7 STANDARDIZED LITHIC TECHNOLOGY AND CRAFTING AT THE "GATEWAY GROUP" FROM CARACOL, BELIZE: IMPLICATIONS FOR MAYA HOUSEHOLD ARCHAEOLOGY

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Households make up the bulk of the ancient Maya archaeological record. These are the historical places where the Maya lived, reproduced, remembered, and worked, thus archaeologists can analyze the artifacts of what peoples did at their living groups. This paper presents and analyzes one of only a few case studies of small chert tools or "drills" from the Maya lowlands to identify what ancient peoples did and possibly infer their potential impact at the local scale. Lithic data from the "Gateway Group" at Caracol, Belize, located approximately 300m southeast of Caana, Caracol's largest structure, and the Conchita Causeway yielded a highly standardized tool assemblage. These data in conjunction with other investigated assemblages enable discussions of the organization of intensive localized lithic and non-lithic craft production. I conclude by describing the importance of this research on how archaeologists might draw relational connections between households using standardization studies and thereby consider the technical learning, sharing, and doing that took place between ancient Maya residences.

Introduction

For decades, Maya archaeologists have focused on the household as a unit of production, both economic and social. Wendy Ashmore and Richard R. Wilk (1988) have argued that due to the household as a "unit of production", the household should be studied as an active social location where archaeologists can reconstruct what ancient peoples *did* at their residences. The development and continued emphasis on Mesoamerican household activities, like craft production shows the organizational dynamics of domestic resource consumption, transformation(s), use, distribution and deposition (Aoyama 1998, 2007; Costin 2001; Hirth 2009a, 2009b). Recently, John E. Clark (2007) has argued that we "rethink" craft production research to emphasize how the physically crafted material might *index* the crafter, contributing to constructions of personhood, and continued practice by archaeologists to breakdown of object/subject dualities (see also Joyce 2007). This approach further emphasized the gendered tasks, spaces, and rituals that surrounded crafting or other domestic production activities (Clark and Houston 1998; Hruby 2007). Such perspectives also ask that archaeologists understand the relational networks of household crafting connecting raw resource materials, crafters, and the greater population. Given these research issues, household craft production is dynamic and must therefore be contextually defined using organization models that question dualistic assumptions, such as elite/commoner production or independent/attached. Through research in Prehispanic Mesoamerica, Kenneth Hirth (2009b) dispels with dualistic models of craft production where labor and time are omnipresent in favor of a multi-crafting approach (see also Shimada 2007). For example, Hirth (2009b:14) asserts we move past dichotomies of part-time/full-time and attached/independent because these have led to an emphasis on labor time and over simplified models of elite control. A multi-crafting approach explores how crafting was organized either continually throughout the life of a given household or how it was intermittent and situated with other subsistence practices. Hirth (2009b:21-23) also emphasizes that a multi-crafting perspective shows that households often practiced different, yet related or contingent, crafting activities and that these multi-crafting behaviors enabled household members to remain adaptable and resilient through time. For example, for households to produce pottery they might also need to produce tools used to quarry and mix clays, build kilns, or inscribe or paint exterior designs on finished forms; they did not only produce pottery.

One major hindrance in archaeological analysis of household based craft production is that little may remain of the material residues of the actual crafting process and tools used. Despite these limitations, investigations at Caracol, Belize have shown that some data on the crafting process can still be recovered and

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interpreted (Chase et al. 2008; Cobos 1994; Pope Jones 1996; Martindale Johnson 2008). In this article, I present analysis of a recent investigation of an ancient Maya household to determine the organization of household based lithic craft production, its technological comparison to other possible workshops at Caracol, other Maya sites, and the potential dynamics of household crafting at Caracol. In particular, I use detailed attribute analysis in conjunction with quantitative tests to determine the degree of standardization of lithic crafts used in various household multi-crafting activities. Cathy Costin (2001) has shown that the presence and degree in crafts standardization is used as a proxy for interpreting levels of production intensity, specialization, and learning and sharing of traditions in craft manufacture across space and time.

This case study in the standardization of technological practice will show that the activities of crafters at the Caracol's Gateway Group were linked to the activities of other households. Arguably, these archaeologically visible shared practices can form the basis for defining ancient communities of practice. Here a "community of practice" is a social unit where individuals and groups learn and share through participation in physical activities, in particular locations (Lave and Wenger 1991). Caracol's chert flake stone data may reinforce an archaeological understanding of a community of practice where shared resources and technical actions among particular networks existed between spatially separate households. A case study of small chert tools from Caracol, Belize demonstrates the importance of lithic analysis to a greater understanding of the diversity, resiliency, and shared dynamics of household lithic and non-lithic craft production during the Classic to Terminal Classic periods (AD 250-900). This article therefore explores how prevailing household crafting models, like multi-crafting, and an understanding of standardization in crafting practices can inform the existence of integral relational networks where technical learning, sharing, and doing existed broadly across an urban area.

Studies of lithic craft standardization will help us to recognize household technological practice and the ways in which households were socially networked through a sharing and learning of lithic reduction, tool manufacture, and use across an ancient low density urban area. In addition, research of this type holds the potential to explore the nature of control over craft production and distribution. For example, the spatial location of household based workshops in relation to roads, markets, and monumental architecture do help to point out the nuances or problems in archaeological interpretations of political and economic controls over craft production.

The ancient Maya's use of flaked and ground stone technology structured and transformed the complexities of daily life and ritual practices (G. Braswell 2011). Much of what archaeologists know regarding the importance of stone for the ancient Maya is from archaeological investigations at ancient Maya households through the traditional emphases on trade and exchange (G. Braswell 2004). At Caracol, Belize, extensive household investigations throughout the site have yielded a wealth of information on the daily and ritual life of the ancient Maya throughout the Preclassic and Classic periods (A. Chase and D. Chase 2004; D, Chase and A. Chase 1998). Through these investigations, the Caracol Archaeological Project found that many households obtained locally available cherts and chalcedonies. It is likely that chert was extracted during the quarrying of limestone bedrock blocks for the construction of agricultural terraces and household structures. Recent LiDAR images have revealed an extensive anthropogenic landscape (A. Chase et al. 2011). Typically, these silica based raw materials are smaller nodules that required heat treatment prior to reduction for tool production taking place at household lithic workshops. During early excavations at many of Caracol's residential groups, researchers recognized that certain crafted small chert tools, including associated lithic reduction debitage, often co-occurred with debris from other crafted materials, such as shell, bone, and slate. These data help to establish a set of operational criteria for determining the presence or absence of intensive lithic crafting and implications regarding the organization of multi-crafting household

workshops at Caracol and potentially, other sites as well.

