11 OBSIDIAN FORM AND DISTRIBUTION AT ACTUNCAN, BELIZE

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Current research on the frequency and distribution of obsidian in Mesoamerican sites provides evidence to suggest that production and exchange mechanisms varied widely. This paper draws together information from multiple sites in the upper Belize River Valley to discuss production and exchange of obsidian in this region. New data from Actuncan, Belize, is presented and added to the discussion of obsidian workshops and marketplaces in the Maya lowlands. Little evidence for production or whole blade trade exists at Actuncan, but data from other nearby sites indicates a regional network of exchange whereby obsidian was traded into the upper Belize River valley as pre-reduced polyhedral cores. Although most cores were further reduced to whole prismatic blades or smaller bladelets at a few discrete workshops before being distributed around the valley, some itinerant merchants processed blades for consumers at large sites, possibly in marketplaces.

Introduction

While obsidian tools have been widely used throughout Mesoamerica for thousands of years, their production and distribution mechanisms varied across time and space. These patterns are especially marked in the southern Maya lowlands, because obsidian had to travel over long distances and though numerous hands to reach the region and its consumers. Distance and exchange modes may explain the distribution of obsidian in sites, but it also may condition its form because the smaller the quantity of obsidian available, the more efficiently it will be shaped into a usable product. This paper offers new data on the form and distribution of obsidian at Actuncan, a long occupied site in the upper Belize River valley, and how exchange mechanisms may have changed over time at the site. While access was likely restricted at Actuncan, as it appears to have been at other sites in the region, obsidian was both a functional and highly valued item that was widely available to all households even as exchange mechanisms shifted through time.

A Brief Summary of Obsidian Form, Production, and Distribution in the Maya Lowlands

High transportation costs likely necessitated the shipment of obsidian to the lowlands as preformed cores or blades because these forms would have eliminated any unnecessary weight (Braswell and Glascock 2011; Hirth and Andrews 2002). Yet despite the long distances from their sources in Guatemala and Mexico, obsidian is found in the majority of residential units in the southern Maya lowlands, but in much lower quantities than it is found in highland Maya areas or in central Mexico (Ford 2004). Southern Maya lowland sites are located a minimum of 300 km from the nearest known obsidian sources in Guatemala but prismatic blades are found at nearly every lowland Maya site in both residential and ceremonial contexts (Ford 2004). Aside from workshops at Tikal in Guatemala, El Pozito in Belize, Ojo de Agua in Chiapas, Mexico, and Laton (site 272-136 near El Pilar) in Belize, few obsidian workshops have been identified in the southern Maya lowlands. Evidence of small scale "point-of-sale" blade production has also been found at Xunantunich (Keller 2006) and Buenavista del Cayo (Cap 2011) in multi-use plazas in upper Belize River valley, but these are not considered workshops. Although it is possible that more large-scale workshops are simply not being identified since debitage was often removed from the workshop and deposited elsewhere (Hintzman 2000; Moholy-Nagy 1990), it is clear from the small number of production sites that obsidian blade manufacture was specialized and restricted to a small number of individuals or workshops, at least outside Tikal. While the Laton workshop may have supplied many upper Belize River valley merchants and consumers with prismatic blades, it is unclear whether it was the only workshop in the region and how obsidian was distributed to sites in the region.

Long-distance import of obsidian into the Maya Lowlands began as early as 1300 B.C. (Hammond 1982). In the Belize River valley, prismatic blades appear as early as the Middle Preclassic period (Awe and Healy 1994; Healy 2006). Obsidian tool technology at Cahal Pech

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began as flakes removed from spall cores in the early Middle Preclassic period before shifting to prismatic blade production in the late Middle Preclassic period, a trend seen in other upper Belize River valley sites, such as Pacbitun and Barton Ramie, as well as other Maya sites in the central Lowlands, such as Seibal and Altar de Sacrificios, and those along the Pacific coast of Guatemala (Awe and Healy 1994; Hintzman 2000).

