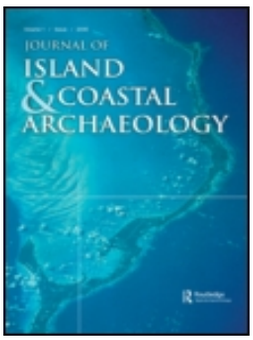

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Coastal Maya Obsidian Trade in the Late Postclassic to Early Colonial Period: The View From San Pedro, Ambergris Caye, Belize

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ABSTRACT

Although substantial work has been done to reconstruct ancient Maya coastal trade from the Late Preclassic through the Early Postclassic periods (400 BC–AD 1200), relatively little is known about trade activity along the Caribbean Coast in Late Postclassic and Early Colonial times (ca. AD 1400 to 1700). By focusing on obsidian artifacts from the site of San Pedro on Ambergris Caye, Belize, one of the few coastal sites for which data are available for the Postclassic to Colonial transition, we attempt to understand how Maya procurement, production, and use of obsidian were organized, and the effect the arrival of the Spaniards had on access to obsidian. The Spanish presence in the Yucatan Peninsula clearly changed Maya life in numerous ways; however, the evidence from San Pedro suggests strongly—although it is not yet unequivocal—that Maya communities along the coast were still able to access obsidian, primarily from the Guatemalan highlands. With comparatively good access to obsidian for blade production, the site appears to have served as an important link in both long-distance and intraregional socioeconomic systems as a way station for moving goods up and down the Caribbean Coast and by funneling resources via a coastal-inland trade network.

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Keywords Mesoamerica, Caribbean, volcanic glass, Maya exchange

INTRODUCTION

In the Maya world, evidence for the trade and exchange of obsidian occurs at many sites over time. Known for its distinct glassine luster and fine cutting edge, obsidian not only served as a standard source of material for utilitarian tools but as an essential component in various ritual and political activities in the form of blood-letting implements and eccentrics. Quarried from outcrops in highland Guatemala and Central Mexico, obsidian was readily transported into the lowlands and traded among both elite and non-elite populations (McKillop 2006:133–136, 249–250).

An assemblage of obsidian artifacts recovered from the site of San Pedro, named after the town on Ambergris Caye in which the site occurs, provides evidence for a considerable reliance on the material and an enduring coastal adaptation that lasted into Early Colonial times. The 'Historic' or Early Colonial period is difficult to bracket, but with regard to Belize, Spanish activity was concentrated from about 1531 to the closing decades of the seventeenth century, when the Itza of Petén were routed and Spanish investment or interest in Belize dissipated (Jones 1989:45, 1998). The British Colonial period is usually seen as beginning in the eighteenth century. With a focus on obsidian blade technology from the Late Postclassic through the Early Colonial period (ca. AD 1400–1700), the research reported here is aimed at reconstructing and providing a better understanding of the processes of acquisition, manufacture, and use of obsidian tools at San Pedro, as well as the site's larger role in the socioeconomy of coastal communities during the early Spanish Colonial period.

OBSIDIAN AND MAYA COASTAL TRADE: A SUMMARY

The economies of Maya Lowland sites were not limited to local interactions and did not exist apart from the complex political, social, and ritual systems that formed the fabric of ancient Maya life. The relationships between and among elites, non-elites, communities, geographic locations, and environmental zones defined the economic role that a site played within its local, regional, and inter-regional contexts. Coastal trade networks and the importance of marine-based exchange have been extensively discussed in various attempts to reconstruct the frameworks of such economic systems (Andrews 1991; Freidel 1978, 1979; Graham 1987, 1989, 1994; Guderjan and Garber 1995; Hammond 1972, 1976; McKillop 1987, 1995a, 1995b, 1996, 2002; McKillop and Healy 1989; McKillop et al. 1988; Mock 1997; Rathje 1971; Rathje and Sabloff 1973; Sabloff 1977; Stemp 2001).

Evidence for long-distance trade along the Caribbean Coast, from as early as the Late Preclassic (400 BC–AD 300), demonstrates that marine and riverine networks linked the highlands of Guatemala and the southern Maya lowlands and functioned as critical routes for communication and trade within the lowlands and around the Yucatan Peninsula (Freidel 1978, 1979). Early interpretations of the time when Maya coastal trade developed in earnest and how it was both socioeconomically and sociopolitically organized have varied. One commonly held assumption among Mayanists is that coastal trade was of critical importance to highland-lowland exchange at many times throughout Maya prehistory (Graham 1994; Hammond et al. 1984; Healy et al. 1984; McKillop and Jackson 1989; Nelson 1985; Rathje 1971; Rathje et al. 1978). Coastal trade and exchange networks have also been considered important to the growth of political and ideological systems integral to the development of lowland city centers and to the interaction between Maya populations in the Classic period (AD 300–900; Rathje 1971).

An important element for the understanding of Maya coastal trade is obsidian. Although basic commodities such as salt (McKillop 2002, 2005) were needed to

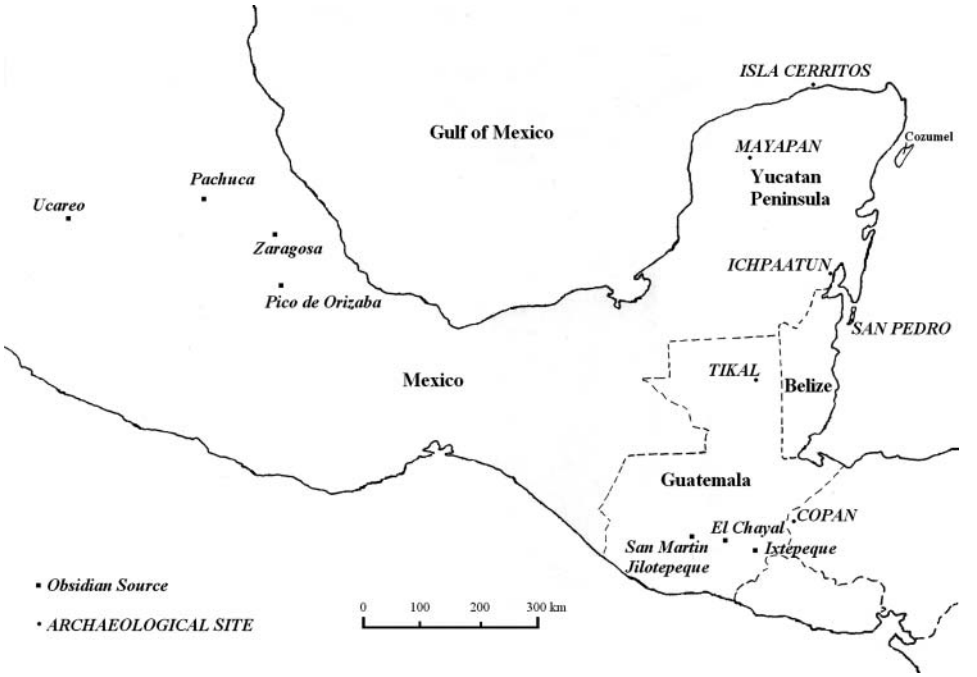


Figure 1. *Map of the major obsidian sources in highland Guatemala and central Mexico.*

