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Importation of Obsidian at Cerro Palenque, Honduras: Results of an Analysis by EDXRF

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Abstract
The results of source analysis by EDXRF of obsidian artifacts from the Mesoamerican site of Cerro Palenque in Honduras are reported and changes over time discussed. Sources of obsidian include Ixtepeque, El Chayal, Jalapa, San Martin Jilotepeque, and San Barolome in Guatemala. Some Pachuca obsidian from Mexico was also found. Honduran sources include La Esperanza and La Union. The implications of the obsidian sources are discussed in the context of changes at Cerro Palenque over time as it becomes the largest settlement in the lower Ulua Valley (Sula Valley) in the ninth century AD.

Keywords
Mesoamerica, Honduras, Ulua Valley, Cerro Palenque, obsidian source analysis, EDXRF

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Comments
This is the English-language version of a paper presented at the VIII Seminario de Antropología Hondureña in Tegucigalpa, Honduras, in 2004.

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Obsidian played an important role in the technological and economic systems of the Precolumbian societies of Mesoamerica. It served as the material from which people made tools for cutting, piercing, scraping, and to serve other utilitarian purposes. The distribution of obsidian deposits is localized due to its volcanic origin but its chemical and physical characteristics make it a more desirable raw material that siliceous rocks such as chert which can be worked in a similar manner and which have a much wide distribution which would probably have made them easier to acquire (Cobean et al. 1971; Glasscock et al. 1998). Since the beginnings of permanent settlement in the region, people created local and long distance exchange networks in order to obtain obsidian. In Honduras, for example, excavations at the site of Puerto Escondido in the lower Ulua river valley, have shown that obsidian use began in the oldest levels of the site, in the Sauce phase which dates to the beginning of the Early Formative or possibly even to the Archaic period (Henderson and Joyce 1998; Joyce and Henderson 2001; Joyce et al. 1999). Other Honduran sites with early deposits, such as Copan, Los Naranjos, and Yarumela, show a similar participation in obsidian exchange (Aoyama 2001; Baudez and Becquelin 1973; Sánchez 1997).

Field and laboratory research have given us much information about the location of obsidian outcrops, mines, and workshops and about its Precolumbian exploitation (Aoyama et al.

1999; Braswell and Glascock 1998; Cobean 2002; Healy et al. 1996; Sheets et al. 1990; Sorensen and Hirth 1984; Stross et al. 1983; Tenorio et al. 1998). As a result of this work, we can identify many sources by their chemical composition through the comparison of trace elements using such instrumental techniques as neutron activation analysis (NAA) and X-ray fluorescence (XRF) or energy-dispersive X-ray fluorescence (EDXRF) (Glascock et al. 1998; Shackley 1998). Another approach that has been used is the identification of sources through a visual inspection of artifacts, taking into account differences in color, opacity, inclusions, sheen, and other characteristics that may differentiate one obsidian flow from another (Braswell et al. 2000; but see Moholy-Nagy 2003 for a contrary view).

Obsidian deposits are localized and not everyone in Precolmbian Mesoamerica had easy access to a nearby source. Nevertheless, one consequence of the geological history of the region is that obsidian sources are not especially rare in Mesoamerica nor very restricted in their geographic distribution (Zeitlin 1982). Sources used by Mesoamerican people have been identified in various parts of Mexico, Guatemala, and Honduras. Technological analyses have demonstrated that some obsidian deposits are better suited to the production of prismatic blades. Other deposits may be used to produce flakes using percussion (Hirth and Andrews 2002). Some deposits are poorly suited to any kind of lithic production due to the presence of inclusions, the degree of hydration, or other factors (Braswell and Glascock 1998; Cobean 2002; Ponomarenko 2004). But the point is that obsidian suitable for the production of prismatic blades is not limited to only one deposit or area. Sources such as Sierra de Pachuca or Ucarero-Zinapecuaro in Mexico, Ixtepeque and El Chayal in Guatemala, and La Esperanza in Honduras were used extensively in antiquity for core-blade industries (Cobean 2002; Sheets et al. 1990). Why, then, do we find evidence throughout time and space that these ancient societies did not just take

advantage of the closest and most accessible obsidian deposit of good quality? Why did people seem to prefer acquiring cores, cobbles, or tools from a number of different localities?