Caracol's Flake Stone Industries, Crafting and a Case-Study in Standardized Production

The continual interest in economic organization at the site of Caracol has revealed the importance of flaked stone analysis in understanding marketplace exchange and the overall distribution of flaked stone crafts amongst residential groups (D. Chase and A. Chase 2014). Though these artifact distributional data are critical for reconstructing the macro-socioeconomic dynamics of Caracol and the overall integration of a very large population, there is always a need to focus on defining and operationalizing household practices through contextual artifact analysis.

Analyses of Caracol's chert "drill" industry highlights the ways in which the local population was situated around a local raw material found in the surrounding karstic bedrock. Currently, the Caracol Archaeological Project has excavated roughly 2000 of these tools (Figure 1). Traditionally "drill" tools are argued to be an essential tool for crafting shell, bone, or slate (A. Chase and D. Chase personal communication [2008]; Cobos 1994; Pope Jones 1996). While a small collection of these tools has been recovered from ritual caches (Pope Jones 1996:70), the majority of these tools come from household refuse deposits within construction fill layers. Similar tools at Tikal were initially understood to be part of a workshop toolkit (Puleston 1969). Olga Puleston (1969:23-45) argues that drill-like tools were most likely used during the Preclassic to Classic periods at Tikal and these tools are small wedge or pointed blade-like tools. Puleston separates tools based on a number of technological and use related attributes into formal Classes A-K.

Cynthia Pope Jones (Pope 1994, 1996:103) describes Caracol's "drills" as produced by a percussion strike to the multidirectional core platform to remove small blades (e.g., tertiary flakes/blades) that are usually thick and robust with steep dorsal ridges. After removal, the blade was retouched laterally on the dorsal surface to make at least one steep lateral side (perhaps for hafting) and shaped

Figure 1. Examples of chert drills (taken from A. Chase and D. Chase 2006: Figure 55). Note: All tools from Gateway Group analysis are illustrated in Martindale Johnson 2008 Appendices A-F.

distally to create a pointed end. The presence of a high number of these tools in association with shell debris indicates their use in shell craft manufacture in a household workshop (Pope Jones 1996, Cobos 1994). Jennifer Braswell (2010) describes an almost identical tool assemblage from a context at Xunantunich, Belize. Braswell (2010) defines these as "drills-on-blades" by stating, "drills have a steep edge angle and a flat dorsal side, making the tool better suited for jabbing, gouging, or drilling by applying the tip to the worked material." Investigations at Caracol's Gateway Group is yet another household example where these tools have been found and it further demonstrates the archaeological evidence for the organizational continuity and complexities of Maya household crafting activities.

Archaeological Investigations at the 'Gateway Group'

The Gateway Group is just beyond the border of the epicenter, approximately 300m east of the Conchita Causeway and Caana, and

