By Moraduchayuq times, Huari had become . . . a place where residents encountered and interacted with different kinds of people–in religious, kin, status, age, gender, ethnicity, and great-house affiliation–who in the world of hamlets and villages, would never encounter one another. (2009b: 213)

The cosmopolitan atmosphere in these prehispanic centers was not only produced by diverse groups permanently living with each other on a daily basis, but also by the continual flow of outsiders drawn to these urban centers for reasons of trade, worship, friendship, education, and other purposes. Contacts of short duration between these visitors and the residents, which we will refer to here as *ephemeral interactions*, are as typical of cosmopolitan centers as the more enduring patterns of co-residency that have attracted most attention from archaeologists, and such ephemeral interactions may have an impact that is comparable to, or perhaps even greater than, that of residential diversity.

Naturally, cosmopolitanism varies in its degree of intensity, and the presence of a cosmopolitan society in one urban center does not imply that an equivalent situation existed at nearby communities, even if such settlements were part of the same state or were characterized by the same dominant culture. To use a modern analogy, today only a short distance from New York City, an urban center that is the very embodiment of cosmopolitanism, one encounters towns in New Jersey and upstate New York that are anything but cosmopolitan. We would argue that the same uneven patterning of cosmopolitanism probably existed in ancient societies as well.

The site of Conchopata, referred to by Isbell and Cook (2002) as "Huari's second city", offers an interesting opportunity to consider the question of cosmopolitanism in the Huari heartland. As already noted, based on the 1999-2003 excavations at Conchopata, Isbell argued that the urban core of site consisted of elite residences or palaces that were occupied by polygamous households (2007). The possibility that wives were being acquired by the elite from distant lands raised the possibility of Conchopata constituting a multi-ethnic urban center that was cosmopolitan in character.

However, subsequent work on Conchopata's osteological collections by biological anthropologist Tiffiny Tung produced a very different picture. Based on strontium isotope and ancient mtDNA data, Tung (2012:97) argued that there is little to suggest that Conchopata was a cosmopolitan center with migrants settling there from far away areas. Rather, Conchopata appears to be a restricted settlement constituted almost exclusively of locals. Even the marriage or reproduction partners at Conchopata appear to have been from the local Ayacucho Basin. While the decapitated and preserved trophy heads recovered at Conchopata proved upon analysis to belong to outsiders, this finding did little to bolster the image of Conchopata as a cosmopolitan center. As a consequence of these findings, Tung (2012:98) concluded:

> Conchopata was an exclusive Wari community that prevented the entrance and social integration of individuals from distant geological zones; it was not a cosmopolitan center to which many Andean peoples migrated, like that observed at Tiwanaku (Blom 2005).

Does the obsidian analysis shed any light on the degree of cosmopolitanism that may have once existed at Conchopata? As has been discussed, all of the obsidian utilized at Conchopata came from the Ayacucho region and, with one exception, all of it came from a single source. Moreover, there is little evidence of any change in the acquisition or usage of obsidian over the many centuries of Conchopata's occupation. It is true that the obsidian came from quarries located eighty-five kilometers to the south, but how much interaction would the Conchopata households have had with the people responsible for mining the obsidian nodules in the Quispisisa outcrops, or those knappers responsible for producing the finished tools or preforms from the nodules? The answer to this is uncertain but it is possible to hypothesize that the impact of this interaction may have been quite limited, particularly given the finding that the preparation of the tools seems to have occurred outside of the Conchopata center itself. The lack of a large number of artifacts from a second or third obsidian source outside the Huari heartland is consistent with the picture of a homogeneous settlement of locals that Tung has hypothesized.

We believe that obsidian source analysis has the potential for picking up traces of ephemeral interactions, as well as more enduring economic linkages. During relatively brief visits to Conchopata, outsiders might be expected to have brought with them knives or other basic tools crafted from the obsidian source favored by their home community. Because obsidian is so brittle, it often suffers small breaks or requires retouching to maintain the tool edge. These actions would produce a small amount of debitage (or tool fragments) that should be encountered if the sample is large enough. We would suggest that when small amounts of debitage or tool fragments from an exotic obsidian source are encountered (*i.e.* less than five percent), ephemeral interactions may be responsible.