Source analyses of samples from Cahal Pech and Pacbitun indicate that at least three obsidian sources---San Martin Jilotepeque, El Chayal, and Ixtepeque---were used by the Preclassic Maya (Healy 2006; Kersey 2006). These sources continued to be used throughout the Classic period, but there are consistent diachronic patterns in the frequencies of these sources found at sites through time. Nelson (1985) suggests that San Martin Jilotepeque was the primary source in the Middle Preclassic before a shift toward El Chayal in the Late Preclassic period. He proposed that this shift occurred when the Olmec began to lose control over obsidian trade (Nelson 1985). El Chayal dominated during the Classic period, but over time Ixtepeque slowly gained in frequency, especially at southern sites along the Caribbean coast during the Late and Terminal Classic periods. In the Postclassic period, Ixtepeque obsidian sources and trade networks was dominant (Nelson 1985).

Norman Hammond (1972, 1976, 1982) proposes that the differential frequencies of Ixtepeque and El Chayal obsidians found in Classic Maya sites are the results of different trade routes. He suggests obsidian from El Chayal was traded to lowland sites through river valleys originating in the Guatamalan highlands; therefore, this source predominates at inland sites. On the other hand, Ixtepeque obsidian was trade via a competing route that followed the Rio Motagua to the Caribbean Sea before moving north along the coast; therefore, this source dominates assemblages at coastal sites (Dreiss and Brown 1989; Hammond 1982). In addition to these sources, a variety of outcrops in central and western Mexico were also obtained by the lowland Maya, but it only arrived in very small quantities. The most common of these highland sources is Pachuca obsidian, which is known for its characteristic green hue and superior quality. Likely, this source was controlled and distributed by Teotihuacan (Dreiss 1988; Spence 1996).

Despite the upper Belize River valley's location far from sources of obsidian, this valuable resource is ubiquitous in household and civic contexts. Annabel Ford's (1991) Belize River Archaeological Settlement Survey (BRASS) found that 56 percent of residences tested contained obsidian. At San Lorenzo, a community near Xunantunich, obsidian is found in all 19 commoner households and special-use structures, where Jason Yaeger (2000:1068-70) found 651 artifacts. Almost all these artifacts were prismatic blade fragments except for one complete blade, four blade tools, and two fragments of eccentrics. At Xunantunich proper, prismatic blades make up almost 40 percent of the tools ("formed artifacts") in Angela Keller's (2006:478) civic center sample, despite the fact that obsidian only comprised seven percent of all lithic artifacts. Evidence from the Laton workshop and Xunantunich proper indicate that blade cores had been pre-shaped when they arrived at these sites (Hintzman 2000:16-17; Keller 2006:536). At Chaa Creek, Samuel Connell (2000) found 206 pieces of obsidian in his excavations of commoner settlements and minor centers near Xunantunich, but noted a dramatic increase in access from the early (AD 600-660) to later (AD 660-780) Late Classic phases. Interestingly, in early Late Classic phase obsidian counts and counts per cubic meters at commoner settlements are five times higher than at minor centers (Connell 2000:545-547).

Marc Hintzman's (2000) research looked more closely at blade production at the Laton workshop. While he found direct evidence for blade production, it appears cores were arriving at the site prepared for production or previously reduced due to the lack of core preparation blades and debitage. In addition, early series blades only represent a small percentage of the assemblage, a pattern which indicates that the cores were at least partially reduced when they arrived at the workshop. His research also supports the claim that craftsmen at workshops in large centers would exchange cores that had reached the end of their use-life to hinterland populations where they were further reduced (Hintzman 2000).

At Tikal, evidence for the trade of pre-shaped cores is also found. Moholy-Nagy (2002) suggests that obsidian arrived in the form of large polyhedral cores that were further reduced on site based on evidence of "bag wear" and the lack of cortex on finished tools. At Tikal, like at other sites, the majority of obsidian was then reduced into prismatic blades, but large flakes were occasionally fashioned into scrapers or bifaces. Obsidian occurred in all types of Classic period Tikal structures and ritual deposits; therefore, it was widely distributed at this large political capital (Mohloy-Nagy 2002). Hattula Moholy-Nagy claims that there is no evidence to suggest that elites controlled the distribution of prismatic blades or thin bifaces at any time, but rather obsidian was probably distributed in a marketplace. However, eccentrics and incised obsidian objects do appear to be limited to elite or ritual contexts. The crafting of these special objects began by the early part of the Late Classic period, and were produced from macroflakes or macroblades removed from large polyhedral cores (Moholy-Nagy 2002). According to Moholy-Nagy (2002), the crafting of novel ritual objects from a material that had served utilitarian purposes for hundreds, maybe thousands of years, implies a secure supply.