fulfill the requirements of everyday existence, emphasis on trade models is often placed on "exotic" materials that were desired by Maya elites. Sabloff (1977) asserted that Classic period trade overwhelmingly involved the transfer of exotic elite goods such as jade and obsidian. Determining what is "exotic" is problematic, however. Jade, for example, is not found in the volcanic highlands and access to obsidian sources for some lowland sites is as easy as access to chert (Graham 1987). Exotic or local, the widespread presence of obsidian throughout inland and coastal sites supports some of the early models of coastal trade.

Based on the spatial distribution of obsidian, Hammond (1972) reconstructed a model of long-distance exchange which emphasized the flow of goods from the Guatemalan highlands via a series of riverine trade routes. Using samples sourced to highland Guatemala, he reasoned that these suppliers were in competition. In Hammond's (1972) model, El Chayal obsidian was traded overland, whereas Ixtepeque obsidian was traded along the coast (Figure 1). Throughout the Classic period, Hammond (1976:80, figure 5) further hypothesized that Maya traders regularly employed coastal networks and used caye settlements at the mouths of major drainage basins as strategic way stations for the funneling of resources to inland communities (McKillop 1987, 1996:51). Other studies (Graham 1987:762–763; Guderjan and Garber 1995:190; Rice et al. 1985:603) suggest more explicitly that such coastal networks served to make goods such as obsidian accessible to all levels of society during the Classic period.

Evidence from contexts of recovery indicates that the Maya preferentially used obsidian from different sources for different purposes, specifically ritual versus nonritual use. Obsidian from different sources may have been acquired through different exchange systems involving open market exchange, political (elite) economy, or some combination of the two in the Late Preclassic

to Classic periods (Haines and Glascock 2006).

Although Hammond's model (1972) laid the foundation for theories of coastal exchange in Belize, we now know that several key facets of the model can be expanded upon, including the number of obsidian sources in the Guatemalan highlands (Braswell 2003) and the mechanisms of exchange. The importance of a coastal network in the distribution of products and information from the highlands to the lowlands and vice versa continues to be recognized, but the extreme complexity of coastal trade is much better understood, specifically as it pertains to the integration of coastal communities into the regional economic systems along the coast (Mock 1997). Building on Hammond's model, Graham (1989, 1994:316) proposed that sites such as Colson Point and Placencia, along the southern coast of Belize, were not only bases for fishing, but were also trading hubs or way stations and served as nodes for local or intraregional trade that began at least as early as the Late Preclassic (Figure 2). Coastal-inland exchange relationships undoubtedly increased the importance of way stations and helped to integrate local or intercommunity economies from Late Preclassic through Postclassic times. Similar coastal-inland economic relationships have been suggested for Northern River Lagoon and Colha (Mock 1997) and Marco Gonzalez and Lamanai (Graham and Pendergast 1989; Pendergast 1990, 1993a:18; Stemp 2001). By the Terminal Classic (AD 800) (if not earlier, as noted above) acquisition of obsidian had developed as some form of market exchange (Braswell 2004:187; Masson 2003:280).

Some interpretations of coastal trade tend to emphasize its increased role in the Postclassic period, particularly in the wake of the Classic period "collapse" and the fall of a number of inland Maya cities (e.g., Rathje and Sabloff 1973; Freidel and Sabloff 1984 for Cozumel). Population migration to coastal zones after the collapse is also seen as a critical factor in an increased reliance on coastal trade (Ball 1977; Mock 1997; Sabloff 1977; Thompson 1970). Others emphasize the expansion of the Itza in the northern Yucatan Peninsula as a factor that contributed to increased coastal maritime trade in the Postclassic (Andrews 1991:161). A significant shift from El Chayal to Ixtepeque as the primary source of obsidian upon which the Maya relied (Nelson 1985), particularly along the coast, also accompanied the demographic and political changes noted after the Classic period (Braswell 2003; Dreiss 1988:49; Dreiss and Brown 1989:72, figure 3).

In response to the expanded importance of coastally oriented commercial hubs in the Early Postclassic, or at least to a situation in which more individuals seem to have become involved in commerce, settlement increased in coastal zones. Coastal populations not only acquired greater access to trade goods, such as obsidian, but many also became increasingly independent (Masson 1997:293–295; Masson 2002). The settlement pattern in the Postclassic period seems to have been of two types: Communities abandoned during the time of collapse in the Late-Terminal Classic period were reoccupied or, as in the case of Lamanai, there was no break in occupation (Graham 2004, 2007; Pendergast 1986, 1993a:18). With the fall of Mayapan, smaller villages and towns began to experience increased social, political, and economic autonomy in the Late Postclassic. A number of coastal and riverine sites such as Santa Rita Corozal (Chase 1985; Chase and Chase 1988), Yakalche (Pendergast 1984), Laguna de On (Masson 1997, 2003), Progesso Lagoon [including Caye Coco, Caye Muerto, Shangrila Resort], and The Last Resort (Masson 1999, 2003; Oland 2009), San Pedro (Graham and Pendergast 1994; Pendergast and Graham 1991; Stemp 2001), Los Renegados (McKillop 1995a), Colson Point, and some sites in North Stann Creek, Silk Grass Creek, and the Sittee River (Graham 1994) provide good evidence for the existence of largely independent, yet economically integrated, Late Postclassic communities with access to obsidian in varying amounts (Braswell 2003:155). Coastal trade endured into the Late Postclassic and clearly continued to be important (Rathje and Sabloff 1973; Sabloff and Rathje 1975; Scholes and Roys [1948] 1968; Tozzer 1941).

