Cohesion and Diversity in Formative Period Maya Lithic Tools and Techniques

A View from San Estevan, Belize

Elizabeth H. Paris

Abstract

This article discusses a Formative period lithic assemblage from the site of San Estevan, in order to highlight the complex regional interaction between Middle Formative period sites in Northern Belize. These relationships have been discussed in the literature through debate over the "Producer-Consumer Model." The San Estevan assemblage reflects activities associated with the local production and consumption of lithic tools, including the testing of raw nodules of chert and chalcedony, tool manufacture, use, resharpening, recycling and discard of exhausted tools. Many of the lithic tools at San Estevan exhibit similar forms and production techniques to tools found in contemporaneous deposits at Colha, Cuello, Cerros, Kichpanha, K'axob and Pulltrouser Swamp. This suggests the existence of fluid, dynamic intercommunity relationships and exchange networks between sites in Northern Belize during the Middle Formative period, in which regional tool types and manufacturing techniques were adapted by local producers to suit the demands of local households.

THE MIDDLE FORMATIVE PERIOD (900–300 BC) was a time of great change in the Maya area of Northern Belize, as it was for many regions of Mesoamerica. It is during this period that we see the first settled villages: specialized workshop communities like Colha, emerging monumental centers such as San Estevan, Lamanai, and Cuello, and smaller agricultural communities such as K'axob and its neighbors at Pulltrouser Swamp (Hammond 1991; McAnany 2004; Potter 2001; Rosenswig and Kennett 2008). It is also during this period that we see the emergence of a distinctive regionalization in lithic styles and technology (Potter 1991:28) with diagnostic tool types and techniques centered around blade, biface, and trimmed flake/uniface subassemblages, which are markedly different from those at other notable Middle Formative Maya sites such as Tikal in the Peten, Barton Ramie in the Belize Valley, or Altar de Sacrificios in the Rio Pasión area (Moholy-Nagy 1976, 1991; Willey 1972; Willey et al. 1965). This particular combination of formal, diagnostic tool types and techniques, which was first recognized in Middle Formative period components at Colha (Potter 1982, 1991), has been termed the Colha Lithic Tradition by Potter (1991:28). In the Middle Formative period, sites with lithic assemblages resembling those of Colha include San

Estevan, K'axob/Pulltrouser Swamp (McAnany 2004; Shafer 1983a), and Cuello (McSwain 1991a, b). Further to the north, Cerros and Santa Rita Cozumel have small Middle Formative period occupations, but investigations of lithic assemblages at these sites have focused on tools and debitage from the larger Late Formative period (300 BC–AD 300) occupations. At Colha, Middle Formative period assemblages are strongly similar to their Late Formative period counterparts, including similar blade and biface forms, single facet adze forms, celts, and macroblade/macroflake blank technology. These tools and techniques are found in Late Formative and Classic period (AD 300–800) components throughout Northern Belize, from Santa Rita Cozumel in the north (Dockall and Shafer 1993), to Moho Cay and San Jose in the south (McAnany 1989). The increase in the number of investigated sites with Colha Lithic Tradition assemblages appears to be concurrent with the shift in lithic production at Colha from small-scale, low-intensity production in the Middle Formative to the large-scale, standardized and high-intensity workshop production that emerged at this site during the Late Formative and Classic periods (Roemer 1991; Shafer 1991; Shafer and Hester 1983, 1986). This suggests that as early as the Middle Formative period, Colha was part of a complex network of interaction with other sites in the region, which may have formed a precedent for intensified production and consumption throughout Northern Belize in later periods. The nature of these interactions, as reflected in the tool forms, technologies, and raw materials used at these sites, is the subject of this paper.

New data on lithic tools and debitage from the site of San Estevan provide an opportunity to understand the complex regional interaction in Middle Formative period Belize, and its relationship to Formative and Classic period economic relationships. These relationships have been discussed in the literature through debate over the "Producer-Consumer Model" (McAnany 1986, 1989, 1991; McSwain 1991b; Shafer 1983a; Speal 2006), which forms the subject of many papers in this section. Middle Formative period traditions can potentially be seen as the precursors of these later exchange relationships, and help us to understand how they developed. The examination of lithic traditions at Middle Formative period San Estevan, presented below, suggests that the site represents a primary production locale where lithic producers relied mainly on local raw materials, while using a suite of tool types and techniques that were imitated, replicated, and exchanged between Middle Formative period sites in Northern Belize.

LITHIC PRODUCERS AND CONSUMERS IN NORTHERN BELIZE

A Theoretical Overview

Focusing on the relationships between producers and consumers is one perspective for understanding the networks of economic interaction within and between individuals, communities and regions. Craftspersons could potentially manufacture products for a variety of consumption spheres within their own houselots, for individual patrons, for personal gifting, as part of tribute obligations, and for commercial exchange or barter at the local, regional or interregional scale (Brumfiel 1991; Clark and Houston 1998; Clark and Parry 1990; Costin 1998; Feinman and Nicholas 2004; Hendon 1996; Stein 1996; Wright 1998). Craftspersons can possess a relatively high degree of autonomy over the terms under which they create and exchange products with consumers or intermediaries, commonly referred to as "independent specialization," while the intervention of elites or other individuals in the production or exchange of these products is referred to as "attached specialization" (Costin 1998:1; Clark 1996; Clark and Parry 1990; King and Potter 1994; McAnany 1995; Shafer and Hester 1983, 1986, 1991). Production processes could also be segmented, in which individuals of varying degrees of skill or social status, or in varying locations, completed different production tasks. In the production of prestige or luxury items, different segments were often carried out by individuals of varying social status (Berdan et al. 2003:99), while production stages for utilitarian goods were often segmented with no evidence of centralized political control (King and Potter 1994; Masson 2001; Rice 1987).

In Northern Belize, most studies of the interactions between producers and consumers of chipped stone tools are a response to what has been called the "Producer-Consumer" model (McAnany 1989, 1991). This model has its origins in the publications resulting from fieldwork at Colha, one of the most extensive lithic workshop deposits ever encountered in Mesoamerica (Shafer and Hester 1983, 1986, 1991), and focuses specifically on the economic relationships between Colha and other sites in the Maya Lowlands, particularly Northern Belize, with regards to lithic tools (Hester and Shafer 1994). Situated adjacent to large deposits of fine-grained, high-quality chert, Late Formative and Classic period components at the site of Colha contained convincing evidence of large-scale workshop deposits, including formal tools with highly standardized forms and production techniques, such as large oval biface celts, tranchet bit tools, stemmed and unstemmed macroblades, and elaborate, complex chert eccentrics which revealed a high level of skill and craftsmanship (Hester and Shafer 1994; Shafer 1983a, 1983b, 1991; Shafer and Hester 1983, 1986, 1991). Shafer and Hester (1983:540) argued that Colha "served as the major center for the production and exchange of chert tools in the Late [Formative] period" and that "contemporary settlements beyond the chert-bearing zone of Colha were the primary recipients of these craft items." They further argue that the lithic producers at Colha were independent specialists, whose products were distributed to two different types of consumer sites: primary consumers, who imported utilitarian lithic tools from Colha through "petty traders" operating within regional communities; and peripheral consumers, who imported eccentrics and stemmed macroblades for ritual and/or symbolic use in elite tombs and caches via "professional traders" or merchants (Hester and Shafer 1994:52; see also Gibson 1989:133; McAnany 1986:269).

Consumer sites identified as recipients of exported Colha lithics (Gibson 1986:191; Hester and Shafer 1994:55; McAnany 1989: Figure 3) include Ambergris Caye, Cuello, El Pozito, Kichpanha, Kohunlich, Laguna de On, Moho Cay, Nohmul, Northern River Lagoon, Pulltrouser Swamp, San Estevan, San Lorenzo and Sarteneja (Figure 1). An additional list of probable consumer sites included Aventura, Chowacol, El Posito, Hick's Cay, Lamanai, Louisville, San Antonio, Yo Creek and Yakalche. Minor production centers were identified at the sites of Altun Ha, Chicawate and Kunachmul (McAnany 1989: Figure 3; see also Kelly 1980; Taylor 1980). Peripheral consumers in the "extended supply zone" (McAnany 1989:Figure 3) in west and central Belize and the Peten, included Barton Ramie, El Mirador, Macanche Island, Pacbitun, Tikal, San Jose and Yaxox, which imported predominantly ritual/symbolic items such as stemmed macroblades and eccentrics (Hester and Shafer 1994; Moholy-Nagy 1991).

Colha was engaged in the specialized production of lithic tools at a large scale, as indicated by the large, dense workshop deposits associated with many of the individual platforms and *aguada* groups (Roemer 1984; Shafer and Hester 1983, 1986, 1991; King 2000, see King, this issue) at the site. Deposits were very dense, with an estimated 960,000 g of debitage per cubic meter (Shafer and Hester 1986), and also included manufacturing failures, blanks, and cores, as well as distinctive debitage such as tranchet flakes and bifacial thinning flakes (Masson 2001, Shafer 1983b). The majority of Colha workshop debris represents the final stage of production, identified by a predominance of bifacial thinning flakes, lack of chunky core shaping and preform manufacturing debris, and low percentages of cortical flakes. Originally, Shafer and Hester (1983) hypothesized that the majority of primary production took place at unspecified quarry locations. However, Masson's (2001) analysis of debitage from five Late-Terminal Classic workshop deposits at Colha suggests that primary production of chert nodules took place at procurement sites and quarries located near aguada group workshops; blanks manufactured in these loci were transported to work areas at individual residence talus workshops where they were crafted into finished tools (Masson 2001:38).

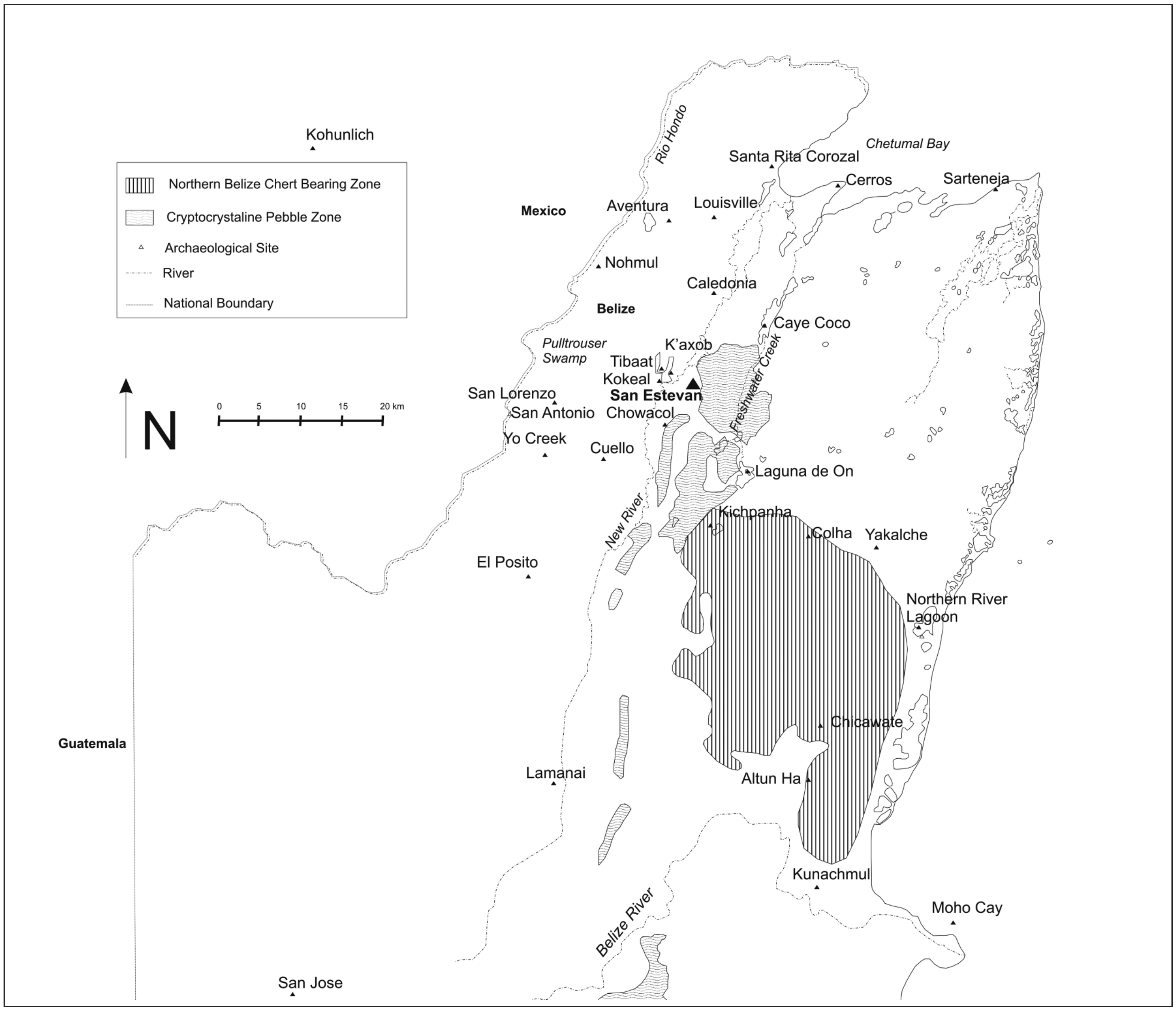

Figure 1. Map of northern Belize, showing the Northern Belize Chert-Bearing Zone, the Cryptocrystalline Pebble Zone, and sites mentioned in the text (illustrated by the author after Dockall and Sharer 1993:Figure 1; McAnany 1989:Figure 1; Rosenswig 2004:Figure 1).