Geoffrey Braswell and Michael Glascock (2011) compared obsidian assemblages at Tikal and Calakmul (which are located approximately 100 kilometers apart in the Peten region of Guatemala) to investigate obsidian exchange mechanisms. While excavations at Tikal have revealed millions of pieces of obsidian, Calakmul contains strikingly less. Braswell and Glascock (2011) postulate that Tikal was a linchpin for obsidian in the Maya lowlands, and elites controlled its exchange through redistribution or administered market exchange. It's possible that Calakmul was only allowed access to Tikal's surplus obsidian through serendipitous exchange relationships with allies. Tikal's great demand for obsidian, as well as its ability to regulate distribution, had an impact on obsidian distributions at sites throughout the lowlands.

According to Braswell and Glascock (2011), obsidian was likely distributed through administered market exchange or redistribution in the Maya lowlands during the Classic period. A bounded exchange system at Tikal would explain the disparity between the quantities of obsidian found there compared to other lowland sites like Calakmul. Ford (1991) also asserts that the distribution of obsidian in the upper Belize River valley was restricted since obsidian frequencies in lowland sites are much lower than those in highland Mexican sites, with the exception of Tikal.

Currently, debates revolve around how elites may have been involved in the production and distribution of obsidian, and how this involvement varied on a site-by-site basis (Aoyama 2011; Braswell and Glascock 2011; Ford 2004). Investigations at the rural community of Laton, located near El Pilar, found evidence that a large elite residence was highly involved in obsidian production due to the high concentration of production by-products throughout the residence (Ford 2004). The minimum quantity of obsidian found at the residence was 3,000 pieces per m^3. Ford (2004) asserts this evidence demonstrates that while there may have been centralized control of the distribution of obsidian, production of obsidian was not centralized. Elites at rural centers may have used the production of obsidian as a way to demonstrate their connection to larger centers (Ford 2004). Alternatively, the elites may have placed these producers on the outskirts as a way to protect the resource and maintain control.

Raymond Sidrys' (1976, 1983) work emphasized the difference in elite and non-elite consumption of obsidian at El Pozito and Lamanai located in northern Belize. At El Pozito, 4,993 obsidian artifacts were found in a Late Classic elite tomb, while only 60 obsidian pieces were found in the 50 test pits excavated at Late Classic house mounds. Even when standardized by the number of stratigraphic levels, he found that elite residential contexts had much more obsidian artifacts than non-elite residences. Similarly, a seventh century offering of 1,025 obsidian cores and 7,503 blades and chips was found in elite contexts at Lamanai (Sidrys 1983). This abundance of obsidian is never seen in non-elite contexts.

It is no surprise that major centers had much greater access to obsidian than minor centers given their ability to control trade routes and monopolize exchanges (Sidrys 1976:454-456). In 1976, Raymond Sidrys created a trade index value by multiplying obsidian density (g/m^3) by distance to source. By his calculations, Tikal has the highest trade index at 4361, followed by Yaxha, Mayapan, and Copan. Comparatively, minor centers with the highest indices, Zacualpa, Seibal and El Baul, have a mean trade index of near 200. Sidrys (1976) calculated the index for Baron Ramie, located downstream from Actuncan in the Upper Belize River valley, and found a trade index of 95. Based on these calculations, it appears that the region was near the tail end of the trade routes, but exactly how these exchanges worked has not been explored.

The goals of this study are to understand the production and distribution of obsidian at Actuncan. Documenting the frequencies of forms (polyhedral cores, whole blades, or prepared blades) will allow a better understanding of trade networks at Actuncan, as well as the nature of its production at the site (or lack thereof). In addition, determining the distribution of obsidian at the site can reveal what mechanisms of exchange brought obsidian to Actuncan and how it changed through time. While no evidence of a formal marketplace has been observed at Actuncan, market exchange may have been occurring nearby during the Classic period.