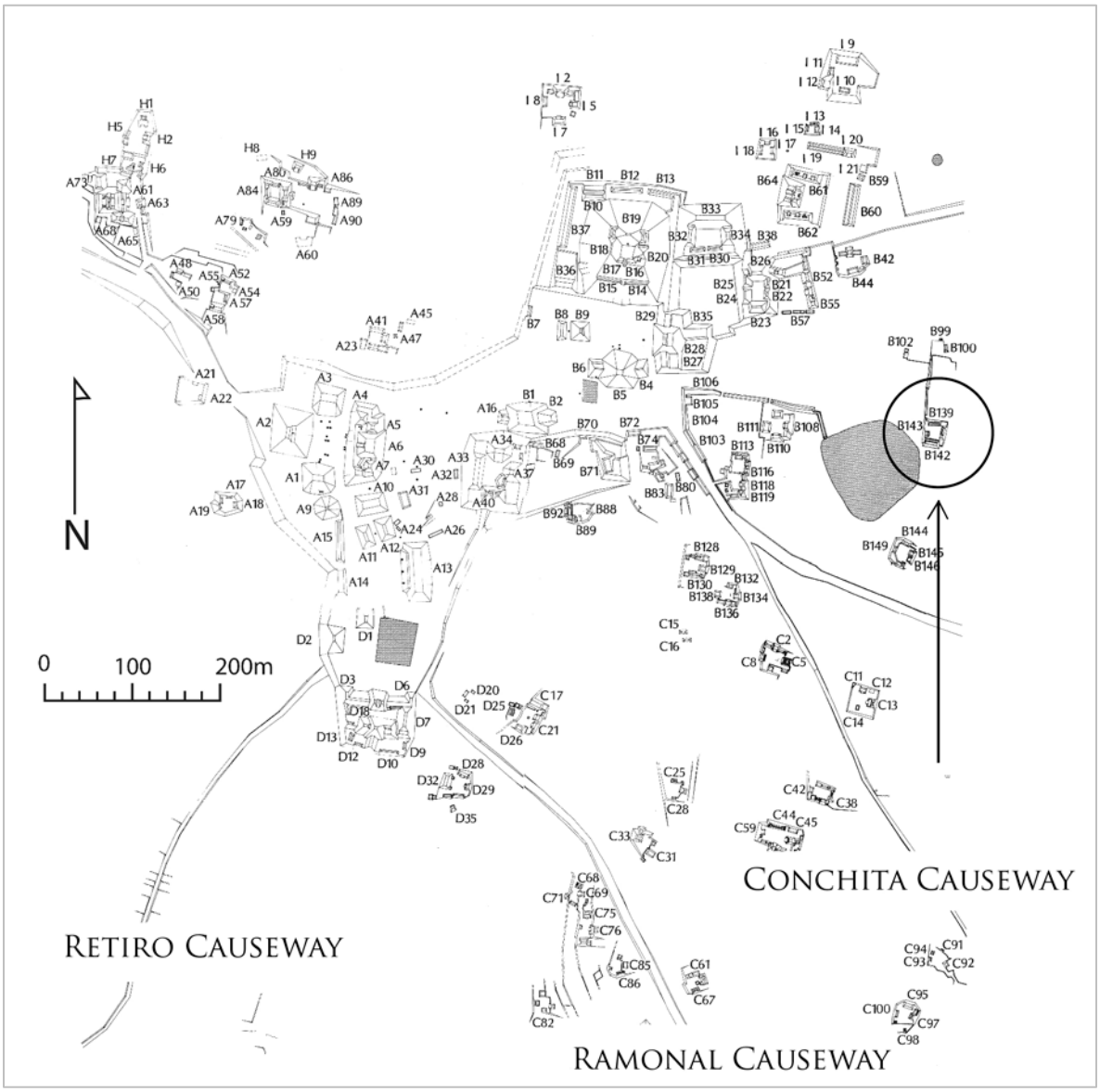

Figure 2. Map of Caracol Epicenter. The Gateway Groups is circled (after A. Chase and D. Chase 1987).

adjacent to Reservoir C. Similar to many other residential groups at Caracol, the Gateway group was composed of four low structures situated around a central plaza. Investigations at the Gateway Group (Figure 2) were initiated to investigate the functional nature of low lying structures just outside the epicenter (A. Chase and D. Chase 2006).

Excavations included a series of small trenches in the southern, eastern, and western platforms. These platforms would have most likely supported perishable superstructures. A test unit was also placed over a small depression just north of the western structure. Small to large axial trench excavations and test units are normal methods used at Caracol and often help to determine the overall chronology of structures based on super-imposed construction episodes and associated fill debris. In addition to general chronology, these excavations expose artifacts deposited in construction fills by the ancient Maya as structures are maintained or remodeled over time. These construction fills often have complete artifacts and fragmented refuse debris from the household's daily activities and therefore have direct implications for inferring a

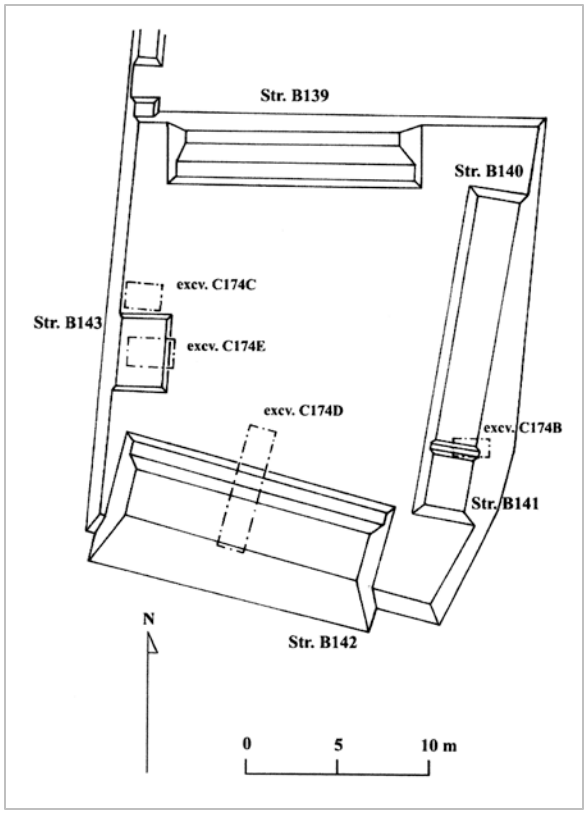

Figure 3. Map of Gateway Group, Caracol, Belize showing locations of excavations (from A. Chase and D. Chase 2006).

household's socioeconomic organization of consumption, production, and distribution of crafts.

Recovered from a series of small trenches and one test pit into a chultun was fill layers yielding an abundance of chert artifacts (Figure 3). Arlen and Diane Chase (A. Chase and D. Chase 2006) suggest that the presence of these chert artifacts in construction fill layers suggested that the Gateway Group was involved in workshop activities during its use in the Terminal Classic Period. Because of the probable presence of a workshop area, all excavations were screened using 1/4" or 1/8" mesh. Unlike other workshops at Caracol no shell or bone craft debris was encountered, thus it is argued that the final crafted material at the Gateway Group workshop may have been wood or some other perishable material. Flake stone data from the Gateway Group were similar to those recovered at other workshop areas located about 1.5 km south along the Conchita Causeway (Pope 1994, Pope Jones 1996). Past analysis techniques, by Pope Jones (Pope 1994, 1996) at Caracol and Puleston (1969) at Tikal, did allow for an comparative assessment of lithic reduction and tool manufacture behavior at the Gateway Group, but a more detailed attribute study beyond length, width, and thickness was conducted to better define the reduction techniques, potential tool use, and how to relate tools to other recovered contexts. Additional analysis was needed to determine the degree of variability or standardization in tool manufacture techniques and use. The presence of standardized technological practice indicates a shared knowledge that can provide insight surrounding the nature of crafting behavior and ancient Maya workshops.

Data and Hypotheses

Excavations at the group yielded a larger than normal sample of chert flake stone materials. Table 1 shows the overall size of the excavations, the number of chert artifacts from the four excavations, and the sampling strategies. A representative sample of artifacts from the Gateway Group comes from the chultun excavation. These included, various faunal remains, a stalactite fragment, a partial chert point, a partial ceramic labret, a partial sandstone palette, worked shell pieces, a large obsidian blade, an obsidian core, chert drills, a shaped and drilled sherd, drilled spondylus shell, a partial slate palette, a stingray spine , and a worked deer tine (A. Chase and D. Chase 2006). An unusual amount of chert was also recovered from the refuse or garbage fills within the chultun and the other structures on the east and south sides of the open plaza. Arlen and Diane Chase (2006) state, "The quantity of chert (in conjunction with the antler tine) indicates that this material was being worked nearby and then perhaps purposefully redeposited in or near the chultun."

