Preliminary Report of the 2005 Field Season at Lamanai, Belize: The Maya Archaeometallurgy Project

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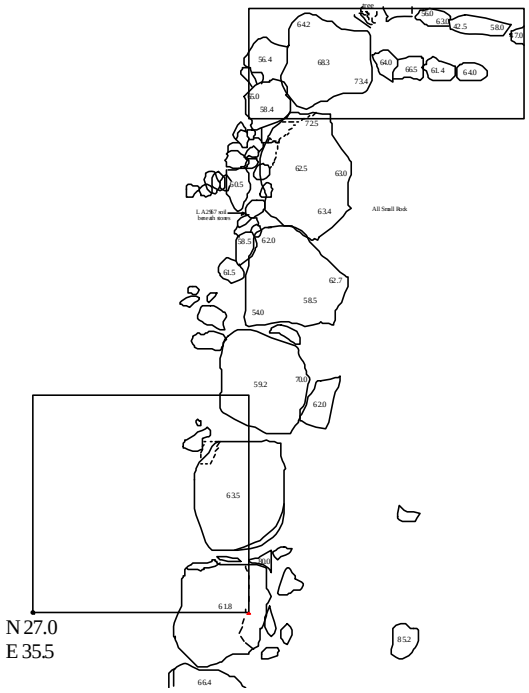

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Abstract

The following is a preliminary report of the 2005 field season at Lamanai, Belize by the Maya Archaeometallurgy Project and Lamanai Archaeological Project Field School. The theoretical background of the Maya Archaeometallurgy Project (MAP) is presented in summary form, along with a more detailed discussion of the methods and results of archaeological investigations in the Terminal Postclassic-Spanish Colonial Period occupation zone at Lamanai. Archaeological research on the nature of Maya metallurgy was conducted as part of a continuing program aimed at educating college students in archaeological field methods at the site of Lamanai. This report summarizes the findings from archaeological excavations at Structure N11-27, a small structure located north of two principal Terminal Postclassic-Spanish Colonial Period structures at Lamanai: N11-3 and N11-18. It is likely that Structure N11-18 represents the residence of Lamanai's *cacique*, or Spanish Colonial Period native authority. Structure N11-27 may represent an outbuilding of sorts for the residents of Structure N11-18. Alternatively, Structure N11-27 might have been used by members of the principal family that resided at nearby Structure N11-18 at the time of Spanish contact.

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Acknowledgements

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Introduction

This report presents the results of archaeological research in 2005 at the Maya site of Lamanai, located in the Orange Walk District of Belize (Figure 1). This field season comprises the fifth season of the Maya Archaeometallurgy Project (MAP), a research program initiated in 1999.

The 2005 field season was sponsored by the University of North Carolina Wilmington (UNCW) and operated under a permit issued by the Belize Institute of Archaeology, National Institute of Culture and History (NICH) to Dr. Scott E. Simmons. The 2005 archaeology program lasted a total of six weeks. During this time a four-week archaeological field school session was held between May 12 and June 9, 2005. A total of thirteen students from UNCW were enrolled in the archaeology field school at Lamanai. Dr. Scott E. Simmons and Ms. Laura Howard served as Co-Directors of the 2005 field school in archaeology at Lamanai.

The field schools at Lamanai have been directed by Dr. Elizabeth Graham from 1998 to 2000 and by Dr. Scott Simmons from 2001 to present. Under the direction of Dr. Simmons the field schools in archaeology at Lamanai have been part of a larger research program known as the Maya Archaeometallurgy Project (MAP). The MAP is a research program focused on studying the specialized production of copper and bronze objects in the Maya Lowland area during Postclassic and Spanish Colonial times. Since its inception in 1999 a central goal of this project has been to understand the relationships that existed between copper production and socioeconomic differentiation and interdependence among the Maya (Simmons 1999, 2004; Simmons and Howard 2003). A larger goal for the research project is to provide insights into the relationships that existed between craft production, socioeconomic integration, and cultural evolution in state-level societies.