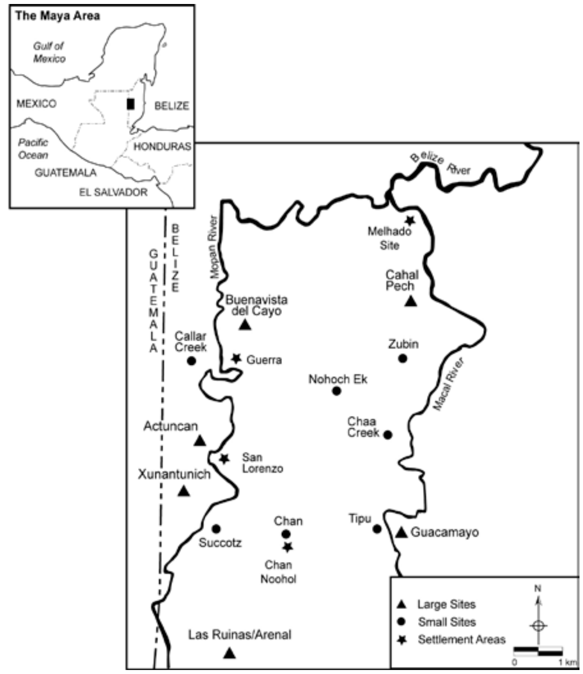

Figure 1. Sites in the upper Belize River valley. Map drafted by Bernadette Capp.

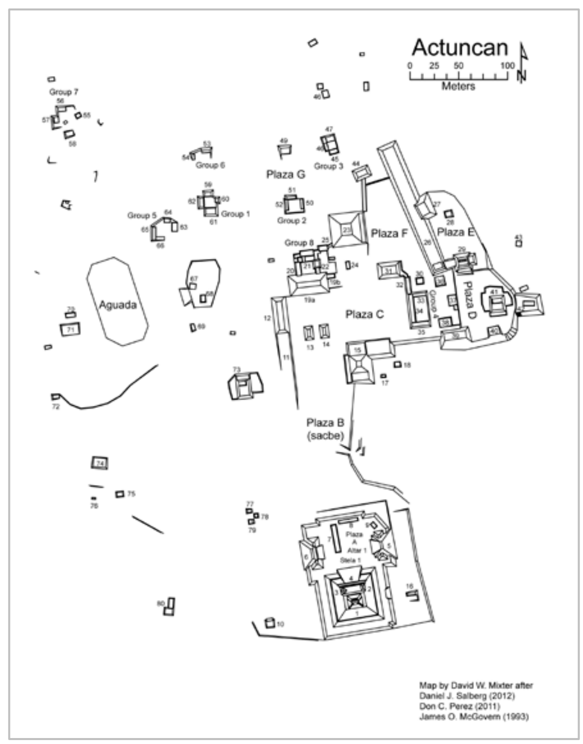

Figure 2. The Site of Actuncan, Belize.

Actuncan: A Major Mopán River Center

Actuncan is situated on a low ridge overlooking the Mopán river valley 2 km south of Xunantunich (Figure 1). Actuncan is arranged in two parts connected by a broad causeway: Actuncan South, dominated by a Preclassic Triadic temple complex, and Actuncan North, a formal civic zone containing a ball court, range structures, pyramids, and households.

The site was settled by 1000 BC, but the ceremonial center as we know it today was likely founded during the Terminal Preclassic period (Figure 2). By the Terminal Preclassic period, Actuncan was the political center of the upper Belize River valley when the triadic temple group and other major civic structures in Actuncan North were greatly expanded. Despite the center's early authority, construction of monumental architecture halts in the Early

Classic period. Later, Actuncan was subsumed within the nearby Xunantunich polity during the Late Classic period, when Structure 19 (the largest range structure at the site) was remodeled befitting a vassal noble (Mixter, Jamison, and LeCount this volume). However, Xunantunich's control over Actuncan lasted only a short time. By the Terminal Classic period, Actuncan's noble residence at Structure 19 was terminated, signaling a rapid disconnect with the overlords at Xunantunich. Coincident with this termination, the domestic structures within the site began to experience new life (Mixter, Rothenberg, and Hahn 2012). During this time, a new integrative civic building centered at Group 4---a large platform surrounded by shrines---was built (Keller and Mendelsohn 2011). Although the exact nature of this architectural group is still debated, this group was the center of a revitalized community situated at Actuncan.

Data for this research comes from excavations at a noble residence (Structure 19 and 20), three elite households (Structures 73, 41, 40 and 29), and six non-elite residential patio-focused groups (Groups 1, 2, 3, 5, 6 and 7). These excavations were undertaken in the 2001, 2004, 2010, and 2011 field seasons under the direction of Dr. Lisa LeCount. When the obsidian assemblage at Actuncan was analyzed in the middle of the summer of 2011, it was comprised of 594 pieces of obsidian, but the final count at the end of the 2011 field season was 795. The initial 594 pieces were analyzed for form, while the final count of 795 was used in the distributional analysis.