A convincing answer to this question needs to take into account the social and political side of economic relations as well as the decisions that powerful and ordinary members of society made. It is striking to what extent the indigenous societies of the region wished to create and maintain exchange networks. In her study of the Tikal obsidian sample, for example, Moholy-Nagy (1999) makes clear that obsidian from various Mexican sources was imported to Tikal from the Late Formative through the Early Postclassic periods despite the presence of Guatemalan sources which were much closer and which produce raw material of the same quality. Moholy-Nagy suggests that the people of Tikal saw a benefit in obtaining prepared cores and finished prismatic blades from far away. Although she does not discuss in depth why this would be the case nor how the materials arrived in Tikal, one could suggest that an important aspect of the process was the opportunity to maintain social relations with closer and more distant groups.

At the same time, certain features of obsidian, such as its location and association with mountains, its color, and its brilliance, as well as its ability to be worked not only into sharp knives but also in objects of complicated form such as eccentrics, contributed to a symbolic meaning which helps explain its religious role (Saunders 2001).

The Site of Cerro Palenque

In the rest of this article, I present the results of part of the study of the acquisition and use of obsidian at the site of Cerro Palenque. The site is located in the hills on the west side of the lower Ulua river valley where the Ulua river meets with the Comayagua river. Although human occupation in the lower Ulua valley dates from the Early Formative period, excavations

carried out in 1982-1983 by Rosemary Joyce indicates that people did not live at Cerro Palenque before the Early Classic period (Joyce 1991:61-62). Early Classic remains are scare and in secondary context but Late Classic occupation is well established in one area of the site, called "CR-44." Here, on the highest elevation of the site, Joyce found five architectural groups which include domestic and religious buildings as well as a reservoir. The architecture of this zone of Cerro Palenque exhibits the features associated with high or elite social status in southeastern Mesoamerica, including an overall massiveness of construction, the use of worked stone and lime plaster, and the presence of architectural sculpture. The relatively small group of people living in CR-44 had access to such imported materials as *Spondylus* shell and jade; and used these materials as part of socially meaningful rituals, such as the deposition of caches (Joyce 1985). Cerro Palenque's inhabitants used Ulua Polychromes, a distinctive stylistic group of painted polychrome pottery types that are found in central Honduras during the Classic period (Joyce 1988).

After AD 850, in the time period known as the Terminal Classic, CR-44 was abandoned but a large amount of new construction in the lower hillslopes made Cerro Palenque into a large and densely populated community. During this period, the number of structures exceeded 500. At the same time, the other important Late Classic centers in the valley, such as Travesia, were markedly reduced in population or abandoned, a process which made Cerro Palenque the largest center in the lower Ulua valley. Associated with this demographic change is a change in the pottery. Ulua Polychromes are replaced as the primary eating and serving ware by a set of fine paste ceramics which have been shown to have stylistic ties with Fine Orange pottery of the Maya lowlands, especially with the group, Altar Fine Orange (Beaudry-Corbett et al. 1993; Hirth 1988; Joyce 1988). Archaeological evidence from Cerro Palenque and other local sites such as

Campo Dos, as well as compositional analysis, indicate that lower Ulua valley fine paste ceramics were locally produced in small scale production facilities (Hendon and Lopiparo 2004; Lopiparo et al. in press; Lopiparo 2004).

Survey and excavations in the Terminal Classic part of the site by Joyce demonstrated that the majority of the structures are grouped into residential compounds but that some concentrations of monumental architecture also exist, the largest of which is located near CR-44 but at a lower elevation (Joyce 1990; Joyce and Hendon 2000). This monumental zone, labeled as part of the site zone CR-157, contains a plaza more than 300 meters in length flanked by high mounds and with a ballcourt at its southern end. In 1998 I began investigating a large residential group built immediately to the south of the ballcourt. Three seasons of excavation have produced a great deal about this group and has confirmed my hypothesis that the inhabitants of the group enjoyed a high social status (Hendon and Lopiparo 2004; Hendon 2000, 2002a,b). The residents of the group continued to have access to imported goods and materials such as marine shell and obsidian. They also engaged in the same kinds of socially significant ritual as their predecessors at CR-44 including the creation of caches containing precious and symbolically significant objects such as *Spondylus* shell, finepaste vessels, and Santana polychrome, a type of Ulua Polychrome that continued to be used into the beginning of the Terminal Classic period. One cache also contained human bone. Although I have not found any jade artifacts, I have found the use of green marble in a cache. I have also found evidence of the production of fine paste vessels and figurines in the form of molds and two kilns.