The research conducted by Drs. Graham and Simmons builds on twelve years of archaeological research directed by Dr. David M. Pendergast, Curator Emeritus of the Royal Ontario Museum (ROM), between 1974 and 1986. During the course of this large-scale, ambitious project, Dr. Pendergast and his associates succeeded in defining the site's chronology, settlement characteristics and range of material culture types and architectural features (Pendergast 1981, 1985, 1986a, 1986b, 1990, 1991). This important research project documented the long duration of Maya occupation at Lamanai. Maize pollen recovered in sediments in the area known as "the Harbour" indicates that the first Maya peoples settled at Lamanai by roughly 1500 BC (Pendergast 1991:338).

The results of archaeological research revealed a long, unbroken sequence of Maya occupation at Lamanai through Preclassic and Classic times (Pendergast 1981). Excavations in the vicinity of the project camp also revealed that Lamanai survived the demographic and sociopolitical collapse that occurred at so many other major Maya sites in the Southern Lowland area during the ninth century AD. Dating of several prominent structures near the lagoon indicated that not only did Lamanai continue to be occupied beyond this period of major cultural transformations, but in a great many regards life at

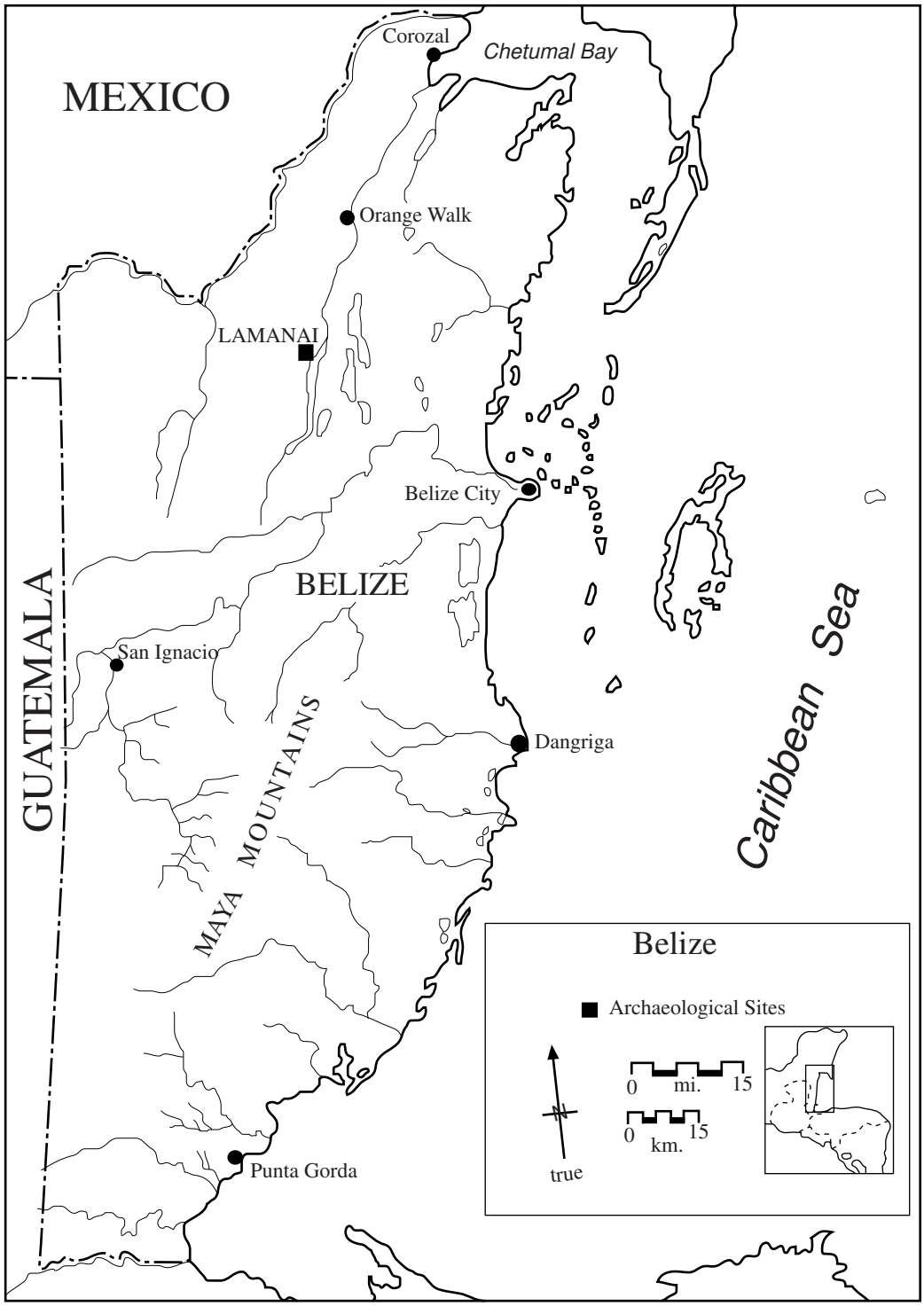

Figure 1
Location of Lamanai and Belize

the site during Postclassic times was as vibrant and dynamic as it had ever been (Pendergast 1986b, 1990). The work of Dr. Pendergast at Lamanai has encouraged further investigations at the site in recent years in a variety of research areas, including household archaeology, ceramic analyses, symbolic flaked lithic tools and, as mentioned above, archaeometallurgy. Research conducted since 1997 by Dr. Elizabeth Graham has focused on investigations in both Classic Period and Late Postclassic Period areas of the site (Graham 2004).

Lamanai was the focus of concentrated, yet intermittent, Spanish involvement beginning in the first half of the sixteenth century (Graham et al. 1989; Jones 1989, 1998; Pendergast 1986a). Following Spanish withdrawal from Belize in the eighteenth century, British interest in Lamanai revolved around ill-fated millworks for sugarcane processing during the last quarter of the nineteenth century. Had the sugarcane operation been a successful enterprise, Lamanai may have been occupied for even longer. As it stands now, Lamanai bears the distinction of being the longest continuously occupied site in the Maya Lowland area.