Methods

In order to measure the differential access of obsidian to elite and non-elites over time at Actuncan, Sara Shults examined standardized counts and weights of obsidian. She chose to calculate these measures based on the weight of obsidian since weight better accounts for breakage particularly when standardizing against other materials like ceramics and lithics. Three ratios are calculated based on the weight of obsidian divided by the 1) weight of ceramics, 2) weight of chert lithics, and 3) volume of excavation matrix. Shults found that she preferred the obsidian-to-sherd ratio because it offers the most accurate correlation of obsidian consumption to other household activities. Obsidian weight to excavation volume ratio is affected by the drastically different amounts of architectural construction at elite and non-elite households. Obsidian weight to lithic ratio measure should correlate to household activities, but it could be affected by production locales for stone tools. If commoner households were more likely to be producing tools with local lithic materials, then the amount of lithics would make the amount of standardized obsidian look very small in comparison to elite households where local lithic production is less likely to have occurred. Obsidian weight to ceramic weight is the most standard means to measure consumption, but it is affected by ritual activities like termination rituals that inflate the amount of ceramics found at households where these ceremonies were held. Nonetheless, both the obsidian-to-ceramic and obsidian-to-lithic ratios show similar trends that correlate well with the rise of centralized power at Actuncan (Shults 2012).

In order to examine the difference in access to obsidian, the ratios were calculated for both status (elite vs. non-elite groups lumped together) and individual households. Therefore, the total weight of obsidian in the group or household was then divided by the total weight of ceramics and lithics for that group or household.

The smaller obsidian assemblage of 594 pieces was analyzed for physical attributes. The type (prismatic blade, flake, core), condition (proximal, medial, distal), the percent of cortex, presence of retouch, platform preparation, number of dorsal ridges, amount of usewear (light or heavy), mass (g), length (mm), width (mm), thickness (mm), and specific color/texture categories were recorded for each piece of obsidian. These variables were used to determine efficiency of use and stage of production. As explained earlier, the larger assemblage was used to document the distribution of obsidian across structures.

Distributional Results

The disparity in obsidian distributions described in Sidrys' studies of Lamanai and El Pozito is not seen at Actuncan (Sidrys 1976,

Table 1. Count of obsidian by household and time period.

Context by Period	*Late Preclassic*	*Early Classic*	*Late Classic*	*Terminal Classic*	*Postclassic*	*Not Established*	*Total*
Group 1	16	73	75	95	-	5	264
Group 2	-	1	4	-	-	-	5
Group 3	-	6	3	-	-	-	9
Group 4	1	2	-	1	-	1	5
Group 5	-	-	42	36	-	13	91
Group 6	1	19	9	7	-	-	36
Group 7	1	7	18	1	-	15	42
Structure 18	-	41	26	-	-	-	67
Structure 19	1	-	-	-	-	-	1
Structure 20	-	-	5	-	-	-	5
Structure 29	-	-	1	-	-	-	1
Structure 40	-	4	19	7	-	9	39
Structure 41	15	13	61	75	36	5	205
Structure 73	-	20	-	-	-	5	25
Total	35	186	263	222	36	53	

Table 2. Total count and weight of obsidian excavated at Actuncan.

Preclassic		**Early Classic**		**Late Classic**		**Terminal Classic**		**Post Classic**	
Count	*Weight*	*Count*	*Weight*	*Count*	*Weight*	*Count*	*Weight*	*Count*	*Weight*
43	26.97g	185	146.65g	265	200.79g	224	173.8g	36	25.28g

1983). All households excavated at Actuncan contained obsidian, but the amount of obsidian they had varied over time (Tables 1 and 2). Not surprisingly, the largest quantities of obsidian are reached in the Late and Terminal Classic periods, which appear to correlate with the rise in population at Actuncan based on our volumetric information. Overall, the access to obsidian increased dramatically in the Classic period, starting in the Early Classic period.