Analysis of the Obsidian at Cerro Palenque

The lithics from Cerro Palenque display the usual features of core-blade industries in Mesoamerica. The most common tool throughout the occupation of the site is the prismatic

blade. Flakes, some with retouch, bifaces, and points made on blades are also present. So far, however, obsidian cores have only been found in Terminal Classic levels (Hendon field inventories; Joyce 1985).

In the Late Classic period, the majority of lithic artifacts were made from obsidian (75 percent of the materials recovered from CR-44). Based on her excavation results, Joyce suggested that a marked change in access to obsidian occurred as part of the transition from the Late Classic to the Terminal Classic (Joyce 1990). In her sample, the Terminal Classic residential groups had much less obsidian and, as a result, made much greater use of the locally available siliceous rocks such as chert. Only 17 percent of the artifacts she excavated were made of obsidian. My excavations, however, indicate that the change was not as abrupt for the entire Terminal Classic population. Almost 47 percent of the lithics from the residential group south of the ballcourt were made of obsidian. Combining the number of obsidian tools found by the two projects, we find that the overall percentage of Terminal Classic obsidian lithics rises to 28 percent. But the distribution is markedly unequal in this period with 64 percent being found in my excavations in a single residential group. It would seem that the importation of obsidian continued in greater quantity that Joyce first thought but that access to and use of obsidian continued to be associated with social status or importance.

Included in the grants received from the National Science Foundation and the H. John Heinz III fund of the Heinz Family Foundation were funds for the identification of the origin of the raw material out of which obsidian tools were manufactured at Cerro Palenque. In 2002, I reviewed the artifacts excavated from Cerro Palenque by Joyce that are stored at the Centro regional del Norte of the Instituto Hondureño de Antropología e Historia in La Lima, Depto. de Cortés. I found 203 obsidian artifacts, or 73 percent of the original sample recovered by Joyce.

The Instituto kindly allowed me to bring these artifacts plus the 236 obsidian artifacts resulting from my excavations to the United States for chemical compositional analysis.

Energy-dispersive X-ray fluorescence (EDXRF) was used to identify the chemical composition of the obsidian and was carried out by Steven Shackley of the Berkeley Archaeological XRF Laboratory of the University of California (see Davis et al. 1998; Shackley 1998 for a description of the method). Due to his interest in obsidian use in the Southwest U.S. and in Mesoamerica, Dr. Shackley has built up a detailed database of the chemical composition of deposits in both regions. His fieldwork in Honduras in recent years has given him an excellent understanding of the Honduran obsidian sources, especially the extensive deposit of La Union which includes the outcrops and river deposits of San Luis and Quebrada Agua Helada studied by Kazuo Aoyama and Michael Glascock (Aoyama et al. 1999; Joyce et al. 2004; Shackley et al. 2004).

The artifacts excavated by the earlier project in the 1980s have been analyzed completely while those excavated more recently are still in process. At this point I am able to discuss in detail the results of the Late Classic obsidian coming from the CR-44 zone. I am also able to give some preliminary data on the Terminal Classic obsidian although I do not yet have the final identifications of the obsidian sources for the residential group south of the ballcourt.

The following charts present the results of the laboratory analysis of the obsidian artifacts excavated in the 1980s. The first chart shows the percentage of each source identified as present in each time period. As can be easily seen, the source of Ixtepeque dominates the assemblage in both phases. Although the percentages are quite low for the other sources, their occurrence cannot be ignored and suggest several aspects of obsidian acquisition. First, in the Late Classic period, the people of Cerro Palenque living at CR-44 received obsidian from five Guatemalan

deposits, including El Chayal, Jalapa, San Martin Jilotepque, San Bartolome Milpas Altas as well as Ixtepeque. They also acquired green obsidian from the Pachuca obsidian source in Mexico. They made use of two Honduran sources, La Esperanza and La Union but did not receive obsidian from the source of Guinope. Second, in the Terminal Classic, the variety of obsidian sources is reduced slightly because no green obsidian arrived at the site. But we can see that material from the Guatemalan and Honduran sources continue to be imported into the community. Third, although there is a reduction in the percentage of Ixtepeque obsidian in the Terminal Classic deposits, it is very small. At the same time, the use of obsidian from La Union, the source closest to the lower Ulua valley of all the sources identified at Cerro Palenque, goes up slightly.