With the exception of the chultun excavation, trench excavations exposed bedrock less than 1.5 meters from the surface humus layer indicating the ephemeral nature of these residential units. The depositional locations and amounts of chert materials from the excavations also shows that there may have been conventional practices for disposing sharp lithic debitage and exhausted tools. For example, the

Table 1. Shows sampling strategy and context, kind of recovered chert lithic materials, and amount sampled. Notice that no lithic materials were excavated from the eastern excavation and only 74 chert artifacts came from the southern excavation. The western (Structure B143 and Chultun) excavations yielded the most amount of lithic material at the group.

Context	***Excavation Dimensions***	***Chert Object***	***Total for Excavation***	***Sampled from Excavation***
			n =	***n =***
C174B (Structure B140)	2.0 m N/S x 1.5 m E/W	n/a (no lithic material)	0	0
C174C/2/6/7/8 /10/11/12/ 14/15/16/ 20/21/22/23* (Chultun)	2.0 m N/S x 1.5 m E/W	Flakes	557	12
		Chunks (Angular Waste)	281	0
		Flake Tools**	60	60
		Total N=	898	72
		Total Weight	5,462.7g	339.8g
C174D/1*** (Structure B142)	6.92 m N/S x 1.5 m E/W	Flakes	71	0
		Partial Biface	1	1
		Flake Tools**	2	2
		Total N=	74	3
		Total Weight	1,839.7g	72.0g
C174E/3/5/7/8/9* (Structure B143)	1.5 m N/S x 2.5 m E/W	Chunks	295	0
		Flakes	1,639	105
		Flake Tools**	219	219
		Total N=	2,156	324
		Total Weight	3,897.7g	588.8g
		Total N=	3,128	399
		Total Weight	11200.1g	1000.6g

Note: * Indicates only sampled lots, not entire excavation. Refer to Lot Diagrams for approximate locations of lots within the excavations (Martindale Johnson 2008, Figures 8 and 11).
** Includes all flakes tools. Not all are included in the analysis.
*** Excluded from analyzed sample as no relevant tool types are present.

majority of chert artifacts (n=2,156) was recovered from discrete lenses of deposited construction fill in Structure B143 (Figure 4), whereas the chultun excavation recovered less than half the amount (n=898). There were more exhausted tools from within Structure B143 than others including the chultun. Furthermore, the chultun strata do not appear as relatively discrete lenses of soil and artifacts that suggests the chultun was filled gradually overtime rather than more rapidly like construction fills in Structure B143.

As stated above, the majority of the data collected were flake stone debitage, but there was also a large sample of formal tools. Although traditionally referred to as Caracol "drills", the analysis will show these tools were most likely used for more than drilling. Braswell (2010) has also shown that these small tools were used for a variety of activities. By analyzing all recovered lithic materials from the Gateway Group, an entire reduction sequence can be reconstructed (Figure 5). The tools most often described as "drills" are small blades removed from direct/ indirect percussion techniques and often still retain high to moderate percentages of dorsal cortex. These artifacts did not co-occur with many other artifacts like other workshops at Caracol, so it is likely that these tools crafted perishable materials, like wood. Perhaps a larger sample from the construction fills at the group will change this default

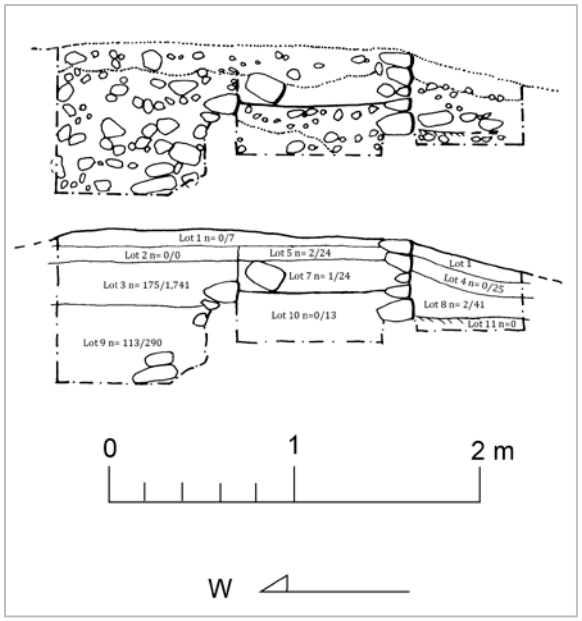

Figure 4. Section (top) and lot diagram (bottom) of Op C174E. Lot diagram shows sampled amount over collected amount (e.g., Lot 3, n=113 sampled out of 1,741 or 113/1,741).

position. These tools, excavated from other house groups have co-occurred with shell and bone crafting debris (Pope 1994).

In order to gain a better understanding of the production and use of these small stone tools, a detailed attribute analysis was devised to test a series of hypotheses. One goal of the detailed analysis was to record data that would enable statistical tests to determine the degree of tool production standardization. There is also data from artifacts to suggest various uses of these tools during crafting activities. These attributes along with a contextual comparison to other households at Caracol formed the basis to construct a number of working hypotheses. These hypotheses along with Kenneth Hirth's (2009b) multi-crafting model described above for the organization of household crafting, help to facilitate a broader understanding of Caracol's domestic production and the diversity of household activities during the Classic to Terminal Classic periods.