Two major varieties of raw material form an important part of these models. Fine-grained chert from the chert-bearing soils at Colha and its surrounding area (commonly referred to as Colha Chert, Northern Belize Chert, and Northern Belize Chert-Bearing Zone Chert) (Hester and Shafer 1984, 1994; Tobey et al. 1994) appears in a variety of colors including gray, brown, honey and yellow, and often appears in banded and mottled combinations of the above colors. Chalcedony, generally a more translucent and slightly less fine-grained material, occurs in a zone to the north and west of the high-quality chert-bearing zone, often referred to as the "Cryptocrystalline Pebble Zone" (McAnany 1989; Oland 1998, 1999). Raw material colors include translucent, milky, and opaque whites, tan, translucent brown, and light gray, and can be distinguished from Northern Belize Chert visually and chemically (Tobey 1986). Nodules of medium-grained chert, and coarse-grained chert, quartz-chalcedony blends, and quartz-chert blends are also hypothesized to come from this zone (McAnany 1989; Oland 1998, 1999). It should be noted that there is some overlap between these two zones, with chalcedonies and medium-to-coarse grained cherts also found in low quantities in the Colha area (Tobey et. al 1994). Additionally, the texture of chert is internally variable within large nodules, with the finest material closest to the cortex layer, and the coarsest material at the center of the nodule (Hester and Shafer 1994:52).

Numerous projects have tested these models through the lithic assemblages of sites throughout Northern Belize, from a wide range of time periods spanning the Archaic period to the Late Postclassic period. Through the painstaking work of the members of the Colha Project, the lithic tool types, debitage types, raw material characteristics, knapping techniques, and socio-economic organization were carefully documented and rigorously analyzed, making inter-site comparisons possible, and exploring various combinations of Costin's (1998) six components of craft production. As a result, most lithic analysis projects in Northern Belize tend to define themselves in terms of their relationship with Colha. Inevitably, the results of these comparisons were highly varied, and served to expand on and/or redefine Shafer and Hester's (1983) original assertion of a Colha-centered exchange system.

Several common themes emerge from the responses to the Producer-Consumer model. Firstly, at most sites, Northern Belize Chert is present in the form of both tools and debitage. There is considerable variation between sites and through time within the region, in terms of the proportion of the assemblage Northern Belize Chert constitutes, and whether evidence for early-stage reduction is present (Speal 2006, 2008). This suggests that the intensity of the economic relationships between these sites and Colha was variable throughout space and time, and cannot be reduced to a simple function of distance of a site from Colha (Speal 2006). Secondly, informal tools are common at most sites in Northern Belize; the analyses differ in their treatment of informal tools in several ways. These include the degree of importance they place on these tools within the assemblage, and to which the informal tools themselves are documented and analyzed. They also differ in how they determine the degree of economic dependence/independence of a particular site with respect to Colha. Third, direct comparisons of tools and debitage can be particularly informative in indicating where and how sites obtained raw materials for formal and informal tools, particularly the relative proportions of tools vs. debitage made out of Northern Belize Chert, chalcedony, and other raw materials (Dockall and Shafer 1993:167).

Data from some "consumer" sites, particularly those dating to the Late Formative and Late Classic periods, have supported and expanded upon the notion that many sites in Northern Belize were heavily dependent on Colha for formal lithic tools. Mitchum's (1991, 1994) analysis of the Late Formative tools at Cerros, located 60 km north of Colha, suggests that Cerros residents imported formal tools from Colha, but also re-sharpened and reworked these primary tools, and imported nodules and large cortical flakes for local, on-site production (Mitchum 1991). Many of the other tools at the site were informal or expedient flake tools thought to have been produced from recycled formal tools and small resharpening flakes (Mitchum 1994:49). Still others were secondary tools, which were recycled through intentional reworking (Mitchum 1994:52). Analyses of lithic tools from the site of El Pozito located just over 30 km to the west of Colha (Hester et al. 1991) are likely the product of the Colha production system, with 82 percent made of Northern Belize Chert, 13 percent of local chalcedony, and five percent from chert sources from Northern Belize. Most formal tools were made of Northern Belize Chert, with only a few made from chalcedony, although the later material was abundant at the site and in the surrounding area. Most formal tools strongly resemble forms found at Colha, with the exception of stemmed bifaces. A wide range of expedient tools were also found at the site, predominantly made from local chalcedonies.

Analyses of lithic tools (Shafer 1983a) and debitage (McAnany 1986, 1989) at sites within Pulltrouser Swamp, in the low-lying wetlands of Northern Belize, suggest these communities had close economic relationships with Colha, importing and resharpening the majority of their formal tools from that site, while also manufacturing expedient tools from locally available chalcedony. Shafer's (1983a) analysis of the lithic tools from several raised field sites and residential units fringing Pulltrouser Swamp, including Kokeal (see Shafer 1983a: Table 12; Turner 1983: Figure 4.4), suggests the presence of numerous formal tools such as oval bifaces, tranchet tools, and macroblades; these tools had forms similar to those from Colha, and were made from Northern Belize Chert, suggesting that they were imported as finished tools from Colha itself. Shafer (1983a) also recognized recycling patterns of formal Colha bifaces, and noted the presence of several types of informal tools that were most often made from chalcedony. These assertions are heavily supported by McAnany's (1989) analysis of tools and debitage from Late to Terminal Classic period deposits at the communities of K'axob, Tibaat, Chi Ak'al, Pech Titon, Kokeal, and Yo Tumben. Formal tools were produced mainly from Northern Belize Chert (94.4 percent; McAnany 1989: Table 1), while debitage flakes are also mainly Northern Belize Chert (75.7 percent; McAnany 1989: Table 2). She argues that if sites were procuring their own raw material, both late-stage production debris and refurbishing debris should be present, whereas if tools were procured in finished form, production debris should be generated and discarded elsewhere. Cortical flakes were interpreted as early-stage production debris, while non-cortical flakes were interpreted as late-stage production or refurbishing flakes. She found that at Pulltrouser Swamp, 94 percent of the Northern Belize Chert flakes were non-cortical, but only 58 percent of the chalcedony flakes were non-cortical (McAnany 1989: Table 4). Conversely, 11 percent of the chalcedony flakes, but only one percent of the chert flakes retain over 50 percent cortex (McAnany 1989: Table 4). Combined with other variables such as edge damage, use-wear and platform characteristics, McAnany concludes that during the Late and Terminal Classic periods, the residents of Pulltrouser Swamp were importing formal tools made from Northern Belize Chert from the site of Colha itself, and that the chert debitage flakes resulted from resharpening and recycling practices. In contrast, informal tools were manufactured on-site from locally obtained chalcedony nodules.

Further research by McAnany and colleagues at K'axob, an agricultural village located at the edge of Pulltrouser Swamp, reinforced these patterns. McAnany and Peterson (2004:294) argue that although Northern Belize Chert tools and debitage dominate the formal tool assemblage, the majority of production debris is made from chalcedony, which was obtained locally as nodules and processed on-site. In contrast, Northern Belize Chert underwent prior processing before additional modification was performed at K'axob itself. Debitage characteristics fit this pattern; chalcedony flakes were longer, wider, and nearly twice as thick as Northern Belize Chert flakes, with a greater proportion of cortical flakes in the sample (35 percent for chalcedony, 10 percent for Northern Belize Chert), a lower average of dorsal flake scars, a lower percentage of bifacial platforms and a greater instance of single-facet platforms (McAnany and Peterson 2004:295). However, Northern Belize Chert was likely the preferred raw material at K'axob; 56.3 percent of all chipped stone artifacts were made from Northern Belize Chert, while 17.4 percent were made from local chalcedony, 8.7 were made from other chert sources, and 17.2 percent were of unknown raw material due to thermal alteration or patination (McAnany and Peterson 2004:281). More significantly, the majority (80.8 percent) of tools (including preforms and recycled tools) were made from Northern Belize Chert. This pattern was not stable, but changed through time; during the Middle Formative and Late Formative periods, there were relatively lower proportions of Northern Belize Chert in use at K'axob relative to chalcedony and other types of chert (McAnany and Peterson 2004:299). Around 200 BC, a shift began in acquisition patterns, after which Northern Belize Chert dominated the assemblage, and other raw materials became relatively less accessible.

Data from Santa Rita Corozal also suggests a high degree of interaction with Colha during the Late Formative period (Dockall and Shafer 1993). Formal tools such as oval bifaces, stemmed macroblades and tranchet-bit tools formed a large portion of the assemblage, in similar styles and using similar techniques to those from Colha. Dense deposits of debitage were recovered from the site, of which 74.8 percent of the sample was chert, while only 25.2 percent of the sample was chalcedony, despite local availability of chalcedony nodules at Santa Rita (Dockall and Shafer 1993:170). Tools may have also been imported into Santa Rita in finished form, perhaps from Colha itself. Non-cortical flakes constituted 71.7 percent of the chert debitage sample and 90 percent of the chalcedony debitage sample at Santa Rita, and the site lacks aborted preforms and bifaces broken in various stages due to manufacturing errors (Dockall and Shafer 1993:168). No polyhedral blade cores, plunging blades, or core rejuvenation flakes were present in the debitage assemblage, suggesting an absence of blade or macroblade production (Dockall and Shafer 1993:168). However, local production of expedient tools was also present as indicated by chert flake cores made from recycled oval bifaces and biface fragments, and small flake cores made from locally available chalcedony nodules (Dockall and Shafer 1993:170–172). Some chalcedony cores were used for the removal of burin spalls, with no use wear indicating use of the core itself as a burin tool (Dockall and Shafer 1993:171). A high level of local consumption of these tools was indicated by fractured and exhausted bifaces, while use-wear patterns and analysis of tool forms indicate that formal tools were often recycled, suggesting the perceived high value of chert as a raw material (Dockall and Shafer 1993:172).

The sites of Chac Balam, Ek Luum and San Juan on Ambergris Caye (Guderjan and Garber 1995) have lithic assemblages that suggest similar lithic tool exchange patterns with Colha to those at Cerros, Santa Rita Corozal, and Pulltrouser Swamp (Hult and Hester 1995:139). Lithic assemblage contexts at these sites date from the Late Classic period to the Middle Postclassic period (Hult and Hester 1995:139). Nearly 87 percent of the tools in the assemblage resembled Colha tool types from these periods, and were made from raw material with the fine-grained texture and color range of Northern Belize Chert (Hult and Hester 1995:159). Other tools were made from chalcedony. Sites contain both utilitarian goods, such as large oval bifaces, general utility bifaces, thin bifaces, and blades, and ritual status goods, such as stemmed macroblades eccentrics, some of which are found in burials at Chac Balam (Hult and Hester 1995:159). Local production focused on resharpening and recycling imported tools: cores (N=2) and hammerstones (N=11) formed a small proportion of the total lithic assemblage (N=1,005), and the polish, use wear, and multiple facets on 11.8 percent of debitage flake platforms identified them as the product of resharpening used tools (Hult and Hester 1995:157–159). Proportions of cortical flakes were low (14 percent) for Northern Belize Chert, but high for chalcedony (87 percent), which formed a small part of the flake assemblage (7 percent).

Analyses of materials from some other sites in Northern Belize contradict the claim for Colha's central economic role, often through an increased emphasis on the importance of expedient and recycled tools, and assemblages in which local chalcedonies play a greater role in the formal tool assemblage. In Late Formative period deposits at Cuello, located 30 km northwest of Colha, McSwain (1991a, b) found that three standardized tool types, the large oval biface, the stemmed macroblade, and the tranchet-bit tool, were imported from Colha as finished tools, in addition to relatively unfinished raw material such as tool blanks. In contrast, Middle Formative deposits contained only one stemmed macroblade, made from materials other than Northern Belize Chert (McSwain 1991b:343). Of the 2,194 flakes examined by McSwain, only 603, or 27.5 percent were of Northern Belize Chert, while most flakes in the assemblage were produced from locally available chalcedony (McSwain 1991b:343). Flakes made of Northern Belize Chert were generally shorter, narrower, and thinner than flakes of other raw material types, and were generally interior flakes with little cortex on the dorsal surface. Additionally, the percentage of tools made from Northern Belize Chert in the assemblages increases over time, from 36 percent and 25 percent in the Early Middle Formative and Late Middle Formative periods, to 49 percent in the Late Formative period. She suggests that Northern Belize Chert could have arrived at Cuello, and also at "consumer" sites such as Pulltrouser Swamp and Cerros, through mechanisms other than the importation of finished formal tools; and that similarity in tool form "could equally result from local imitation stimulated by stylistic criteria or (perhaps more likely) by similarity of local needs for specific tool forms" (McSwain 1991b:346).