The second chart represents an attempt to put the Cerro Palenque results in a larger regional context. It shows the percentage of obsidian imported to a series of sites or regions in southeastern Mesoamerica, specifically, Quirigua in Guatemala; the Zapotitan valley in El Salvador; and the following places in Honduras: the Copan valley; the region of La Entrada; the Naco valley; Cerro Palenque and Puerto Escondido, both in the lower Ulua valley; the region of El Cajon, and Selin Farm in the Aguan valley (Aoyama 1994; Bouey n.d.a, n.d.b; Freter 1988:109; Healy et al. 1996; Hirth and Coskren 1989; Joyce et al. 2004; Shackley et al. 2004; Sheets et al. 1990; Stross et al. 1990). The examples are placed in the chart in approximate western to eastern order. Before discussing the patterns visible in this and the following charts, let me explain how it was created. I tried to limit the comparison to those data that dated from the Late Classic period. In order to use the most similar data possible, I also limited the comparison to those studies which had carried out chemical analysis through the use of neutron-activation analysis (NAA) or X-ray fluorescence (XRF or EDXRF) because the two methods

measure trace elements in different but comparable ways (Glascock et al. 1998; Shackley 1998). This means that no study which relied on visual identification to determine the provenance of the obsidian has been included (e.g., Aoyama 1989, 1994, 2001). At the same time, it should be noted that the studies vary in terms of when they were carried out and the size of the sample analyzed. The Quirigua analysis was carried out some time ago and the Selin Farm sample consists of only two pieces of obsidian (Stross et al. 1983; Healy et al. 1996). The Naco valley obsidian study was not able to identify the origin of almost one-third of the sample (Bouey n.d.a, n.d.b). And the artifacts studied from Copan were all prismatic blades (Freter 1988:109). All these factors may affect the comparison. Older studies do not reflect advances in the identification of new sources or the development in the understanding of the chemical composition of sources already known. A large number of unidentified objects suggests limitations in the comparative database available to the laboratory (Bouey n.d.a, n.d.b). Small samples or those consisting of only one type of tool may cause problems in the degree to which the sample is representative of the larger population.

Despite these limitations, the comparison does suggest some interesting patterns and contrasts. In order to facilitate the comparison, I have divided the obsidian deposits into two groups, those from Guatemala and those from Honduras. The chart of the Guatemalan sources confirms what other analysts have suggested, that Ixtepeque was the most frequently used of the Guatemalan sources during the Late Classic period in much of southeastern Mesoamerica. But at the same time, we can see a notable variation in access and use of obsidian in the lower Ulua valley. Cerro Palenque acquired more obsidian from Ixtepeque and had access to a greater variety of sources than did Puerto Escondido, which received more obsidian from El Chayal.

Viewing the distribution of Ixtepeque obsidian, the chart shows that the most western of the regions (Quirigua, the Zapotitan valley, and the Copan valley) relied heavily, perhaps even exclusively, on that source. But, moving into Honduras, the percentage of this type of obsidian does not demonstrate a smooth or continuous reduction from west to east, or from the Copan valley into the more central part of the country which is further from the source. In contrast, the occurrence of Ixtepeque obsidian at Cerro Palenque is much higher than in region of La Entrada or the Naco Valley while its occurrence at Puerto Escondidto and the Selin Farm site is substantial. In fact, it is the region of El Cajon which appears distinctive in its preference for obsidian from the source of La Esperanza rather than Ixtepeque.

The next chart includes only the Honduran sources identified in one or more of the samples, La Esperanza, La Union, and Guinope. Again, we can see quite a bit of variation. Neither Quirigua nor the valleys of Zapotitan or Copan seem to take advantage of Honduran sources[1]. In the lower Ulua valley, the people at Puerto Escondido made greater use of obsidian from La Union while the residents of CR-44 at Cerro Palenque hardly used any obsidian from Honduran sources.

How should we interpret these differences in obsidian importation at Cerro Palenque? The raw material of the Ixtepeque and La Esperanza flows serves well for the manufacture of prismatic blades (Aoyama 1989; Sheets et al. 1990; Sorensen and Hirth 1984). The source of La Esperanza is much closer to the lower Ulua valley. Survey of the source area itself has shown that the deposit was mined and collected while the data from El Cajon sites indicate that at least some of this activity took place in the Late Classic period (Hirth and Coskren 1989; Sorensen and Hirth 1984). Why not import more obsidian from this source? Why prefer to obtain