During the latter part of the Royal Ontario Museum's project at Lamanai, the Spanish Colonial Period site center became a prominent focus of research, particularly the area around the two Spanish churches for which the nearby village of Indian Church is named. A variety of copper artifacts had already been recovered in the area of Early and Middle Postclassic occupation, located north of the Spanish churches. Metal artifacts appear at Lamanai in considerable quantity in both the Middle Postclassic period and the years of the Terminal Postclassic and early Spanish Colonial periods. The two eras of major occurrence were separated by a hiatus of nearly two centuries in which metal objects seem to have disappeared almost entirely from Lamanai's artifact inventory, and at the same time seem to have assumed an at least partially different meaning in the community's life. The research conducted during the field school in archaeology at Lamanai during the last several years has contributed much information toward our understanding of the nature of Maya metallurgy. Future research at Lamanai is also expected to provide further insights into this largely unknown Maya technology and the role it played in the political economy of the site in Terminal Postclassic and Spanish Colonial times.

The report begins with a summary discussion of the theoretical foundations and main research goals of the Maya Archaeometallurgy Project. A brief summary of the current state of knowledge of Maya metallurgy is presented next, followed by a short history and of previous archaeological investigations by the ROM and Maya Archaeometallurgy Projects. The methods and results of fieldwork during the 2005 field season are presented immediately afterwards. Finally, the results of metallurgical analyses conducted by Dr. Aaron Shugar on copper artifacts recovered in 1999 during the first field season of the MAP are presented, as are the results of faunal analyses conducted on material recovered during the past five field seasons by Mr. Norbert Stanchly. Their analyses appear as appendices in this report.