Evidence from the lithic assemblage at the site of Saktunha (Speal 2005, 2006), located on one of the small off-shore islands along the coastal lagoons of Northern Belize, also suggests the practice of a wider variety of lithic production and consumption strategies than predicted by the Producer-Consumer model. Speal (2006) suggests that the residents of Saktunha, which was occupied during the Late and Terminal Classic periods, locally produced the majority of lithic tools used in household contexts. The majority (70 percent) of the lithic assemblage consisted of Northern Belize Chert, while 12 percent consisted of Northern Belize chalcedonies, or some other source, and 18 percent was from unknown sources (Speal 2006:13). Early-stage reduction debris made of Northern Belize chert suggests that locals imported Northern Belize chert cobble cores to produce many of these tools, while others were imported in finished form. The residents of Saktunha also frequently re-sharpened imported bifacial celts using a distinctive alternating bevel technique. The high proportion of bifacial thinning flakes in the Saktunha assemblage (14 percent of all diagnostic debitage) suggests that some of the bifacial celts were locally manufactured, rather importing finished, formal bifacial celts from Colha. It is noteworthy that the majority of contexts at Saktunha date to the Terminal Classic period, during which production and exchange patterns at Colha underwent a significant shift, and focused on the surplus production of blades for export (Hester and Shafer 1994; Masson 2001; Roemer 1984).

The following analysis of the lithic assemblage at San Estevan attempts to address these themes by examining a Middle Formative period sample at a time when Colha lithic producers were engaged in relatively small-scale cottage-industry tool manufacture, and the intensified, specialized workshop production identified in Late Formative and Classic period deposits had not yet begun (Potter 1991). Even in this early period, sites in Northern Belize appear to have shared a common lithic tradition, consisting of similar tool forms and technologies, while each site relied predominantly on local production to supply the demands of own households.

The San Estevan Lithic Assemblage

San Estevan is located on the New River in Northern Belize (Figure 1), approximately halfway between Lamanai and Cerros (Rosenswig 2004, 2008; Rosenswig and Kennett 2008). Other sites located nearby include Nohmul, Colha, Cuello, Kichpanha, Pulltrouser Swamp and K'axob (Rosenswig and Kennett 2008). The site has been the locus of archaeological projects by William Bullard (1965), Norman Hammond (1975), Laura Levi (1993, 1996, 2002, 2003), and most recently by Robert Rosenswig and Douglas Kennett (Rosenswig 2007, 2008; Rosenswig and Kennett 2008). Occupation at San Estevan spans the Middle Formative through Late Classic periods, with substantial Late Formative and Classic period ceremonial architecture (Hammond 1975; Rosenswig 2007). Rosenswig and Kennett argue that San Estevan was one of 10 to 12 competing polities coexisting during the Late Formative period, and was located approximately midway between Lamanai and Cerros along the New River, and also midway between Nohmul and Colha, which would have connected it to both coastal maritime trade routes and overland trade routes to the Peten (Rosenswig and Kennett 2008:137).

The lithic artifacts discussed in this paper (Table 1) were excavated during a 2005 field school directed by Dr. Robert Rosenswig and Dr. Douglas Kennett. The tools discussed here were excavated in 2005 from layers with Early (900 BC to 600 BC) and Late (600 BC to 300 BC) Middle Formative period components, as identified through association with Swasey, Bladen and Mamon ceramics, and Late Formative period plaster floors dated from 50 BC to AD 40 (Rosenswig and Kennett 2008:Table 1). These plaster floors, which covered at least 250

Table 1. Counts and proportions of tools from the San Estevan sample, by raw material types.

	Tools						Flakes					
	Middle Formative		Late Formative		Total Tools		Middle Formative		Late Formative		Total Flakes	
Raw Material	#	%	#	%	#	%	#	%	#	%	#	%
Chalcedony	131	47.1	32	46.4	163	47.0	6349	73.1	474	70.5	6823	72.9
Northern Belize Chert	36	12.9	4	5.8	40	11.5	348	4.0	24	3.6	372	4.0
Medium-grained Chert	64	23.0	19	27.5	83	23.9	1517	17.5	119	17.7	1636	17.5
Coarse Chert	7	2.5	3	4.3	10	2.9	261	3.0	19	2.8	280	3.0
Quartz/Chalcedony blend	14	5.0	8	11.6	22	6.3	11	0.1	2	0.3	13	0.1
Quartz/Chert blend	9	3.2	1	1.4	10	2.9	112	1.3	11	1.6	123	1.3
Quartz blend	7	2.5	2	2.9	9	2.6	21	0.2	3	0.4	24	0.3
Chert/Chalcedony blend	2	0.7	0	0.0	2	0.6	39	0.4	5	0.7	44	0.5
Chert/Coarse Chert blend	1	0.4	0	0.0	1	0.3	1	0.0	0	0.0	1	0.0
Coarse Chert/ Chalcedony blend	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	3	0.0
Fully Patinated Chert	0	0.0	0	0.0	0	0.0	2	0.0	0	0.0	2	0.0
Fully Patinated Chalcedony	0	0.0	0	0.0	0	0.0	17	0.2	15	2.2	32	0.3
Limestone	1	0.4	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0
Marble	1	0.4	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0
Unknown	5	1.8	0	0.0	5	1.4	3	0.0	0	0.0	3	0.0
Total	278	100.0	69	100.0	347	100.0	8684	100.0	672	100.0	9356	100.0

square meters of the site center, represent the earliest known civic-ceremonial architectural construction event at San Estevan, and created a public space for these activities (Rosenswig 2008:2). These plaster floors effectively seal the dark Middle Formative midden contexts below them throughout the majority of the 2005 excavated area (Rosenswig and Kennett 2008:133). An AMS radiocarbon date from charcoal embedded in these midden contexts produced a calibrated age of 800–760 BC (Rosenswig and Kennett 2008:Table 1). The contexts are concentrated in Plaza C, which was bulldozed to make way for the town garbage dump, leaving the earliest site components exposed. Test units in 2005 were placed at eight suboperations near the base of Structure XV, the largest remaining structure at the site. All lithic tools and debitage excavated during the 2005 were analyzed by the author with the assistance of Dr. Marilyn Masson, field school students and laboratory assistants. The sample includes 347 lithic tools (Table 2) and 9,356 debitage flakes (Table 3), of which 1,566 flakes had edge damage suggesting use (Table 4), from suboperations 3, 4, 5, 6 and 7 (see Rosenswig and Kennett 2008: Figure 3B). Of the lithic artifacts in the sample, 278 tools and 8,684 flakes came from Middle Formative period midden contexts (Rosenswig 2008:127), while 69 tools and 672 flakes came from the Late Formative plaster floors and subfloors (Table 1). Tools and flakes from contexts located stratigraphically above the Late Formative period plaster floor, including fill from the platform of Structure XV, and components with modern disturbance and contamination were analyzed, but were eliminated from the study sample.

Lithic tools were analyzed according to the following variables that were coded in the analysis: artifact number, context, date recovered,

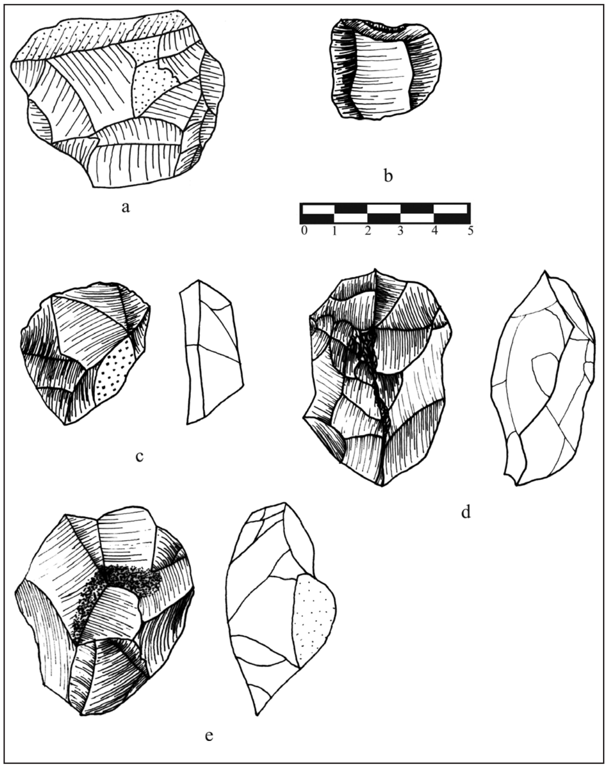

Figure 2. Cores: a. Polyhedral flake core; b. microcore; c. bifacial microcore; d. bifacial microcore/phase 1 biface; e. phase 1 biface (illustrated by the author).

secondary/final tool type, section, raw material type, raw material color, breakage type, percentage of cortex, heat treatment, primary tool type, type and location of edge damage; patina, length, width, thickness, and edge angle (if applicable). The approximate number of sides and the size of the flake scars were recorded for cores. Lithic debitage was sorted through mass analysis using 2 in, 1 in, 0.5 in and 0.25 in nested screens (following Masson 1989, 2001). Flakes of each screened fraction were also individually analyzed for raw material type, raw material color, percentage of cortex on the dorsal surface (0 percent, 1–24 percent, 25–49 percent, 50–74 percent, 75–99 percent, or 100 percent), fire damage, edge damage, and patination. Each flake in the sample was examined for edge damage with an 8× magnification hand lens, and may indicate use of these flakes as unmodified, expedient tools.

The lithic artifacts in the San Estevan assemblage indicate that residents engaged a wide variety of activities. The lithic tools can be broadly grouped into four technological classes: blade, burin, biface and uniface, and also include tools used in lithic tool production such as cores, hammerstones and pre-forms. The combination of formal reduction sequences, tool maintenance and resharpening, recycling, and informal tool production and retouching creates a diverse assemblage from expediently-utilized and/or retouched debitage to highly formal tools that conform to a specific design. As discussed below, both the formal and informal tools produced and consumed at San Estevan during the Middle Formative often closely resemble those found at sites throughout Northern Belize.

LOCAL PRODUCTION AT SAN ESTEVAN

In this sample from San Estevan, the majority of lithic tools appear to have been locally produced, used, recycled, and discarded at the site itself. Evidence for this behavior comes from both tools and debitage, fulfilling four major criteria employed here for local production: 1. The presence of biface preforms (rare) and manufacturing failures (rare) from all stages of reduction (Figure 2 , Table 2); 2. Polyhedral cores indicating the production of small blades, distinct from the large blades found at Colha (Figure 3); 3. A high percentage (41.6 percent) of cortical debitage, suggesting early stage reduction of cores and cobbles (Table 3); and 4. Debitage that reflects the production of formal and/or informal tools, including tranchet flakes, although these are extremely rare in the assemblage (Table 2, Figure 9). Lithic production techniques included both blade and burin techniques for the production of blades and burin spalls, as well as bifacial and unifacial percussion flaking, and grinding/polishing, resulting in a diverse assemblage of formal, expedient, and recycled lithic tools. A full description of artifact types and attributes found in this sample is available in Paris 2007 (see also Paling 2008).

Raw material types represented in the assemblage included fine-grained chert thought to come from the Chert-Bearing Zone soils to the south (Hester and Shafer 1984; Tobey et al. 1994), as well as chalcedony, medium-grained chert, and coarse-grained chert, quartz-chalcedony blends, and quartz-chert blends thought to come from the Cryptocrystalline Pebble Zone to the north, which lies in close proximity to the site of San Estevan (McAnany 1989; Oland 1998, 1999). The majority of the lithic tool assemblage is chalcedony, which constitutes 47.0 percent of tools and 72.9 percent of flakes (Table 1). Medium-grained chert is the second most common material at 23.9 percent of tools and 17.5 percent of flakes. Northern Belize Chert forms a small proportion of tools at 11.5 percent and flakes at 4.0 percent. Other raw materials such as quartz blends formed the remaining 17.6 percent of tools and 5.7 percent of flakes (Table 1). This suggests that the residents of San Estevan produced tools mainly from other raw materials of generally lower quality than Northern Belize Chert, which were most likely obtained from the Cryptocrystalline Pebble Zone near the site itself. While proportions of different raw materials used at San Estevan remained relatively stable from the Middle to the Late Formative periods (Table 1), proportions of both tools and flakes made from Northern Belize Chert declined, although it should be noted that the Late Formative period artifact sample (N=741) is smaller than the Middle Formative period sample (N=8962).

Artifacts associated with lithic production such as cores, hammerstones, tested cobbles, and pre-forms make up 36.9 percent of the San Estevan assemblage (Table 2, Figure 2). Three tested cobbles found were small in size, and included one chalcedony, one quartz-chalcedony blend, and one quartz blend nodule. The polyhedral cores (N=109) in the assemblage were generally small in size, suggesting that they were exhausted cores resulting from the production of flakes and that the original cobbles or nodules were small. They were mostly chalcedony (55.0 percent) and medium-grained chert (12.8 percent), with a small percentage (5.5 percent) made from Northern Belize Chert. Some of these cores had a distinctive bifacial shape, but were distinguished from Phase 1 bifaces by their thickness and a rounder outline as opposed to a more elongated or elliptical outline. The Phase 1 bifaces, which were defined following criteria established by Dial and Collins (1998), lacked cortex and evidence of edge damage, and were primarily made from chalcedony or quartz blend.