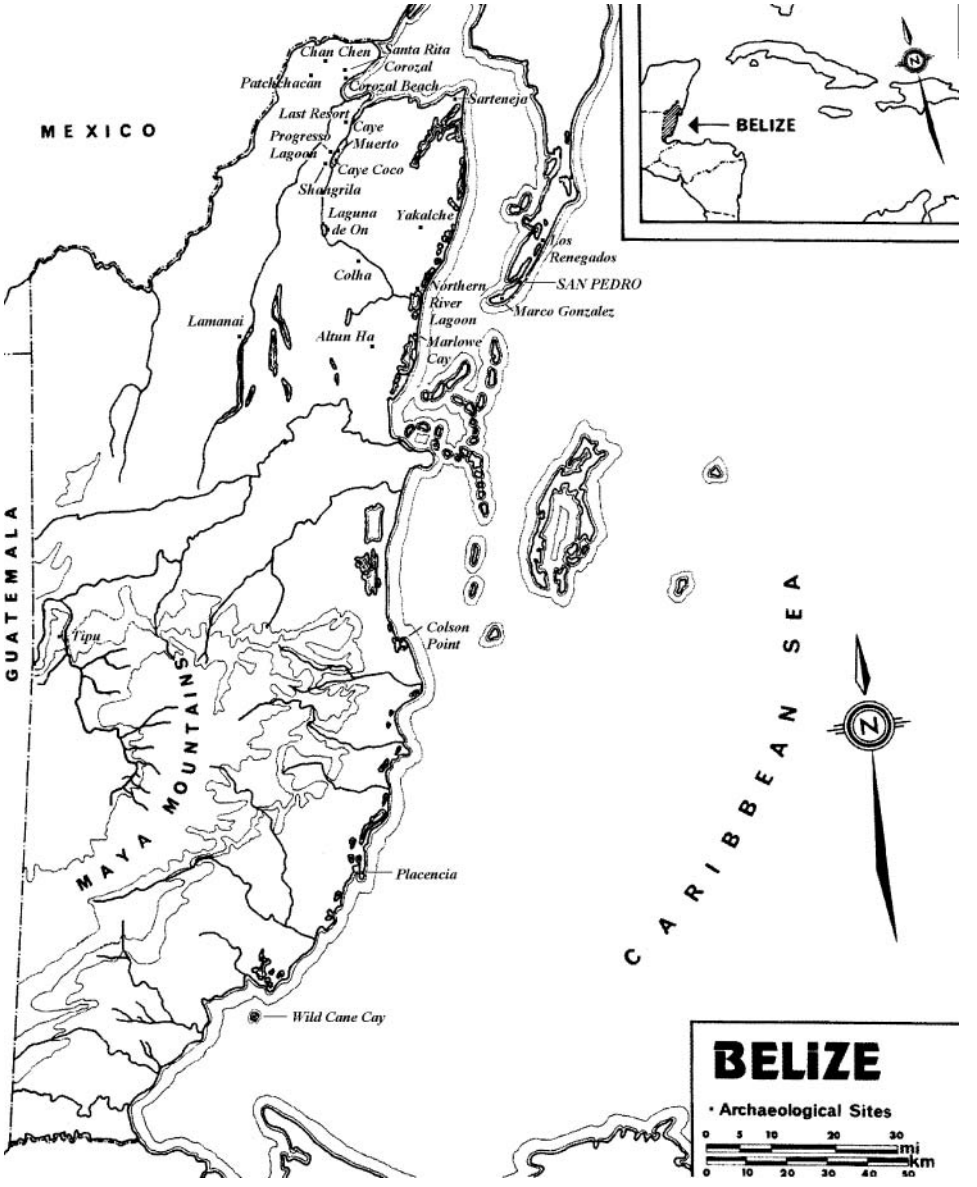


Figure 2. *Map of Maya archaeological sites in Belize (modified from Graham and Pendergast 1989:figure 1).*

When the Spaniards arrived, Maya communities in Yucatan and Belize were organized into sociopolitical units of various levels, groups of which were interpreted by the Spaniards as "provinces." Although they were not provinces, strictly speaking (Okoshi Harada 2006), some communities were under the authority of a regional lord or *halach uinic* (Jones 1989; Restall 1997; Roys 1957). Some cities functioned as a kind of capital from which the affairs of other communities were administered. In the

Figure 3. *Excavation on the Sands Hotel property in the modern resort town of San Pedro, Ambergris Caye, Belize.*

wake of the Spanish conquest, restructuring endeavors disrupted, and in many cases permanently altered or terminated, several key facets of traditional social, economic, and political systems, including trade (Palka 2009). At Tipu, in central Belize, for example, there is evidence that the Maya continued to have access to some items, such as chert, but that overland trade in obsidian was disrupted, at least by the seventeenth century (Graham 1991:323–324). Tipu, however, was a reduction community. Its proximity to non-Christian Itza and Kowoj communities in Petén meant that it experienced relatively intensive interference by the Spaniards, and its members were moved bodily to Petén in 1707 (Jones 1998:408). At that same time, in the early eighteenth century, Spanish records refer to Maya in coastal communities who remained outside any sort of administrative or political control (Jones 1998:388).

Despite a substantial decline in Maya population in the first century following colonization, Maya culture continued to thrive in many ways, thanks in large part to the strength of its system of kinship and the preservation of its social organization based on the *cah* (the bounded community and sociopolitical organization within it) and the *chibal* (the patronym group). Such cohesion, however, also proved beneficial to Spaniards seeking tribute and *corvée* labor (Farriss 1984:47–48; Restall 1997:20–28). Not all Maya succumbed to political domination, however, and many managed to slip the yoke of the colonizers. In some areas, Maya fleeing the Spaniards found refuge in Belize and parts of Campeche and Quintana Roo where, influenced and in some cases actually stimulated to act by the Petén Itza, they organized themselves to resist the colonizers and assert their independence (Jones 1989, 1998).

Despite the economic pressures and social disruptions imposed on the indigenous population, many Maya, particularly those in the poorly administered or unconquered

territories in Quintana Roo, Belize, and in the Petén region of Guatemala experienced various degrees of autonomy and independence from the Spaniards (Fariss 1984; Jones 1982, 1989; Restall 1997). In the trading sphere, exchange among Maya merchants endured. Although the Spaniards ultimately gained control of most major exchange goods and trade routes (Palka 2009:336), Maya populations throughout Mesoamerica continued to trade among themselves through covert channels and black markets. Using secret trade routes and port sites, Maya merchants maintained strong trade relationships across traditional political lines well into the Late Colonial period (Jones 1982). Limited access to metal goods meant that obsidian would have remained an important resource for many Maya communities in Early Colonial times. Given the fact that the Belize coast was not a focus of Spanish interest, and that Maya fled to coastal communities as late as the early eighteenth century in an effort to avoid colonial control, obsidian is likely to have been traded and accessed via coastal ports.