Theoretical Foundations and Research Goals for the MAP

The research issues that are addressed by the Maya Archaeometallurgy Project intersect with several prominent areas of topical research in the humanities. One of these issues is human social identities - how they are created, negotiated and transformed by both individuals and the groups to which they belong (Cohen 2000; Friedman 1992; Giddens 1979; Holland et al. 2001; Jones 1997; Mann 1986; Shennan 1994; Voss 2005). Social Identity Theory, as it was originally conceived by social psychologists, is concerned with understanding the varied ways that individuals identify with, and behave as part of social groups, adopting shared attitudes, beliefs and behaviors (Tajfel 1982; Tajfel and Turner 1986; Turner 1999). Multi-disciplinary research from the fields of anthropology, ethnohistory and recently materials science, has contributed much to the discourse on social identities and social inequalities in Mesoamerica (Chase and Chase 1992; Costin and Wright 1998; French 2000; Gillespie 2000, 2001; Hendon 1999; Hirth 1993; Hosler 1994, 1995; Hosler and Macfarlane 1996; Lohse and Valdez 2004; Restall 1997, 1998; Sandstrom 1991; Smith 1987; Tozzer 1941). We are particularly interested in understanding the social identities of those individuals in ancient Maya society who transformed raw materials into functionally and socially valuable goods, the craft specialists. Additionally, we want to know who had access to certain symbols of social status, such as the copper bells, ornaments, tweezers and other adornments that probably acted as identifiers of social standing among the Maya.

A considerable amount of anthropological research has been devoted to the topic of craft specialization in recent years (Brumfiel 1987; Brumfiel and Earle 1987; Clark and Parry 1990; Clark and Houston 1998; Costin 1991, 1998; Costin and Wright 1998; Dobres and Hoffman 1994; Earle 1987, 2002; Inomata 2001; Jacobs 2000; Masson and Friedel 2002; Peregrine 1991; Schortman and Urban 2004; Wailes 1996; Wilk 1996). The Maya Archaeometallurgy Project combines research from these and other sources to elucidate who the craft specialists were in contact period Maya society and to provide substantive information on the identities and social positions of Maya craft specialists in late precolumbian and Spanish contact times. The project is unique in that it is the first and only one of its kind focusing on the specialized production of metal objects and the role of metal craft specialists in late Maya Lowland society.

A second area of inquiry to which the MAP research contributes is the study of Native American adaptations to European colonialism. Within the field of anthropology the broad topic of culture contact and its repercussions has a long history of research, particularly in the Americas (Bray 1993; Burkhart and Gasco 1996; Cahill and Tovias 2005; Deagan 1998; Dirks 1992; Dyson 1985; Farnsworth 1992; Ferro 1997; Gasco 2005; Gosden 2004; Jones 1989, 1998; Lightfoot 2005; Rogers and Wilson 1993; Thomas 1989, 1990, 1991; Voss 2005). Specific studies of the impacts of Spanish colonial policies on the Maya have yielded valuable insights into the ways in which Maya groups both retained traditional elements of their culture and adopted certain practices (such as Christian worship) introduced by the Spanish (Carmack et al. 1996; Clendinnen

1987: Farris 1984; Graham 1991; Graham et al. 1989; Jones 1989, 1990; Patch 1993; Restall 1997, 1998; Pendergast 1991).

In economic and social realms, it appears that the Spanish had varying degrees of influence on transforming certain traditional Maya ways of life. This influence may have extended to those visible symbols that reinforced Maya social identities, but this remains to be substantiated. For instance, preliminary results of MAP research indicate that traditional Mesoamerican symbols of status and identity (i.e., copper tweezers, bells, rings and clothing ornaments) do not appear to have been replaced with Christian symbols, such as crucifixes and medallions of Catholic saints. These and other metal objects were adopted by certain indigenous groups in the Americas and eschewed by others (Bamforth 1993; Eaton 1989; Graham 1998; Hester 1989; Scarry 1990; Thomas 1988, 1993). But at present we have only a very hazy picture of the identities of those Maya that had access to these powerful symbols of social status, whether the symbols were of Spanish or Maya origin. Once the advent of copper metallurgy is determined and our picture of those Maya is clearer it will be possible to more fully assess the impacts of Spanish colonialism on specific components of late Maya culture, particularly those nodes where social and economic realms intersect.

Broad MAP Research Questions

The Maya Archaeometallurgy Project (MAP) is a long-term, multi-disciplinary research project that seeks answers to a range of questions revolving around the issues of craft specialization and its varied roles in the political economies of late Maya communities. These questions include: who were the craft specialists in Spanish Contact Period Maya society? How did they identify themselves individually and as a social group? How did copper objects function as symbols of Maya cultural values, and how were they used to perpetuate expressions of selfhood and status in Maya society during this period? What were the productive contexts within which craft specialists worked in Contact Period Maya society? Were copper metallurgists attached to elites, did they work independently, or were their efforts undertaken within some other productive contexts that have yet to be identified?