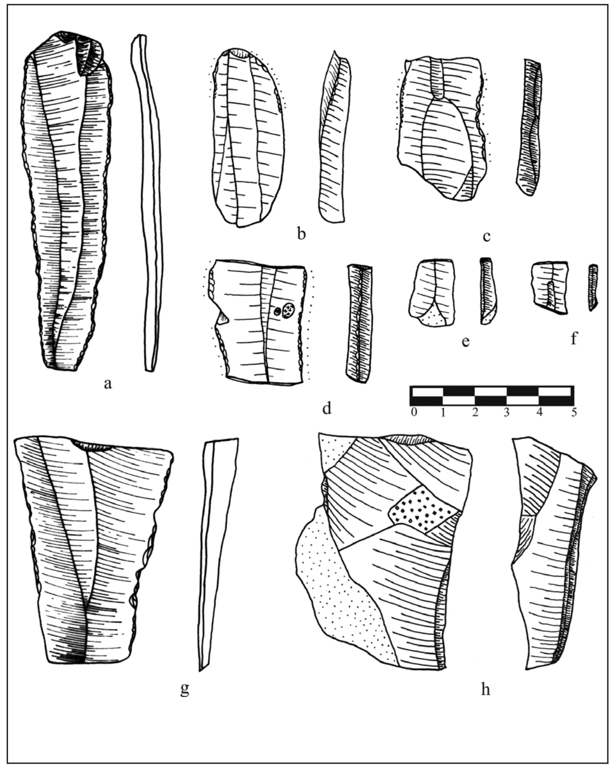

Figure 3. a-d. Prismatic blades; e-f. small prismatic blades/flake blades; g. macroblade; h. blade and flake core (illustrated by the author [a-h] and April Cantrell [a]).

The assemblage contained 21 hammerstones, which were characterized by a high degree of percussive edge damage. The majority of hammerstones were made of chalcedony (42.8 percent) or harder materials such as coarse cherts and quartz blends. None of the hammerstones in the assemblage were made from Northern Belize Chert. Sixty-one point nine percent of the hammerstones were recycled from polyhedral flake cores, and one of these was then recycled into a polishing stone. All hammerstones, including those recycled from cores, were generally small in size (4–7 cm in diameter), and tended to be spherical or elliptical in outline with evidence of battering and crushing on at least one edge. Eighteen out of 21 hammerstones, including those recycled from cores, had some cortex left on the surface.

Table 2. Counts of tool types at San Estevan for Middle Formative and Late Formative period samples by most common raw material types: Medium-grained chert (C), Northern Belize Chert (NBC), and Chalcedony (CHL).

	Middle Formative				Late Formative				
Primary Tool Type	**C**	**NBC**	**CHL**	**MF Total**	**C**	**NBC**	**CHL**	**LF Total**	**Grand Total**
archaic constricted adze								1	1
biface	1	4		5					5
bifacial microcore	1	2	7	11	1		1	2	13
bifacial microcore/phase 1 biface				3			1	1	4
blade	12	5	22	40	1		2	3	43
blade core		1		1					1
blade with retouch		1		1					1
burin core	1			1	1			1	2
burin spall	1			1					1
burin spall perforator/drill			4	4					4
core	5	2	26	50	2		16	26	76
core/tested cobble			1	2					2
eccentric						1		1	1
expedient biface	1			1					1
expedient biface- discoidal	2		1	3					3
expedient biface- elongate w/ primarily edge retouch			1	2	1	1	1	3	5
expedient biface- elongate w/edge retouch, or uniface	1			1					1
expedient biface- elongate w/ greater retouch	5	2	2	9	1			1	10
expedient biface- irregular w/ primarily edge retouch	1	3	4	8	2			2	10
expedient biface- irregular w/ greater edge retouch	4	1	3	8	1	1	1	3	11
expedient biface- retouched flake		1		1					1
failed phase 1 biface			1	1					1
flake with bifacial retouch	2	2	4	8			1	1	9
flake with retouch	3	4	15	30	1		1	2	32
flake with retouch/expedient chopper			1	1					1
hammerstone			2	5			1	3	8
informal blade			1	1					1
informal large biface/chopper			1	1					1
large biface	1			1					1
large expedient biface	2	1		3					3

Blade and burin spall technology were both locally employed at San Estevan, although not on a large scale (Figures 3, 4). Most blades are small pressure blades (under 10 cm long and 5 cm wide). The assemblage includes one blade core, of an irregular shape, with blade scars of multiple widths and a few large flake scars. Of the six burin cores, all appear to have used to produce burin spalls, rather than the burin/graver tools known from other regions of North America. Four out of the six burin cores appear to have been recycled from other tools such as unifaces and bifaces. The desired end products of burin technology were most likely burin spall perforators; five of these tools were represented in the lithic tool sample. They are square or triangular in cross-section, with a pointed, and occasionally modified, distal end (see below).

A significant proportion (46.1 percent) of the flakes in the San Estevan assemblage had some cortex on the dorsal surface (Table 3); this suggests that many of the tools were the result of local production. This pattern is reflected in the tool assemblage (Table 5), with cortex present in far greater proportions on informal tools (47.1 percent) and artifacts

Table 2. Counts of tool types at San Estevan for Middle Formative and Late Formative period samples by most common raw material types: Medium-grained chert (C), Northern Belize Chert (NBC), and Chalcedony (CHL). *(continued)*

	Middle Formative				Late Formative				
Primary Tool Type	**C**	**NBC**	**CHL**	**MF Total**	**C**	**NBC**	**CHL**	**LF Total**	**Grand Total**
large expedient biface or hammerstone								1	1
macroblade	4			4					4
macroflake			2	3					3
microblade core	1			1					1
microcore	4	2	7	15	1		2	3	18
notch			1	2	2			2	4
opposed lateral scraper	1	1		2					2
oval biface—celt-like shape					1			1	1
perforator		1		1					1
perforator/graver		1		1					1
phase 1 biface	1		2	3					3
polished celt							1	1	1
polishing stone				2					2
possible uniface	1			1					1
scraper							1	1	1
spur	1		2	4					4
stemmed blade/pointed biface			2	3	2		1	3	6
tested cobble			1	2				1	3
tranchet flake				1					1
uniface	7	2	18	29	2		2	5	34
uniface/possible T-shaped tool	1			1					1
uniface/retouched macroflake						1		1	1
Total	64	36	131	278	19	4	32	69	347

Table 3. Debitage from the San Estevan sample: proportions of cortical flakes by raw material types (% of row total).

Material	**0% cortex**	**1-24% cortex**	**25-49% cortex**	**50-74% cortex**	**75-99% cortex**	**100% cortex**	**unknown**	**# Flakes**	**% Flakes**
Med.-grained Chert	58.2%	24.7%	5.7%	4.6%	4.3%	2.5%	0.0%	1636	17.5
Chert/Coarse Chert blend	100.0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1	0.0
Chert/Chalcedony blend	70.5%	11.4%	2.3%	11.4%	4.5%	0.0%	0.0%	44	0.5
Coarse Chert	56.8%	21.1%	8.2%	5.0%	5.7%	3.2%	0.0%	280	3.0
Coarse Chert/Chalcedony blend	33.3	66.7%	0.0%	0.0%	0.0%	0.0%	0.0%	3	0.0
Northern Belize Chert	55.9%	25.5%	7.8%	3.2%	6.2%	1.3%	0.0%	372	4.0
Chalcedony	58.5%	25.2%	5.5%	5.3%	3.4%	2.0%	0.0%	6823	72.9
Fully Patinated Chert	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2	0.0
Fully Patinated Chalcedony	62.5%	25.0%	0.0%	3.1%	6.3%	3.1%	0.0%	32	0.3
Quartz blend	58.3%	20.8%	4.2%	4.2%	12.5%	0.0%	0.0%	24	0.3
Quartz/Chert blend	44.7%	33.3%	8.9%	4.9%	4.9%	3.3%	0.0%	123	1.3
Quartz/Chalcedony blend	46.2%	15.4%	23.1%	7.7%	0.0%	7.7%	0.0%	13	0.1
unknown	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	3	0.0
Total Flakes	5441.0	2344.0	538.0	475.0	358.0	199.0	1.0	9356	100.0

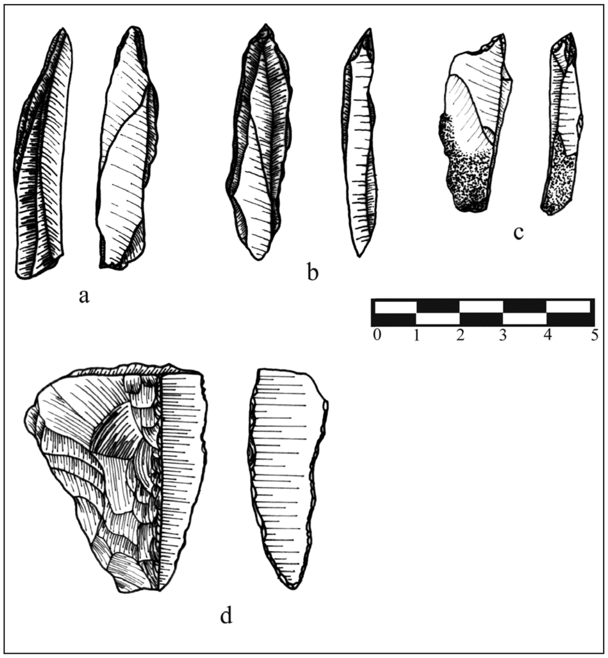

Figure 4. a-c. Burin spall perforators; d. burin core made from recycled biface fragment (illustrated by the author).

associated with lithic production (64.4 percent) than on formal tools (24.1 percent). While the assemblage included some formal bifaces (Figure 5), including oval bifaces (N=1), and polished celts (N=1), most of these dated to the Late Formative period (Table 2). Other bifacial tools (Figures 6–9) were informal (N=1) and expedient bifaces (N=45), flakes with bifacial retouch (N=9), bifacial scrapers (N=1), opposed lateral scrapers (N=2), and reduced fragments (N=3) that resemble recycled segments of large oval bifaces identified at Cuello and Pulltrouser Swamp (McSwain 1991a; Shafer 1983a). Some informal tools such as notches (N=5), flake perforators, gravers and spurs (N=6), unifaces (N=33), and flakes with retouch (N=32) were produced from percussion flakes in a variety of sizes, were probably obtained from the numerous, exhausted, polyhedral flake cores (N=109) found at the site. Expedient bifaces were highly variable in form and quality, and included tools that were discoidal, elliptical and irregular in outline. Some expedient bifaces have relatively parallel dorsal and ventral sides, suggesting that they were recycled fragments of formal bifaces, while others were

Table 4. Flake counts from the San Estevan sample from Middle and Late Formative period contexts, by raw material and the presence or absence of edge damage suggesting use wear.

	Middle Formative			Late Formative			
Material	edge damage	no damage	Total	edge damage	no damage	Total	Grand Total
Med.-grained Chert	188	1329	1517	33	86	119	1636
Chert/Coarse Chert blend	1		1				1
Chert/Chalcedony blend	12	27	39		5	5	44
Coarse Chert	33	228	261	3	16	19	280
Coarse Chert/Chalcedony blend		3	3				3
Northern Belize Chert	81	267	348	4	20	24	372
Chalcedony	1015	5334	6349	131	343	474	6823
Fully Patinated Chert	2		2				2
Fully Patinated Chalcedony	17		17	15		15	32
Quartz blend	1	20	21	1	2	3	24
Quartz/Chert blend	25	87	112	3	8	11	123
Quartz/Chalcedony blend		11	11		2	2	13
unknown	1	2	3				3
Grand Total	1376	7308	8684	190	482	672	9356

Table 5. Proportions of cortical and non-cortical tools, for formal, informal, and production tool categories in the San Estevan sample.

% Cortex	Formal tools	Informal tools	Production tools	# Tools
0%	73.9%	52.9%	35.6%	184
1-24%	18.0%	19.2%	44.7%	99
25-49%	6.3%	13.5%	12.1%	37
50-74%	1.8%	5.8%	6.1%	16
75-99%	0.0%	7.7%	0.8%	9
unknown	0.0%	1.0%	0.8%	2
Total Tools	111.0	104.0	132.0	347

made from more irregular large primary flakes and secondary flakes, or from retouching multiple edges of a formal uniface. Expedient bifaces form a technological continuum that is linked to flakes with bifacial retouch, which are modified in the same manner, but to a lesser degree, and in contrast to expedient bifaces, proximal bulbs and striking platforms have a low degree of modification. 31.9 percent of the expedient bifaces and 77.8 percent of the flakes with bifacial retouch had some amount of cortex on the dorsal surface of the tool. Similar patterns are noted for more extensively modified unifaces, which form a continuum of modification with "flakes with retouch." Unifaces also vary widely in form, including discoidal, elliptical, and denticulate varieties (Figure 8), while flakes with retouch have a low degree of modification on the working edges of the dorsal surface. 48.5 percent of unifaces and 63.6 percent of flakes with retouch had some degree of cortex on their dorsal surface.