SAN PEDRO: SITE DESCRIPTION

Located in the southern part of Ambergris Caye, the northernmost chain of islands along Belize's barrier reef, the town of San Pedro lies on comparatively high ground between the coral sand beaches and mangrove swamps which make up the limestone-based landmass. The town probably comprises more than one "site", but since excavations took place in home and hotel backyards and as rescue operations during restaurant construction, no pattern of settlement is known and our reference to San Pedro as a single "site" is simply expedient. We can say that San Pedro, therefore, is one of at least 22 known prehistoric sites on the caye that date from as early as the Late Preclassic (ca. 400 BC) to as late as the Early Colonial period (Guderjan 1995a; Pendergast and Graham 1991). Originally excavated in the early 1990s (Pendergast and Graham 1991) (Figure 3), some parts of what is now San Pedro appear to have been first occupied as early as the Late Classic period (AD 600). Available evidence from several excavations in the town confirms that occupation was extensive and intensive in the Late Postclassic period. Supported primarily by seriated ceramic evidence and/or associations with Spanish material culture, such as olive jar sherds, gunflints, or metal objects, Late Postclassic and Early Colonial-period deposits were identified at a number of locations throughout the modern town of San Pedro (Graham and Pendergast 1994; Pendergast and Graham 1991). Unfortunately, there is no case in which deposits are not disturbed to some extent by the inherent fluid characteristics of sand and natural phenomena such as hurricanes, wind erosion, and land crab burrowing. Because San Pedro is now a resort town it has also undergone considerable construction and building expansion in the last three decades. Therefore although we know that the Maya were on the caye in Early Colonial times, we cannot state categorically that the obsidian found in deposits with colonial artifacts is primary. Nonetheless, evidence from aspects of stratigraphy and apparent associations with house floors suggest strongly that obsidian was being acquired at this time.

Like the majority of windward sites on Ambergris Caye (Guderjan 1995b), no architecture that could be called monumental has been encountered in San Pedro. Maya residences are represented by packed earthen or thinly plastered floors that probably supported pole and thatch houses that have long since decayed (Graham and Pendergast 1994). Burials, however, were recovered from beneath house floors (Figure 4); of those excavated, most lacked grave goods either local or non-local (i.e., basalt, jade, pottery). Only two obsidian blade fragments were recovered from Late Postclassic-Early Colonial burials on the Alamilla property. However, indications of an elite or noble presence can be gleaned from the results of a rescue excavation on the Rosalita property in the northern sector of the modern town which revealed burials with individuals with flattened foreheads and the presence of comparatively elaborate floors and possible building platforms at some locations. Earlier levels produced the

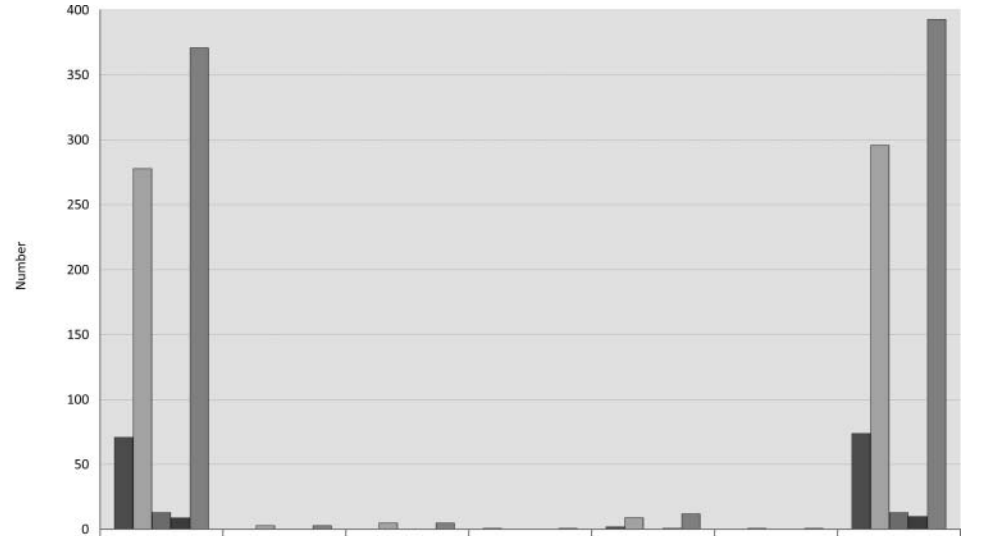
Figure 4. *Excavating a simple burial on the Sands Hotel property at San Pedro.*

charcoal strata and Coconut Walk pottery that point to intensive salt production in Late Classic times. This sand-tempered, unslipped ware mainly consists of crudely made, thin-walled bowls with slightly incurved sides that are argued to have been used to produce salt cakes from sea water (Graham 1994:153–156, 247). What we can say is that San Pedro was a community of at least some social differentiation. Its members were engaged in a range of subsistence and trading activities suited to coastal life, including salt production (Pendergast and Graham 1991; Stemp 2001; Williams et al. 2009).

METHODS OF OBSIDIAN SOURCING AT SAN PEDRO

For the San Pedro obsidian artifacts, we established only four visual groups: El Chayal,

Ixtepeque, 'other—gray', and 'other—black' obsidian. The attribution of source locations for all of the obsidian artifacts was based on visual identification following the system of attributes developed by other analysts, specifically Braswell et al. (2000), and the use of a small comparative collection consisting of El Chayal and Ixtepeque obsidian blades. Stemp visually sourced the obsidian artifacts relying on optical criteria that included color, the degree of translucency, surface texture, the presence and size of banding and/or other inclusions, and the diffusion of refracted light. Obsidian from each of the main Guatemalan sources can vary in appearance. However, El Chayal obsidian is generally milky gray or clear gray/dark gray with a frosted appearance. Banding, when present, tends to be wide and irregular. Milky gray pieces tend to have less banding and few inclusions, whereas clearer examples frequently have banding and small, dark inclusions. Ixtepeque obsidian is usually blackish-brown to blackish-gray in appearance with a reddish-caramel tinge. Most Ixtepeque obsidian has comparatively straight, narrow banding, but few, if any, granular inclusions. Whereas El Chayal obsidian is smooth with a somewhat duller surface sheen and 'dry soap' texture, Ixtepeque material tends to be very smooth with a very shiny or 'glassy' surface. Characteristics of cortex were not used to source the artifacts because almost all blades, flakes and cores lacked a cortical rind. All artifacts were examined under fluorescent light while resting on a white surface. At present, no trace element random sampling (i.e., NAA, XRF) has been conducted on this assemblage and as a result current source analysis must be regarded as preliminary because visual examination has not been combined with a geochemical sourcing technique. However, based on visual analysis alone, the overwhelming majority of the obsidian artifacts appear to be from either the El Chayal or the Ixtepeque