While all households had access to obsidian, determining exchange mechanisms is more difficult (Shults 2012). While the majority of households appear to maintain a relatively steady quantity of obsidian through time based on the ceramic-to-obsidian ratio, Structure 41, an elite residence, increased its quantity in each time period. By the Terminal Classic period it contained the most obsidian of any household excavated at Actuncan (Shults 2012). Group 6, a structure though to be a special-use area associated with commoner residents at Group1, also has notably high quantities of obsidian in the Late Classic period. Therefore, obsidian consumption is determined by both activities and social status.

As discussed above, Maya elites are often characterized as regulating access to obsidian, but based on our data, they were not tightly restricting access. Further, exchange relationships between local elites and commoners appear to have shifted over time. Overall, the obsidian-to-sherd ratio lends evidence to suggest that access to obsidian did not equalize over time as predicted in market-based models (Hirth 1998), rather, elites gained more access to this resource. But they did so only in the Late Classic period (Table 3 and Figure 3). Before the Late Classic period, elites and commoners appear to have relatively equal access to obsidian. Relatively even distribution across status in earlier time periods may mean

Table 3. Standardized obsidian weight by status across time.

	Late Preclassic		Early Classic		Late Classic		Terminal Classic	
Variable Weight (g)	*Elite*	*Non-elite*	*Elite*	*Non-elite*	*Elite*	*Non-elite*	*Elite*	*Non-elite*
Obsidian	8.24	9.66	36.27	63.24	69.57	107.86	56.93	116
Ceramics	66925	115827	162936	209238	253344	711589	94700	669181
Lithics	11630	26967	24680	50589	63844	186957	25856	264079
Volume	10.25	8.96	11.52	9.65	38.42	23.62	13.93	29.70
Obs/Sherd Ratio x 1000	.123	.083	.222	.302	.275	.152	.601	.173
Obs/Lithic Ratio x1000	.709	.358	1.47	1.25	1.09	.577	2.2	.439
Obs/Volume	.80	1.07	3.14	6.55	1.41	4.57	4.09	3.91

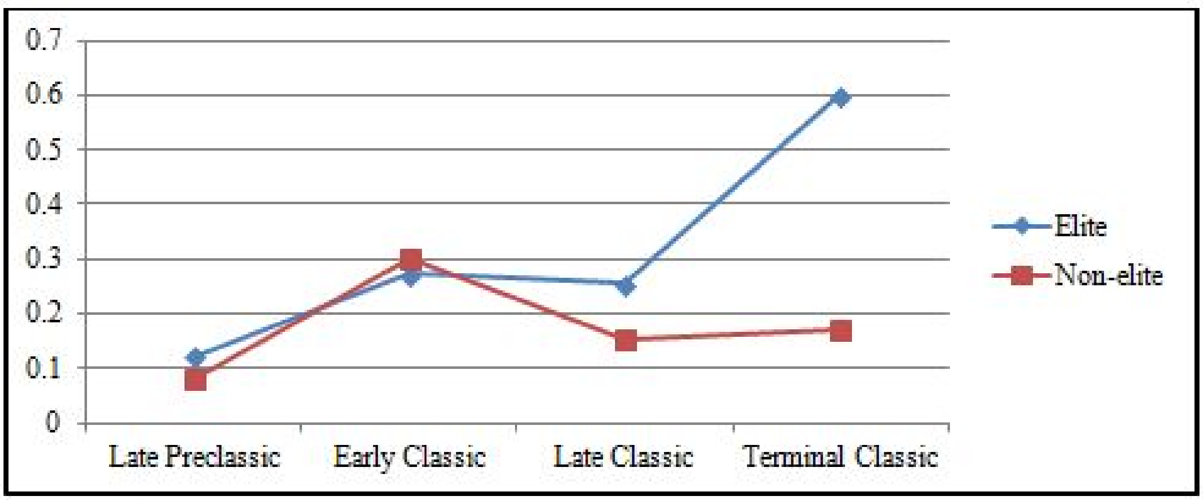

Figure 3. Obsidian-to-sherd Ratio in Elite and Commoner Households by Period.

that obsidian was initially circulated through 1) reciprocal relations, 2) redistribution by corporate governance, or 3) markets. I suggest the more parsimonious explanation for the distribution of obsidian before the Late Classic period is either reciprocal relations or redistribution.