Other evidence for local production of lithic tools comes from the lithic debitage characteristics. Experimental biface reduction models by Pecora (2001:180), involved the analysis of debitage produced during each reduction stage, suggest relative frequencies of large flakes (>0.5") are greater in the earlier stages and smaller in the later

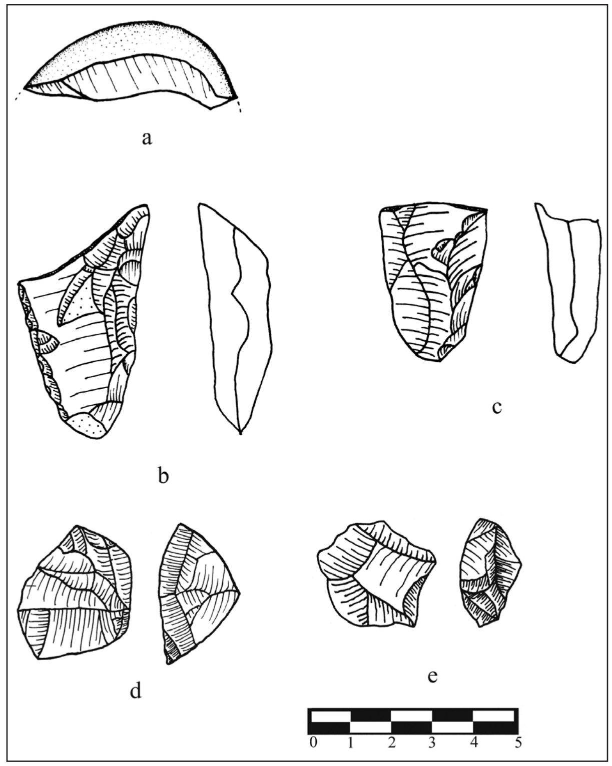

Figure 5. Formal bifaces and recycled biface fragments: a. Polished celt; b-c. stemmed blade/pointed biface stems; d. miniature uniface/flake with retouch (no edge damage); e. miniature biface (no edge damage; illustrated by the author).

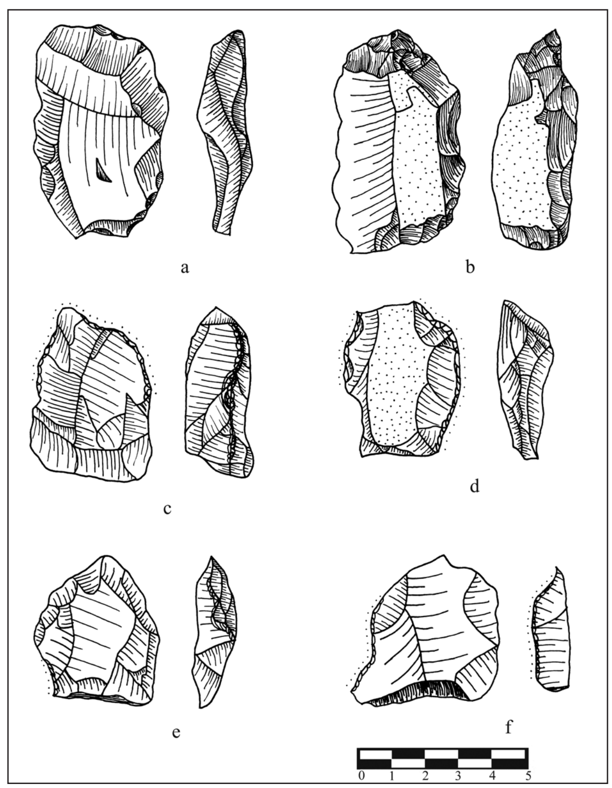

Figure 6. Expedient bifaces: a-b. elongate with greater retouch; c-d. elongate with primarily edge retouch; e-f. irregular with primarily edge retouch (illustrated by the author).

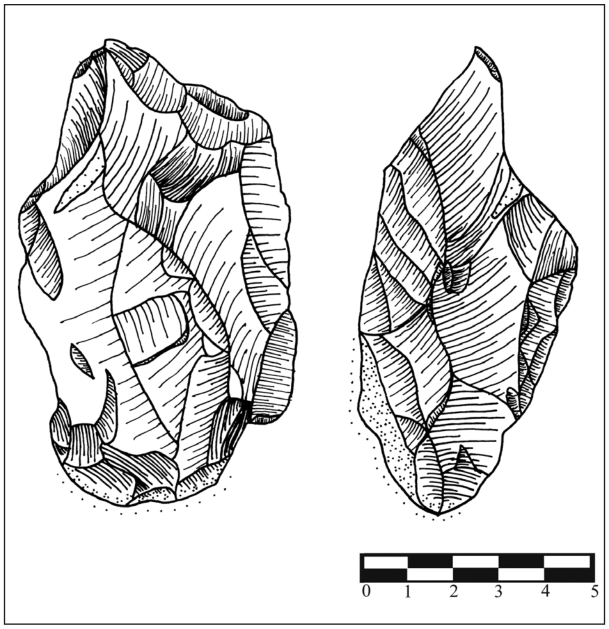

Figure 7. Informal large biface/chopper with heavy edge damage (illustrated by the author).

stages, while small debris (<0.5 in) is generated in both earlier and later stages of production (see also Masson 1989). When the relative proportions of flake sizes are examined and compared to experimental models (Ahler 1989), it is possible to predict high frequencies of small flakes under 0.25 in. In the San Estevan debitage sample, the greatest number of flakes fell into the 0.5–1 in size category, followed by flakes in the 1.0–2.0 in category, while the percentage of flakes smaller than 0.25 in is significantly underrepresented because of the use of 0.25 in mesh in excavations (Table 6). The documentation of microdebitage flakes (smaller than 0.25 in) requires column sample analysis or flotation analysis (Hester and Shafer 1986; Moholy-Nagy 1990); flotation samples taken from the 2005 excavations are currently pending analysis. Three possible explanations for the under-representation of small flakes include: 1) San Estevan tool

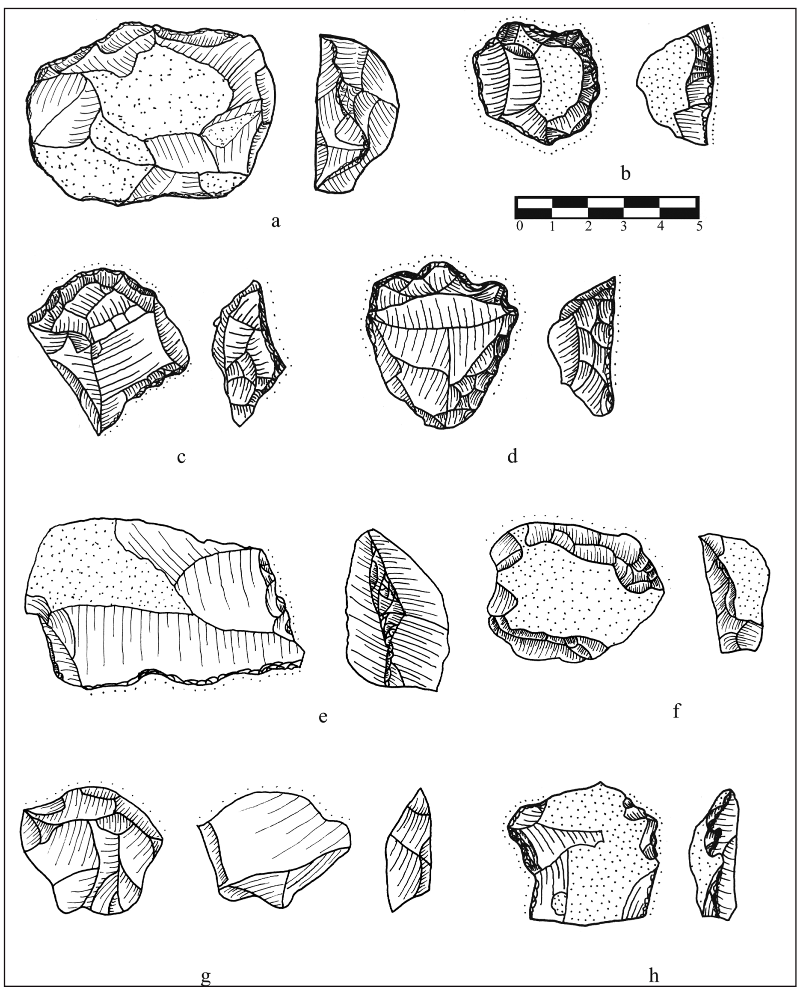

Figure 8. Unifacial tools: a-c. Miscellaneous unifaces; d. denticulate uniface; e-f. flakes with retouch; g-h. flake with bifacial retouch (illustrated by the author).

Table 6. Size grade distribution (proportions), by raw material, of San Estevan debitage sample (% of row total).

Material	Flake Size						# Flakes
	<0.25″	0.25–0.5″	0.5–1.0″	1.0–2.0″	>2.0″	unknown	
Med.-grained Chert	0.8%	17.1%	39.7%	39.5%	2.9%	0.0%	1636
Chert/Coarse Chert blend	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	1
Chert/Chalcedony blend	0.0%	15.9%	25.0%	54.5%	4.5%	0.0%	44
Coarse Chert	1.4%	15.0%	31.8%	45.4%	6.4%	0.0%	280
Coarse Chert/Chalcedony blend	0.0%	0.0%	0.0%	66.7%	33.3%	0.0%	3
Northern Belize Chert	0.0%	12.9%	40.3%	44.9%	1.6%	0.3%	372
Chalcedony	0.8%	19.9%	34.8%	41.2%	3.3%	0.1%	6823
Fully Patinated Chert	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	2
Fully Patinated Chalcedony	0.0%	0.0%	3.1%	75.0%	21.9%	0.0%	32
Quartz blend	0.0%	12.5%	20.8%	58.3%	8.3%	0.0%	24
Quartz/Chert blend	0.0%	5.7%	27.6%	55.3%	10.6%	0.8%	123
Quartz/Chalcedony blend	0.0%	0.0%	7.7%	61.5%	30.8%	0.0%	13
unknown	0.0%	33.3%	33.3%	33.3%	0.0%	0.0%	3
Total Flakes	71.0	1743.0	3256.0	3897.0	324.0	7.0	9356

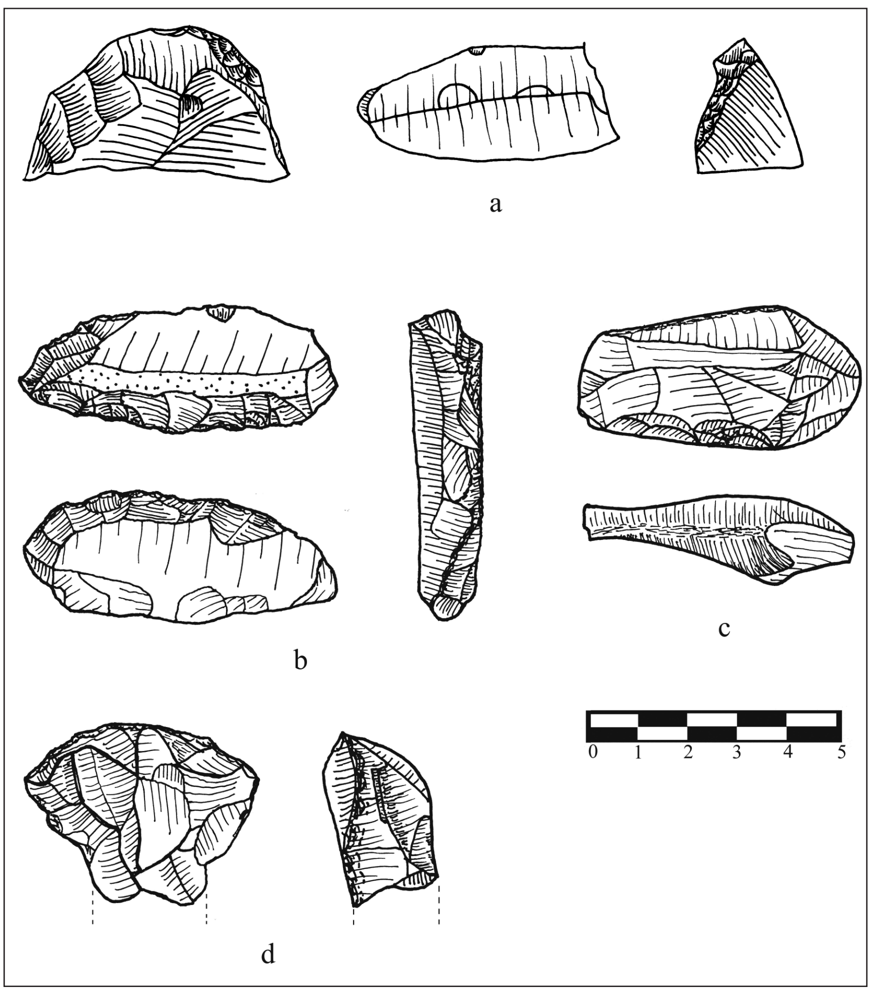

Figure 9. a. Possible tranchet flake; b-c. opposed lateral scrapers; d. possible T-shaped tool (illustrated by the author).

technology was mainly a large flaking technology; 2) The debitage was removed from the primary production site and dumped in the location where it was recovered in excavation, leaving the small flakes behind (see Mallory 1986; Shafer and Hester 1986); and 3) Small flakes were represented in excavated deposits, and may be represented in the flotation samples. Upon examination of the 100 non-recycled polyhedral flake cores found at the site, 8 have flake scars 0.25–0.5 in, 23 have flake scars 0.5–1 in, 29 have flake scars 1–2 in, and 11 have flake scars greater than 2 in. Thus, pending analysis of the flotation samples from San Estevan, I currently favor the first hypothesis. Additionally, the relative proportions of flake sizes suggest that both early and late stages of production are represented at San Estevan, reflecting all stages of tool manufacture, tool resharpening, and recycling practices.