In the case of Huari, posited as a cosmopolitan center by Isbell, samples of fifty-three artifacts were analyzed from the surface. The majority (ninety-six percent) were of raw material from the Quispisisa deposits. Significantly, there also were single artifacts coming from the Potreropampa source in the Department of Apurímac and from the Alca source in the Cotahuasi Valley of the Department of Arequipa. These obsidian deposits are outside the Ayacucho heartland, but within the territory dominated by the Huari state (Burger *et al.* 2000, 2006b; Schreiber 1992). The two exotic obsidian artifacts, constituting less than four percent of the total obsidian analyzed, are visually indistinguishable from the Quispisisa obsidian. Their presence at Huari suggests visits from individuals from distant lands, a pattern consistent with the postulated cosmopolitan nature of the urbanized Huari capital.

A similar pattern can be found at the large Huari center of Pikillacta in Cusco. Unfortunately, only nine artifacts have been analyzed from this site. Of these, the preponderance (n=8) came from the Quispisisa source, but one was of volcanic glass quarried at the Potreropampa deposit in Apurímac.

An even better example of this patterning, perhaps because the sample analyzed was larger, comes from the Huari center established at

Cerro Baúl, in the Moquegua Valley. Based on excavations at the site, it was hypothesized (Williams *et al.* 2012) that many of the activities there were related to banqueting and religious worship by visitors to this remarkable spot located at the interface between Huari and Tiwanaku spheres of influence. In an initial study of a sample of 89 surface artifacts using INAA and XRF, it was found that the massive deposit at Alca, located in the Cotahuasi Canyon of Arequipa, was the principal source provisioning Cerro Baúl; seventy-nine percent of the artifacts analyzed came from these deposits located far to the north. Significantly, there were also small numbers of obsidian artifacts from the Quispisisa source (eight percent), the Potreropampa source (eight percent), and the Chivay source (three percent) (Burger 2006; Burger *et al.* 2006a). An even larger sample (n=276) of tools and debitage from Cerro Baúl was subsequently studied by Patrick Ryan Williams, Laure Dussubieux, and Donna Nash (2012) using other methods, specifically a portable XRF and LA-ICP-MS. Their results confirmed that the preponderance of obsidian came from the Alca source, and that small amounts of obsidian also came from the Quispisisa and Chivay sources. While the Williams *et al.* study did not identify artifacts of Potreropampa obsidian from Apurímac, this is likely due to sampling strategies. The pattern that emerges in both studies is that the Cerro Baúl obsidian assemblage consists mainly of Alca obsidian, but artifactual obsidian also appears from at least three other sources. Once again, the consistency of this pattern with predicted expectations for a cosmopolitan society is noteworthy, and fits well with Williams's model of a continual flow of outsiders to the site.

A final case worth considering is that of Tiwanaku because it has often been put forward as a cosmopolitan Andean center occupied by a multi-ethnic residential population and visited by a mix of pilgrims and traders involved in ephemeral transactions. An initial study at Lawrence Berkeley Laboratory of sixteen obsidian artifacts collected from the surface of Tiwanaku indicated that all of the samples analyzed came from the Chivay obsidian source, three hundred kilometers to the northwest (Burger and Asaro 1977, 1979). However, a study of a much larger sample consisting of 147 obsidian artifacts from eight different sectors of Tiwanaku revealed a much more complex picture (Glascock and Giesso 2012). While the majority (eighty-six percent) of the obsidian assemblage came from the Chivay source, fourteen percent came from eleven other sources. None of these secondary sources constituted more than three percent of the sample. Many of them cannot yet be identified, but small amounts of obsidian definitely came from the central Bolivian sources of Sora Sora (n=3), Charaña (n=3), and Sopocachi (n=1). Another two obsidian artifacts were from Cerro Zapaleri near Bolivia's southern frontier with Chile and Argentina. The latter source is some eight hundred kilometers south of Tiwanaku (Glascock and Giesso 2012). All four of these rare sources fall within the sphere of Tiwanaku influence and would be in areas from which pilgrims, traders and other visitors would be expected to come. Moreover, the compositions of artifacts from the remaining six unidentified sources do not match the chemical signatures of any sources or artifacts from the Central Andes, and so it is likely that these artifacts likewise were brought from other areas in the south central Andes within Tiwanaku's sphere of interaction. Significantly, four artifacts produced from non-Chivay sources proved to be of obsidian obtained at the Quispisisa source. As already noted, obsidian from this source dominated the Huari heartland and was closely associated with the Huari state. During the Middle Horizon, artifacts of Quispisisa obsidian even became common at the Huari center of Pikillacta near Cusco. Thus, despite the incomplete knowledge of south-central Andean obsidian sources, the presence of eleven types of obsidian at Tiwanaku suggests a multiplicity of ephemeral interactions, including contacts with people coming from the Huari sphere of influence hundreds of kilometers to the north.