Specifically, I use standardization statistics and contextual data to test whether or not the Gateway Group was involved in lithic crafting to produce non-lithic crafts that were then distributed outside the house. In so doing, I ask (1) does the assemblage of flake tools

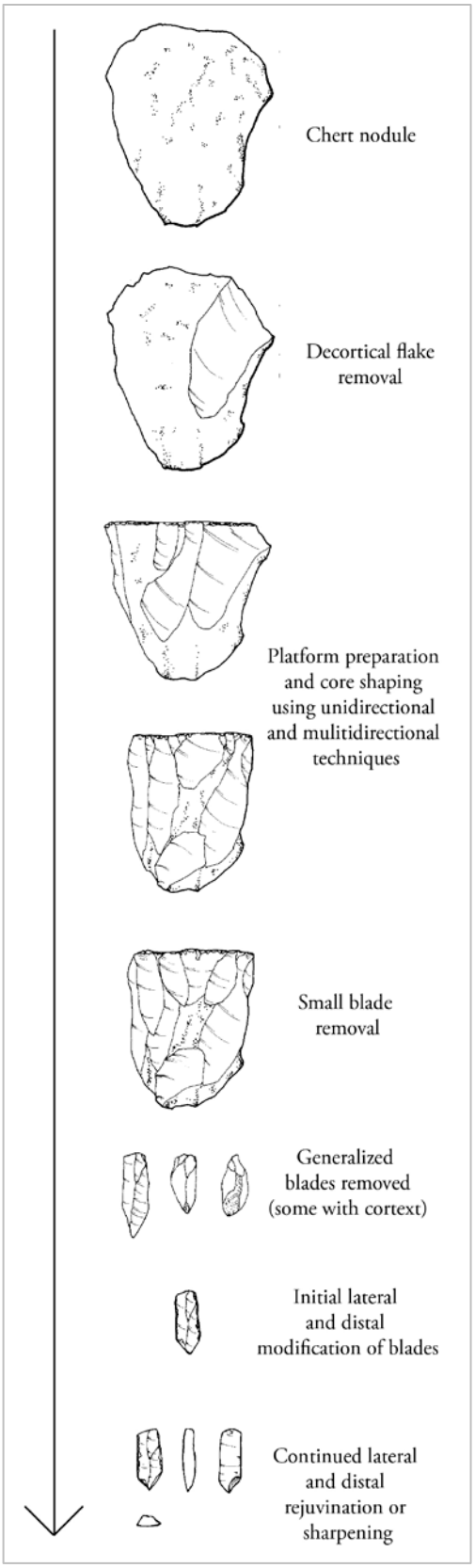

Figure 5. Idealized reduction sequence in the production of small chert tools based on excavation data.

Table 2. Hypotheses tested using household contextual data and chart flake stone analysis.

Variables			*Day-to-day quotidian practice*	*Intensive tool production for household use*	*Intensive tool production for extra-household distribution of tools*	*Production of tools to make crafts for extra-household distribution*
	Flake Stone Use at Households →					
	Presence of Standardization[1] →		Low (Higher Variability)	High (Low Variability)	High	High
	Contextual Data[2] →	*Similar used tools in trash of household*	Low (when compared to others)	High	Low (to None)	High
		Similar tools present at other households	Higher Probability	High	Low	Low
		Number of production debris (lithic and craft debitage) in trash	Lower #'s than others	Higher	Higher	Higher
	Multi-crafting / Implications for Household Organization[3] →	*Contingent or Independent*	Contingent (tools used to craft another material)	Contingent	Independent (b/c the tool is the craft being distributed)	Contingent
		Inside or Outside Household Consumption	Inside	Inside	Outside	Inside

Note: 1- determined by CoV statistics; 2- developed through the excavation history of the Caracol Archaeological Project; 3- adapted from Hirth (2009b:21-23)

exhibit significant levels of standardization and (2) does the contextual and artifact data from the Gateway Group align with data from other household workshop crafting areas from Caracol? And then by using these observations in conjunction with Hirth's (2009b) contingent/ independent and spatial criteria of inside versus outside for crafting organization, I make inferences regarding the organizational type(s) of crafting that took place. This later interpretive framework is important for how archaeologists establish cross-cultural comparisons for the organization of craft production.

Four hypotheses were tested (Table 2). Was chert used for daily *non-crafting* quotidian activities craft production? If so, we might expect to see lower counts of tools recovered from trash or construction fills, a higher degree of tool variability (i.e., tools lack standardized form), similar assemblages at other households, and little to no crafting debris present. Second, did the Gateway Group produce standard tools for daily household practice that did *not* include the production of crafts intended for economic distribution outside the house? If so, then there would be tools, similar (and non-standardized) tools, associated reduction debitage in household refuse, and a higher probability for this practice at other households. Thirdly, did the Gateway Group produce chert tools for extra-household distribution? If so, then tools would have probably been highly standardized because these tools were intended for exchange outside the household. There would also be little or no tools present in the excavations. Lastly, were chert

tools produced at the household intended to then craft some other material that was later distributed outside the house? This last organizational mode is likely if there is a high degree of standardization and exhausted tools and tool production debitage is present in household refuse. Furthermore, support for this crafting mode suggests the Gateway Group as a locus of intensive craft production if there is a lack of similar data from other investigated house groups. This implies that not all households crafted with the same level of intensity or duration. Although these hypotheses are not mutually exclusive, they do help to create heuristic categories to establish a working understanding of household crafting organization that included the production and use of flake stone tools.

Methods: Quantitative and Coded Attributes

Attribute analysis was the principle method of understanding the overall morphological characteristics of small chert tools from the Gateway Group. These attributes were also developed to help standardize analyses of these tools for future excavations and to prepare for data sharing amongst interested researchers (see Martindale Johnson 2008:117-144). A total of at least thirty-five measurements or coded attributes were recovered on 175 tools when applicable. Usual measurements, like length, width, thickness, and weight were recorded during the initial infield cataloging performed during each field season at Caracol. Other attributes were recorded to gain a more detailed understanding of tool raw materials and manufacturing techniques. These included descriptive attributes like completeness, color, and cross-section. Manufacturing techniques were better understood by gathering metric data for statistical tests as well and these included plan form (i.e., how many sides a tool has [Martindale Johnson 2008:54, Fig. 14]), measurements of each side of a particular plan form, percent of cortex, and proximal platform thickness or thinning. Use information was described by recording the location, type, and invasiveness of retouch or edge damage per side, distal bit type, bit width, and bit length, the presence of distal retouch on ventral surface for resharpening, and edge angle per side if applicable (Martindale Johnson 2008:122-129).