Comparisons with McAnany's model from Pulltrouser Swamp (1989) suggest that at San Estevan, primary reduction sequences of raw material nodules took place at the site itself. In McAnany's (1989: Table 4) study, 94 percent of the Northern Belize Chert flakes lack cortex entirely and one percent of Northern Belize Chert flakes had over 50 percent cortex. In contrast, 50 percent of the chalcedony flakes from the site lacked cortex, while 11 percent had over 50 percent cortex. In her interpretation of these patterns, Northern Belize Chert was imported into the site in the form of finished tools, and all Northern Belize Chert flakes resulted from recycling and resharpening practices. In contrast, chalcedony tools were produced at Pulltrouser Swamp itself from locally procured nodules of raw material. At San Estevan, 58.1 percent of all flakes lacked cortex, while 30.8 percent were secondary flakes with 1–49 percent cortex, and 11.0 percent of flakes had over 50 percent cortex (Table 7). These proportions are relatively similar across material types, and between flakes from Middle and Late Formative period contexts, with a slight drop in the proportion of tertiary flakes in the Late Formative across all raw material types (although this may be due to the smaller sample size of Late Formative (N=672) versus Middle Formative flakes (N=8,684). These patterns are most similar to McAnany's model for in situ production of chalcedony tools from locally procured nodules. The similarity of proportions of cortical flakes across raw material types suggests that medium-grained chert, Northern Belize Chert, and chalcedony nodules may have been reduced using similar production methods. These patterns contrast with Pulltrouser Swamp (McAnany 1989) and Cuello (McSwain 1991b) where proportions of tertiary flakes are much higher for Northern Belize Chert than for chalcedony and other raw materials.

EXCHANGING TOOL TYPES AND MANUFACTURING TECHNIQUES IN NORTHERN BELIZE

Many of the formal tool types found at San Estevan closely resemble tools found in Middle and Late Formative period deposits at Colha, Cuello, Cerros, Kichpanha, K'axob and Pulltrouser Swamp (Gibson 1986; Hammond 1991; Hester 1982; Hester et al. 1980; Hester et al. 1983; Hester and Shafer 1984; Lewenstein 1987; McAnany and Peterson 2004; McSwain 1991a; Mitchum 1994; Potter 1991; Shafer 1982; Shafer 1983a, b; Shafer and Hester 1983, 1986, 1991). These include blades, burin spalls, bifaces, recycled biface fragments, expedient bifaces, a possible tranchet flake, a possible T-shaped tool, and flake perforators/gravers. Blades (N=43) include prismatic blades and small flake blades (Figure 3), and range in width from 0.8 to 4.2 cm with an average thickness of 0.7 cm, and are generally smaller than macroblades from Colha and Cuello (Potter 1982, 1991; McSwain 1991a). Large macroblades represent a small portion of the San Estevan assemblage (N=4), and range from 2.5 to 4.8 cm in width. The majority of small prismatic blades were made from chalcedony (56.0 percent) while others were made from medium-grained chert (29.2 percent) and Northern Belize Chert (14.6 percent), whereas all four macroblades were made from medium-grained chert. However, the low frequency of blade cores in the assemblage (N=1) leaves open the possibility that most or all of these blades were imported from other sites. A similar technology

Table 7. Relative proportions of primary, secondary and tertiary flakes at sites in northern Belize, by raw material and chronological phase.

Site	Material	Period	0%	1-49%	50-100%	Source
San Estevan	all types	Middle/Late Formative	58.1%	30.8%	11.0%	
San Estevan	Med.-grained chert	Middle Formative	58.2%	30.3%	11.5%	
San Estevan	NBC	Middle Formative	56.6%	32.5%	10.9%	
San Estevan	Chalcedony	Middle Formative	59.0%	30.6%	10.4%	
San Estevan	Med.-grained chert	Late Formative	58.0%	31.1%	10.9%	
San Estevan	NBC	Late Formative	45.8%	45.8%	8.3%	
San Estevan	Chalcedony	Late Formative	51.0%	33.3%	14.8%	
Pulltrouser Swamp	Chalcedony	Late-Terminal Classic	50.0%	39.0%	11.0%	(McAnany 1989)
Pulltrouser Swamp	NBC	Late-Terminal Classic	94.0%	5.0%	1.0%	(McAnany 1989)
Cuello	NBC	Early Middle Formative	85.0%*	11.0%**	3.5%	(McSwain 1991b)
Cuello	all other types	Early Middle Formative	67.0%*	24.0%**	8.8%	(McSwain 1991b)
Cuello	NBC	Late Middle Formative	84.0%*	12.0%**	4.0%	(McSwain 1991b)
Cuello	all other types	Late Middle Formative	65.0%*	25.0%**	9.7%	(McSwain 1991b)
Cuello	NBC	Late Formative	87.0%*	10.0%**	3.6%	(McSwain 1991b)
Cuello	all other types	Late Formative	59.0%*	29.0%**	11.8%	(McSwain 1991b)
K'axob	all types	Early Middle Formative	80.7%	.	.	(McAnany and Peterson 2004)
K'axob	all types	Late Middle Formative	82.5%	.	.	(McAnany and Peterson 2004)
K'axob	all types	Early Late Formative	84.4%	.	.	(McAnany and Peterson 2004)
Santa Rita Corozal	NBC	Late Formative	71.7%	.	.	(Dockall and Sharer 1993)
Santa Rita Corozal	Chalcedony	Late Formative	90.0%	.	.	(Dockall and Sharer 1993)
Colha (talus workshops)	NBC	Late-Terminal Classic	~75.0%	~15.0%	~10.0%	(Masson 1999)
Colha (*aguada* workshops)	NBC	Late-Terminal Classic	55–70.0%	~15.0%	15–30.0%	(Masson 1999)

*McSwain (1991b:Table 13, 14) includes all flakes with <5% cortex in this category.
**McSwain (1991b:Table 13, 14) includes all flakes with 5-50% cortex in this category.

was used to produce burin spall perforators, which are thick and triangular or square in cross-section. The majority of burin spalls are made from chalcedony (80.0 percent), and one was made from medium-grained chert. Additionally, most of the burin spalls have pointed distal ends, and were most likely used as perforators or gravers. Middle Formative period assemblages at Colha and Kichpanha also contained burin spall drills, where they have been interpreted as drills associated with shell working activity (Gibson 1986, Potter 1991). Other types of perforators were made from small, slightly modified flakes, a technology also noted at Cerros, K'axob and Cuello (McAnany and Peterson 2004; McSwain 1991a; Mitchum 1994).

Other tool types and technologies common throughout Northern Belize during the Middle and Late Formative periods include bifacial and unifacial flaking technologies. Formal bifaces such as oval bifaces and polished celts were found in Late Formative period deposits, while stemmed blades/pointed bifaces and informal/expedient bifaces were found in both Middle and Late Formative period contexts (Table 3). All of these types have analogs at numerous sites in Northern Belize. Large oval bifaces are characterized by a distinctive teardrop or celt-like shape, length that is two and a half times the width, a relatively thin profile, and even, symmetrical, bifacial removal of flakes from both faces on the lateral and distal edges (Shafer 1983a; Shafer and Hester 1983), and have been identified sites throughout Northern Belize including Cuello, Colha, Cerros, K'axob, Pulltrouser Swamp, and Kichpanha (McAnany and Peterson 2004; McSwain 1991a; Mitchum 1994; Potter 1991; Shafer 1982, 1983a; Shafer and Hester 1983, 1986, 1991; Shafer et al. 1979). They are dominant in assemblages at Colha by the Middle Formative period (Shafer 1994:141), and remain in use through the Late Classic period (Shafer and Hester 1983:531); the example in the San Estevan assemblage dates to the Late Formative period. Polished celts, which are present in assemblages at Cuello and Colha (McSwain 1991a; Shafer 1994) in Middle and Late Formative period assemblages, respectively, are characterized by a symmetrical, bifacial, elliptical cross-section, and are first chipped into shape and then finished by abrasion (Shafer 1994). The example in the San Estevan assemblage dates to the Late Formative period; it has a celt-like distal end, a lenticular cross-section, and is made from chalcedony. Other formal bifacial tools in the San Estevan assemblage include six proximal ends of either stemmed blades or large oval bifaces. Stemmed blades are large marcoblades that have flakes removed from the distal end to form a long tapered point, while the proximal end is worked into a parallel or contracting "stem" suitable for hafting (Shafer 1994). Stemmed blades have been found at Colha, Cuello and Pulltrouser Swamp (McSwain 1991a; Potter 1982; Shafer 1983a; Shafer and Hester 1983, 1991); at Colha and Cuello they date to both the Middle and Late Formative periods, as do the examples in the San Estevan assemblage. The assemblage also included the medial section of a formal biface whose original form could not be determined due to breakage, but had a lenticular cross-section and roughly parallel edges. It came from a Middle Formative period context and was made from medium-grained chert.

Distinctive tranchet adzes and tranchet flakes are well-documented at Colha during the Late Formative and Classic periods (Shafer 1983b), and are also found at Cuello and Cerros (McSwain 1991a; Mitchum 1994). A possible tranchet flake was found at San Estevan (Figure 9); however, the surface is flatter than most tranchet flakes, which would have resulted in a plane, rather than an adze. It could be the result of poor application of the tranchet technique, or a midsection break that occurred at the same approximate location that a tranchet technique would be applied. The possible tranchet flake was made from quartz/chalcedony blend; the coarser grain of the raw material may have impeded correct removal of the flake. Another distinctive tool in the assemblage included a possible T-shaped adze, such as those noted at Colha, Cuello, Kichpanha and K'axob (Gibson 1986:110; McAnany 2004; McSwain 1991a; Potter 1991). Smaller than its more triangular-shaped counterparts at Colha, and lacking the characteristic flake scar on the distal edge of the dorsal surface, it more closely resembles the smaller examples from Cuello.

Similar types of informal tool production and the recycling of formal tools present at San Estevan are also found at sites throughout Northern Belize. Spurs, gravers, and perforators made from flakes, burins, and modified blades were common at Cuello (McSwain 1991a), K'axob (McAnany 2004), Colha (Potter 1991), and Cerros (Mitchum 1991, 1994), and are thought to have been used in working wood and/or shell at these sites. Notches, thought to be used in woodworking (Lewenstein 1987) were also produced at Cerros (Mitchum 1994). Expedient bifaces are common informal tools at sites throughout Northern Belize, including Cuello (McSwain 1991a) and Cerros (Mitchum 1994).

Sites in Northern Belize also shared similar recycling practices. Shafer (1983a) noted the presence of small unifacial and bifacial nubbins at Pulltrouser Swamp, and described the stages by which large oval bifaces were recycled. Three examples are present in Middle Formative period contexts at San Estevan (Table 8), and other examples are present at Cuello (McSwain 1991a). The San Estevan assemblage reflects the use of a variety of recycling techniques: 1. Tools with multiple types of edge damage; 2. Tools modified from their original form through percussion flaking or retouch; and 3. Tool sections or fragments with retouch and/or edge damage along mid-section breaks. Recycled tools formed 12 percent of the Middle Formative period tool sample (34 out of 278 tools), and 10 percent of the Late Formative period tool sample (7 out of 69 tools), suggesting that tool recycling was practiced through time. Blades, formal and expedient bifaces, unifaces, and cores were the most commonly recycled tool forms: blades were retouched or turned into perforators; broken large bifaces became smaller expedient bifaces, miniature bifaces and unifaces, notches, and hammerstones; unifaces were modified into expedient bifaces, burin cores, and scrapers; and cores were turned into hammerstones and polishing stones. The presence of edge damage on 16.7 percent (N=1,566) of debitage flakes (Table 4) suggests that unmodified debitage flakes were also part of the recycling process, possibly as expedient cutting implements.

The similarities in informal tool production and recycling practices at sites throughout sites in Northern Belize suggest that Formative sites were exchanging more than the end products of formal lithic tool production; rather, a wide range of general production practices, technologies and knapping strategies, and raw materials themselves were shared by sites throughout the region. At Middle Formative period sites, assemblages that combine debitage, preforms, cores, hammerstones, and used, broken, and recycled tools suggests most lithic production took place at individual sites, for use by local residents. The assemblages reflect the production of a wide range of tools using blade, burin, bifacial, and unifacial techniques. Many of these tools would have been used to create other products for household maintenance and craft production, such as notches, perforators and gravers for working shell and/or wood. Widespread similarities suggest strong, community-based economies, whose residents may have produced their own status items such as shell ornaments. While Middle Formative period communities may have had relatively independent economies in terms of lithic tool and shell ornament production, as implied by the redundancy of lithic assemblages, fine-grained chert appears to have been exchanged between Colha and/or other sites in the Northern Belize Chert-Bearing Zone, and communities to the north in the Cryptocrystalline Pebble Zone.