It is intriguing that although Chivay source obsidian was the only kind that appears at Tiwanaku's largest public structure, the Akapana, small quantities of the minor obsidian types occur in all but two of the nine sectors of the site, including a local shrine. Glascock and Giesso (2012:94) interpret this as a result of the continuation of locally established exchange networks that were absorbed into the pattern of long-distance exchange carried out by Tiwanaku residents. We believe, however, that at least some of this rare obsidian can be ascribed to a multiplicity of ephemeral interactions that brought visitors to the sprawling six square kilometer altiplano city for a variety of reasons including worship and exchange. In our view, the presence of obsidian from twelve obsidian sources at Tiwanaku clearly supports the model of this center as an Andean city that was cosmopolitan in character. Significantly, in the altiplano heartland outside of Tiwanaku, all sites except for Lukurmata and Khonkho Wankane show only evidence of Chivay obsidian (Glascock and Giesso 2012:93).

Given the above examples, it is striking that in our analysis of 93 obsidian artifacts from Conchopata, there was not a single obsidian artifact made from volcanic glass quarried outside of the Ayacucho heartland. This lack of diversity occurred despite a conscious effort made to select obsidian artifacts from a range of activity areas and building contexts at Conchopata (Figure 4). To summarize, the obsidian analysis described here provides no support for a model of Conchopata as a cosmopolitan urban center. As noted earlier, the sample of obsidian analyzed spans the four to five century occupation of Conchopata, and the sourcing results provide no evidence that this pattern of insularity changed over time. Judging from the obsidian results, Conchopata was significantly less cosmopolitan than some of the other centers in the Huari and Tiwanaku spheres of interaction.

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ANALYSIS OF OBSIDIAN FROM THE EXCAVATIONS OF PRE-HUARI SITES IN AYACUCHO		
Sites sampled	*Elevation (masl)*	*Ecozone*
Ac100 (Pikimachay)	2850	Thorn forest scrub
Ac102 (Iyamachay)	3000	Thorn forest scrub
Ac158 (Puente Cave)	2582	Thorn forest riverine
Ac300 (Ruyru Rumi)	4032	Puna
Ac335 (Jaywamachay)	3350	Humid woodlands
Ac351 (Tukumachay)	4350	Puna
Ac500 (Chupas Cave)	3496	Humid woodlands
Ar23 (Chupas)	3600	Humid woodlands
Ar18 (Wichqana)	2640	Thorn forest riverine

				Obsidian source	
Site	*Zone*	*Phase*	*Estimated dates*	*Quispisisa*	*Puzolana*
Ac100	f-2	Jaywa	6900 ± 300 BC	1	
Ac102	VIII	Puente	7250 ± 350 BC	1	
	VII	Piki	5610 ± 150 BC	2	
	VI	Chihua	3600 – 3000 BC		3
Ac158	XIII	Jaywa	6950 ± 150 BC		1
	XII	Jaywa	6500 ± 200 BC		1
	XI	Jaywa	5900 ± 150 BC	2	
	IX	Piki	5250 ± 200 BC	1	
	VIII	Piki	5210 ± 125 BC	1	
	VII	Piki	4900 ± 150 BC	2	1
	VI	Piki	4720 ± 120 BC	1	
	V	Piki	4700 ± 200 BC	1	
	QH	Chihua	4000 ± 120 BC	1	
Ac300	C-north	Chihua	3400 – 2700 BC	6	
	C-south	Chihua	3400 – 2700 BC	4	
Ac335	M-N	Puente	9000 – 8400 BC	1	
	K	Puente	9000 – 8400 BC	3	
	J-2	Puente	8300 – 7500 BC	3	
	I	Puente	7500 – 7100 BC	2	
	H	Puente	7500 – 7100 BC	2	
	G	Jaywa	7100 – 6300 BC	2	
	F	Jaywa	7100 – 6300 BC	5	
	E	Jaywa	7100 – 6300 BC	1	
	D	Jaywa	7100 – 6300 BC	5	
	C	Jaywa	7100 – 6300 BC	4	
Ac351	C-2	Cachi	2450 ± 250 BC	2	
	C-1	Cachi	1950 – 1600 BC	1	
Ac500	F	Piki	Approx. 5400 BC	2	
	E	Piki	4710 – 4610 BC	1	
	D-1	Cachi	Approx. 2950 BC	1	2
Ar23	EIP		1 – 350 AD		1
	EH		400 – 100 BC	5	6
Ar18	EH		800 – 300 BC	2	

Table 1. Analysis of obsidian from the excavations of Pre-Huari Sites in Ayacucho.

