ANCIENT MAYA PROCUREMENT AND USE OF CHIPPED CHERT AND CHALCEDONY TOOLS AT MARCO GONZALEZ, AMBERGRIS CAYE, BELIZE

by

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and
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Abstract

Archaeological investigations at the site of Marco Gonzalez on Ambergris Caye, Belize have revealed a long, continuous occupation sequence extending from at least the Late Preclassic into the Late Postclassic periods. This location, so rich in many marine-based resources and well placed to serve as a trading seaport, was completely lacking in suitable lithic raw material for chipped stone tool manufacture. Consequently, the Marco Gonzalez Maya developed complex strategies for the curation of the limited chert and chalcedony tools imported from the mainland. The inhabitants of this site focused on maintaining, reusing, and recycling the formal stone tools to reduce the rate of lithic raw material consumption and extend tool use-lives. They relied on the informal component of the assemblage for the further completion of tasks on the caye. To reconstruct the specific patterns of stone tool procurement and use at Marco Gonzalez, the lithic assemblage was examined in terms of tool typology, raw material types, reduction strategies, and tool functions based on microwear analysis.

INTRODUCTION

As inhabitants of an island, the ancient Maya from Marco Gonzalez needed a series of technological strategies that would enable them to thrive in their coastal environment. Although they may have lived away from the mainland, they were not isolated from it. A complex series of socio-political and socio-economic networks kept them very much connected to the larger Maya community to which they belonged. One facet of the lifeway of the Ambergris Caye Maya concerns their reliance on tools manufactured from chert and chalcedony. Ancient Maya civilization was characterized by a dynamic social, political, and economic system that integrated territories, site hierarchies, and environmental zones, and incorporated chipped cryptocrystalline silicate stone tools as fundamental components for successful existence.

Specifically how the Maya of Marco Gonzalez acquired, used, and maintained their tools is of primary concern when attempting to understand and reconstruct their behavior in an area of the Maya world that was characterized by a particular range of environmental demands. This paper concentrates on evidence derived from tool types, raw material types, reconstructed reduction strategies, and use-wear analysis to argue that the inhabitants of Marco Gonzalez engaged in substantial curation of their

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chert and chalcedony tools. This contention is evidenced through heavy use, maintenance, re-use, and recycling, in response to a lack of locally available stone on Ambergris Caye.

THE OCCUPATION HISTORY OF MARCO GONZALEZ

The site of Marco Gonzalez is located eight kilometers south of the modern resort town of San Pedro (Figure 1). The site was named for the fourteen-year old boy who first led archaeologists to it in 1984. The first excavations at the site were undertaken in April and May of 1986, with additional fieldwork in 1990 (Pendergast and Graham 1987; Graham and Pendergast 1989). Based on the ceramic and stratigraphic evidence, the excavations document long-term occupation and activity from around 100 BC to the 15th century AD (Graham and Pendergast 1989; Pendergast and Graham 1991; Stemp 2001).

The earliest evidence of activity at the site dates to about 100 BC, and the presence of a well built floor, probably associated with a house, suggests that Marco Gonzalez was not simply a fishing or shellfish collection station at this time. Unfortunately, Classic and Preclassic deposits lie largely submerged, which rendered excavation difficult and reconstructions of activities challenging (Graham and Pendergast 1989). One specialized activity at the site in the Late Classic Period (AD 600-800) was salt production. Evidence for this is based on the discovery of layers of charcoal mixed with sherds from thin, crudely made and poorly fired, shallow bowls and dishes known as Coconut Walk unslipped (see Graham 1994: 153-156, Fig. 5.7d), which had been incorporated in the core of later structures. Coconut Walk vessels are believed to have been used as containers for a saline brine that was subjected to high heat to evaporate the water to form salt cakes (*sal cocida* [Andrews 1983: 16-18]); the salt cakes could then be easily transported (see Guderjan 1988; Graham 1989, 1994; Graham and Pendergast 1989; MacKinnnon and Kepecs 1989; McKillop 1991, 1995, 2002; Valdez and Mock 1991; Mock 1994; Andrews and Mock 2002).

In the 9th century, salt processing ceased or significantly diminished, whereas substantial construction activity was initiated and evidence of exchange or trade activities increased, attesting to the site's continued importance. Ceramics included Tohil Plumbate ware, San Jose V redware outcurved bowls and basins (see Thompson 1939: Fig 78; Graham 1987: Fig. 2d, f), and Buk phase pottery (see Graham 1987: 81-87, Figs. 4, 5). These types collectively indicate re-orientation and expansion of long distance trade in the Terminal Classic and Early Postclassic periods, directed towards sites in mainland Belize, Guatemala, El Salvador, and parts of Mexico. Based on the site's location ad the presence of imported goods such as black obsidian, Sierra de las Navajas green obsidian, jade, chert, granite, limestone, haematite, and the ceramic types discussed above, Marco Gonzalez probably served as a hub in an exchange network involving both coastal and inland communities (Graham and Pendergast 1989; Pendergast and Graham 1991).

Marco Gonzalez experienced a decline in occupation density and construction activity sometime during the fourteenth century (Graham and Pendergast 1989: 13-14; Pendergast 1990: 176-177, 1993:112). From AD 1450 to the arrival of the Spaniards in 1544, it appears the site was largely abandoned. It has been suggested that most of the inhabitants moved to the present location of San Pedro town by approximately AD 1400. By that time, deterioration in local environmental quality as a result of sedimentation and coastal accretion increasingly distanced the Marco Gonzalez community from the sea and windward breezes (Graham 1989: 136-137; Graham and Pendergast 1989; Pendergast and Graham 1991; Dunn and Mazzullo 1993).

THE LITHIC ASSEMBLAGE FROM MARCO GONZALEZ

During the excavations at Marco Gonzalez, a total of 1494 lithic artifacts was recovered. The types of tools recovered from the site can be divided into formal (13.8%) and informal (86.2%) sub-assemblages. Formal artifacts include large and small bifaces, blades, blade-tools, and a small number of unifacial tools (Table 1). The informal category includes by-products of tool manufacture (debitage) and a few tools on flakes produced opportunistically

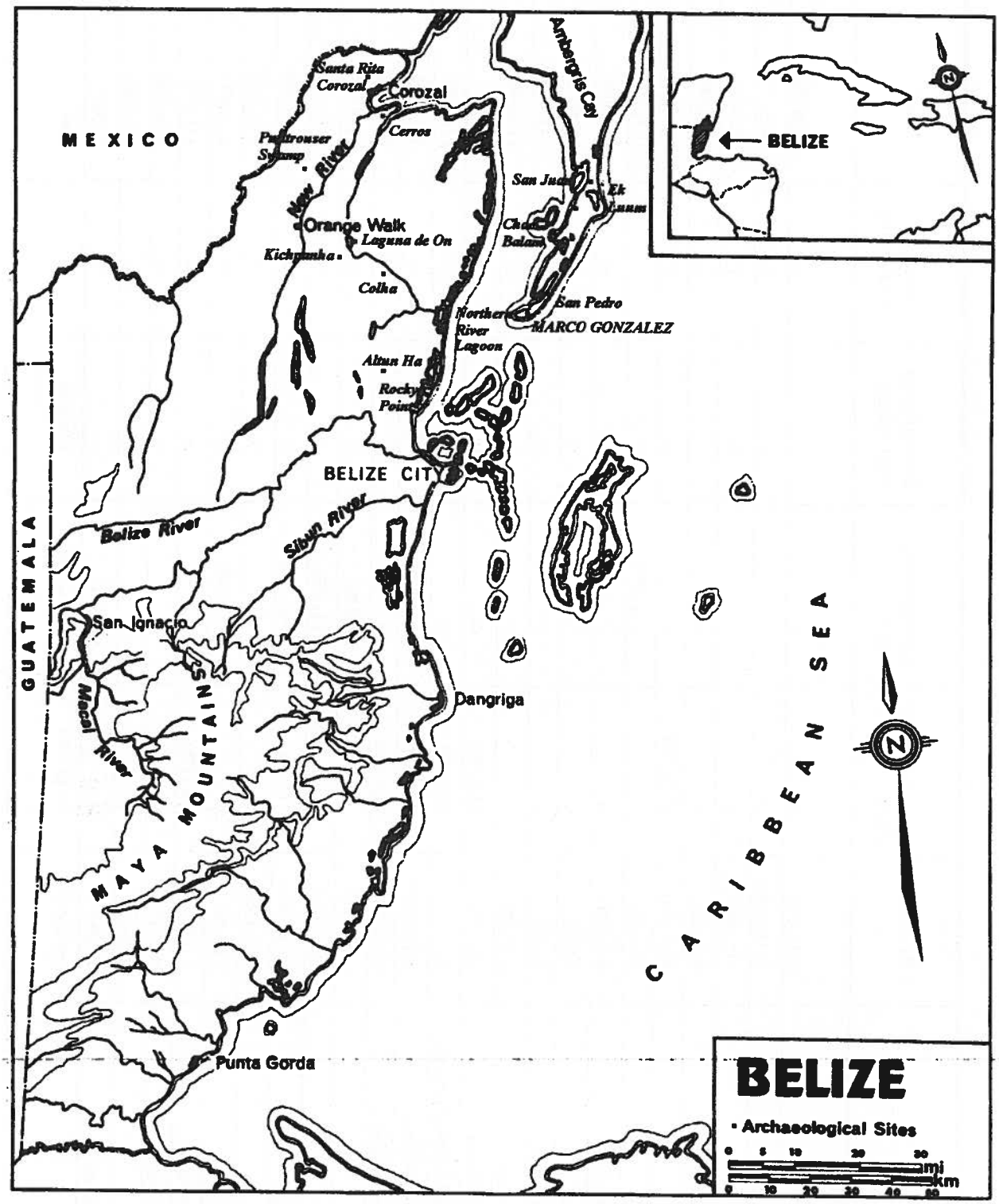

Figure 1. Map of Belize showing the location of Marco Gonzalez and other archaeological sites mentioned in the paper (modified from Graham and Pendergast 1989: Figure 1).

Table 1. Formal tool types by raw material type from Marco Gonzalez, Ambergris Caye, Belize.