	Blades	Polyhedral cores	Polyhedral core fragments	Cortical flakes	Non-cortical flakes	Blocky fragments	Total
El Chayal	71	0	0	1	2	0	74
Ixtepeque	278	3	5	0	9	1	296
Other - gray	13	0	0	0	0	0	13
Other- black	9	0	0	0	1	0	10
Total	371	3	5	1	12	1	393

Figure 5. *Obsidian tool types by visual source group from San Pedro.*

source, following a method of binary sorting. Obsidian artifacts that could not be placed in the El Chayal or Ixtepeque groups were assigned to the 'other—gray' or 'other—black' groups. Those in the 'other—gray' group likely originate from highland Guatemala or Mexico, but owing to peculiarities in color, translucency, banding/inclusions, and texture we were not confident in assigning them to a specific source. The artifacts assigned to the 'other—black' obsidian group contained opaque artifacts that are believed to have originated from locations in the highlands of Guatemala or outcrops in Central Mexico.

THE OBSIDIAN ASSEMBLAGE FROM SAN PEDRO

In all, 393 obsidian artifacts were recovered from Late Postclassic-Early Colonial period deposits at San Pedro. Most of the obsidian was assigned to the Ixtepeque group, based on visual assessment of qualitative characteristics. A substantial number (74 or 18.8%) of the artifacts were identified as coming from El Chayal, whereas very small amounts of obsidian were assigned to the 'other—gray' (13 or 3.3%) or 'other—black' (10 or 2.5%) groups (Figure 5). In contrast with a number of other coastal sites in the Maya Lowlands (Andrews et al. 1989; Boxt 1989; Graham and Pendergast 1989; McKillop 1989, 1995b), no green obsidian (Spence 1996) was found during excavation of San Pedro. Judging by the lack of green obsidian and the possibility of very small quantities of 'other—gray' and/or 'other—black' obsidian from Mexico, there seems to have been minimal acquisition of obsidian at San Pedro from Central Mexican sources. It is, on the other hand, quite clear that the Maya at the site were engaged in the acquisition of obsidian from the Guatemalan highlands with a heavy reliance on material of Ixtepeque origin. The data seem to conform to expectations based on obsidian frequencies from numerous Postclassic Maya sites, which indicate a heavy reliance on material from Ixtepeque, with much smaller amounts coming from El Chayal or other sources in the Guatemalan highlands or from Central Mexico (Braswell 2003).

The overwhelming majority of the artifacts reflects blade production and occurs in the form of blades and blade fragments (371 or 94.4%) and polyhedral blade cores and core fragments (8 or 2%) (Figure 6). The remaining pieces are debitage, represented by some flakes and a single blocky fragment. The blades were classified based on their conformity to the morphological description of a tool that measures at least twice as long as it is wide and possesses relatively straight, parallel sides (Crabtree 1968:463; Sheets 1975:371). Typically, one or two dorsal ridges extend down the length of a blade and produce a triangular or trapezoidal section profile; blades with three or four such ridges were not uncommon (see Crabtree 1968). The blade cores and fragments exhibit flake scars indicative of unidirectional blade removal. However, one polyhedral core and one core fragment clearly reveal bidirectional blade removal with some blade scars originating from the distal ends of the artifacts. This indicates an attempt to produce blades from very nearly exhausted cores. The dimensions of the three whole cores recovered from the site indicate that the artifacts are completely exhausted (Table 1); however, the cores are slightly longer than those produced experimentally by Sheets and Muto (1972:632, table 1). Although the blade reduction occurring at San Pedro would have likely been performed by specialists, possibly traveling knapper-merchants (see Hirth 2008), the slightly greater length of the exhausted cores and the larger striking platforms remaining on them may suggest that the tool-makers at the site were not as skilled or efficient in terms of maximizing the number of blades removed from each polyhedral core. In the majority of cases, the whole blades and proximal blade fragments demonstrate evidence for grinding on their striking platforms to facilitate the purchase of an indenter or punch tool (Figure 7), as would be expected for Postclassic-period obsidian blade production (McKillop, 1995a:165; see Crabtree 1968:463; Sidrys 1979:594–595). The cores and core fragments recovered are characterized by ground striking platforms as well.

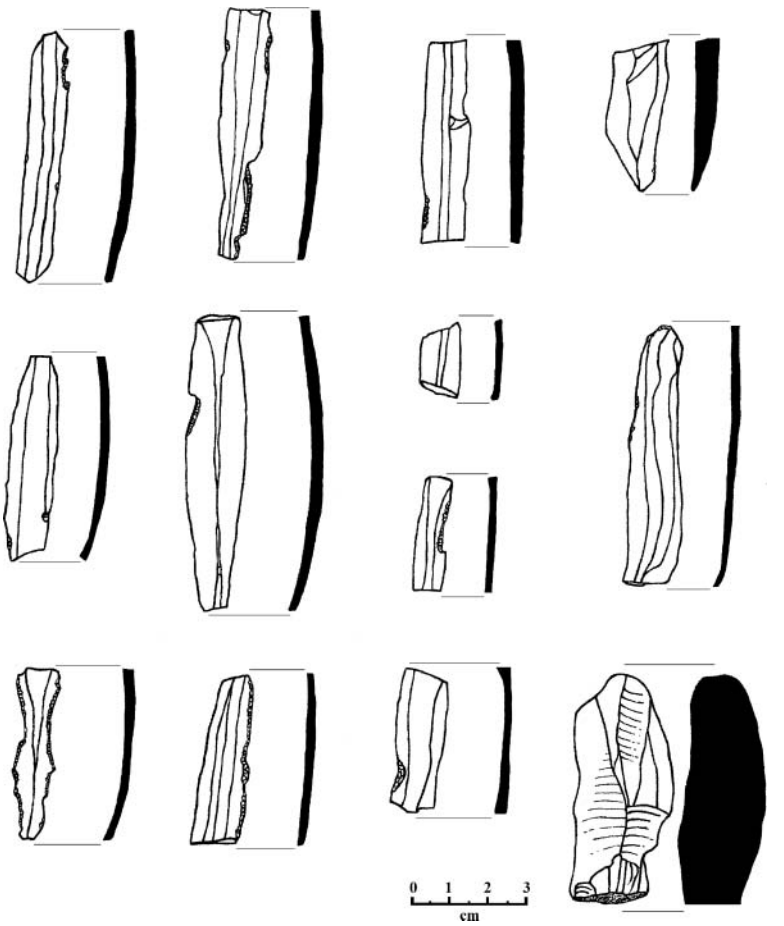


Figure 6. *Illustrations of obsidian blades, blade fragments and an exhausted core from San Pedro.*

Flake debitage and angular shatter, which inevitably accompany production efforts, are scarce at the site. Only one cortical flake, 12 non-cortical flakes, and a single blocky fragment were identified in the San Pedro lithic assemblage. The few flakes with intact striking platforms demonstrate variability in platform preparation; two are not ground, one is partially ground and two are ground. Some flake fragments may have been the product of ad hoc or casual percussion of cores or core fragments, but there is little to support the suggestion that this was an important component of reduction strategies at the site.