*ANID**	*FIELD_ID*	*Al (ppm)*	*Ba (ppm)*	*Cl (ppm)*	*Dy (ppm)*	*K (ppm)*	*Mn (ppm)*	*Na (ppm)*	*Source Name*
RLB439	3933A	68804	892	315	1.364	35189	366	28621	Quispisisa
RLB440	2951A	65644	771	279	1.298	36944	361	28089	Quispisisa
RLB441	3961A	70402	762	227	1.850	39101	365	28504	Quispisisa
RLB442	3959A	67478	748	248	1.754	36977	360	27979	Quispisisa
RLB443	3926A	65159	711	302	1.424	39421	360	27903	Quispisisa
RLB444	3960A	65855	880	249	1.640	38350	364	28661	Quispisisa
RLB445	3944A	65767	748	274	1.537	38178	359	27935	Quispisisa
RLB446	3957A	72105	306	475	1.309	40341	446	31198	Puzolana
RLB447	3963A	69819	740	328	1.752	38795	367	28613	Quispisisa
RLB448	3965A	68139	703	229	1.388	35697	365	28275	Quispisisa
RLB449	2945A	69009	696	305	1.369	37003	376	29542	Quispisisa
RLB450	3966A	68395	773	261	1.690	37285	361	28249	Quispisisa
RLB451	3964A	62300	762	244	2.189	36563	362	28356	Quispisisa
RLB452	3928A	66988	669	277	1.865	40086	357	26697	Quispisisa
RLB453	2952A	66718	773	241	1.796	34717	361	28264	Quispisisa
RLB454	2949A	71583	858	261	1.429	39455	367	28936	Quispisisa
RLB455	2961A	69275	812	236	1.484	36569	365	27973	Quispisisa
RLB456	2946A	66302	764	262	1.522	40685	365	27201	Quispisisa
RLB457	2953A	69215	698	240	1.781	37860	373	28961	Quispisisa
RLB458	2950A	66892	800	319	1.702	40143	378	29066	Quispisisa
RLB459	3936A	71330	781	267	1.825	36607	363	28016	Quispisisa
RLB460	2966A	70101	845	313	1.354	35696	367	28553	Quispisisa
RLB461	2962A	67865	786	267	1.509	36803	366	28487	Quispisisa
RLB462	2960A	65700	811	239	1.366	38652	367	28257	Quispisisa
RLB463	2959A	69252	822	251	1.586	35370	363	28297	Quispisisa
RLB464	2947A	71597	829	301	1.081	38316	370	28370	Quispisisa
RLB465	2942A	67403	706	300	1.741	36665	371	28665	Quispisisa
RLB466	2974A	67743	668	292	1.693	38003	368	28382	Quispisisa
RLB467	3938A	68864	659	281	1.780	38546	372	28711	Quispisisa
RLB468	3934A	73587	742	287	1.603	38021	372	29018	Quispisisa
RLB469	3962A	74091	644	260	1.752	40039	373	29014	Quispisisa
RLB470	2954A	68379	666	258	2.039	39133	370	29113	Quispisisa
RLB471	2958A	70533	670	282	2.278	37351	365	27804	Quispisisa
RLB472	2956A	70766	699	248	1.541	36478	366	28328	Quispisisa
RLB473	2955A	69549	654	268	1.256	35802	366	28416	Quispisisa
RLB474	3956A	66944	651	261	1.391	38155	368	28328	Quispisisa
RLB475	3952A	68872	752	208	1.809	37275	374	28966	Quispisisa
RLB476	3954A	65726	715	296	1.619	36133	366	28300	Quispisisa
RLB477	3953A	67978	674	260	1.794	38771	370	28557	Quispisisa
RLB478	3951A	68411	666	278	1.832	35694	366	28335	Quispisisa
RLB479	3947A	67461	686	259	1.814	39339	376	28746	Quispisisa
RLB480	3950A	70953	754	244	1.820	34149	370	28221	Quispisisa
RLB481	3945A	70733	695	280	1.883	37654	366	28131	Quispisisa
RLB482	3948A	72202	724	262	1.560	38177	374	28781	Quispisisa
RLB483	3937A	66315	609	282	1.814	37242	360	27942	Quispisisa
RLB484	2944A	65951	590	257	1.838	36280	358	27750	Quispisisa
RLB485	3958A	72275	646	273	1.573	39650	370	28711	Quispisisa
RLB486	3942A	67702	684	261	1.910	37049	369	28527	Quispisisa
RLB487	3932A	72451	798	269	1.454	37101	367	28421	Quispisisa
RLB488	3939A	72047	666	299	1.225	35812	371	28577	Quispisisa