Tool Type	CBZ Chert	Other mainland chert	Indeterminate chert	Brown/honey chalcedony	Gray chalcedony	Total
Oval bifaces	13 (6.3%)	0	0	0	0	13 (6.3%)
General-utility bifaces	22 (10.7%)	0	0	0	0	22 (10.7%)
T-form bifaces	1 (0.5%)	0	0	0	0	1 (0.5%)
Biface hammerstones	6 (2.9%)	0	0	0	0	6 (2.9%)
Biface preforms	1? (0.5%)	1? (0.5%)	0	0	0	2? (1%)
Lenticular bifaces	8 (3.9%)	0	4 (1.9%)	0	0	12 (5.8%)
Stemmed thin bifaces	8 (3.9%)	0	1 (0.5%)	0	0	9 (4.4%)
Bi-pointed thin bifaces	2 (1%)	0	0	0	0	2 (1%)
Shouldered thin bifaces	2 (1%)	0	0	0	0	2 (1%)
Side-notched bifaces	1 (0.5%)	0	0	0	0	1 (0.5%)
Shouldered thick bifaces	1 (0.5%)	1 (0.5%)	0	0	0	2 (1%)
Small side-notched bifaces (points)	0	1 (0.5%)	0	0	0	1 (0.5%)
Miscellaneous thin bifaces	23(11.2%)	3 (1.5%)	8 (3.9%)	1 (0.5%)	0	35 (17%)
Miscellaneous thick bifaces	17 (8.3%)	1 (0.5%)	0	0	0	18 (8.7%)
Biface edges	23 (11.2%)	1 (0.5%)	2 (1%)	0	0	26 (12.6%)
Blades	10 (4.9%)	0	3 (1.5%)	0	0	13 (6.3%)
Retouched blades	11 (5.3%)	1 (0.5%)	1 (0.5%)	0	0	13 (6.3%)
Stemmed blades	9 (4.4%)	0	0	0	0	9 (4.4%)
Macroblades	3 (1.5%)	0	1 (0.5%)	0	0	4 (1.9%)
Retouched macroblades	2 (1%)	1 (0.5%)	0	0	0	3 (1.5%)
Stemmed macroblades	6 (2.9%)	0	0	0	0	6 (2.9%)
Scrapers	4 (1.9%)	0	0	0	0	4 (1.9%)
Special finds (bifaces)	2 (1%)	0	0	0	0	2 (1%)
TOTAL	175 (85%)	10 (4.9%)	20 (9.7%)	1 (0.5%)	0	206

Table 2. Informal tool types by raw material type from Marco Gonzalez, Ambergris Caye, Belize.

Tool Type	CBZ Chert	Other mainland chert	Indeterminate chert	Brown/honey chalcedony	Gray chalcedony	Total
Primary flakes (100% dorsal cortex)	4 (0.3%)	5 (0.4%)	1(<0.1%)	1(<0.1%)	0	11 (0.9%)
Secondary 3 flakes (>50% dorsal cortex)	27 (2.1%)	11 (0.9%)	5 (0.4%)	0	0	43 (3.3%)
Secondary 2 flakes (< 50% dorsal cortex)	153 (11.9%)	27 (2.1%)	22 (1.7%)	4 (0.3%)	1 (<0.1%)	207 (16.1%)
Tertiary flakes (0% dorsal cortex)	486 (37.7%)	61 (4.7%)	18 (1.4%)	2 (<0.2%)	6 (0.5%)	573 (44.5%)
Secondary 2 retouched flakes (<50% dorsal cortex)	8 (0.6%)	1 (<0.1%)	0	0	0	9 (0.7%)
Tertiary retouched flakes (0% dorsal cortex)	23 (1.8%)	0	2 (<0.2%)	0	0	25 (1.9%)
Secondary 2 bifacial thinning flakes (<50% dorsal cortex)	20 (1.6%)	2 (<0.2%)	1 (<0.1%)	2 (<0.2%)	1 (<0.1%)	26 (2%)
Tertiary bifacial thinning flakes (0% dorsal cortex)	131 (1%)	5 (0.4%)	5 (0.4%)	2 (<0.2%)	0	143 (11.1%)
Secondary 2 macroflakes (<50% dorsal cortex)	0	1 (<0.1%)	0	0	0	1 (<0.1%)
Drills on flakes	1 (<0.1%)	0	0	0	0	1 (<0.1%)
Flake cores and fragments (multi-directional, pyramidal)	14 (1.1%)	0	0	0	0	14 (1.1%)
Flake cores and fragmentss recycled into hammerstones	3 (0.2%)	1 (<0.1%)	0	0	0	4 (0.3%)
Blocky fragments	159 (12.3%)	23 (1.8%)	26 (2%)	0	1 (<0.1%)	209 (16.2 %)
Blocky fragments recycled into hammerstones	4 (0.3%)	0	1 (<0.1%)	0	0	5 (0.4%)
Potlids and burnt fragments	11 (0.9%)	0	6 (0.5%)	0	0	17 (1.3%)
Total	1044 (81.1%)	137 (10.6%)	87 (6.8%)	11 (0.9%)	9 (0.7%)	1288

(Table 2).

The overwhelming majority of formal tool forms excavated from Marco Gonzalez is identical to the tool types produced at Colha and other workshop locations on the mainland of northern Belize (Shafer and Hester 1983; Hester and Shafer 1984; Hester 1985). Because the types recognized from Colha are so widely distributed throughout sites in northern and central Belize, most archaeologists working in these areas follow its general typological sequence when analyzing their lithic assemblages (i.e., Shafer 1983; McAnany 1986; 1989; Lewenstein 1987; Michaels 1989; Hester *et al.* 1991; Mitchum 1991, 1994; Potter 1991; Roemer 1991; Masson 1993; Hult and Hester 1995; Santone 1997; Stemp 2001, 2004a, 2004b). In addition to relying on the lithic typology established for Colha to organize the classification of the formal tools recovered from Marco Gonzalez, the Colha sequence also assisted in determining the chronology of occupation at the site.

LITHIC RAW MATERIAL TYPES IDENTIFIED AT MARCO GONZALEZ

The lithic assemblage from Marco Gonzalez consists of a variety of cryptocrystalline silicates, including chert-bearing zone or "CBZ" chert, other mainland chert, chalcedony, and indeterminate chert or chalcedony.

"Chert Bearing Zone" (CBZ) Chert

The first chert type includes raw material from the chert-bearing zone (CBZ) on the Belize mainland. This identification is based on visual similarities to the grain size and range of characteristic colors and patterns of cherts found at the massive production site of Colha, Orange Walk District, Belize (Shafer 1983:214; Hester and Shafer 1984:164; Mitchum 1986:105; McAnany 1989:344). This high quality material from central Northern Belize has been described as a usually opaque, fine-grained, cryptocrystalline silicate that ranges in color from gold or yellow banded, honey brown to grayish brown, and banded and/or mottled tan and gray (Shafer and Hester 1983:521; Hester and Shafer 1984: 164; McAnany 1989:334; Mitchum 1991:45, 1994:54). CBZ chert has also been recovered from other production locations in Northern Belize, mostly Late Classic workshops and a quarry (e.g., Altun Ha, Chicawate, Kunahmul, Maskall, and Sand Hill: Hester and Shafer 1984:159).

Other Mainland Chert

A second category of chert established for Marco Gonzalez is a default classification for artifacts that were not classifiable as either CBZ material or chalcedony. The cherts in this category are of comparatively low quality; however, their precise sources are not known at this point. Although some mainland sources of cryptocrystalline silicates other than the CBZ have been documented by archaeologists working in Northern Belize, there has been no chemical identification linking cherts from Marco Gonzalez to these non-CBZ sources. It is believed that some of the lower quality chert may be from a variety of known local coastal or inland sources, such as Northern River Lagoon (Mock 1997), Rocky Point (Kelly 1982), Midwinter Lagoon (S. Mazullo, pers. comm. 2000), or Laguna de On (Masson 1993, 1997; Oland 1999a, 1999b).

Chalcedony

The third category of cryptocrystalline silicates recovered from Marco Gonzalez is chalcedony. The chalcedonies range in grain-size from medium-coarse to fine, fibrous quartz and are mostly translucent to semi-translucent whitish-gray, honey-yellow, or brown in color. This type of stone is similar to specimens from Pulltrouser Swamp and Kichpanha (Shafer 1982:168; McAnany 1989:334; Mitchum 1991:45). Because there are no known sources of chalcedony on Ambergris Caye, the stone recovered at Marco Gonzalez is probably from one or more mainland sources, possibly areas north of the CBZ, across the Freshwater Creek and New River faults: Kichpanha, Laguna de On, Progresso, or Richmond Hill (Hester and Shafer 1984:158, 160; Michaels 1989:163; Mitchum 1991:45; Oland 1999a:105, Table 1, 1999b).

Indeterminate Chert or Chalcedony

Chipped chert or chalcedony artifacts recovered from the excavations at Marco Gonzalez the color

or grain size of which could not be reliably determined were classified as indeterminate. Typically, these artifacts had been subjected to post depositional conditions that significantly altered their exterior surfaces. Processes of severe burning (Mandeville 1973; Purdy 1974), white patination (Rottländer 1975; Stapert 1976), and black patination [manganese oxidation] (Cackler *et al.* 1999, 2000: see Shafer and Hester 1990:281; Hester and Shafer 1994; Mitchum 1994) prevented the accurate identification of lithic raw material type and, consequently, the determination of provenance of these tools.

THE MARCO GONZALEZ LITHIC ASSEMBLAGE BY RAW MATERIAL TYPE

The vast majority of non-obsidian chipped tools from Marco Gonzalez were manufactured from CBZ chert (1220 or 81.7%), whereas the remaining tools in the assemblage were made from other mainland cherts (146 or 9.8%), indeterminate cherts or chalcedonies (107 or 7.2%), brown or honey-colored chalcedonies (12 or 0.8%), and gray chalcedonies (9 or 0.6%). In terms of weight, the assemblage consists of 21,209.3 grams (78.2%) of CBZ chert, 4375.9 grams (16.1%) of other mainland chert, 1393.9 grams (5.1%) of indeterminate cryptocrystalline silicates, 82.9 grams (0.3%) of brown or honey-colored chalcedony, and 75 grams (<0.3%) of chalcedony. The weights of the different raw materials at the site parallel the quantities of artifacts by raw material type and reaffirm the heavy reliance on CBZ chert by the Marco Gonzalez Maya.

The majority of all formal tools (85.5%) was manufactured from CBZ chert, although this raw material type was also used to produce simple flakes and flake tools from non-standardized, multi-directional flake cores and a small number of pyramidal flake cores. Other mainland cherts made up only 5% of the formal tool component, whereas 10.8% of the informal lithic sub-assemblage was so classified. Nevertheless, substantially more of the other mainland chert (93.2%) was used in informal lithic reduction than in the production of formal tools.