No other obsidian tool forms were recovered from San Pedro, so it is clear that the Maya relied on their chert tools for many activities that might have required these types of implements (Stemp 2001, 2004). Unlike the inhabitants of other Maya sites with significant Late Postclassic and Early Colonial period occupations, such as Progresso Lagoon and Caye Coco (Masson 1999; Oland 2009), Santa Rita Corozal (Shafer and Hester 1988), Lamanai and Tipu (Simmons 1995, 2002), the San Pedro villagers did not produce the simply designed and easily made small side-notched chert or obsidian points, insofar as present evidence indicates

Table 1. **Exhausted obsidian core dimensions.**

Core dimensions	Sheets and Muto (1972: table 1)	San Pedro—Ixtepeque (mean of N = 3)
Core length (cm)	8.2	9.0
Core width (cm)	2.7	2.4
Core thickness (cm)	2.1	2.3
Platform length (cm)	1.1	1.9
Platform thickness (cm)	0.5	1.3

(see Stemp 2001). Small side-notched points like these were affixed to arrows and used for hunting and in warfare (Simmons 1995, 2002). It appears likely that the primary reason for the absence of the distinctive points is that there was no need for them. The island environment of Ambergris Caye is not likely to have supported large numbers of big game, such as tapir or deer, and subsistence depended heavily on the sea, as is demonstrated by faunal analysis from Marco Gonzalez (Seymour 1991) and isotopic evidence from San Pedro human remains (Williams et al. 2009). Moreover, there is no evidence of piercing or cutting on human skeletal elements to suggest that the caye Maya utilized bows and arrows for fighting, although it is possible that weathering of the bones may have affected the preservation of any superficial cut marks (J. Maxwell, personal communication 2009).

OBSIDIAN TRADE AT LATE POSTCLASSIC-EARLY COLONIAL SAN PEDRO

The assemblage from San Pedro provides substantial evidence on which to base reconstructions of patterns of obsidian acquisition,

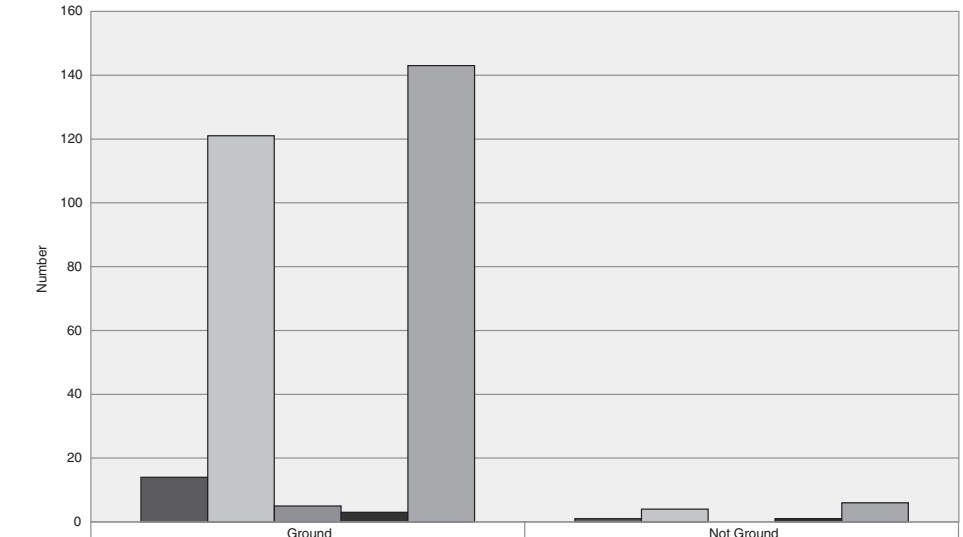


Figure 7. *Platform types on whole obsidian blades and proximal blade fragments from San Pedro.*

Table 2. **Obsidian blade sections by visual source group at San Pedro.**

Blade section shape	El Chayal	Ixtepeque	Other gray	Other black	Total
Triangular (1 dorsal ridge)	6 (8.5%)	35 (12.6%)	1 (7.7%)	0	42 (11.3%)
Trapezoidal (2 dorsal ridges)	59 (83.1%)	221 (79.5%)	11 (84.6%)	9 (100%)	300 (80.9%)
Other (3+ dorsal ridges)	6 (8.5%)	22 (7.9%)	1 (7.7%)	0	29 (7.8%)
Total	71 (100%)	278 (100%)	13 (100%)	9 (100%)	371 (100%)

reduction, and use. Given the very high proportion of Ixtepeque and El Chayal obsidian in deposits which we propose are likely to be Early Colonial, the concomitant is that Spanish activity did not affect coastal trade in obsidian. It is quite likely the San Pedro Maya acquired their obsidian primarily from the Guatemalan highland sources through exchange networks that focused on coastal transport of obsidian, probably in watercraft such as large canoes (McKillop 1996, 2005). But some of the obsidian in the 'other—gray' or 'other—black' groups may have originated from Mexican sources. As such, the sources represented by the obsidian assemblage from San Pedro would conform to the coastal circum-Yucatan Peninsula trade model. In this model, Mexican obsidian is found in higher proportions at more northerly coastal sites such as Isla Cerritos, whereas much smaller quantities occur at sites situated farther south along the coast, including those on Ambergris Caye (Andrews et al. 1989; Guderjan et al. 1989; McKillop 1995a).

As regards access to obsidian at the site, perhaps the most obvious component of the obsidian assemblage aside from the heavy reliance on material from Ixtepeque is the almost complete absence of cortical and noncortical flakes and blocky fragments. This suggests that cores arrived already prepared for blade removal. Although only exhausted blade cores and blade core fragments of Ixtepeque obsidian were recovered, we believe that El Chayal obsidian also arrived as prepared polyhedral blade cores. The lack of percussion blades and recovery of only two "first-series" pressure blades in the San Pedro assemblage confirm nearly complete provisioning from cores that had already been partially used as polyhedral cores. This pattern conforms with end stages in the reduction sequence as presented by Clark (1986:figure 6, table 2, 1988:figure 5) in which the recovered lithic assemblage contains extremely few flakes, some of which are cortical, as well as some exhausted polyhedral cores and fragments and very large quantities of prismatic blades. However, the assemblage from San Pedro deviates from this reduction sequence somewhat in that it lacks core rejuvenation flakes and only includes two distal blade fragments with plunging (*outre-passé*) terminations.