Perhaps influence over the production and distribution of new, often symbolically charged materials, such as metal, was one of the measures Maya elites implemented to maintain their support, validate and reinforce their political and economic power and promote the dynamic stability of those centers not abandoned following the Classic Period 'collapse.' Earle (2002:1) asserts that the political economy is "channeled to create wealth and finance institutions of rule." Did powerful individuals at Lamanai control or oversee the work of craftspeople engaged in copper metallurgy as a way to create wealth for themselves and legitimate their rule? Alternatively, non-elite, independent specialists may have produced copper status and utilitarian objects and could have been influential in their distribution, not only for the enhancement or legitimization of their social status, but for reasons of commercial exchange. Did copper production provide an independent means by which Maya craft specialists and their families could manipulate these objects as symbols of social and economic distinction?

An important objective of MAP research is to explain the context and organization of copper craft production in Contact Period Maya world and how craft specialists were integrated into Maya economies during this time. Because of its long occupation history and rich archaeological record Lamanai is ideal for addressing questions of how dynamic social and economic stability were manifested in the late precolumbian Maya world. Yet at present there is a paucity of information available on the integration of craft specialists into Maya economic systems in Contact Period times. This is illustrated clearly in the recent publication of an edited volume entitled *Ancient Maya Political Economies* (Masson and Friedel 2002). Only 3 of the 14 articles addressed research focusing on the Maya Postclassic Period, and none focused on craft specialists in Spanish Contact Period political economies.

Graham (2002:415) reminds us that in the Maya area "elites and non-elites both configured the structure of the economy, including the political economy, and that even in cases of what appear to be elite control, non-elites structure the product." In broad terms this research is aimed at understanding how elites and non-elites configured both the structure of the economy and their social status in complex societies through the medium of specialized crafting. By examining the interrelated nature of craft production and social and economic status and power, this study will help to refine current theoretical models currently used by anthropologists.

One such model is the "prestige-goods" or "wealth finance" model. Prestige goods models posit elite control over at least one point in the sequence of craft production and/or distribution, including possibly elite crafting of wealth objects as a means of legitimizing status and manipulating political economies (Earle 2002; Schortman and Urban 2004). Inomata (2001) identifies Classic Period Maya elites as the producers of some finely crafted items, echoing Ames's (1995) concept of *embedded* specialization whereby elites produce crafts for their own use or for the use of other high-status individuals to legitimize their positions of power and status. But Janusek's (1999) embedded specialization takes place in domestic contexts in which kin relations play a more prominent role than elite supervision or control of production.

The recent work of Ames (1995) and Janusek (1999) points to the need for anthropologists to move beyond the simple conceptual dichotomy of independent and attached specialization to better understand how productive activities were structured in ancient economies. This research seeks to further refine our definitions of the contexts of production and improve our understanding of the social relations of specialized crafting. Specifically, a long-term goal of the MAP research is to provide important insights into the ways in which producers negotiated their social identities in complex societies through specialized crafting. In this way the work will contribute to a more complete understanding of the ways in which craft producers played integral roles in the social milieu of ancient complex societies.

To summarize, the main goals of the Maya Archaeometallurgy Project at Lamanai are to:

- Determine how metal production was organized through time. We're particularly interested in the *context* of production, and especially in determining whether copper metalsmiths worked independently, were attached to local elites or worked within some other kinds of productive contexts
- Understand the specific nature of productive activities, such as the creation of molds, smelting, casting, and annealing techniques, and recycling behavior
- Examine current models that focus on the relationships between craft production, political economies and socioeconomic complexity and contribute to the discourse on these topics through the research of the MAP