Table 2 (Part 1). MURR short-INAA results for obsidian artifacts from the excavations at Conchapata, Ayacucho.

ANID	FIELD_ID	Al (ppm)	Ba (ppm)	Cl (ppm)	Dy (ppm)	K (ppm)	Mn (ppm)	Na (ppm)	Source Name
RLB489	3946A	70077	719	275	1.675	35065	373	28569	Quispisisa
RLB490	3949A	67275	677	241	1.449	37560	367	28313	Quispisisa
RLB491	3943A	68977	735	262	2.114	38389	369	28702	Quispisisa
RLB492	2948A	63881	749	227	2.000	34193	367	28280	Quispisisa
RLB493	2943A	69996	693	290	1.497	36124	370	28264	Quispisisa
RLB494	3929A	68854	646	268	1.822	36559	364	28496	Quispisisa
RLB495	3931A	72196	726	253	1.581	38303	366	28377	Quispisisa
RLB496	3921A	69484	626	366	1.414	38648	371	28723	Quispisisa
RLB497	2936A	65940	619	258	1.761	35884	364	28399	Quispisisa
RLB498	2937A	72331	738	211	1.971	36616	370	28448	Quispisisa
RLB499	2938A	70251	644	246	2.033	36387	364	28319	Quispisisa
RLB500	3922A	75162	833	257	1.776	38792	375	29190	Quispisisa
RLB501	2940A	63732	612	282	1.845	37114	362	28014	Quispisisa
RLB502	3924A	73098	767	280	2.289	35622	366	28476	Quispisisa
RLB503	3925A	72504	764	320	2.070	36378	364	28490	Quispisisa
RLB504	3970A	67986	639	261	1.551	34309	363	28408	Quispisisa
RLB505	2978A	71385	790	253	1.533	34765	359	28005	Quispisisa
RLB506	2977A	69787	850	247	1.366	36942	372	29160	Quispisisa
RLB507	2976A	73468	675	243	1.445	36367	372	28905	Quispisisa
RLB508	2975A	68353	845	234	1.359	33483	367	28454	Quispisisa
RLB509	2973A	68247	646	269	1.806	35591	365	28707	Quispisisa
RLB510	2972A	69425	779	260	2.128	35643	365	28431	Quispisisa
RLB511	2971A	71313	601	258	2.126	37067	370	28903	Quispisisa
RLB512	2970A	69847	760	240	2.018	34608	359	28119	Quispisisa
RLB513	2968A	69898	692	255	1.642	39130	369	28780	Quispisisa
RLB514	2965A	74824	677	279	1.878	36500	370	29107	Quispisisa
RLB515	2964A	75529	792	270	1.995	35902	375	29182	Quispisisa
RLB516	2963A	68101	783	262	1.857	34607	364	28392	Quispisisa
RLB517	2967A	73964	709	224	1.892	35174	366	28418	Quispisisa
RLB518	3927A	73085	825	308	1.745	37206	369	28108	Quispisisa
RLB519	2957A	68801	714	229	1.729	34540	366	28723	Quispisisa
RLB520	3968A	69735	667	274	1.705	36519	365	28558	Quispisisa
RLB521	3941A	69620	711	288	1.269	36284	367	28734	Quispisisa
RLB522	3967A	71172	780	244	1.770	34571	369	28812	Quispisisa
RLB523	3940A	72238	650	252	1.195	36323	371	28991	Quispisisa
RLB524	2969A	71233	674	263	1.516	32727	365	28623	Quispisisa
RLB525	3969A	69699	760	307	1.706	39688	373	28965	Quispisisa
RLB526	3923A	70530	629	219	1.874	37649	372	28766	Quispisisa
RLB527	2939A	69333	706	261	1.511	37746	374	28933	Quispisisa
RLB528	3920A	69733	843	235	1.894	38184	372	28577	Quispisisa
RLB529	2941A	69394	638	230	2.051	37816	372	28735	Quispisisa
RLB530	3935A	70216	700	254	1.628	56197	370	19786	Quispisisa
RLB531	3955A	68358	708	233	1.528	38968	367	28338	Quispisisa

Table 2 (Part 2).MURR short-INAA results for obsidian artifacts from the excavations at Conchapata, Ayacucho.
*ANID=Analytic Number Identification (lab number).