DISCUSSION AND CONCLUSIONS

As suggested by the data presented above, the Middle Formative period in many ways laid the groundwork for the far-reaching economic networks supplied by the Colha lithic workshops of the Late Formative and Classic periods through the creation of a common lithic tradition. McAnany (1991:281) reminds us that it may be more useful to think of exchange networks as embodying a set of particular social relationships. The economic networks and social relationships that developed in the Middle Formative period at sites such as San Estevan, Colha, Cuello, and K'axob appear to have developed in the absence of strong community interdependence or specialization. However, the broad redundancies in tool types, production techniques, and products made from similar tool types (i.e., shell ornaments), combined with small-scale, low-volume exchange of high-quality raw materials for primary production, suggests that some degree of cultural unity and inter-site communication existed between sites in Northern Belize that transcended community independence. The high proportions of cortical flakes made from Northern Belize Chert in Middle Formative period samples at San Estevan suggest the possibility that raw nodules may have been obtained from Colha, potentially through exchange networks (Table 7). Cortical flakes made of Northern Belize Chert are also present in Middle Formative contexts at other sites such as K'axob and Cuello (McAnany and Peterson 2004; McSwain 1991b; Speal 2008), although in lower proportions than observed at San Estevan (Table 7). Middle Formative exchange networks may have become the channels through

Table 8. Types and quantities of recycled tools at San Estevan, listed by primary, secondary, and tertiary form/function, separated by Middle Formative (MF) and Late Formative (LF) contexts.

Primary	Secondary	Tertiary	MF	LF	Total
biface	burin core	.	1		1
biface	miniature biface	.	1		1
biface	miniature uniface/flake with retouch	.	2		2
blade	blade with retouch	.	4	1	5
blade	perforator	.	1		1
blade	spur	.	1		1
core	hammerstone	.	7	2	9
core	hammerstone	polisher/grinder	1		1
core	scraper	.		1	1
expedient biface	notch	.	1		1
expedient biface—discoidal	hammerstone	.	1		1
expedient biface—elongate with primarily edge retouch/uniface	expedient biface—irregular with primarily edge retouch	.	1		1
expedient biface—elongate with greater retouch	hammerstone	.		1	1
large biface	expedient biface—irregular with primarily edge retouch	.	1		1
large expedient biface	expedient biface—discoidal	.	1		1
large expedient biface	expedient biface—elongate with greater retouch	.	1		1
large expedient biface	expedient biface—irregular with primarily edge retouch	.	1		1
large expedient biface	hammerstone	.		1	1
macroblade	burin core	.	1		1
macroflake	burin core	.	1		1
macroflake	uniface	.	1		1
microcore	expedient biface—irregular with primarily edge retouch	.	1		1
microcore	polished minicore	.		1	1
possible uniface	possible eccentric	.	1		1
uniface	bifacial scraper	.	1		1
uniface	burin core	.	1		1
uniface	expedient biface—elongate with greater retouch	.	1		1
uniface	expedient biface—retouched uniface	.	1		1
Total			34	7	41

which the standardized products of Colha workshops were exchanged in Late Formative and Classic period time periods (Hester and Shafer 1994:54; McAnany 1986:253), supplying consumers with an extant need for the types of tools produced by the workshops (including blades, tranchet adzes, large oval bifaces, etc.). Perhaps more significantly, evidence for the expansion of economic networks, and development and cultivation of exchange dependencies between sites throughout Northern Belize during these later periods suggests a change in the power relationships between communities, as political entities grew in scale beyond the community village level (see Rosenswig and Kennett 2008).

At San Estevan, most of the formal and informal tools in the assemblage were produced from chalcedonies and medium-grained cherts, most likely obtained from nearby deposits in the Cryptocrystalline Pebble Zone. The large proportion of informal and recycled tools at the site suggests that the majority of lithic production at the site was independent, small-scale, and relatively unskilled, and could have been carried out by a mixture of part-time specialists working seasonally in conjunction with agriculture (Hagstrum 2001), or non-specialists. Few tools match the skilled, specialized products produced at Colha during the Late Formative and Classic periods, although certain tools, such as the blades, burin spalls, polished celt, and stemmed blades/bifaces were undoubtedly the product of considerable time and effort.

The San Estevan assemblage also serves to highlight certain aspects of previous studies on lithic production, consumption and exchange in Northern Belize, including those from later time periods. While many studies focus on formal tool types and technologies, independent production of expedient tools was noted in the same studies, and appears to have taken place at most sites in most time periods. These expedient tools appear to have been locally produced, whether or not sites produced their own formal tools, imported them, or imported blanks and pre-forms. More study and publication of expedient tool assemblages is needed, as there are few bases for comparison; despite their value, debitage studies alone cannot encompass the variation in production practices. Many studies also note the recycling of formal tools across sites in Northern Belize, although there is a need for greater quantification of this practice across space and time.

Evidence for local production at multiple sites, combined with similarities in tool types and techniques, suggests fluid, dynamic intercommunity relationships and exchange networks between Middle Formative period sites in Northern Belize. While the identification of raw materials based on visual sourcing alone is not conclusive, it suggests that the majority of tools at San Estevan were made at the site itself from locally available raw materials, namely chalcedonies, medium-to-coarse grained cherts, and quartz-chert and quartz-chalcedony blends. A small percentage of tools, particularly blades, were made from fine-grained cherts, most likely obtained from Colha or its neighbors in the Northern Belize Chert-Bearing Zone. The exchange of high-quality raw materials and variations in tool form throughout the region suggest that during the Middle Formative, site residents shared knapping techniques and traditions more often than they exchanged the tools themselves, and that local producers at each site adapted regional techniques to suit the demands of local households.

ACKNOWLEDGMENTS

Many thanks to all of the staff and students of the San Estevan Project 2005, who assisted with the excavation, washing, analyzing, and drawing of these artifacts. Special thanks to Marilyn Masson, project directors Robert Rosenswig and Douglas Kennett, Liz France, April Cantrell, and to Beverly Chiarulli and Rissa Trachman for organizing the Rocking Belize session at the 2008 Society for American Archaeology Meeting. Thanks also to Nicholas Pagnucco, Justin Lowry, Jason Paling, Ricardo Vázquez Leiva, Jared Latimer, members of the Rocking Belize session, Terry Powis, and an anonymous reviewer for their helpful comments on earlier versions of this article; any errors remain entirely my own.

REFERENCES

Ahler, S. A.
1989 Mass Analysis of Flaking Debris: Studying the Forest Rather than the Tree. In *Alternative Approaches to Lithic Analysis*, edited by D. O. Henry and G. H. Odell, pp. 85–118. Archaeological Papers of the American Anthropological Association No.1.

Aoyama, K.
1999 *Ancient Maya State, Urbanism, Exchange, and Craft Specialization*. University of Pittsburgh Memoirs in Latin American Archaeology No. 12, Pittsburgh.
2007 Elite Artists and Craft Producers in Classic Maya Society: Lithic Evidence from Aguateca, Guatemala. *Latin American Antiquity* 18(1):3–26.

Berdan, F. F., M. A. Masson, J. Gasco and M. E. Smith
2003 An International Economy. In *The Postclassic Mesoamerican World.*, edited by M. E. Smith and F. F. Berdan, pp. 96–108. University of Utah Press, Salt Lake City.

Brumfiel, E. M.
1991 Tribute and Commerce in Imperial Cities: The Case of Xaltocan, Mexico. In *Early State Economies*, edited by H. J. M. Claessen and P. van de Velde. Political and Legal Anthropology, volume 8, Transaction Publishers, New Brunswick and London.

Bullard, W. R., Jr.
1965 *Stratigraphic Excavations at San Estevan, Northern British Honduras.* Royal Ontario Museum, Occasional Paper 9. University of Toronto Press, Toronto.

Clark, J. E.
1996 Craft Specialization and Olmec Civilization. In *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe*, edited by B. Wailes, pp. 187–199. The University Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia.

Clark, J. E. and D. D. Bryant
1997 A Technical Typology of Prismatic Blades and Debitage from Ojo de Agua, Chiapas, Mexico. *Ancient Mesoamerica* 8:111–136.

Clark, J. E. and S. D. Houston
1998 Craft Specialization, Gender and Personhood among the Postconquest Maya of Yucatan, Mexico. In *Craft and Social Identity*, edited by C. L. Costin and R. P. Wright, pp. 31–46, M. E. Whalen, general editor. Archaeological Papers of the American Anthropological Association Number 8, Arlington, VA.

Clark, J. E. and W. J. Parry
1990 Craft Specialization and Cultural Complexity. In *Research in Economic Anthropology*, edited by B. L. Isaac, pp. 289–346. vol. 12. JAI Press, Inc., Greenwich, Conn.

Costin, C. L.
1998 Housewives, Chosen Women, Skilled Men: Cloth Production and Social Identity in the Late Prehispanic Andes. In *Craft and Social Identity*, edited by C. L. Costin and R. P. Wright, pp. 123–141, M. E. Whalen, general editor. Archaeological Papers of the American Anthropological Association Number 8, Arlington, VA.

Crabtree, D. E.
1982 *An Introduction to Flintworking*. Occasional Papers of Idaho Museum of Natural History, Number 28. Idaho Museum of Natural History, Pocatello, ID.

Dial, S. W. and M. B. Collins
1998 Bifaces, bifacial tools, perforators, burins and spalls. In *Wilson-Leonard: An 11,000-year Archaeological Record of Hunter-Gatherers in Central Texas, Volume II: Chipped Stone Artifacts*, edited by M. B. Collins, pp. 507–535. Studies in Archaeology 31, Texas Archaeological Research Laboratory, The University of Texas at Austin. Archaeology Studies Program, Report 10, Texas Department of Transportation, Environmental Affairs Division.

Dockall, J. E. and H. J. Shafer
1993 Testing the Producer-Consumer Model for Santa Rita Corozal, Belize. *Latin American Antiquity* 4(2):158–179.

Feinman, G. M. and L. M. Nicholas
2004 Unraveling the Prehispanic Highland Mesoamerican Economy: Production,

Exchange and Consumption in the Classic Period Valley of Oaxaca. In *Archaeological Perspectives on Political Economies.*, edited by G. M. Feinman and L. M. Nicholas, pp. 167–188. University of Utah Press, Salt Lake City.

Gibson, E. C.
1986 *Diachronic Patterns of Lithic Production, Use, and Exchange in the Southern Maya Lowlands*, Unpublished Ph.D. dissertation, Department of Anthropology, Harvard University, Cambridge, Massachusetts.

Guderjan, T. H. and J. F. Garber
1995 *Maya Maritime Trade, Settlement, and Populations on Ambergris Caye, Belize*. Maya Research Program and Labyrinthos, San Antonio, Texas and Lancaster, California.

Hagstrum, M.
2001 Household Production in Chaco Canyon Society. *American Antiquity* 66(1):47–55.

Hammond, N.
1975 Maya Settlement Hierarchy in Northern Belize. In *Studies in Ancient Mesoamerica, II*, edited by J. A. Graham, pp. 40–55. Contributions of University of California Archaeological Research Facility No. 27. University of California, Berkeley.
1991 *Cuello: An Early Maya Community*. Cambridge University Press, Cambridge.

Hayden, B. and A. Cannon
1983 Where the Garbage Goes: Refuse Disposal in the Maya Highlands. *Journal of Anthropological Archaeology* 2:117–163.

Hendon, J. A.
1996 Archaeological approaches to the Organization of Domestic Labor: household practice and domestic relations. *Annual Review of Anthropology* 25:45–61.

Hester, T. R.
1982 The Maya Lithic Sequence in Northern Belize. In *Archaeology at Colha, Belize: The 1981 Interim Report.*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton, pp. 39–59. The Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Ricerche Ligabue, Venezia, San Antonio.

Hester, T. R. and H. J. Shafer
1984 Exploitation of Chert Resources by the Ancient Maya at Colha, Belize. *World Archaeology* 16(2):157–173.
1991 *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*. Monographs in World Archaeology No. 1, Prehistory Press, Madison, Wis.
1994 The Ancient Maya Craft Community at Colha, Belize, and Its External Relationships. In *Archaeological Views from the Countryside: Village Communities in Early Complex Societies*, edited by G. M. Schwartz and S. E. Falconer, pp. 48–63. Smithsonian Institution Press, Washington and London.

Hester, T. R., H. J. Shafer and T. Berry
1991 Technological and Comparative Analyses of the Chipped Stone Artifacts from El Pozito, Belize. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 67–84. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.

Hester, T. R., H. J. Shafer and T. C. Kelly
1980 Lithics from a Preceramic Site in Belize. *Lithic Technology* 9(1):9–10.

Heydon, D.
1983 Symbolism of Ceramics. In *The Aztec Templo Mayor*, edited by E. H. Boone, pp. 113–27. Dumbarton Oaks Research Library and Collection, Washington DC.

Hirth, K. G., B. Andrews and J. J. Flenniken
2006 A Technological Analysis of Xochicalco Obsidian Prismatic Blade Production. In *Obsidian Craft Production in Ancient Central Mexico*, edited by K. G. Hirth, pp. 63–95. The University of Utah Press, Salt Lake City.

Hult, W. and T. R. Hester
1995 The Lithics of Ambergris Caye. In *Maya Maritime Trade, Settlement, and Populations on Ambergris Caye, Belize*, edited by T. H. Guderjan and J. F. Garber, pp. 139–161. Maya Research Program and Labyrinthos, San Antonio, Texas and Lancaster, California.

Kelly, T. C.
1980 The Colha Regional Survey. In *The Colha Project: Second Season, 1980 Interim Report*, edited by T. R. Hester, J. D. Eaton and H. J. Shafer, pp. 51–69. The Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Ricerche Ligabue, Venezia.