[1] Although it should be noted that a visual analysis of a larger sample of Copan obsidian by Kazuo Aoyama (2001:Table 1) has identified a very small occurrence of obsidian from La Esperanza (0.2%), El Chayal (0.1%), San Martin Jilotepeque (0.01%), and Ucarero (0.1%)

obsidian from places further away when a deposit of the same material of similar quality is closer? Aoyama (1989, 1994, 2001) has noted a marked preference for Ixtepeque obsidian instead of La Esperanza material in the region of La Entrada. He has suggested that the inhabitants of this region wished to maintain a close connection with the Copan polity, a suggestion that he supports with the fact that the people of La Entrada used a great deal of Copador pottery. Technical analyses have indicated that this polychrome pottery was produced in the Copan region and western El Salvador (Beaudry 1987). Aoyama attributes the La Entrada examples to the Copan valley (see Sato 1993). Underlying his discussion is the idea that the Copan polity controlled the importation and distribution of Ixtepeque obsidian in Honduras.

But in the lower Ulua valley, we have little evidence of close and on-going exchange relations with the Copan valley of the sort evident in the La Entrada region. Hirth (1988) claims that Copador is absent in the valley although excavations at Travesía have produced a sherd (Rosemary Joyce, personal communication, 2004). Furthermore, the architecture and sculpture of CR-44 indicates the existence of an aesthetic system distinct from those of the Copan Maya (Hirth 1988; Joyce 1990). While Ulua Polychromes were imported into the Copan valley in substantial amounts and appear in elite residential and funerary contexts (Gerstle and Webster 1990), more seem to be from the Lake Yojoa area and Comayagua valley (Viel 1993a, b) although lower Ulua valley types are also present (Maca 2004).

These observations lead to the conclusion that, while some sort of interaction with the Copan valley took place during the Late Classic period, this interaction did not constitute the primary or largest scale set of exchange networks that lower Ulua societies participated in. Nor did communities such as Cerro Palenque rely on interaction with Copan to develop exchange relationships with the Maya lowlands. Pottery and marble vessels suggest on-going interaction

with Maya societies in Belize and Guatemala (Hirth 1988; Joyce 1990). In other words, Late Classic lower Ulua valley communities were part of varied long-distance networks, of which western Honduras was only one. The Ulua river offers a riverine route that connected groups living along it with a maritime system of exchange that included the societies of Belize and the Yucatan peninsula from an early point in time and continued up to the time of Spanish contact (Healy et al. 1984; Hirth 1988). In terms of the social processes underlying exchange of such materials as obsidian, the importation of obsidian by Cerro Palenque indicates an interest in maintaining contact with numerous distant and closer by groups.