Because so little chalcedony was recovered at Marco Gonzalez, it is difficult to determine patterns of raw material consumption or tool production. Only one thin biface fragment of brown/honey colored chalcedony was recovered from the site and only a handful of simple flakes, bifacial thinning flakes, and blocky fragments (1.8% of the informal sub-assemblage) was manufactured from this silicate. These data suggest that chalcedony was not an important lithic import and, as at many sites in Northern Belize, was mainly used for simple core reduction to produce flakes (Shafer 1983; Hester and Shafer 1984; Lewenstein 1987; McAnany 1989; Dockall and Shafer 1993).

STONE TOOL CONSUMPTION AND THE LOCUS OF PRODUCTION

No naturally occurring sources of chert or chalcedony have been identified on Ambergris Caye. The assemblage pattern observed at Marco Gonzalez is similar to other consumer sites that had no direct access to lithic resources, such as Cerros (Mitchum 1986, 1991), Pulltrouser Swamp (Shafer 1983; McAnany 1986, 1989), Chac Balam, San Juan, Ek Luum (Hult and Hester 1995), Santa Rita Corozal (Dockall and Shafer 1993), and San Pedro (Stemp 2001, 2004b). Evidence that identifies Colha as a stone tool production center, such as substantial quantities of reduction debitage, tool preforms, tools broken at various stages of manufacture, and exhausted production implements, including hammerstones, antler billets, and edge abraders (see Shafer and Hester 1983; 523, 535; Hester and Shafer 1991:156, Fig. 1), are mostly absent from the Marco Gonzalez assemblage. The two potential biface preforms identified at the site may in fact be discoidal/bifacial flake cores, as they seem too small to have served as blanks for large biface production and were rather poorly executed.

Further support for the claim that stone tools were not being produced at Marco Gonzalez can be seen in the ratio of cores to flakes, the high percentages of non-cortical debitage, and the very low ratio of flakes to bifaces. McAnany (1986:231, 1989) has demonstrated that the ratio of flakes to cores at a site can be used as a gross indicator of the degree of primary reduction; a low ratio, in which there are few flakes compared to the number of cores, is in-

Table 3. Percentage of non-cortical debitage from consumer sites in northern Belize.

Sites	Percentage of Non-cortical Debitage	Reference
Pulltrouser Swamp	89%	McAnany 1986
Northern Ambergris Caye (Ek Luum, Chac Balam, San Juan)	86%	Hult and Hester 1995
Laguna de On	72.8%	Masson 1993
Santa Rita Corozal	71.7%	Dockall and Shafer 1993
Marco Gonzalez	71.4%	Stemp 2001
San Pedro	70.7%	Stemp 2001

Table 4. Experimental and archaeological manufacture of bifaces and production debris.

	Experimental lenticular biface (Tomka 1989)	Estimated debris ratio (large whole bifaces: whole simple and bifacial thinning flakes from Marco Gonzalez[1])
Original core dimensions (cm)	8.8 x 6.5 x 2.4 (lenticular chert nodule)	NA
Biface dimensions (cm)	8.2 x 4.4 x 1.0	NA
Primary flakes (100% cortex)	10 (5.4%)	0.1 (0.3%)
Secondary (3) flakes (>50% cortex)	21 (11.4%)	1 (2.6%)
Secondary (2) flakes (<50% cortex)	42 (22.8%)	9.8 (25.4%)
Tertiary flakes (0% cortex)	111 (60.3%)	27.7 (71.8%)
Blocky fragments	3	15.9
Flake fragments	small flake fragments[2]	43.5 (12.7 cortical)

1. The estimated debris ratio from Marco Gonzalez is calculated in terms of cortical and non-cortical flakes and blocky fragments recovered from the site divided by the total number of large whole bifaces (i.e., for 1 biface there were 0.1 primary flakes).
2 Flake fragments are included in the flake categories (primary, secondary 3, secondary 2, tertiary) above. An additional 2,051 flakes, fragments, and chunks passed through 1/4 inch mesh.

dicative of a primary assemblage. At sites such as Pulltrouser Swamp and Santa Rita Corozal, the ratios of Colha-like chert flakes to cores were 46:1 and 74:1, indicating that the Colha-like chert assemblages at these sites were not produced by early stage reduction (Dockall and Shafer 1993:170). At Marco Gonzalez, the ratio of unretouched CBZ chert flakes to whole cores was 221:1 (Stemp 2001:107). If this technique is considered reliable, then there is little support for early stages of manufacture at Marco Gonzalez.

Consumer sites should also possess high percentages of non-cortical debitage, given that flakes with substantial cortical covering are generally associated with the earlier or primary stages of tool production and would most likely be recovered at manufacturing locales (McAnany 1986:226-227; Dockall and Shafer 1993). The assemblage from Marco Gonzalez conforms to this pattern with a high percentage non-cortical debitage recovered (Table 3). These data argue against this site as a lithic production locus, but strongly suggest that the inhabitants of Marco Gonzalez were primarily repairing and reworking the finished tools that they acquired from elsewhere as end stages in the reduction continuum.

In addition to the lack of evidence for primary reduction stages at Marco Gonzalez, it appears that biface manufacture was not performed at this site, based on the ratio of lithic debris (whole and fragmentary cortical and non-cortical simple and bifacial thinning flakes) to whole bifaces. If the Marco Gonzalez data are compared to those supplied by Tomka's (1989) experimental reduction of a lenticular biface, the low numbers of flakes to bifaces at this caye site indicate that bifaces were not being produced there (Table 4). However, the higher percentages of tertiary flakes at Marco Gonzalez do support the argument for tool maintenance and repair.

Furthermore, because there does not appear to be any standardized method at Marco Gonzalez of resharpening tools, and there is ample evidence for hinge- and step-terminated flakes and flake scars on tools (i.e., 22.2% of the whole and distal fragments of tertiary CBZ simple and bifacial thinning flakes possessing hinge terminations), the Maya at this site reveal a relatively low level of skill in stone tool production or repair (Costin 1991:32). Since there was no ready, abundant source of stone for tool manufacture in their coastal environment and because stone tools were provided in finished form from mainland workshops, the inhabitants of Marco Gonzalez may never have had the opportunity or the inclination to fully develop flint-knapping skills and knowledge through apprenticeship, mentoring, or simple repetition, or they may have lost those skills through lack of practice (Ferguson 2003 for "embedded learning"; McAnany 1986:266-267, 1991:280; McSwain 1991:349).

In sum, given the lack of chert and chalcedony sources on the caye, the relative proximity of the mainland workshops, the lack of manufacturing evidence at Marco Gonzalez, and the comparatively poor skill level demonstrated in tool repair and recycling, it is argued that trade or exchange for finished lithic products was the primary method of indirect stone tool acquisition for the inhabitants of Marco Gonzalez. Nevertheless, a quantity of CBZ chert and chert from other sources that arrived on the Caye was relied upon to produce informal core and flake tools.

LITHIC REDUCTION, CURATION, AND TOOL USE-LIFE AT MARCO GONZALEZ

The "life history" or use-life of artifacts recovered from the archaeological record has been thoroughly presented by Schiffer (1972, 1976), with further discussion and elaboration of the more specific concept of curation by others, including Binford (1973, 1977, 1979), Hayden (1976), Bamforth (1986), Nelson (1991), Shott (1996), and Odell (1996). Despite disagreement concerning terminology and application of the curation concept to material culture, specifically stone tools, a number of important explanations for why people engaged in this behavior have arisen. One is the reduced availability of appropriate raw material for the manufacture of tools (see Odell 1996: 74, Fig. 8 for "scarcity-induced economizing activity"). Given the restricted access of Ambergris Caye inhabitants to chert and chalcedony, curation was of extreme importance to maximize the potential use of available lithic raw material. Although most stone tools arrived on the Caye in finished form, the specific strategies governing how these tools were employed was of great economic concern for those inhabiting a lithic-poor coastal environment. In response to this, the Maya at Marco Gonzalez seem to have adopted appropriate reduction strategies that focused on curation of the available lithic assemblage through processes of heavy use, maintenance, re-use, and recycling.

LITHIC REDUCTION STRATEGIES AT MARCO GONZALEZ BY TOOL TYPE

Despite the general concern over access to scarce lithic resources by the Maya at Marco Gonzalez, no single pattern of lithic reduction and curation was universally employed at the site. This is because reduction techniques vary with tool type and function and with changing needs (both current and anticipated), and they also reflect the decisions of the individual(s) using the tool (Hayden *et al.* 1996). Although some variability was observed in discard patterns and failure rates of the lithic artifacts excavated from this site (Shott 1989, 1995; Shott and Sillitoe 2004), consistently similar reduction sequences emerged for the chipped stone tools that were initially categorized into the same types. These

categories included large bifaces, lenticular bifaces, a variety of small thick and thin bifaces, blades and macroblades, stemmed blades and stemmed macroblades, informal tools manufactured from the debris of tool maintenance, repair and recycling, and useable flakes from simple core reduction

Large Bifacial Tools (Figure 2)

At Marco Gonzalez, almost all of the large bifacial tools and fragments thereof were manufactured from CBZ chert (96.7%). Most bifaces recovered during excavations demonstrate a similar reduction pattern with the maintenance of the original form for as long as possible through episodes of repair until the tool broke into fragments or was recycled into a different type of tool. The decision to recycle was dependent on tool size and shape. At least one reason for this reduction strategy seems to be the very flexible or versatile nature of large bifaces based on their generalized design and their potential application to different tasks without need for