*ANID**	*RLB446*	*RLB495*
FIELD_ID	*3957A*	*3931A*
La (ppm)	22.0	26.8
Lu (ppm)	0.117	0.168
Nd (ppm)	12.55	16.42
Sm (ppm)	2.39	3.16
U (ppm)	5.76	8.97
Yb (ppm)	0.83	1.11
Ce (ppm)	40.4	49.9
Co (ppm)	0.186	0.482
Cs (ppm)	3.78	11.00
Eu (ppm)	0.301	0.420
Fe (ppm)	5005	5617
Hf (ppm)	3.83	3.24
Rb (ppm)	115	176
Sb (ppm)	0.257	1.269
Sc (ppm)	1.56	1.36
Sr (ppm)	69	143
Ta (ppm)	1.89	1.18
Tb (ppm)	0.213	0.265
Th (ppm)	14.99	19.27
Zn (ppm)	39	30
Zr (ppm)	126	154

Table 3.MURR long-INAA results for two obsidian artifacts from the excavations at Conchapata, Ayacucho. *ANID=Analytic Number Identification (lab number).

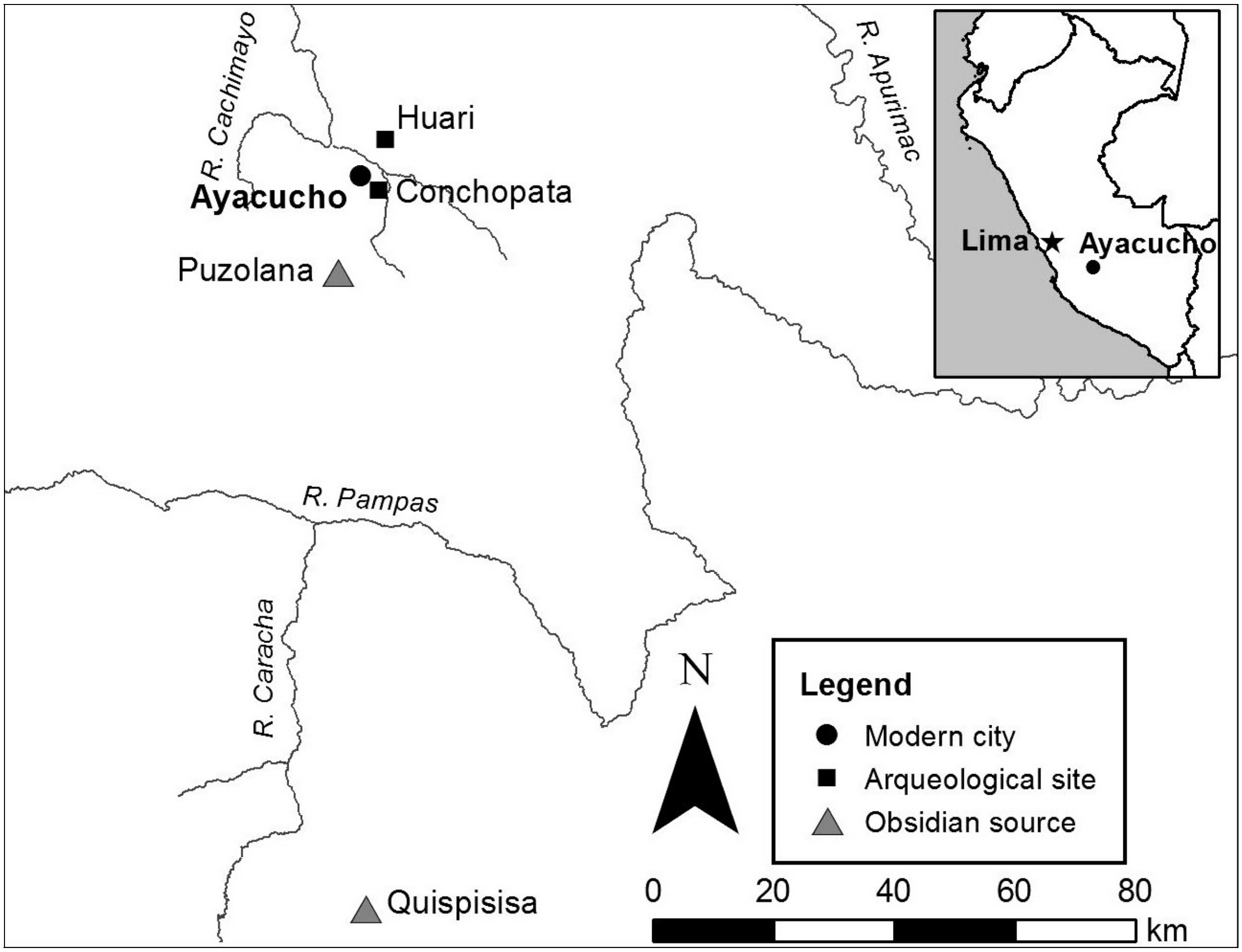

Figure 1. Location of relevant archaeological sites and obsidian sources in Ayacucho.

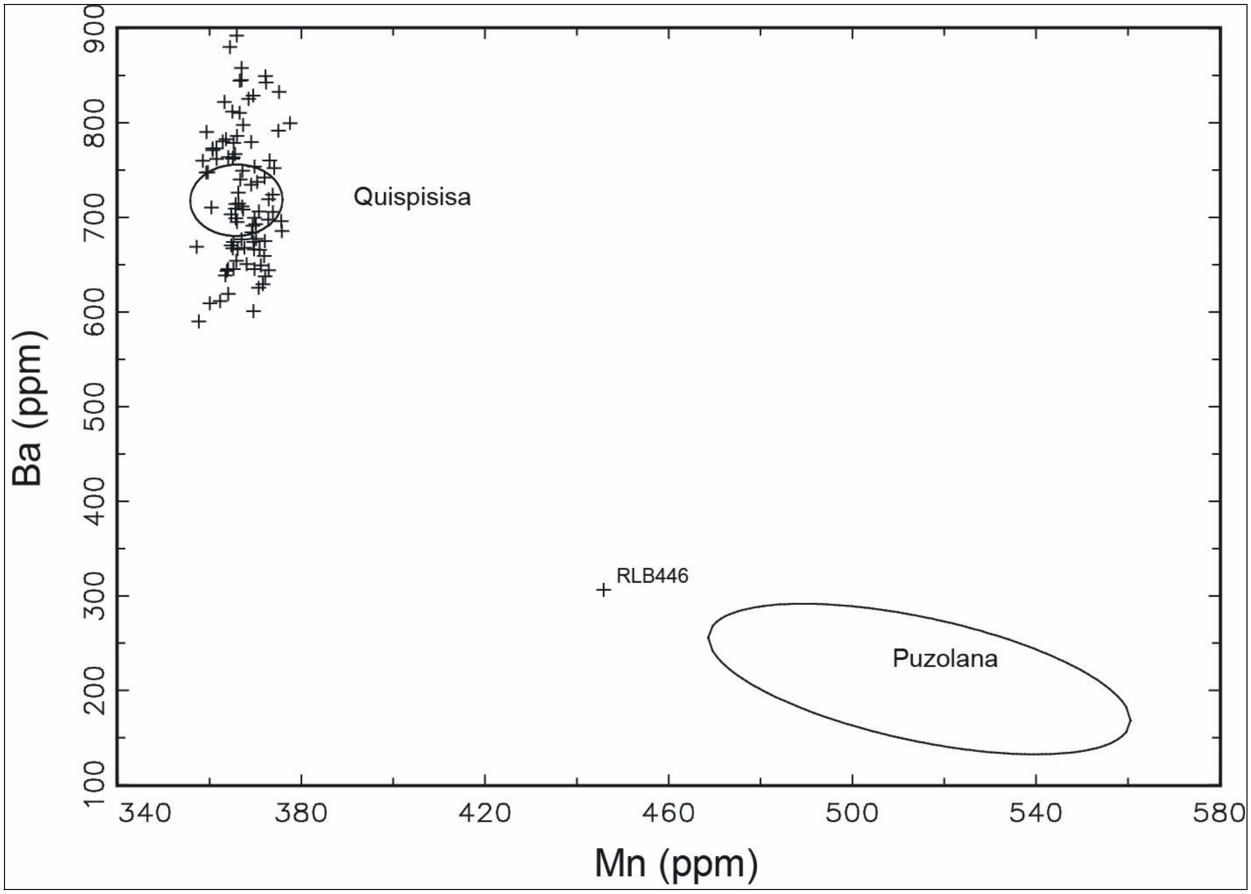

Figure 2. Bivariate plot of Mn vs Ba for Conchopata artifacts analyzed by short-INAA showing 95% confidence ellipses for well-known sources.