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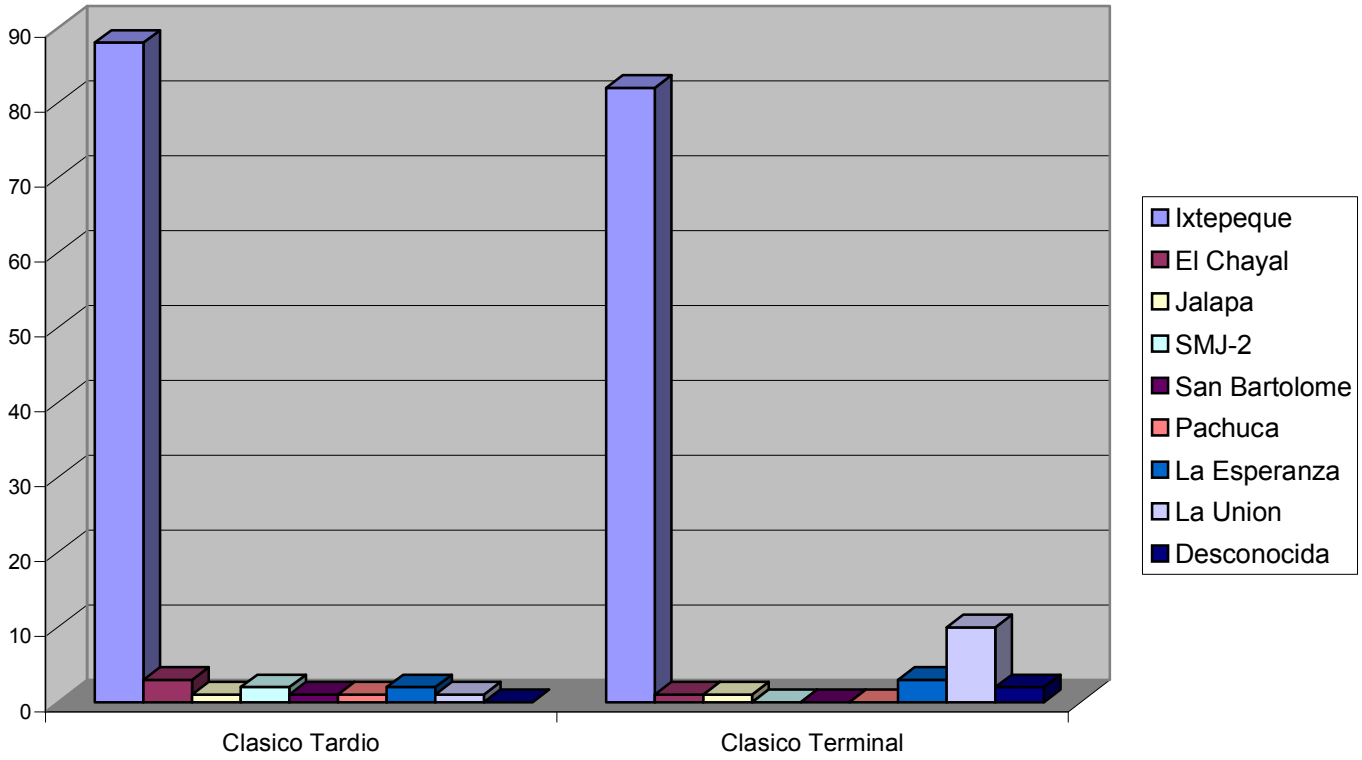