King, E. and D. Potter
1994 Small Sites in Prehistoric Maya Socioeconomic Organization. In *Archaeological Views from the Countryside: Village Communities in Early Complex Societies*, edited by G. M. Schwartz and S. E. Falconer, pp. 64–90. Smithsonian Institution Press, Washington D.C.

King, E. M.
2000 *The organization of Late Classic lithic production at the prehistoric Maya site of Colha, Belize: A study in complexity and heterarchy*, Unpublished Ph.D. dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia.

Levi, L. J.
1993 *Prehispanic Residence and Community at San Estevan, Belize.*, Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona.
1996 Sustained Production and Residential Variation: A Historical Perspective on Lowland Maya Domestic Economy. In *Managed Mosaic: Ancient Maya Agriculture and Resource Use*, edited by S. L. Fedick, pp. 92–106. University of Utah Press, Salt Lake City.
2002 An Institutional Perspective on Prehispanic Maya Residential Variation: Settlement and Community at San Estevan, Belize. *Journal of Anthropological Archaeology* 21:120–141.
2003 Space and the Limits to Community. In *Perspectives on Ancient Maya Rural Complexity*, edited by G. Iannone and S. V. Connell, pp. 83–93. Monograph 49. The Cotsen Institute of Archaeology, University of California, Los Angeles.

Lewenstein, S. M.
1987 *Stone Tool Use at Cerros*. University of Texas Press, Austin.
1991 Edge Angles and Tool Function Among the Maya: A Meaningful Relationship? In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 207–218. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.

Mallory, J. K.
1986 "Workshops" and "Specialized Production" in the Production of Maya Chert Tools: A Response to Shafer and Hester (1983). *American Antiquity* 51:152–158.

Masson, M. A.
1989 *Lithic Production Changes in Late Classic Maya Workshops at Colha, Belize: A Study of Debitage Variation*, Unpublished M.S. thesis, Department of Anthropology, Florida State University, Tallahassee.
2001 The Economic Organization of Late and Terminal Classic Period Maya Stone Tool Craft Specialist Workshops at Colha, Belize. *Lithic Technology* 26:29–49.

McAnany, P.
1986 *Lithic Technology and Exchange Among Wetland Farmers of the Eastern Maya Lowlands.* Unpublished Ph.D. dissertation, University of New Mexico, Albuquerque.
1991 Structure and Dynamics of Intercommunity Exchange. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 271–293. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.

McAnany, P. and P. A. Peterson
2004 Tools of the Trade: Acquisition, Use and Recycling of Chipped Stone. In *K'axob: Ritual, Work, and Family in an ancient Maya village.*, edited by P. McAnany, pp. 279–305. Monumenta Archaeologica 22. Cotsen Institute of Archaeology, University of California, Los Angeles.

McAnany, P. A.
1989 Stone-Tool Production and Exchange in the Eastern Maya Lowlands: The Consumer Perspective from Pulltrouser Swamp, Belize. *American Antiquity* 54(2):332–346.

1995 *Living with the Ancestors: Kinship and Kingship in Ancient Maya Society*. 1st ed. University of Texas Press, Austin.
2004 *K'axob: Ritual, Work, and Family in an ancient Maya village*. Cotsen Institute of Archaeology, University of California, Los Angeles.

McSwain, R.
1991a Chert and Chalcedony Tools. In *Cuello: An Early Maya Community*, edited by N. Hammond, pp. 160–169. Cambridge University Press, Cambridge.
1991b A Comparative Evaluation of the Producer-Consumer Model for Lithic Exchange in Northern Belize, Central America. *Latin American Antiquity* 2(4):337–351.

Mitchum, B. A.
1991 Lithic Artifacts from Cerros, Belize: Production, Consumption, and Trade. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 45–54. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.
1994 *Lithic Artifacts from Cerros, Belize: Production, Consumption and Trade*. Unpublished Ph.D. dissertation. Department of Anthropology, Southern Methodist University, Dallas.

Moholy-Nagy, H.
1976 Spatial Distribution of Flint and Obsidian Artifacts at Tikal, Guatemala. In *Maya Lithic Studies: Papers from the 1976 Belize Field Symposium*, edited by T. R. Hester and N. Hammond, pp. 91–108. Special Report 4, Center for Archaeological Research, The University of Texas at San Antonio.
1990 The Misidentification of Mesoamerican Lithic Workshops. *Latin American Antiquity* 1(3):268–279.
1991 The Flaked Chert Industry of Tikal, Guatemala. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 189–202. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wisconsin.
1997 Middens, Construction Fill, and Offerings: Evidence for the Organization of Classic Period Craft Production at Tikal, Guatemala. *Journal of Field Archaeology* 24(3):293–313.

Oland, M.
1998 Lithic Raw Material Sources at the Southern End of the Freshwater Creek Drainage. In *Belize Postclassic Project 1997: Laguna de On, Progresso Lagoon, Laguna Seca*, edited by M. A. Masson and R. M. Rosenswig, pp. 163–181. Report to the Department of Archaeology, Belmopan, Belize. Institute of Mesoamerican Studies Publication No. 2. University at Albany-SUNY, Albany, New York.
1999 Lithic Raw Material Sources at the Southern End of the Freshwater Creek Drainage: A View from Laguna de On, Belize. *Lithic Technology* 24(2):91–110.

Paling, J. S. R.
2008 The Lithic Tools from San Estevan. In *San Estevan Archaeological Project 2008*, edited by R. M. Rosenswig, pp. 107–125. Institute of Mesoamerican Studies Publication No. 15, University at Albany, SUNY.

Paris, E. H.
2007 The Lithic Tools and Debitage of San Estevan, 2005. In *The San Estevan Project, 2005*, edited by R. M. Rosenswig, pp. 75–92. Institute of Mesoamerican Studies Publication No. 14, University at Albany, SUNY.

Pecora, A. M.
2001 Chipped Stone Tool Production Strategies and Lithic Debris Patterns. In *Lithic debitage: context, form, meaning*, edited by W. J. Andrefsky, pp. 173–190. University of Utah Press, Salt Lake City.

Potter, D. R.
1980 Archaeological Investigations at Operation 2012. In *The Colha Project: Second Season, 1980 Interim Report*, edited by T. R. Hester, J. D. Eaton and H. J. Shafer, pp. 173–184. The Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Ricerche Ligabue, Venezia.

1982 Some Results of the Second Year of Excavation at Operation 2012. In *Archaeology at Belize: The 1981 Interim Report*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton, pp. 98–122. The Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Ricerche Ligabue, Venezia.

1991 A Descriptive Taxonomy of Middle Preclassic Chert Tools at Colha, Belize. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 21–29. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.

Rice, P. M.

1987 Economic change in the lowland Maya Late Classic Period. In *Specialization, Exchange, and Complex Societies*, edited by E. M. Brumfiel and T. K. Earle. Cambridge University Press, Cambridge.

Roemer, E. J.

1984 *A Late Classic Maya Lithic Workshop at Colha, Belize*, Master's thesis, Department of Anthropology, Texas A&M University, College Station.

1991 A Late Classic Workshop at Colha, Belize. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 55–66. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wisconsin.

Rosenswig, R. M.

2004 The Late Archaic Occupation of Northern Belize: New Archaeological Excavation Data. *Research Reports in Belizean Archaeology* 1:267–277.

2007 *The San Estevan Project, 2005*. Institute of Mesoamerican Studies Publication No. 14, University at Albany, SUNY.

2008 *San Estevan Archaeological Project 2008*. Institute of Mesoamerican Studies Publication No. 15, University at Albany, SUNY.

Rosenswig, R. M. and D. J. Kennett

2008 Reassessing San Estevan's Role in the Late Formative Political Geography of Northern Belize. *Latin American Antiquity* 19(2):123–145.

Shafer, H. J.

1982 A Preliminary Report on the Lithic Technology from Kichpanha, Belize. In *Archaeology at Colha, Belize: The 1981 Interim Report*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton. Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Recerche Ligabue, Venezia.

1983a The Lithic Artifacts of the Pulltrouser Area: Settlements and Fields. In *Pulltrouser Swamp: Ancient Maya Habitat, Agriculture, and Settlement in Northern Belize*, edited by B. L. I. Turner and P. D. Harrison, pp. 212–245. University of Texas Press, Austin.

1983b The Tranchet Technique in Lowland Maya Lithic Tool Production. *Lithic Technology* 12(3):57–68.

1991 Late Preclassic Formal Tool Production at Colha, Belize. In *Maya Stone Tools: Selected Papers from the Second Maya Lithic Conference*, edited by T. R. Hester and H. J. Shafer, pp. 31–44. Monographs in World Archaeology No. 1. Prehistory Press, Madison, Wis.

1994 A Late Preclassic Household Lithic Assemblage at Colha: Operation 2011 Midden. In *Continuing archaeology at Colha, Belize*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton, pp. 137–154. Studies in Archaeology 16, Texas Archaeological Research Laboratory, The University of Texas at Austin, Austin.

Shafer, H. J. and T. R. Hester

1979 Lithic Research at Colha: An Overview. In *The Colha Project, 1979: A Collection of Interim Papers*, edited by T. R. Hester, pp. 18–27. Center for Archaeological Research, University of Texas at San Antonio, San Antonio.

1983 Ancient Maya Chert Workshops in Northern Belize, Central America. *American Antiquity* 48(3):519–543.

1986 Maya stone-tool craft specialization and production at Colha, Belize: reply to Mallory. *American Antiquity* 51:148–66.

1991 Lithic craft specialization and product distribution at the Maya site of Colha. *World Archaeology* 23(1):79–97.

Sheets, P. D. and G. R. Muro
1972 Pressure Blades and Total Cutting Edge: An Experiment in Lithic Technology. *Science* 175:632–634.

Speal, C. S.
2005 *A Conjunctive Approach to Ancient Maya Economic Structure: Levels of Integration, Modes of Exchange, and the Lithic Assemblage from Cabbage Ridge, Belize*, M.A. thesis, Department of Anthropology, University at Albany, SUNY.
2006 Regional Economic Interaction in the Coastal Maya Lowlands: The Lithic Assemblage of Saktunha, Belize. *Lithic Technology* 31(1):3–26.
2008 Beyond Belize: Economic Geography through Comparative Lithic Data. Paper presented at the 73rd Annual Meeting of the Society of American Archaeology, Vancouver, British Colombia, Canada.

Stein, G. J.
1996 Producers, Patrons, and Prestige: Craft Specialists and Emergent Elites in Mesopotamia from 5500–3100 BC. In *Craft Specialization and Social Evolution: In Memory of V. Gordon Childe*, edited by B. Wailes, pp. 25–38. The University Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia.

Taylor, A. J.
1980 Excavations at Kunahmul. In *The Colha Project: Second Season, 1980 Interim Report*, edited by T. R. Hester, J. D. Eaton and H. J. Shafer, pp. 241–250. The Center for Archaeological Research, The University of Texas at San Antonio and Centro Studi e Ricerche Ligabue, Venezia.

Tobey, M. H., H. J. Shafer and M. W. Rowe
1994 Trace element investigations of chert from northern Belize. In *Continuing archaeology at Colha, Belize*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton, pp. 267–275. Studies in Archaeology 16, Texas Archaeological Research Laboratory, The University of Texas at Austin, Austin.

Torrence, R.
1986 *Production and Exchange of Stone Tools*. Cambridge University Press, Cambridge.

Turner, B. L. I.
1983 The Excavation of Raised and Channelized Fields at Pulltrouser Swamp. In *Pulltrouser Swamp: Ancient Maya Habitat, Agriculture, and Settlement in Northern Belize*, edited by B. L. I. Turner and P. D. Harrison, pp. 30–51. University of Texas Press, Austin.

Willey, G. R.
1972 The Artifacts of Altar de Sacrificios. *Papers of the Peabody Museum, Harvard University* 64(1).

Willey, G. R., W. Bullard, J. Glass and J. Gifford
1965 Prehispanic Maya Settlements in the Belize Valley. *Papers of the Peabody Museum, Harvard University* 54.

Wright, R. P.
1998 Crafting Social Identity in Ur III Southern Mesopotamia. In *Craft and Social Identity*, edited by C. L. Costin and R. P. Wright, pp. 57–70, M. E. Whalen, general editor. Archaeological Papers of the American Anthropological Association Number 8, Arlington, Virginia.

ABOUT THE AUTHOR

Elizabeth Paris recently received her Ph.D. in Anthropology at the University at Albany, SUNY, with funding from a Dumbarton Oaks Junior Fellowship in Pre-Columbian Studies. She earned her M.A. in Anthropology at the University at Albany, SUNY in 2006, and her B.A. in Anthropology at the University of Colorado-Boulder in 2004 (with distinction, Phi Beta Kappa). She is currently an adjunct instructor in the Department of Anthropology and Sociology at the University of Southern Mississippi. Her primary interests include the organization of economic exchange networks from a household perspective, and the social context of craft production and household wealth. Her dissertation field research project, the Proyecto Económico de los

Altos de Chiapas, investigated the political economy of Moxviquil and Huitepec, two Postclassic Mayan sites in the Jovel Valley of highland Chiapas, Mexico. The field project was directed with Roberto López Bravo (Director, Museo Regional de Chiapas), and was supported by an NSF Doctoral Dissertation Improvement Grant. She is also involved in ongoing research on metallurgical production at Mayapan, Yucatan, Mexico.