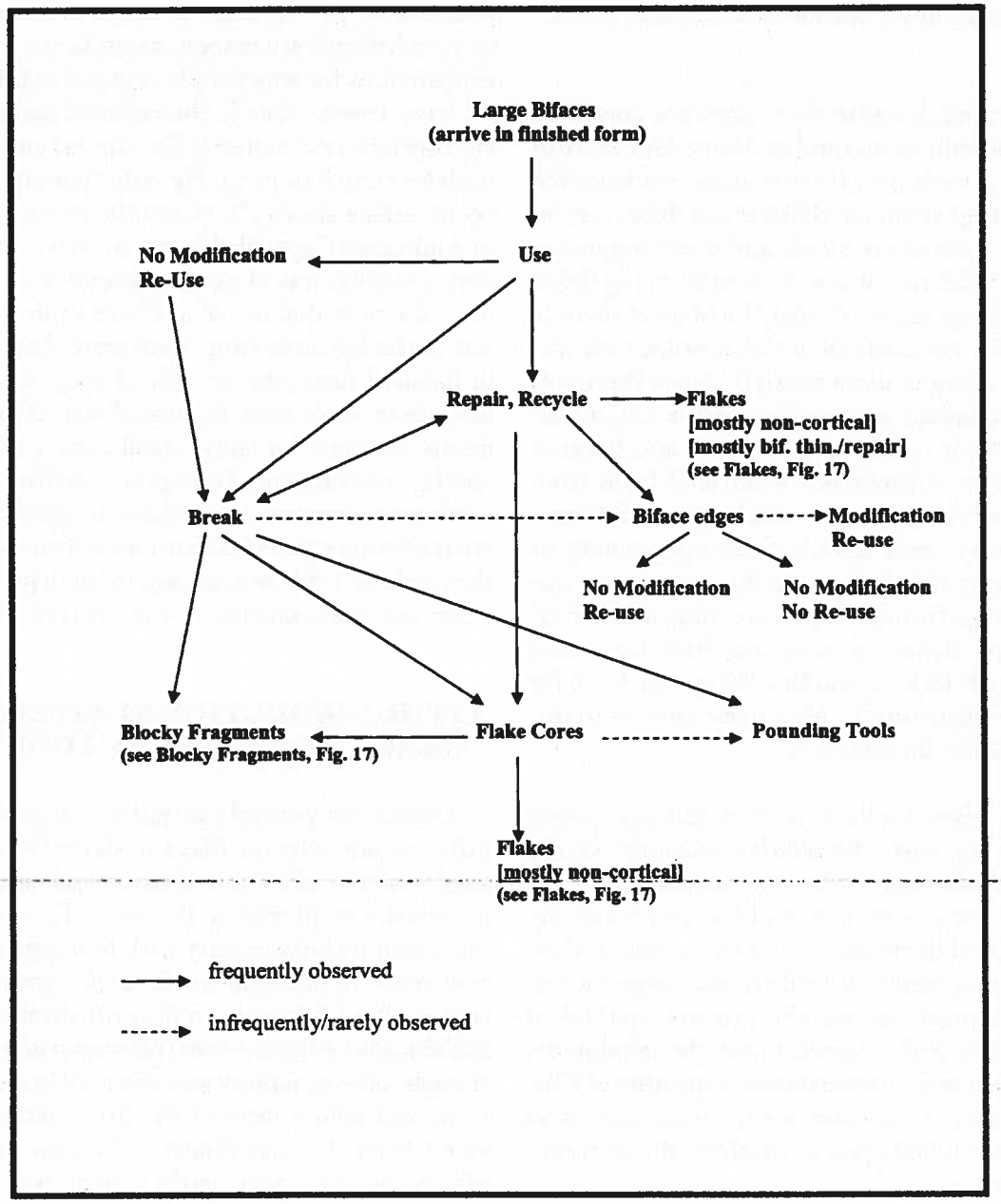

Figure 2. Reduction and use sequence for large bifaces (oval, general-utility, celts) at Marco Gonzalez, Ambergris Caye, Belize.

significant alteration of form, which reduced the need for tools designed for specific activities. (Shafer 1983; Bleed 1986; McAnany 1986, 1988; Kelly 1988; Nelson 1991; Hayden *et al.* 1996).

Although large bifaces that were heavily used are expected to have been smaller in size and to possess steeper edge angles as they were progressively reduced, Hayden (1987; Hayden *et al.* 1996:25) has noted that the use of billets or soft hammers assists in preventing the rapid consumption of raw material and in maintaining relatively low, and therefore still serviceable, edge angles on bifaces. As a measure of large biface use, one technique that has been employed by archaeologists considers the index of whole tool length to thickness. As bifaces were used and sequentially reduced, there should have been a decrease in the length-to-thickness ratio. Unfortunately, reliably determining any indices of length-to-thickness at this site is very difficult because of the extremely fragmentary nature of the assemblage. There are not enough complete tools in a single class, specifically large bifaces, to calculate this index accurately. However, if the dimensions of the two whole oval bifaces (Figure 3) from Marco Gonzalez are compared to those of the large bifaces from other consumer sites in Northern Belize and a production locus, such as Colha, there is some support for the heavy use and repair of bifaces recovered on the southern end of Ambergris Caye (Table 5).

The determination of heavy biface use based on steepness of edge angle is possible using the artifacts recovered from Marco Gonzalez. Lewenstein (1991:207) noted that experimental and archaeological chipped stone axes usually possess bit angles between 45° and 75°, whereas the range for stone adze bits is 40° - 87°. At Cerros, Lewenstein (1991:211) found that artifacts classified as hoes had a median bit angle of 74°, while her axes and adzes possessed steeper median bit angles, measuring 77° and 78°, respectively. Overall, her Cerros tools had bit angles that ranged from 70°-80+° (Lewenstein 1991:215). This follows an expected pattern based on tool use and resharpening: the longer the bifaces were used, the more flakes were removed from impact and maintenance, and the steeper the edges became. At Marco Gonzalez, the range of distal edge angles for the oval, general utility, and miscellaneous thick bifaces is 53° - 84°, with a median of 78°. Based on the data above, the measurements from Marco Gonzalez mirror those from Cerros, where extreme biface use, resharpening, and re-use have been documented.

During the process of sequential reduction, these large bifaces may break and no longer be used for their initial or primary task(s). To extend the use-life of the raw material from which the bifaces were manufactured and create other tool forms needed by the Caye Maya, some fragments of large bifaces from this site were recycled into hammerstones or pounding tools (Figure 4). This practice of large biface recycling has been similarly noted at other sites on both northern and southern Ambergris Caye (Hult and Hester 1995: Fig. 84; Stemp 2001: Fig. 9d, g, h, 2004a: Fig. 5) and in Northern Belize (Shafer 1983: 216, 224, Fig. 12-2, 233; McAnany 1986: 186, Fig. 23, 1988: 5, Fig. 3; Lewenstein 1987; Dockall and Shafer 1993), where tools were usually acquired from the workshops of the CBZ. Some large biface fragments were also used as cores for the production of flakes that could have been used in an expedient technology.

All of these factors associated with large biface technology would collectively increase the use-life and minimize the discard rate of chert and chalcedony tools and fragments. Such conservation would contribute to decreasing the overall demand for lithic raw material at the site.

Bifacial Thinning Flakes and Biface Edge Fragments (Figure 2)

At Marco Gonzalez, 89.3% of all the bifacial thinning flakes were made from CBZ chert, while 88.5% of the biface edges were manufactured from this material. Given that most of the large bifacial tools recovered from this site were produced in Northern Belize, this observation is not surprising. Not only did a reliance on biface technology contribute to a reduced need for varieties of task-specific tools, but it also permitted easier rescharpening and reuse of stone tool components. In addition, it produced flakes and biface edges of various shapes and dimensions that could be used for additional tasks as the bifacial core was reduced in size and changed form (Kelly 1988:718-719; Nelson 1991; Hayden *et al.* 1996:19).

Table 5. Dimensions of whole oval bifaces from Marco Gonzalez and other sites in Northern Belize.

Location	Number of tools	Length(mm)	Width(mm)	Thickness (mm)	Source
Marco Gonzalez	2	102-105	52-61	20-25	Stemp 2001:46
San Pedro	1	119	66	29	Stemp 2001:33
Cerros	23	145-215	68-83	18-26	Mitchum 1991:46
Pulltrouser Swamp	291	60-186	40-74	15-25	McAnany 1986:203
Chac Balam	2	146-173	70-73	21-26	Hult and Hester 1995:151
Colha (Late Preclassic form)	-	180-300	80-120	20-30	Shafer 1991:33

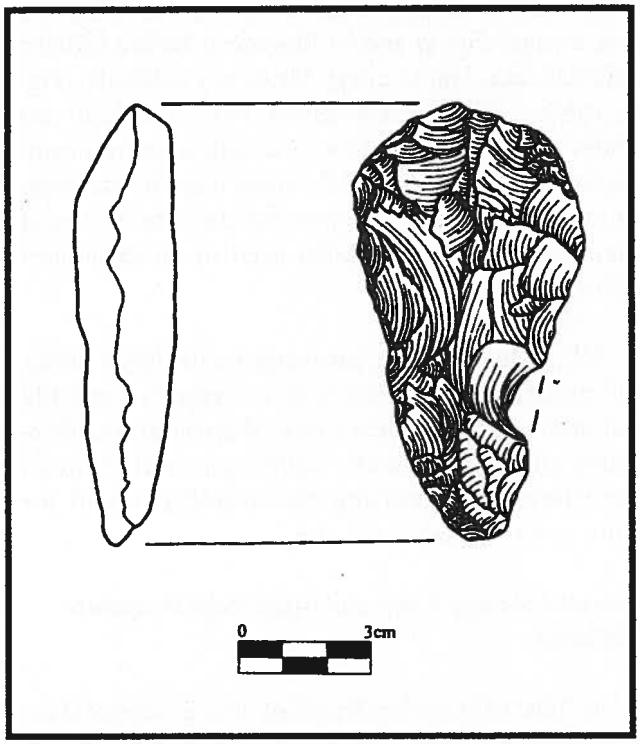

Figure 3. A whole oval biface (MG26/2) from Marco Gonzalez, Ambergris Caye, Belize.

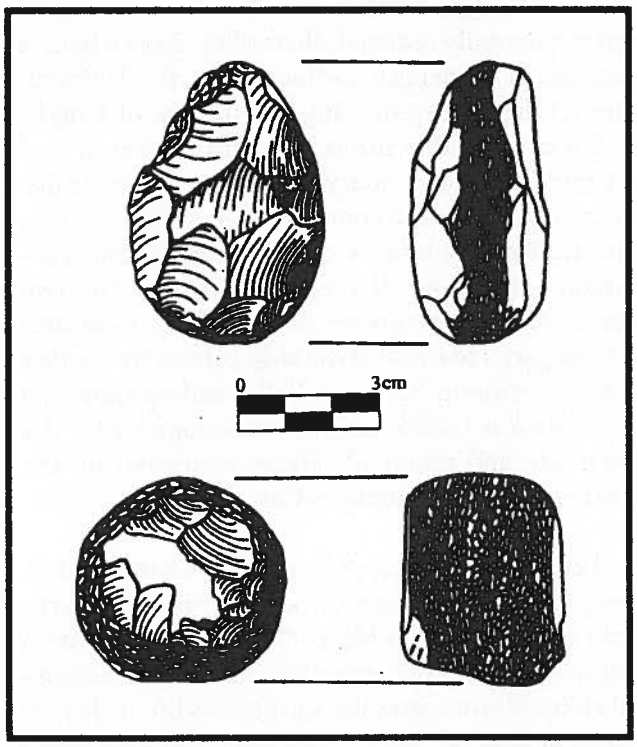

Figure 4. Recycled biface fragments (top: MG 129/3, bottom: MG 26/4) from Marco Gonzalez, Ambergris Caye, Belize.