Although each of these attributes helps to define the chert tools in greater detail, only some of these attributes provided data to suggest a particular degree of standardization and general tool use. For example, edge angle on lateral sides did not directly contribute to understanding tool standardization, but these data did highlight the potential multifunctional nature of these tools. Tool plan form or the number of sides and side dimensions of a tool was very informative for testing the presence or absence of standardization in tool production. Standardization can be simply understood as the degree to which metrics of a sample possess little statistically significant variation around a calculated mean. Measuring standardization is calculated by dividing the sample standard deviation by the mean to produce a number between 0 and 1 (*V* or *CoV* = *SD/x*, where *V* or *CoV* is the *Coefficent of Variation*, *SD* is the *Standard Deviation*, and *x* is the sample *mean*). A *V* or *CoV* closer to 0 equates to less variation and thus more standardization. *CoV* in this research is presented as a percent by multiplying the final decimal by 100. What is challenging is to determine which artifact attributes to include and measure. The *CoV* results presented are from measurements of metric dimensions and particular coded attributes of 175 small chert tools. For example, the distal end is the portion that was intentionally shaped, used, and retouched consistently to manufacture crafts. As shown below many of the tools have an equal number of sides (e.g., 4, 5, or 6 sided) with statistically similar metric proportions and features.

Measuring standardization among artifact assemblages is not new. It has proven effective in analyses of variation in ceramic production and style in the Andes (Costin 1991) and even in groundstone metate manufacture in northern Mexico which imply where and how many crafters may have been involved in production (VanPool and Leonard 2002). *CoV* statistics have shown little variation in recent results of geochemical analysis of obsidian artifacts by portable XRF (Brandt et al. 2012). Valentine Roux (2003:768) states, "degree of standardization may be assessed through raw

Table 3. *CoV* statistics expressed as a percent of variation for tool Types 3-6. The table also gives ranges of unifacial dorsal edge angle on tool types between 60°-90° (adapted from Martindale Johnson 2008: Figures 7 - 13).

Type	*n=*	*Length*	*Width*	*Thickness*	*Side A*	*Side B*	*Side C*	*Side D*	*n=*	*Angle*
3	17	36%	40%	36%	38%	33%	-	-	not recorded	
4	8	21%	22%	26%	95%	90%	68%	89%	3	75-85°
5 (all)	146	21%	17%	29%	37%	43%	26%	28%	146	61-89°
5 only with distal rejuv.	88	11%	13%	25%	28%	35%	18%	21%	included with all Type 5	
6	4	12%	12%	31%	23%	23%	22%	17%	4	62-89°

material composition, manufacturing techniques, form and dimensions, and surface decoration." Roux (2003) further asserts that standardization in craft production can help archaeologists understand the intentional mechanical habits and skills of people and their organization of production. The continuity of production conventions across space and time implies strong traditions in learning and sharing of information, and so the determination of standardization can prove highly informative. It may also be a proxy for the number of craft producers (Costin 2001:301). It is not used in flake stone analysis very often or at all in Mesoamerica primarily because lithics, unlike ceramics, are reductive versus additive and thus are more likely used to compare some unintended errors in reduction. As a result, the *CoV* statistics are slightly higher or closer to 1 (see Eerkins and Bettinger 2001). For example, ceramic *CoV* tends towards < .17 of 17% variation and flake stone lithics tend towards < 11-34 percent depending on the measured attribute(s).

Discussion and Implications

Both the data and methods described above support the hypothesis that the Gateway Group produced small chert blade tools to make or modify crafts within a household workshop context. These crafts were then distributed outside the household to other households probably through transactions at a marketplace. In this section I will discuss and review important features or attributes of the small chert tools that reinforce the likelihood that standardized production and use was practiced at the Gateway Group.

First, the dimensions of many of the tools situate into one of four plan forms: Type 3, Type 4, Type 5, or Type 6. Second, these tools had varying degrees of standardization within these Types and Type 5 tools or those with a converging distal tip, parallel lateral sides and a flat proximal platform were the most standardized and probably represent the "ideal type" to be used for crafting. Table 3 shows *CoV* statistics for length, width, thickness, and Sides A-D of various plan forms or tool types. Generally, the table shows that tools were manufactured and further retouched on a standardized blade size. For example, Type 5 tools (n=146) exhibited a less than 29 percent variation in overall length, width, and thickness. The further processing or shaping and using the blade as a tool created a standardized sidedness. Again, looking at Type 5 tools, measurements of Side A (the right distal side when viewing a tool dorsally) only showed a 28 to 37 percent variation with and without distal rejuvenation respectfully.

Distal rejuvenation was also a regular practice on Type 5 tools – although not exclusive to them – and was typically knapped by a small ventral pressure flake initiated from the dorsal surface. This practice would have created a sharp bit and an almost hook like end that could have been affective for incising (Martindale Johnson 2008:63 Figure 15). The presence of this kind of rejuvenation was previously unrecorded from other tools known from Caracol, but it appeared as though this was a regular feature of many of the tools from the Gateway Group. A 2x2 chi-square analysis (with one degree of freedom) for all tool types separated by the presence or absence of distal rejuvenation showed that there was a statistically significant ($X^2 = 48.3$ or $p = 0.0001$) association between distal rejuvenation for Type 5 and Type 6 tools (Martindale Johnson 2008:61 Table 4).

Through the actions of the crafter to distally rejuvenate Type 5 tools that are measured to be one standard deviation (*SD*) of the mean (n=88), he or she created a more standardized shaped distal bit (see Table 3). Because of the lack of this rejuvenation feature on Type 3 or Type 4 tools, it is possible these tools could have had other functions in antiquity. Unfortunately no time or resources were available during the initial study to determine micro-wear patterns on these or any tools, but such a study would help to make better informed conclusions.

Numerically coded retouch location and type, as well as measured edge angles, further reinforced the standardized use of these tools. These attributes were measured on Type 4, 5, and 6 tools because of the presence of lateral margins, apart from the converging distal bit portion. These analyses were conducted to infer whether or not these tools were used for more than drilling, incising, or piercing. All tools had unifacial retouch on the dorsal surface and edge angles (Table 3) consistent with experimental wood-working studies (Lewenstein 1991:214). These edge angles also suggest that these tools could have been used to scrap a material in addition to drilling, piercing, and incising.