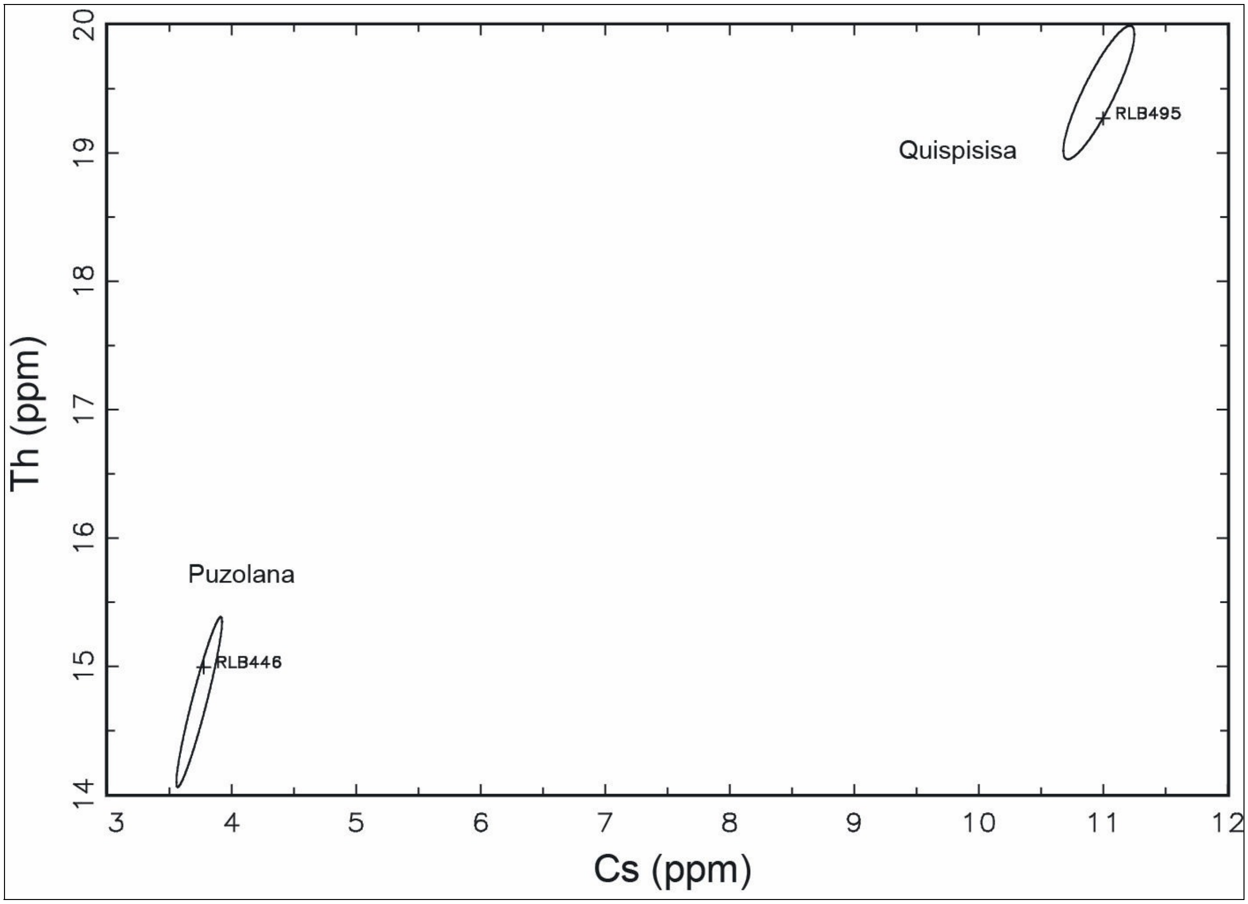

Figure 3. Bivariate plot of Cs vs. Th for two Conchopata obsidian artifacts analyzed by long-INAA showing 95% confidence ellipses for well-known sources.

Figure 4. Shading indicates the provenience of obsidian artifacts analyzed from Conchopata.