The flakes that were deliberately struck from the bifaces were sometimes produced using a soft-hammer, as witnessed by some lipped striking platforms, and were also detached by a hard-hammer, as seen in many right-angled, beveled striking platforms (Shafer 1983; Shafer and Hester 1983: 524, 531, Fig. 6). There is no pattern of association between specific large biface types and the types of bifacial flakes removed from them. The Maya made use of both types of flakes, but rarely modified them through retouch to render them better for task completion. It appears that bifacial thinning flakes and biface edges were chosen for certain activities based on combinations of size, edge shape, and edge angle.

Lenticular bifaces (Figure 5)

Only twelve lenticular biface fragments were recovered from the excavations at Marco Gonzalez.

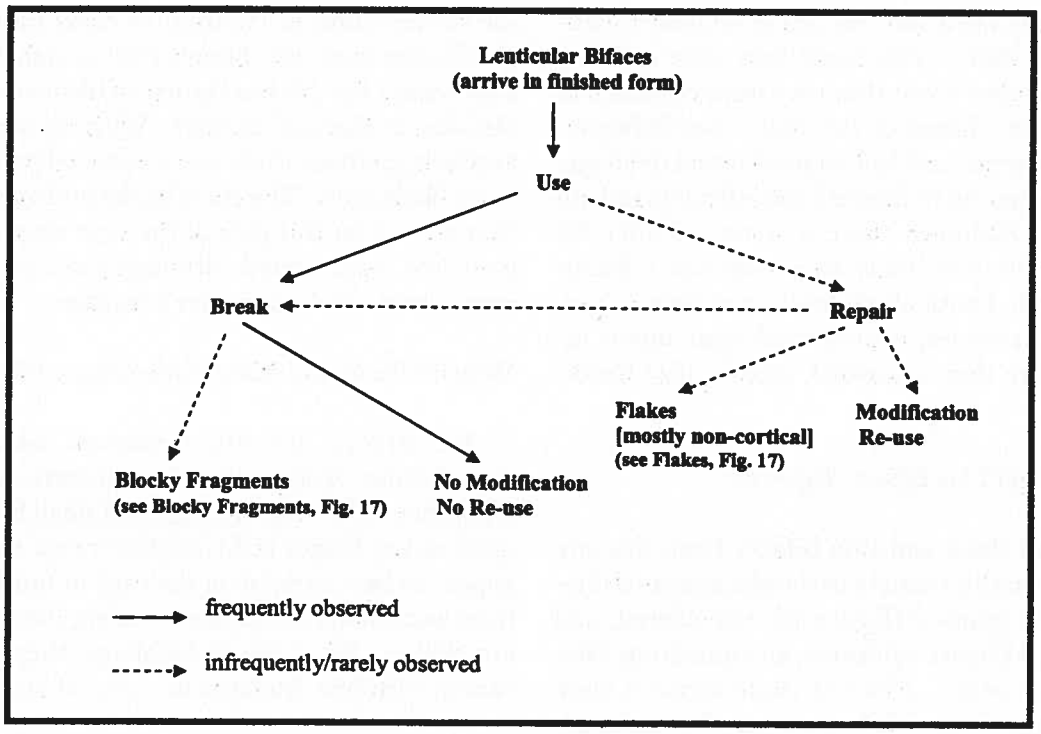

Figure 5. Reduction and use sequence for lenticular bifaces at Marco Gonzalez, Ambergris Caye, Belize.

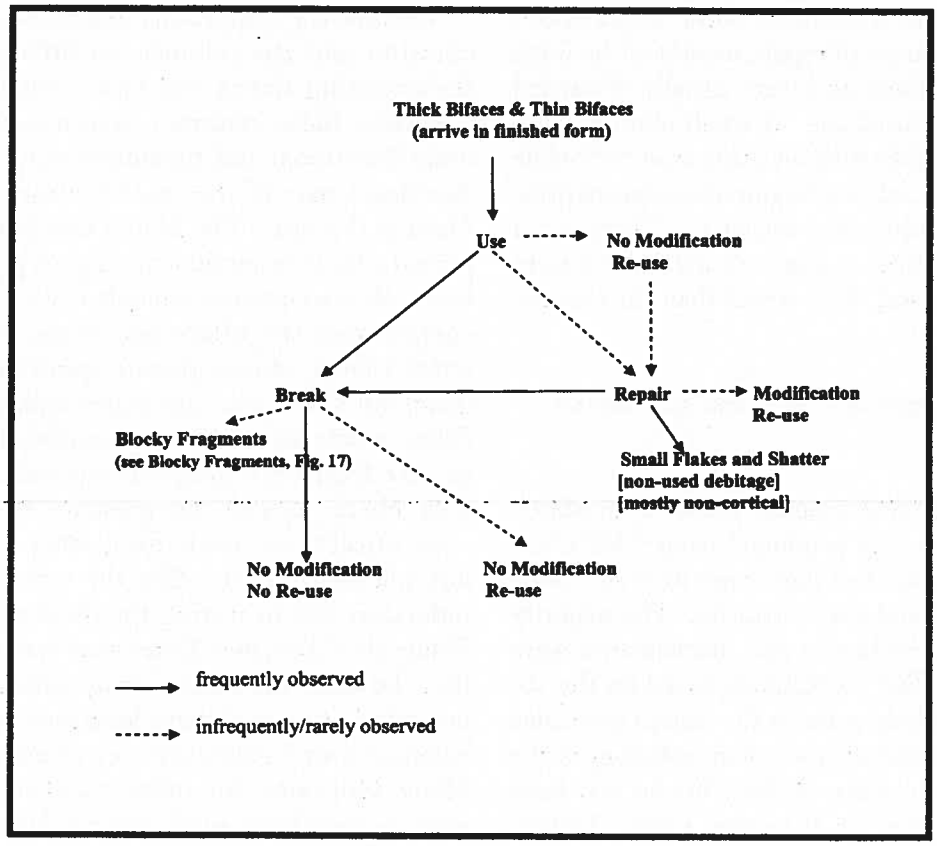

Figure 6. Reductions and use sequence for thick and thin bifaces (simple, side-notched, stemmed, shouldered, bi-pointed) at Marco Gonzalez, Ambergris Caye, Belize.

Of these, only eight (66.7%) can be reliably identified as CBZ chert. The other four were so badly weathered and/or burnt that they were classified as indeterminate. Based of the tools' morphologies, raw material types, and lack of production debitage, they were acquired in finished form from mainland workshops. Although there is some evidence for edge repair on these tools, they were not substantially curated. Lenticular bifaces were used to perform some activities, experienced some minor repair, and were then discarded, usually after breakage.

Small Thick and Thin Bifaces (Figure 6)

The small thick and thin bifaces from this site are represented by a variety of simple, stemmed (Figures 7-12), bi-pointed (Figure 13), shouldered, and side-notched (Figure 14) forms, and numerous bifacial tool fragments. Most of these artifacts were manufactured from CBZ chert (72.5%), although some were made from other mainland cherts and chalcedonies. Patterns of acquisition, reduction and use indicate that these tools were primarily acquired from the mainland in finished form, experienced some minimal amount of repair, mostly in the form of edge resharpening, and were usually discarded after primary or initial use. A small number were re-used for other tasks without being modified, while some modification of tool fragments occurred prior to their uses for additional activities. There was a more concerted effort at Marco Gonzalez to curate the smaller thick and thin bifaces than the lenticular bifaces.

Retouched and Unretouched Blades and Macroblades (Figure 15)

Retouched and unretouched blades from Marco Gonzalez were mostly produced from CBZ chert (78.8%); however, some of these tools were also made from other mainland cherts (15.2%). The majority of the unretouched blades and macroblades were products of the CBZ workshops, based on the absence of formal blade cores in the Marco Gonzalez lithic assemblage and the overall morphology of the artifacts. However, some of these blades may have been retouched once on the caye. Other Ambergris Caye sites, including San Pedro, San Juan, Ek Luum, and Chac Balam, also reveal little evidence for conservation or curation of chert blades (Hult and Hester 1995: 160; Stemp 2001:41-42). One possible reason for this was the use of blades made from obsidian at Marco Gonzalez. With obsidian blades available, perhaps there was a reduced premium on chert blade tools. The chert blades and macroblades that arrived on this part of the caye were never repaired or resharpened, although some of the fragments were used again after breakage.

Stemmed Blades and Macroblades (Figure 16)

All fifteen of the stemmed blades and macroblades, or fragments thereof, were made from CBZ chert. As with the large and small bifaces and most of the blades at Marco Gonzalez, these tools appear to have arrived on the caye in finished form from workshops in the chert-bearing zone of Northern Belize. After use or breakage, they were discarded with few attempts to curate them further.

Simple, Retouched, and Unretouched Flakes and Flake Cores (Figure 17)

Despite the importance placed on large biface curation and the reliance on bifacial thinning/resharpening flakes and biface edges at Marco Gonzalez, flakes removed from non-standardized, multidirectional and pyramidal cores were also a significant part of the tool inventory used by the Maya at this site. The Marco Gonzalez Maya employed a basic reduction strategy to produce informal tools manufactured mostly from CBZ cherts to complement the biface and blade strategies described above. A considerable quantity of the other mainland chert was also relied upon to produce flakes or flake tools. Although almost all of the cores or core fragments from this site were made from CBZ chert (94.4%), the presence of cortical and noncortical flakes made from other cryptocrystalline silicates indicates that the same type of core reduction was occurring for these types, as well. While the CBZ chert flakes were removed from either the multi-directional or pyramidal chert cores imported from mainland locations and from the exhausted or broken bifaces already present at Marco Gonzalez, the other mainland chert flakes seem to have been solely the products of informal core reduction.

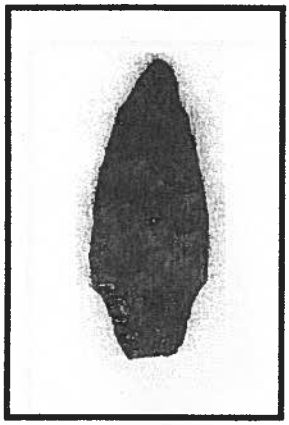

Figure 7. Thin Middle Postclassic stemmed biface from Marco Gonzalez: MG05/04; dimensions: 5.3 x 2.5 x 0.6 cm.