The Gateway Group, compared generally to other household artifact assemblages, shows that it is unique among most, but similar to a select few. Household investigations at Caracol generally encounter household floors and construction fills above and below these dense plaster levels. Materials recovered from these construction fills, like those of the Gateway Group, have yielded assemblages of flake stone artifacts that help to define household practice and in some cases, can be quantifiably shown to exhibit more intensive activities. Reflecting on these kinds of data from construction fills or other refuse contexts from nearly 195 household investigations, the Caracol Archaeological Project can preliminarily show that 173 or 88.7% of households have chert artifacts, but 43 or 22% of household investigations exhibited chert counts over an average of 385. While quantitative counts alone cannot be used to designate crafting activities, the technological analysis of lithic materials within these households can provide a means to define crafting communities. However, in this case, both published and preliminary studies have shown that when a higher amount of chert artifacts are recovered, the assemblages include the complete reduction sequence, including utilized tools.

Now that the Gateway Group is understood to practice lithic production to make or modify crafts we can situate it generally within organization models of craft production. I argue these tools were a contingent component to the larger crafting process, because both finished and utilized tools were recovered, as well as a complete debitage assortment of the overall reduction sequence or *chaine operatoire* are present; these tools were produced, used, and disposed of inside the house. These tools were not an independent craft in and of themselves intended for distribution outside the household. Other house groups at Caracol must have exhibited this type of organization because some excavated households do yield the presence of small chert tools but do not show evidence of their *in situ* production. This would mean that some households did manufacture or craft chert tools for extra-household distribution, while others were consumers rather than producers. It is likely, however, that the Gateway Group household could have produced these tools in abundance intended for both internal use and external distribution.

The Gateway Group is not unlike other households that yielded the relative abundance and presence of these small tools. Many of the excavated tools from Caracol have a similar morphology and appear to have comparable macro-scale use, retouch, or edge damage. Unlike the majority household groups throughout Caracol, however, the Gateway Group is not located near agricultural land and it is likely that a majority of household wealth came from craft production. These characteristics enable a more informed perspective into the adaptability and resiliency of ancient Maya households in an urban landscape, by highlighting household economic and social activities *apart* from agricultural subsistence production. Although this household may be unique in spatial location, the flake stone data show the crafters followed site wide conventions or traditions of tool manufacture and use. In so doing they

continued to remain connected to other household crafters through sharing materials, knowledge, and technical skill.

Lastly, the location of the Gateway Group adjacent to the city center and near multiple causeways could be argued to suggest a level of elite involvement over what kinds of crafts were produced as well as how they were distributed. However, this is not the case. The dominant perspective at Caracol is control over the distribution, not the production of goods via multiple market locations (A. Chase and D. Chase 2004). Technological practice was most likely learned and shared through the histories of household crafting traditions at Caracol, rather than through elite management. The widely distributed evidence of household chert flake stone crafting practice appears to support arguments for a relative equal access to locally available raw materials and reduction techniques. As stated earlier, the potential for local cherts to be available by simply surveying the karstic landscape for cherts during anthropogenic landscape transformations and still others procuring cherts through multiple market locations, implies very little elite involvement or control over crafting infrastructure, supporting previous interpretations of local rather than elite control of production.

Conclusions

This study was conducted to understand the dynamic organization of household practice through a study of the standardization of lithic technology in conjunction with general household patterns at Caracol, determined through the nearly thirty years of investigation. The study of standardized flake stone artifacts highlights the interconnectedness and diversity of multiple households that formed a community across a large site in terms of similar use of local resources for similar ends: those of craft production. The Caracol tradition of this type of tool production and use is confirmed through using *CoV* statistics and contextual data. This study created heuristic operations to organize data on flake stone artifacts from households with a focus on both metric and non-metric attributes. Furthermore, the broader goal was to develop similar analytical methods for effective transparency and data sharing. The hypotheses were designed to facilitate testable interpretive criteria of household organization, levels of crafting intensity, and better spatial and temporal controls regarding technological practice.

Households provide space in which people learn and transmit knowledge through practice. Once these households are networked, via causeways, a market economy, or other mechanism they can become larger "communities of practice" or overlapping social locations where technological knowledge is manifest in the production and use of tools for craft production. These communities of practice are not static and isolated to households within a "site boundary", but rather have fluid boundaries stretching far beyond the household and overlap through a variety of shared social activities. Perhaps, a focus on the technological traditions in the tools of craft production that appear at household based workshops throughout a diverse region might enable a more comprehensive perspective to lithic studies, social organization, and the learning or sharing of practices beyond ritual uses of eccentrics, bifaces, and obsidian blades.

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References

Aoyama, Kazuo

1999 Ancient Maya State, Urbanism, Exchange, and Craft Specialization: Chipped Stone Evidence from the Copan Valley and the La Entrada Region, Honduras. Dissertation, University of Pittsburg Department of Anthropology.

2007 Elite Artists and Craft Producers in Classic Maya Society: Lithic Evidence from Aguateca, Guatemala. *Latin American Antiquity* 18(1):3-26.

Ashmore, Wendy and Richard Wilk
1988 Household and Community in the Mesoamerican Past. In *Household and Community in the Mesoamerican Past*, edited by W. Ashmore and R. Wilk, pp. 1-27. University of New Mexico Press, Albuquerque.

Brandt, Steven A., Lucas R. Martindale Johnson, and Arlen F. Chase
2013 A Comparative Study of Multiple Bruker Tracer III Calibrated Instruments using Identical Analytical and Operational Procedures: Implications for Past, Present and Future obsidian studies. Paper presented at the 2013 SAA.

Braswell, Jennifer
2010 Elite Craft Production of Stone Drills and Slate at Group D, Xunantunich. In *Classic Maya Provincial Politics: Xunantunich and Its Hinterlands*, edited by L. LeCount and J. Yaeger, pp. 161-183. University of Arizona Press, Tucson.