Braswell (2004) suggests that "down-the-line dyadic exchange" or reciprocal relations appears to have been the primary way cores and tools from the San Martin Jilopeteque source were exchanged prior to the Classic period since there is no evidence of a controlling polity at the source during that time. Once these materials arrived at sites, it is possible that Preclassic corporate leaders redistributed obsidian relatively equitably across households as a means to consolidate political power. According to Richard Blanton and colleagues (1996), the Preclassic Maya may have been ruled by a corporate rather than network strategy. In corporate governance strategies individuals in ruling positions emphasize power-sharing assemblies rather than hierarchical bureaucracies and redistributive mechanisms that function to allocate the flow of wealth from upper to lower social ranks rather than centralize wealth. This may have been the case at Actuncan.

However, after the Classic period, elites appear to manipulate the distribution of obsidian because by the Terminal Classic period elite households had three times as much obsidian than commoners when the obsidian-to-ceramic and obsidian-to-lithic ratios are considered (Table 3). This is an intriguing shift in the distribution of obsidian, since according to Kenneth Hirth (1998), a more even distribution of imported artifacts would be expected if a marketplace offered goods equally to all. At Actuncan, the opposite appears to have happened. During those periods in which markets are thought to have appeared at Xunantunich (Keller 2006) and Buenavista del Cayo (Cap 2011), access was more limited than in previous times. This pattern could be a result of more established hierarchies during the Late Classic period. Elite may have felt it was no longer necessary to recruit followers by redistributing obsidian and preferred to redistribute it to elites more often than to commoners. It is also possible that obsidian was for sale in markets, but that its price was fixed by elites at a level that prohibited its equitable distribution as predicted by unregulated market models (Hirth 1998).

Formal Characteristics of Actuncan's Obsidian

Actuncan's obsidian collection is largely composed of prismatic blades with only 6.5 percent of the assemblage representing flakes and production refuse (Table 4). Two of the cores were found in Group 1, a commoner plazuela, and the other two were found at Structure 41, an elite structure, but the blades were distributed across elite and non-elite households. These data suggest no correlation between socioeconomic status and blade production. John Clark (1997) states that around 180 blades could be produced per core; therefore, it is technically possible that the four cores could have produced the almost 600 blades found at the site since. However, Actuncan's blades are very narrow (mean width 10 mm) with the largest ones measuring approximately 2 cm and the smallest around 3 mm in width (Table 5). None showed noticeable signs of core preparation which reflects the absence of first series blades (De Leon et al. 2009). These data suggest that the blades were not being produced at Actuncan, or at least not at any of the structures excavated thus far. Braswell and Glascock (2011) suggest that travelling blade producers may have sold expended cores, particularly at sites where obsidian was especially rare.

Clark (1987) and others (Clark and Lee 1984; Jackson and Love 1991) have come to the consensus that blades were traded exclusively between producer in the highlands and consumers in the lowlands for nearly 1,000 years before cores began to be traded. Once cores were traded, blades continued to be traded but in a number of different forms (De Leon et al. 2009). Jason De Leon and colleagues provide a methodology for determining how blades were exchanged. Blades were traded in three primary modes: whole-blade trade, processed-blade trade, and local-blade production. In whole-blade trade, they expect to see evidence of the trade of complete blades without corresponding cores and the processing of blades into smaller pieces at sites where consumers used them. This reduction sequence should result in one proximal section, one distal section, and two or three medial sections for each blade. Some complete blades would also likely be found (De Leon et al. 2009). If the blades were processed prior to trading, then distal segments of late series blades would have been discarded since their more extreme curvature makes them less desirable for fine cutting tasks. This should results in proximal-distal and medial-distal ratios of near 6:1 (De Leon et al. 2009:118). Finally, in local-blade production cores were reduced on site or within the region by local craftsmen or travelling merchants (De Leon et al 2009: 118). In this case, some complete blades would be expected along with proximal-distal ratios of 1:1 and medial-distal rations within the range of 2:1 or 3:1. In addition to these indices, secondary production evidence should also be present in the form of core preparation flakes, first series blades, and microdebitage. This methodology is helpful in determining whether blades were produced on-site or imported as whole or processed blades in all time periods at Actuncan.

Table 4. Frequency of obsidian artifact types found at Actuncan.

Cores	*Flakes*	*Proximal Blades*	*Medial Blades*	*Distal Blades*	*Reworked Flakes or Blades*	*Total*
4 (0.6%)	33 (5.4%)	128 (22%)	402 (68%)	20 (3.4%)	4 (0.6%)	591 (100%)

Table 5. Mean and range of prismatic blade fragment measurements.