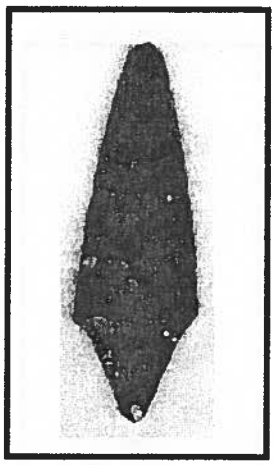

Figure 8. Thin Middle Postclassic stemmed biface from Marco Gonzalez: MG18/01; dimensions: 10.4 x 3.9 x 0.8 cm.

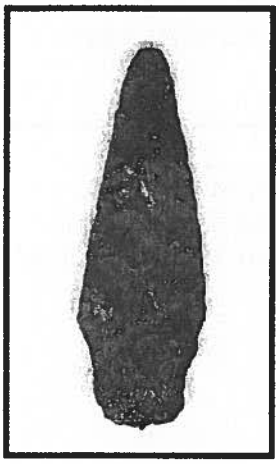

Figure 9. Thin Middle Postclassic or later stemmed biface from Marco Gonzalez: MG 28/01; dimensions: 7.3 x 2.6 x 0.8 cm.

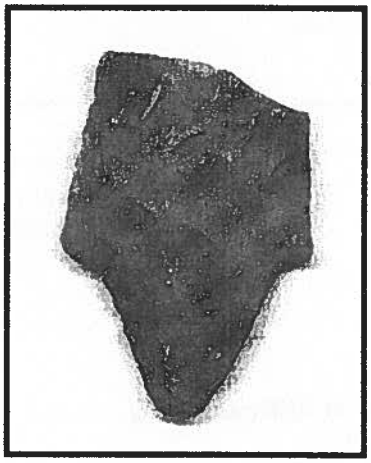

Figure 10. Thin Middle-to-Late Postclassic stemmed biface from Marco Gonzalez: MG 129/01; dimensions: 5.2 x 3.7 x 1.0 cm.

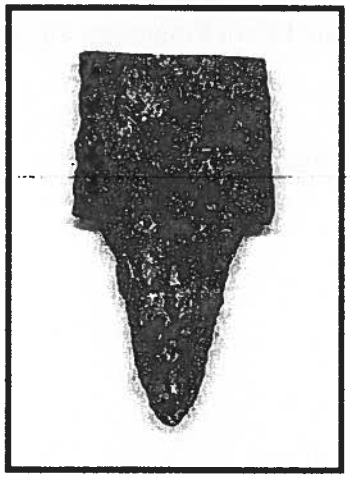

Figure 11. Thin Postclassic stemmed biface from Marco Gonzalez: MG 135/05; dimensions: 5.4 x 3.0 x 0.7 cm.

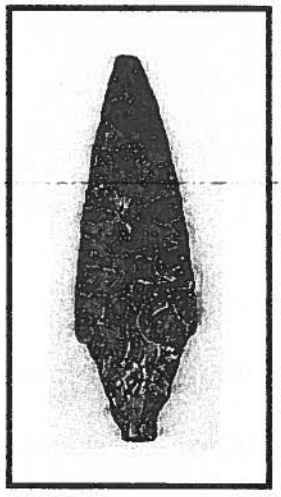

Figure 12. Thin Postclassic stemmed biface from Marco Gonzalez: MG 233/02; dimensions: 9.6 x 3.1 x 0.8 cm.

Figure 13. Thin Postclassic bipointed biface from Marco Gonzalez: MG 95/01: dimensions: 9.8 x 2.9 x 0.8 cm.

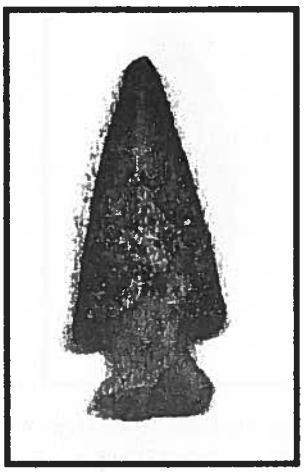

Figure 14. Thin Early Postclassic side-notched biface from Marco Gonzalez: MG 192/02; dimensions: 6.4 x 2.7 x 0.8 cm.

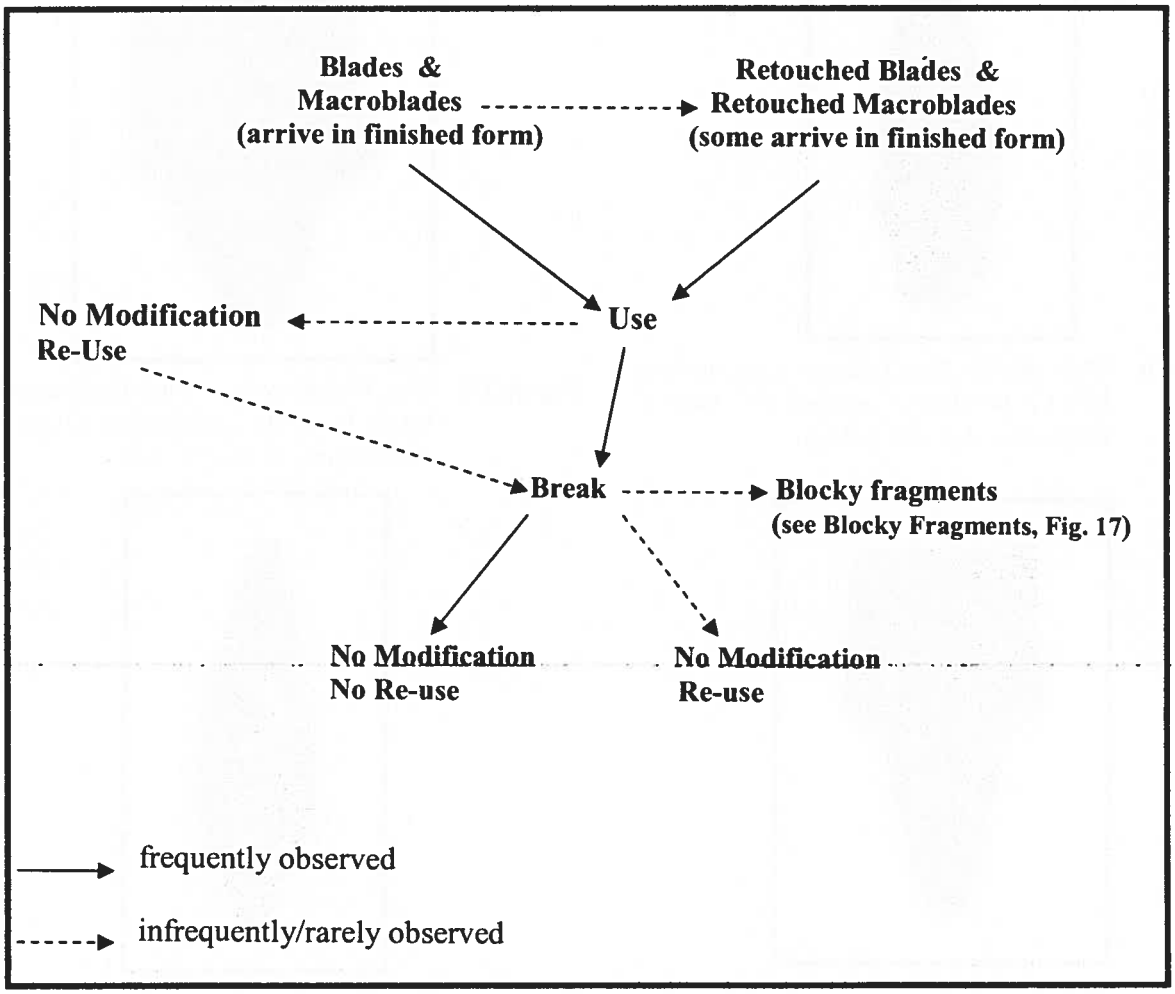

Figure 15. Reduction and use sequence for blades and macroblades at Marco Gonzalez, Ambergris Caye, Belize.

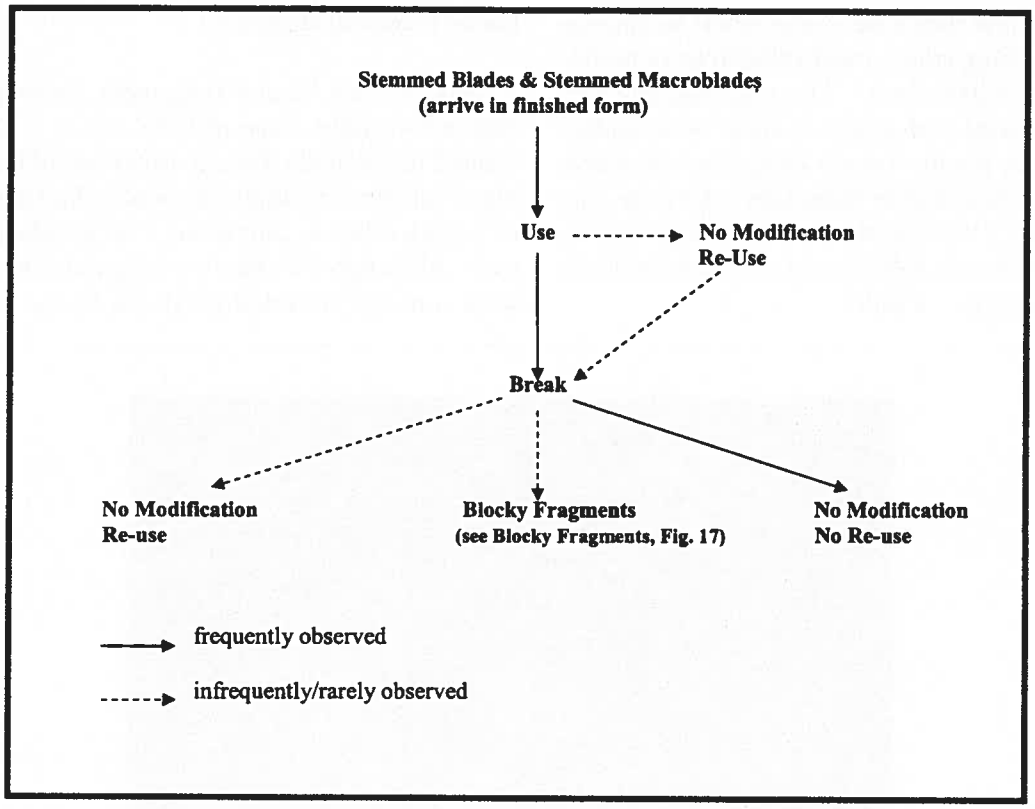

Figure 16. Reduction and use sequence for stemmed blades and stemmed macroblades at Marco Gonzalez, Ambergris Caye, Belize.