Braswell, Geoffrey E.
2004 Lithic Analysis in the Maya Area. In *Continuities and Changes in Maya Archaeology: Perspectives at the Millennium*, edited by C. W. Golden and G. Borgstede, pp. 177-200. Routledge, New York.

2011 The Technology of Ancient Maya Civilization. In *The Technology of Maya Civilization: Political Economies and Beyond in Lithic Studies*, edited by Z. Hruby, G. Braswell, O. Mazariegos, pp. 1-14. Equinox Publishing, Sheffield.

Chase, Arlen F. and Diane Z. Chase
2004 Exploring Ancient Economic Relationships at Caracol, Belize. *Research Reports in Belizean Archaeology* 1:115-127.

2006 Trying to Understand the End: Continued Investigations of Small Structures in and near Caracol's Epicenter. Season Report. Belize Institute of Archaeology. (http://www.caracol.org/reports/2006.php)

Chase, Arlen F., Diane Z. Chase, Elayne Zorn, and Wendy Teeter
2008 Textiles and the Maya Archaeological Record. *Ancient Mesoamerica* 19(1): 127-142.

Chase, Arlen F., Diane Z. Chase, John F. Weishampel, Jason B. Drake, Ramesh L. Shrestha, K. Clint Slatton, Jaime J. Awe, and William E. Carter
2011 "Airborne LiDAR, archaeology, and the ancient Maya landscape at Caracol, Belize," *Journal of Archaeological Science* 38(2):387-398.

Chase, Diane Z. and Arlen F. Chase
1998 The Architectural Context of Caches, Burials, and Other Ritual Activities for the Classic Period Maya (as Reflected at Caracol, Belize). In *Function and Meaning in Classic Maya Architecture*, edited by S. Houston, pp. 239-332, Dumbarton Oaks, Washington, D.C.

2014 Ancient Maya Markets and the Economic Integration of Caracol, Belize. In edited by XX, pp. XX-XX Archaeological Papers for the American Anthropological Association. No. XX

Clark, John E.
2007 In Craft Specialization's Penumbra: Things, Persons, Action, Value, and Surplus. In *Rethinking Craft Specialization in Complex Societies: Archaeological Analyses of the Social Meaning of Production*, edited by Z. X. Hruby and R. K. Flad, pp. 20-36. Archaeological Papers of the American Anthropological Association, No. 17.

Clark, John E. and Stephen D. Houston
1998 Craft Specialization, Gender, and Personhood among the Postconquest Maya of Yucatan, Mexico. *Archaeological Papers of the American Anthropological Association* 8(1): 31-46.

Cobos, Rafael
1994 Preliminary Report on the Archaeological Mollusca and Shell Ornaments of Caracol, Belize, edited by A. Chase and D. Chase, pp. 139-147. Pre-Columbian Art Research Institute, San Francisco.

Costin, Cathy L.
1991 Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production. *Archaeological Method and Theory* 3:1-56.

2001 Craft Production Systems. In *Archaeology at the Millennium: A Sourcebook*, edited by G. M. Feinman and T. D. Price, pp. 273-327. Kluwere Academic/ Plenum Publishers, New York.

Eerkins, Jelmer W, and Robert L. Bettinger
2001 Techniques for Assessing Standardization in Artifact Assemblages: Can We Scale Material Variability? *American Antiquity* 66(3): 493-504.

Hirth, Kenneth G.
2009a Housework and Domestic Craft Production: An Introduction. In *Housework and Domestic Craft Production*. Edited by Kenneth Hirth. Archaeological Papers of the American Anthropological Association 19(1):1-12

2009b Craft Production, Household Diversification, and Domestic Economy in Prehistoric Mesoamerica. In *Housework and Domestic Craft Production*. Edited by Kenneth Hirth. Archaeological Papers of the American Anthropological Association 19(1):13-32

Hruby, Zachary X.
2007 Ritualized Chipped-Stone Production at Piedras Negras, Guatemala. In *Rethinking Craft Specialization in Complex Societies: Archaeological Analyses of the Social Meaning of Production*, edited by Z. X. Hruby and R. K. Flad, pp. 68-87. Archaeological Papers of theAmerican Anthropological Association, No. 17.

Joyce, Rosemary A.
2007 Figurines, Meaning, and Meaning-making in Early Mesoamerica. In *Image and Imagination: A Global Prehistory of Figurative Representation*, edited by C. Renfrew and I. Morley, pp. 101-110. McDonald Institute Monographs, Cambridge.

Lave, Jean and Etienne Wenger
1991 Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, Cambridge.

Lewenstein, Suzanne
1987 Stone Tool Use at Cerros: The Ethnoarchaeological and Use-Wear Evidence. University of Texas Press, Austin.

Martindale Johnson, Lucas R.
2008 Tools of a Local Economy: Standardization and Function among Small Chert Tools from Caracol, Belize. Master's Thesis, University of Central Florida, Department of Anthropology.

Pope, Cynthia
1994 Preliminary Analysis of Small Chert Tools and Related Debitage at Caracol, Belize. In *Studies in the Archaeology of Caracol, Belize*, edited by D. Z. Chase and A. F. Chase, pp. 148-156. PARI Monograph 7, San Francisco.

Pope Jones, Cynthia.
1996 Small Chert Tools and Debitage from Craft Areas at the Maya Site of Caracol, Belize. Unpublished MA Thesis, University of Texas Austin.

Puleston, Olga. S.
1969 Functional Analysis of a Workshop Tool Kit from Tikal. Unpublished MA Thesis, University of Pennsylvania.

Roux, Valentine
2003 Ceramic Standardization and Intensity of Production: Quantifying Degrees of Specialization. *American Antiquity* 68(4):768-782.

Shimada, Izumi
2007 Introduction. In *Craft Production in Complex Societies*, edited by I. Shimada, pp. 1-24. University of Utah Press, Salt Lake.

VanPool, Todd L. and Robert D. Leonard
2002 Specialized Ground Stone Production in the Cases Grandes Region of Northern Chihuahua. *American Antiquity* 67(4): 710-730.