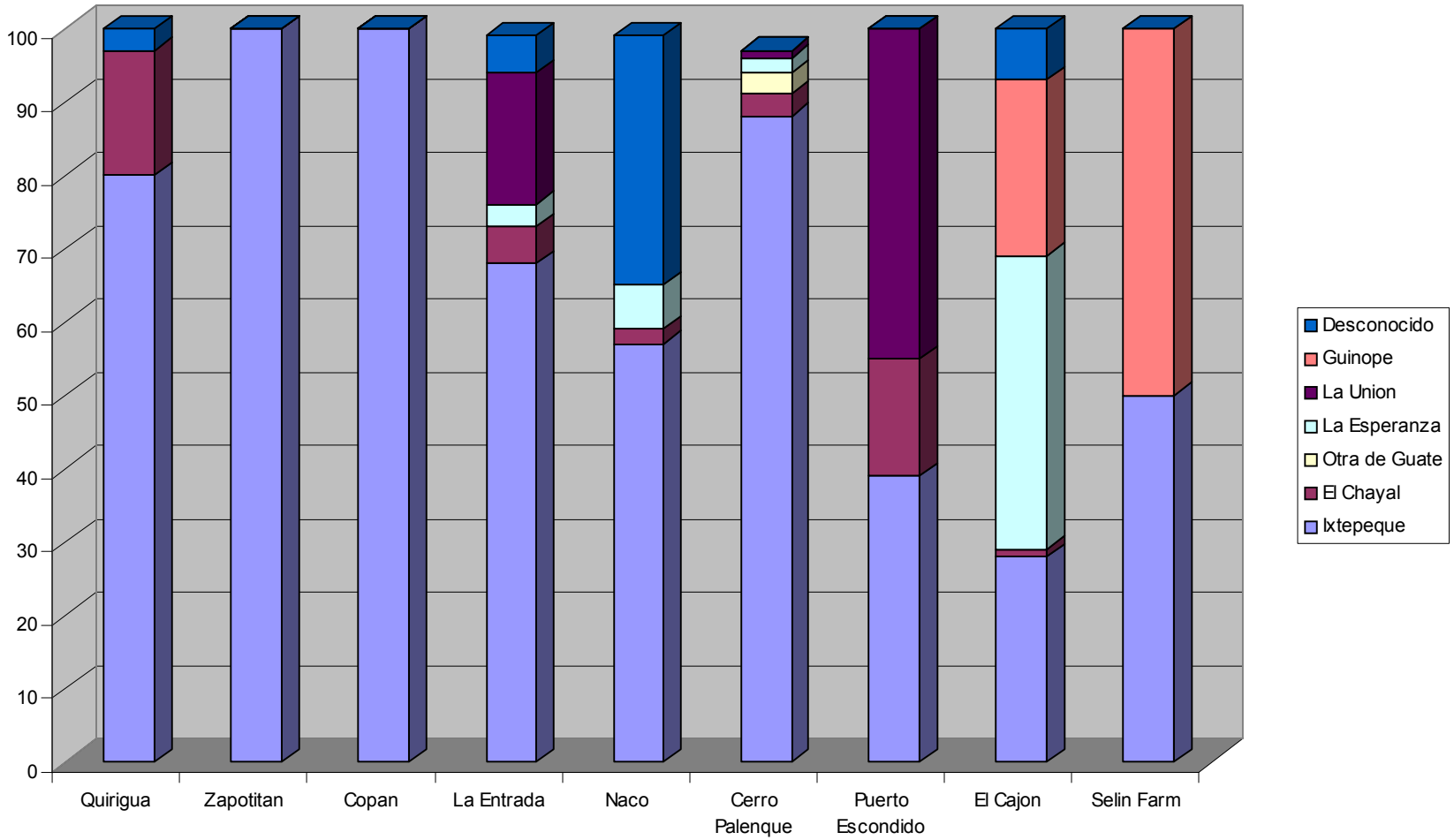
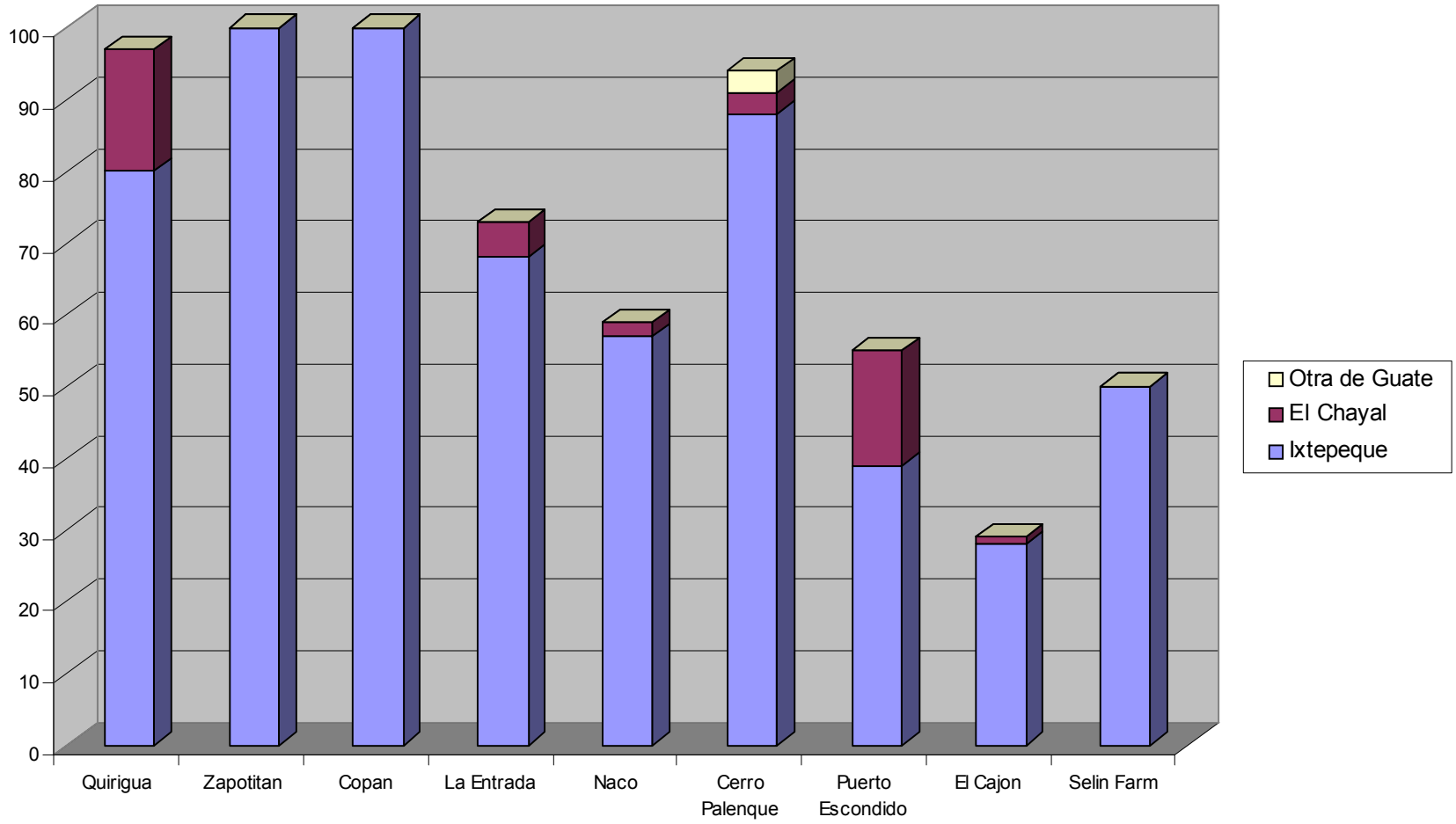