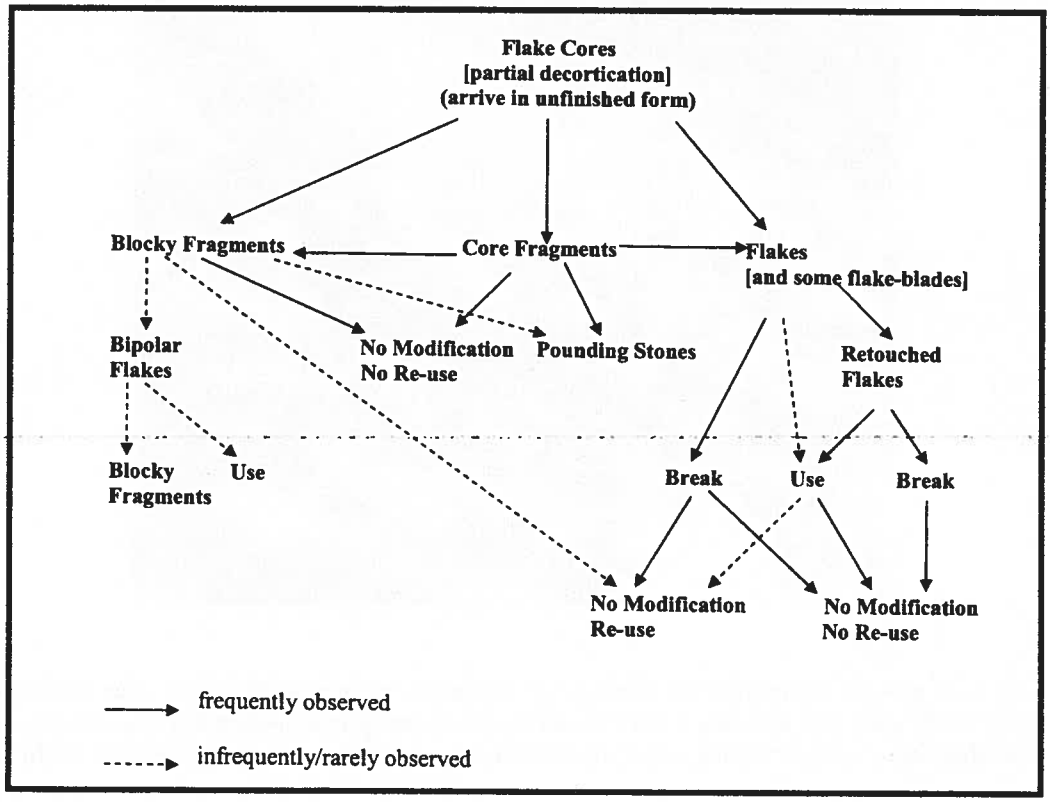

Figure 17. Reduction and use sequence for flake cores at Marco Gonzalez, Ambergris Caye, Belize.

Relatively few flakes were retouched to ameliorate their working edges; most (88.5%) were manufactured from CBZ chert. The edge retouch was typically unifacial and seems to have been undertaken to either create steeper edges for transverse actions or to consolidate flake tool edges for cutting activities. Of those that were retouched, only one tertiary flake was deliberately manufactured into a specific tool type - a drill.

Blocky Fragments (Figure 17)

Most of the blocky fragments recovered from Marco Gonzalez were of CBZ chert. They were created incidentally through processes of formal tool repair and/or recycling, informal reduction of cores to produce flakes, and stone tool breakage during use. Although the blocky fragments themselves were not the intended products in the reduction

Figure 18. This is an example of multiple uses on a single tool edge (200x magnification). The non-cortical flake (MG129/68) possesses use-wear traces of sawing wood (reciprocal longitudinal motion parallel to the tool edge) and planing/whittling wood (unidirectional transverse motion perpendicular to the tool edge).

sequences, they were seen as important sources of stone at certain times. Some of them functioned as usable tools (see below), while a limited number of the larger ones served as small bipolar cores to manufacture more flakes.

THE USE OF STONE TOOLS AT MARCO GONZALEZ: THE MICROWEAR EVIDENCE

In addition to the information acquired through reconstruction of reduction strategies, the ability to determine tool function is important to more accurately piece together the processes of stone tool use, re-use, multiple use, and recycling at Marco Gonzalez. Rather than inferring function on the basis of tool morphology, all 1494 silicate artifacts were examined for traces of edge chipping, striations, and polishes. Tool surfaces and edges were viewed and photographed under both high- and low-power magnification using two binocular microscopes (a Nikon model Y-2 LABOPHOT polarizing microscope and a Leitz-Wetzlar ORTHOPLAN-POL polarizing microscope) with bright-field illumination at 10X - 500X magnification and a Bausch & Lomb stereoscopic microscope with dark-field illumination at 7X - 30X magnification. In order to identify use-wear characteristics on the artifacts, a reference collection of experimental chert tools was produced (Stemp 2001, 2004a).

Based on microwear evidence, 34.8% of all chipped chert and chalcedony artifacts recovered from Marco Gonzalez were used. Both the formal (Table 6) and informal (Table 7) components of the assemblage demonstrate substantial use associated with the completion of numerous tasks. Significantly, 26.8% of the tools with traces of use-related damage possess evidence of multiple uses. The practice of employing tools for more than one task is further evidence for maximizing the use-lives of stone tools in a chert-poor region.

Overall, evidence for re-use and multiple uses is most commonly represented by the presence of two or more used edges or surfaces on a single tool, two or more use-related polishes on a single tool edge or surface (Figure 18), or evidence for secondary/subsequent use on or intersecting an artifact fracture plane and/or exposed ventral surface. Not surprisingly, tools classified as "formal" possessed more evidence for re-use or multiple uses, whereas the informal flakes, cores, and blocky fragments were more often single-use, disposable tools (Table 8). For all tool types, the most common form of multiple use is a single implement with two or more edges that were each used for a single activity (50.4%). Fewer tools possessed secondarily/subsequently used edges (41.1%) or demonstrated multiple uses on a single edge (8.5%).

Large Bifacial Tools (Figure 2)

The two primary uses and re-uses of these tool types were chopping wood and digging/hoeing soil (46.5%). Unlike the use-wear patterns seen at Pulltrouser Swamp (McAnany 1986; see Shafer 1983:242), where oval bifaces in the Late and Terminal Classic were primarily associated with field maintenance activities such as hoeing soil as opposed to field clearance such as chopping wood and digging/hoeing soil (McAnany 1986:199, 216), the oval bifaces and other large celts at Marco Gonzalez possess use-wear damage consistent with both woodwork and contact with soil. However, too few large bifacial tools with use-wear (N=28) were recovered from Marco Gonzalez to establish any reliable association between tool type and activity beyond the observation that oval bifaces, general-utility bifaces and celts were used to perform the same ranges of activity.

There is some use-wear evidence for multiple uses on the large bifaces, but this usually indicates that a single tool was used to both chop or adze wood and dig or hoe sand/soil (7.2%). Based on the coastal environment and soil composition of Ambergris Caye, it has been argued that evidence for digging or hoeing would probably be related to land clearance for village settlement, harbor construction and maintenance, or gardening, as opposed to large-scale agricultural pursuits (Stemp 2001:157-158). The majority of the recycled large biface fragments were used for multiple stone-crushing or pounding activities (17.9%), in addition to infrequent tasks such as scraping bone (3.6%).

Table 6. Nmber of formal tools with use-wear by raw material type at Marco Gonzalez, Ambergris Caye, Belize.

Tool Type	CBZ chert	Other mainland chert	Indeterminate chert	Brown/honey chalcedony	Gray chalcedony	Total
Large bifaces (oval, general-utility, T-form, preforms, miscellaneous, including recycled into hammerstones)						
Number of tools	60	2	0	0	0	62
Number of tools with use-wear	28 (46.7%)	0	0	0	0	28 (45.2%)
Lenticular bifaces						
Number of tools	8	0	4	0	0	12
Number of tools with use-wear	4 (50%)	0	0	0	0	4 (33.3%)
Thick and thin bifaces (simple, side -notched, stemmed, shouldered, bipointed, miscellaneous)						
Number of tools	37	5	9	1	0	52
Number of tools with use-wear	14 (37.8%)	2 (40%)	1 (11.1%)	0	0	17 (32.7%)
Retouched and unretouched blades and macroblades						
Number of tools	26	2	5	0	0	33
Number of tools with use-wear	14 (53.8%)	1 (50%)	0	0	0	15 (45.5%)
Stemmed of blades and macroblades						
Number of tools	15	0	0	0	0	15
Number of tools with use-wear	8 (53.3%)	0	0	0	0	8 (53.3%)
Biface edge fragments (oval, general-utility, celts)						
Number of tools	23	1	2	0	0	26
Number of tools with use-wear	16 (69.6%)	1 (100%)	0	0	0	17 (65.4%)
Scrapers						
Number of tools	4	0	0	0	0	4
Number of tools with use-wear	4 (100%)	0	0	0	0	4 (100%)
Special finds (bifaces)						
Number of tools	2	0	0	0	0	2
Number of tools with use-wear	0	0	0	0	0	0

Table 7. Number of informal tools with use-wear by raw material type at Marco Gonzalez, Ambergris Caye, Belize.