Late stage reduction of polyhedral blade cores can also be identified on the basis of the number of prismatic blades with trapezoidal sections. This blade shape is the product of previous blade removals, which result in the reduction of blade width as the circumference of the core is reduced. High frequencies of blades with trapezoidal sections also suggest deliberate attempts to maximize the quantity of blades removed from a core. Most (81%) of the blades recovered from San Pedro are trapezoidal in section, whereas only 42 (11%) are triangular in section (Table 2). This contrasts with Sheets and Muto's (1972:633) data from experimental obsidian core reduction, in which 33% of blades were triangular in section and 67% were trapezoidal, suggesting that later stage blade production was the norm at San Pedro.

The greater quantity of narrow blades, as defined on the basis of comparisons of mean blade width with those produced experimentally by Sheets and Muto (1972) (Table 3), supports the conclusion that most blades were removed from the cores at later stages of production. The presence of some smaller blades or "bladelets" indicates further reduction of exhausted pressure

Table 3. **Obsidian blade lengths, widths, and cutting-edge to mass ratios from Maya sites.**

	Period of occupation	Mean blade length (cm)	Range—blade length (cm)	Mean blade width (cm)	Range—blade width (cm)	Cutting edge/mass ratio (cm/g)
Experimental reduction (Sheets and Muto 1972:table 1)	n/a	10.4	6.2–12.7	1.53	0.8–2.4	2.3
San Pedro—El Chayal[a]	Late Postclassic–Early Historic	4.1	4.1	1.46	0.7 –2.11	5.0
San Pedro—Ixtepeque	Late Postclassic–Early Historic	7.3	5.6–9.2	1.3	0. –2.5	4.89
San Pedro—other gray[b]	Late Postclassic–Early Historic	n/a	n/a	1.45	0.95–2.0	4.21
San Pedro—other black[b]	Late Postclassic–Early Historic	n/a	n/a	1.46	0.7–2.0	4.68
Los Renegados—El Chayal (McKillop 1995:table 30)	Postclassic	n/a	n/a	1.3	n/a	4.49
Los Renegados—Ixtepeque (McKillop 1995:table 30)	Postclassic	n/a	n/a	1.34	n/a	4.19
Los Renegados—all gray (McKillop 1995a:table 30)	Postclassic	n/a	n/a	1.34	n/a	4.19
Wild Cane Cay—El Chayal (McKillop 1996:table 3)	Early Postclassic	n/a	n/a	1.10	n/a	4.34
Wild Cane Cay—Ixtepeque (McKillop 1996:table 3)	Early Postclassic	n/a	n/a	1.50	n/a	3.13
Wild Cane Cay—all gray (McKillop 1996:table 3)	Early Postclassic	n/a	n/a	1.23	n/a	4.55
Patchchacan—all obsidian (Sidrys 1979:table 1)	Postclassic	n/a	n/a	1.19	n/a	6.64
Corozal Beach—all obsidian (Sidrys 1979: Table 1)	Postclassic	n/a	n/a	1.14	n/a	5.12
Santa Rita Corozal—all obsidian (Sidrys 1979:table 1)	Postclassic	n/a	n/a	1.15	n/a	5.24

(Continued on next page)

Table 3. **Obsidian blade lengths, widths, and cutting-edge to mass ratios from Maya sites.*(Continued)***

	Period of occupation	Mean blade length (cm)	Range—blade length (cm)	Mean blade width (cm)	Range—blade width (cm)	Cutting edge/mass ratio (cm/g)
Chan Chen—all obsidian[c] (Sidrys 1979:table 1)	Postclassic	n/a	n/a	1.11	n/a	6.56
Sarteneja—all obsidian (Sidrys 1979:table 1)	Late Postclassic	n/a	n/a	1.07	n/a	7.44
Ichpaatun—all obsidian (Sidrys 1979:table 1)	Late Postclassic	n/a	n/a	1.14	n/a	5.66
Mayapan—all obsidian (Sidrys 1979:table 1)	Late Postclassic	n/a	n/a	1.1	n/a	5.70

Note. [a]Only one whole El Chayal obsidian blade recovered; [b]No whole obsidian blades recovered; [c]The majority of obsidian dates to this period, but not all.

cores (Hirth 2008:446). The smaller blades should not be confused with "first series" pressure blades, as they lack any evidence for percussion scars on their dorsal surfaces (Clark 1988:15).

OBSIDIAN AS A PRECIOUS COMMODITY

The presence of narrow blades may also suggest some efforts to conserve obsidian during blade production; this seems reasonable in view of the necessity of acquiring the material from distant sources, especially in colonial times when so many earlier exchange patterns had been disrupted. Greater blade width has been correlated with earlier access to obsidian along coastal trade routes (see McKillop 1987 for Wild Cane Cay). If the San Pedro Maya were gaining access to the obsidian supply later than the inhabitants of some other sites, possibly those farther south along the Belize Coast, it seems likely that their blades would on average be thinner.

The existence of efforts to conserve obsidian at San Pedro can be tested by examining the cutting-edge to mass ratios of the blades (Sheets and Muto 1972:175; Sidrys 1979). The ratios have been identified as indicators of the greater conservation of obsidian with an increase in distance from the source. Based on the work of Sheets and Muto (1972:table 1), the complete exhaustion of a polyhedral blade core would result in the production of blades with a mean cutting-edge to mass ratio of 2.3 (cm/g). At San Pedro this ratio ranges from a mean of 3.4 for 'other—gray' obsidian to 5.0 for obsidian assigned to the El Chayal group. More important, the blades of Ixtepeque obsidian have a mean of 4.9 (Table 3). The data suggest a much greater effort than usual to produce thinner, longer blades, which is indicative of both skillful blade production and the conservation of raw material.

The density of obsidian recovered during excavations, with about 6 items/14.7g of obsidian per cubic meter of soil, indicates that the quantity of the material acquired by the San Pedro Maya was generally low. This contrasts sharply with the amount of obsidian at the Wild Cane Cay site that had a density of 17 items/16.8 g of obsidian per cubic meter of soil in the Classic period and 136 items/134.4 g of obsidian per cubic meter of soil in the Postclassic (McKillop 1989:33, table 1). However, the density of obsidian at San Pedro is generally greater than those at most Classic period inland sites, except for major regional centers such as Tikal and Copan (Sidrys 1976:table 1). It

seems that the San Pedro Maya were not able to obtain as much obsidian as reached sites identified as more important socioeconomic or sociopolitical players.