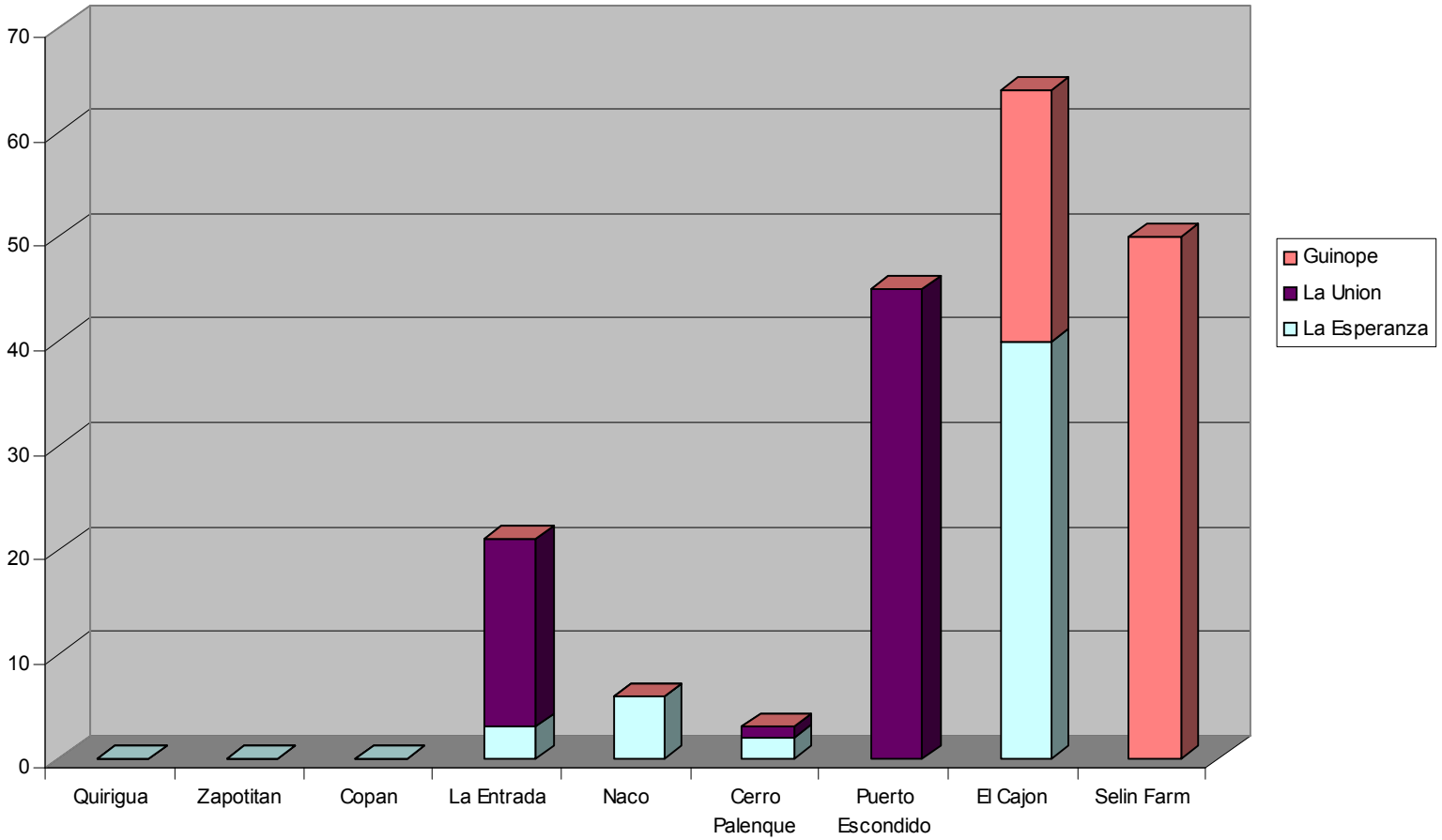
Obsidian Sources Imported into Cerro Palenque during the Classic and Terminal Classic Periods



Comparison of Obsidian Access at Sites or Archaeological Regions in Southeastern Mesoamérica in the Late Classic Period



Guatemalan Sources



Honduran Sources