Tool Type	CBZ chert	Other mainland chert	Indeterminate chert	Brown/honey chalcedony	Gray chalcedony	Total
Bifacial thinning and repair flakes						
Number of tools	151	7	6	4	1	169
Number of tools with use-wear	93(61.6%)	4(57.1%)	3 (50%)	1 (25%)	1 (100%)	102 (60.4%)
Simple, retouched and unretouched flakes						
Number of tools	701	105	48	7	78	68
Number of tools with use-wear	281 (40.1%)	14 (13.3%)	7 (14.6%)	0	1 (14.3%)	303 (34.9%)
Drills on flakes						
Number of tools	1	0	0	0	0	1
Number of tools with use-wear	1 (100%)	0	0	0	0	1 (100%)
Macroflakes						
Number of tools	0	1	0	0	0	1
Number of tools with use-wear	0	0	0	0	0	0
Multidirectional and pyramidal flake cores and fragments (including those recycled into hammerstones)						
Number of tools	17	1	0	0	0	18
Number of tools with use-wear	8 (47.1%)	1 (100%)	0	0	0	9 (50%)
Blocky fragments (including those recycled into hammerstones)						
Number of tools	163	23	27	0	1	214
Number of tools with use-wear	18 (11%)	0	1 (3.7%)	0	0	19 (8.9%)
Potlids and burnt fragments						
Number of tools	11	0	6	0	0	17
Number of tools with use-wear	0	0	0	0	0	0

Table 8. Number of used tools by multiple use categories at Marco Gonzalez, Ambergris Caye, Belize

Tool Type	Number of Used Tools	Number of Used Tools by Multiple Category[1]		
		Two or more used edges/surfaces	Two or more uses on a single edge/surface[2]	Secondary/subsequent uses[3]
Large bifaces	28	6 (21.4%)	1 (4.2%)	1 (4.2%)
Lenticular bifaces	4	2 (50%)	0	0
Thick and thin bifaces	17	4 (23.5%)	0	2 (11.8%)
Retouched and unretouhced blades and macroblades	15	2 (13.3%)	0	1? (7.7%)
Stemmed blades and macroblades	8	2 (25%)	0	0
Scrapers	4	0	0	0
Drills on flakes	1	0	0	0
Bifacial thinning and repair flakes	102	23 (22.5%)	4 (3.9%)	48 (47.1%)
Biface edge fragments	17	6 (35.5%)	3 (17.6%)	6 (35.3%)
Simple retouched and unretouched flakes	303	17(5.6%)	4 (1.3%)	0
Multidirectional and pyramidal flake cores and core fragments	9	4 (4.44%)	0	0
Blocky fragments	19	5 (26.3%)	0	0

[1] The multiple use data do not include evidence of haft polish

[2] Denotes the presence of use-wear evidence for at least two different motions and/or contact materials on a single edge or surface of a tool.

[3] Denotes the presence of use-wear evidence of a secondary or subsequent use event based on the location of the use-wear (i.e., on or intersecting an artifact fracture plane and/or exposed ventral surface following tool breakage or reduction through flaking, such as that produced on the interior surface of a bifacial thinning flake).

Bifacial Thinning Flakes and Biface Edge Fragments (Figure 2)

The substantial reliance on large bifaces and the by-products of biface reduction can be demonstrated by the fact that 102 (60.4%) bifacial thinning flakes and flake fragments from Marco Gonzalez possess edge chipping, striations, or polishes indicative of use. Moreover, many of the edge fragments from large tools possess evidence of substantial use. Of the 102 bifacial thinning flakes and fragments, 37 had use-wear on their dorsal surfaces and/or proximal edges consistent with activities such as digging/hoeing sand or soil (18.6%) and chopping/adzing wood (17.7%) prior to their detachment from large bifaces. The biface edge fragments possessed similar use-wear evidence, including wood polish associated with chopping and adzing (58.8%) and heavily striated sand/soil polish associated with digging and hoeing (29.4%). This is considered reliable supporting evidence for recycling or repair of bifaces rather than tool production at this site (*cf.* Shafer 1983).

Based on use-wear evidence, the bifacial thinning flakes and edge fragments were also employed for a large variety of activities, ranging from cutting soft materials like meat, fresh hide and plants (24.5%) to whittling or scraping antler, bone, and wood (14.3%). Bifacial thinning flakes and biface edge fragments were used in a variety of situations if their form was amenable to the required task. Much of this activity occurred as secondary uses after the flakes were removed from their parent bifaces. Frequently, the use-wear traces on these artifacts are found on ven-

tral surfaces or fracture planes that were exposed only after a biface resharpening or repair event. It is believed that subsequent edge use on bifacial thinning flakes and biface edge fragments suggests curation of these *ad hoc* tools.

Lenticular Bifaces (Figure 5)

The four lenticular bifaces with use-wear traces at Marco Gonzalez show a limited number of different uses: cutting/slicing and sawing. There was little sign of multiple use or re-use beyond two used edges on a single tool. Most lenticular bifaces were used to complete an initial task and were then discarded. These tools were not recycled into other forms and tool fragments were not used for other activities.

Small Thick and Thin Bifaces (Figure 6)

A small number of these bifaces were re-used for other tasks without being modified, while some modification of tool fragments occurred prior to their uses for additional activities. Although only a third of these tools possess some use-chipping, striations, and polish, a fairly wide range of activities was performed. Tools were mostly used for cutting and slicing soft materials like meat (17.6%), scraping or whittling wood (11.8%), and piercing meat and bone (17.6%). Based on micropolishes or residual hafting resin or mastic, many seem to have been hafted (35.3%). Evidence of actions is found on some tools identified as projectiles based on the observation of some "spin-off" flake removals on their tips. Aside from what may be considered their primary uses, there are only two obvious examples of secondary or subsequent use of biface fragments based on the locations of use-wear. Whole tools and tool fragments were not curated to any significant degree, as most were discarded without any evidence of further use.

Retouched and Unretouched Blades and Macroblades (Figure 15)

Just under half of these tools were used for a variety of activities, predominantly scraping (33.3%), cutting/slicing (33.3%), and sawing (20%) of various contact materials, with very little evidence for re-use. After tools were acquired and used for the completion of tasks, there is no technological evidence that they were modified for re-use after breakage, although re-use without modification has been documented in at least one instance.

Stemmed Blades and Macroblades (Figure 16)

Based on the limited amount of use-wear evidence on the fifteen stemmed blades and stemmed macroblades recovered, these tools were regularly hafted implements (62.5%) that were almost exclusively used for scraping (12.5%) and cutting or slicing (37.5%) activities. Because few of them possess well-developed use-wear traces, it is difficult to reliably determine their range of functions. None of them demonstrates evidence for multiple uses on a single edge. Based on the use-wear evidence and the lack of substantial edge retouch and further reduction, there is no pattern of their re-use. They were not modified for completion of additional tasks.

Simple, Retouched and Unretouched Flakes (Figure 17)

The fact that roughly 35% of all unretouched flakes recovered during excavations possess some evidence of use underscores the importance of all available stone tools for the completion of tasks at this site. A wide range of activities was performed with unretouched flakes, including cutting/slicing bone, meat, dry and fresh hides, plants, and wood; sawing bone, ceramics, shell, stone, and wood; scraping/planing/whittling bone, hides, and wood; notching ceramics and shell; chopping/adzing wood; and digging in sand and soil. The majority of unretouched flakes were used for a single activity or for one use-event (93.5%), with few possessing use-wear evidence on more than one surface. Only four flakes retain polish indicative of multiple uses on a single surface or edge. Based on their simple design and ease of manufacture, flakes were mostly disposable *ad hoc* tools in the lithic inventory of Marco Gonzalez.

Nevertheless, a small quantity of primarily CBZ chert flakes were deliberately modified to render them more amenable to specific tasks. Of those flakes, just under two-thirds were used to perform some activity. Most activities involved the cutting/

slicing of meat, hide and bone (23.8%) and the scraping or whittling of hard contact materials (42.9%). Their edge angles were correlated with their functions: the flakes with steeper-angled edges were scrapers, whereas the acute-angled flakes were knives. There is little evidence to suggest that these tools were regularly used for more than one activity or were curated for use at a later time; but some tools have multiple used edges or surfaces (19%).

Flake Cores (Figure 17)

The use-wear evidence preserved on the multidirectional and pyramidal flake cores from Marco Gonzalez indicates that this informal component was also relied upon for the completion of tasks on the caye. Half of the small number of cores and core fragments posses traces of use. They were used expediently for a number of single-use activities, the pounding or crushing of stone (i.e., hammerstones) being their main functions. The hammerstones, with their many used edges and surfaces, are the only core fragments that possess evidence of multiple tool use.

Blocky Fragments (Figure 17)

Testaments to the reliance on all available stone for the completion of tasks on the southern end of Ambergris Caye are the several blocky fragments employed as expedient tools. Although only 8.9% retain evidence of use, the fact that any of these fragments were used at all, rather than simply discarded, is important. Most of them (73.7%) were single-use implements. The use-wear evidence on variously shaped of the individual fragments suggest that they were used for a variety of single tasks, including cutting/slicing, plants, hide and bone (26.3%); scraping dry hide, wood, and bone (15.9%); sawing/shaping stone (10.5%); digging in sand/soil (5.3%).; chopping wood (5.3%); notching shell (5.3%); and scaling fish (5.3%), with a concentration on use as hammerstones (26.3%).

DISCUSSION

The majority of formal tools from Marco Gonzalez was acquired from Colha and other workshops in Northern Belize, with additional procurement of stone for the production of simple flakes from non-standardized cores from the CBZ and other mainland locations. The number and limited variety of formal tool types excavated from this site are indicative of a generalized tool inventory that permitted the effective completion of a range of diverse tasks that met the local needs of a relatively small coastal population. Moreover, both the lack of large numbers of task-specific tools, such as scrapers or drills, and the use-wear observed on the artifacts indicate that the Maya were not engaged in specialized production, such as hide processing or bead manufacture.

The chert and chalcedony assemblage at Marco Gonzalez was treated as a curated technology with the purpose of extending tool use-life and conserving precious raw material. The heavy use, reuse, and recycling of large bifacial tools and the more moderate curation of other tool forms, such as smaller bifaces and some blades, demonstrate that raw material scarcity based on the geology of the caye created a need to maximize output from formal tools and debitage (see Bamforth 1986:48). The informal lithic artifacts, mostly flakes, bifacial thinning flakes, flake cores, and blocky fragments, possess little evidence of edge retouch or deliberate shaping to create more specialized tools; however, they played an important role as expedient technology in the adaptation of the Marco Gonzalez Maya to their coastal environment.

CONCLUSIONS

Based on the analysis of the chipped chert and chalcedony artifacts from Marco Gonzalez, it appears that the coastal Maya were dependent on tools acquired from the mainland. With no ready sources of appropriate material for tool production, they developed a combination of technological strategies to extend the use-life of this precious commodity. These strategies were based on extreme large biface use, the use of large bifaces as flake cores, moderate conservation of other formal tool types (small bifaces, blades, and macroblades), and simple core reduction to produce informal flakes

The re-use and multiple uses of formal and informal tools provided the Maya with appropriate

means to respond to their subsistence and economic needs. How access to, and use of, other tool materials, such as obsidian, wood, bone, or shell, affected decisions governing the procurement and use of silicates at Marco Gonzalez is not fully known. This information, when available, will undoubtedly assist in a more complete understanding of curated tools in the daily lives of the coastal Maya.

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