	Dorsal Ridges	*Mass (g)*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*
Mean	*1.98*	*.68*	*18.9*	10.5	2.6
Range	*(0-5)*	*(.004-2.48)*	*(3.39-51.88)*	(3.07-21.59)	(0.92-14.16)

Table 6. Mean CE/M ratio, width, and thickness by time period.

Variables by Period	Late Preclassic	Early Classic	Late Classic	Terminal Classic	Postclassic
CE/M ratio	7.04	8.89	7.44	7.56	8.5
Mean Width (mm)	10.95	10.6	10.58	10.43	10.96
Mean Thickness (mm)	2.61	2.77	2.71	2.79	2.71

At Actuncan, the majority of the blades are small, processed fragments with proximal ends making up 22 percent of the assemblage, medial fragments making up 68 percent, and the remaining 3 percent are distal ends (Table 4). The proximal-distal ratio is just under 6:1, and the medial-distal ratio is 17:1. While is possible that a few distal ends were misidentified during analysis, an error De Leon and colleagues (2009) warn to avoid, it is unlikely that so many were misidentified. This implies that blades were being imported already processed to Actuncan.

Early in the analysis, it was clear that the blades were all very narrow and most were short fragments of blades (Table 5). Not only were the blades small, but there were no large tools or eccentrics and only four cores. Since Actuncan is located approximately 300 km from the nearest source, access was limited and each piece was used to its full extent. When a resource is scarce, individuals will likely take care to use it as efficiently as possible (Fowler 1991).

Sidrys (1979) found that on average sites farther from the source were more efficient with their use of obsidian. He used the "cutting edge to mass" ratio (CE/M) to measure this efficiency. This ratio is calculated by taking the cutting edge length in centimeters for both sides of blade (basically length multiplied by two), then dividing it by the mass in grams. He estimated that sites beyond 300 linear km from an obsidian source would have highly efficient CE/M ratios ranging from 5 to 7. If Actuncan falls into the same pattern as the sites in Sidrys' study, then a ratio of between 5 and 7 is expected since Actuncan is located 294 km from El Chayal and 315 km from Ixtepeque. The data shown in Table 6 make it clear that at Actuncan, blades were being produced and consumed highly efficiently, in fact, even more efficiently than at any site Sidrys analyzed. The mean CE/M ratio at Actuncan for the entire occupation was 7.84, the mean width was 10.58 mm, and the mean thickness was 2.74 mm (Shults 2012).

Discussion

Currently, there is little evidence for blade production in the households at Actuncan. Nor does it appear that whole prismatic blades were traded or exchanged to the site. Instead they may have been produced and processed into smaller pieces at another site nearby and exchanged to Actuncan through redistribution or markets. Since sites in the upper Belize River valley are located 300 linear kilometers from the nearest source, it seems logical that the long-distance traders from the highlands would have transported the obsidian in the most energy efficient manner to the area. This would mean leaving behind all excess material and transporting cores or processed prismatic blades into the lowlands.

How obsidian changed hands from long-distance traders to consumers is unclear, but it is evident that elites had a fair amount of involvement in its exchanges. At Actuncan, obsidian was available starting in the Middle Preclassic period, but during the Late Classic period, elites had greater access to it than commoner households by a three-to-one ratio. Actuncan elites may have had greater access to obsidian through preferred trade partnerships, redistribution from paramounts, or buying power at an administered market at another site nearby. Based on the form of obsidian, consumers at Actuncan received their obsidian as ideally sized bladelets produced from whole prismatic blades. Processing of blades and bladelets occurred at workshops like Laton near El Pilar (Ford 2004; Hintzman 2000) or perhaps at elite residences in large centers nearby. There is also evidence that local merchants processed and exchanged them at markets in centers (Cap 2011; Keller 2006).

Evidence provided by this study indicates that obsidian was not exchanged in a fully commercial market during the Classic period. While other nearby sites like Buenavista del Cayo and Caracol are purported to have had marketplaces, it is unclear whether obsidian was exchanged the same way as local and perishable items that have been identified in market contexts (Cap 2011; Chase and Chase 2001). Even if obsidian was exchanged in the marketplace, it is likely that the elite administered the amount in circulation or fixed its price at a level that prohibited its equitable distribution.

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