In addition to estimates of number of artifacts by volume of excavated soil, the ratio of whole blades and proximal blade fragments to cores may provide some idea of the number of tools produced at the site. With the experimental reduction of a polyhedral core by Sheets and Muto (1972:table 1) as a baseline for comparison, there appear to be far fewer blades produced at San Pedro than originally thought. Sheets and Muto (1972:table 1) produced 83 blades from a single core, whereas the ratio from San Pedro is 46.7 blades/core for all obsidian and 41.7 blades/core for Ixtepeque obsidian. It appears that the San Pedro Maya were producing about half as many blades per core, which suggests that cores arrived on the caye in a substantially reduced condition. If we were to change the number of blades produced during the reduction of a single core from 83 to 125 (McKillop 1989:39) or 150 (Clark 1986:36), the difference is even more dramatic. The evidence may also indicate that substantial quantities of finished blades produced at the site did not remain there, having been traded inland for other resources (Johnson 1976:126–127).

DISCUSSION AND CONCLUSIONS

Although the evidence indicates that obsidian arrived on Ambergris Caye in the form of already partially reduced polyhedral cores, how toolmakers, possibly knapper-merchants, initially acquired the material is not clear. As a result, it is not possible to apply more specific procurement and provisioning models (e.g., Hirth 2008 for Teotihuacan) to San Pedro. The obsidian from San Pedro conforms to the pattern in which sites along the coast are characterized by wider blades and lower cutting-edge to mass ratios than sites further inland, and it is therefore clear that site location, size, and period of occupation were all important factors in determining the community's role in an extensive exchange network. An example of proximity to sources on a major trading route and hence more immediate access to obsidian is very clearly provided by Early Postclassic Wild Cane Cay, where Ixtepeque obsidian blades were considerably wider and the cutting-edge to mass ratios were much lower. As a site strategically located near the mouth of the Motagua River, Wild Cane Cay enjoyed more immediate access to obsidian than sites farther up the Belize Coast or farther inland (see McKillop 1987, 1989; McKillop et al. 1988).

Of greater importance is the information that San Pedro provides concerning coastal trade before and during the time of Spanish activity in Belize. As noted above, although contexts at the site are mixed, leaving secure dating open to question, the occurrence of Spanish-period artifacts with obsidian combined with the heavy emphasis on Ixtepeque obsidian and the presence of other highland Guatemalan obsidian suggest that existing trade networks continued to be maintained to some degree along the coast following Spanish arrival. Although we have relied on visual sourcing of artifacts in this study, we recognize the need to complete a randomized trace element analysis to verify the reliability of these results.

The lack of evidence for early stage reduction also points to the trading of obsidian along the coast via other communities of the period, although such communities are not well documented archaeologically and only minimally ethnohistorically (Jones 1989:xvi–xvii, map 2; Pendergast 1993a:18). San Pedro is one of a very few sites with Colonial-period artifacts identified on Ambergris Caye (Graham and Pendergast 1994; Guderjan 1995b:10, table 1; Pendergast and Graham 1991). This may be due to the fact that population decrease along the coast seems very likely to have occurred in the sixteenth century (see Jones 1989), possibly with a demographic shift to inland locations to avoid the increasingly frequent encounters with pirates, privateers, and other ships' crews plying the Caribbean. The presence of fewer Maya on the coast must have affected the quantity of obsidian being exchanged along this route. A decrease in way stations or transshipment points likely further reduced

the ease of transport of obsidian to sites farther inland.

Although Spanish cultural remains have been recovered mixed with Maya artifacts at San Pedro (Pendergast and Graham 1991), it appears that there was less disruption of Precolumbian Maya lifeways as compared with numerous mainland communities (Masson 1999; Masson et al. 2003); for example, the caye community was not displaced to the mainland as part of the process of reduction. The San Pedro Maya continued to import chert (Stemp 2001, 2004) and obsidian for tool manufacture, and also had access to pottery and small quantities of other mainland resources such as jade and basalt (Guderjan 1995b:11; Pendergast and Graham 1991). Perhaps their successful adaptation to the caye and their expertise in the acquisition of marine-based resources allowed the people of San Pedro to persist as a small community generally ignored by the Spaniards—perhaps they were simply too far away and difficult of access. This was not the case at inland sites such as Tipu and Lamanai (Graham 1991; Jones 1989; Pendergast 1993b) where mission churches were built and *encomienda* tribute exacted. However, the effects of Spanish domination caused significant change. One notable difference between inland sites and San Pedro is in the use of obsidian. As noted above, there is some evidence to suggest that Spanish interference in inland communities somehow interrupted access to obsidian; for example, hydration dates for obsidian from Tipu suggest that the community's Colonial-period occupants were recycling obsidian blades from earlier contexts in order to manufacture small projectile points (Graham 1991:324; Graham and Pendergast 1988; Graham et al. 1989:1258). No such recycling activity appears to have occurred at San Pedro, as far as the evidence indicates.

It is not likely that the Spaniards deliberately prevented access to obsidian per se. The Spanish tribute system emphasized items that were important to the Spaniards, such as cotton and cacao, and the Maya were required to produce the range of goods which they owed in tribute to the Spaniards (Jones 1989, 1998; Palka 2009; Restall 1997). The Maya are known to have had some access to metal cutting tools, but no such implements were recovered from San Pedro. The shift in economy and politics surely meant that the old ways and the old trading patterns of the Maya were disrupted to some extent. Moreover, as the Maya fled administered communities, their contacts and established trade routes undoubtedly changed. This is likely to have made access to obsidian more difficult for some, particularly because obsidian had to come from the highlands. In this scenario, it is not at all surprising that coastal communities might still have been able to gain access to obsidian as sea travel continued along the coast and among the cayes and atolls. There is little doubt that Dávila's and Montejo's journeys south from Yucatan to Honduras left the Spaniards distinctly unimpressed with the Belize coast (Chamberlain 1948:121–122). As long as Maya coastal travel was not a threat to the Spaniards, nor completely threatened by pirates or privateers, it most likely continued. Based on our evidence, we suggest that San Pedro served as a critical artery for moving long-distance goods like obsidian along the coast and inland to those communities outside the Spanish gaze. A role as middle-man in coastal-inland trade likely contributed to the continued Maya presence in the southern part of Ambergris Caye.

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