Since V. Gordon Childe's research into the nature of specialized copper production and the role that metallurgy played in the development of complex societies in Europe a number of such studies have continued in various regions of the Old World (Al-Saa'd 2000; Brown 1995; Bronson 1996; Chapman 1996; Childe 1936, 1942, 1951, 1958; Earle 2002; Levy and Shalev 1989; Rothenberg and Blanco-Freeijeiro 1981; Sheehan 1999; White and Piggott 1996). In contrast, research on copper metallurgy in the New World has focused almost exclusively on areas in West Mexico (Hosler 1985, 1986, 1994, 1995; Pollard 1987) and South America (Donnan 1973; Graffam et al. 1994, 1996; Hosler 1994; Lechtman 1985; Shimada 1994) and the relationships between the two areas. A prominent gap exists in our knowledge of metalworking and its role in the production and maintenance of social and economic complexity in the Maya Lowland area. Data derived during the course of the Maya Archaeometallurgy Project will be used to address issues regarding the relationships between craft production, political economies, and cultural evolution.

Historical Context – Maya Metallurgy

Metallurgy appeared relatively late in precolumbian Mesoamerica (Hosler 1986, 1994, 1995; Lechtman 1985), and copper objects did not begin arriving at Maya Lowland sites until very late in precolumbian times (Bray 1977; Hosler 1986, 1994; Pendergast 1962; West 1994). The earliest evidence of metallurgy in Mesoamerica comes from West Mexico, where smiths began working native copper ores by approximately AD 600. Two centuries later copper metallurgy was flourishing in West Mexico (Hosler 1994:12). It was the metallurgical technology that developed in West Mexico, in the states of Jalisco, Nayarit, Guerrero, Michoacan, and Mexico, that spread to other regions of Mesoamerica, including the Maya Lowlands, in Late Postclassic times (by ca AD 1400).

With their wondrous new sounds and colors, copper objects were certainly novel commodities during late precolumbian times in the Maya area (Bray 1977; Hosler 1994; Pendergast 1962; West 1994). But neither native copper deposits nor substantial copper ore sources are found in appreciable quantities within the Maya Area. Copper artifacts, and later the specialized technology needed to produce them, were imported from areas within West Mexico and Lower Central America to the Maya Lowlands, probably via the New River, the Bay of Chetumal and the Caribbean (Figure 1).

Throughout the first several millennia of their history the Maya had relied on stone and other locally available materials from which they could fashion utilitarian tools that could perform a variety of everyday tasks. Likewise, a variety of materials, including stone and shell, were used to create personal adornments. Beginning in Middle Postclassic times, copper artifacts imported from West Mexico made their appearance at Lamanai (Hosler 1994, 1995: Pendergast 1981, 1984, 1986b, 1990, 1991). By the 13th Century AD copper-tin bronze objects were arriving at Lamanai from both West Mexico and lower Central America. The local southeastern Mesoamerican metalworking tradition was characterized by lost wax cast status ornaments; some of these were from copper-gold alloys, others were from copper-tin bronze or copper-arsenic bronze. These objects include elaborate plain-walled bells, filigree finger rings and buttons.

During the Spanish Colonial Period, Maya groups at Lamanai were producing their own copper objects, and Pendergast (1991:339-340) has suggested that the Terminal Postclassic Period residents of Lamanai probably developed metallurgy prior to the arrival of the Spanish, although this critical assumption remains to be vigorously tested. The strongest evidence for copper production at Lamanai consists of four copper ingots, two casting reservoirs, seven prills (solidified droplets of copper that are a by-product of smelting and casting) and a variety of mis-cast bells and pieces of scrap sheet metal recovered from Terminal Postclassic and Historic Period deposits. These finds are indicative of metal processing and present compelling evidence for on-site copper casting activities. However, several prominent pieces of the puzzle still elude us in our efforts to gain a full picture of Maya metallurgy and the craft specialists engaged in copper production. These include locating a casting center where furnace features should be found, moulds used for casting metal objects, the source(s) of the copper metal, and the social roles that coppersmiths played within Maya society.

Previous Investigations in the Terminal Postclassic and Contact Period Zone

The Royal Ontario Museum's Lamanai Archaeological Project

During the first years of the 12-year span of the ROM Lamanai archaeological project, Pendergast and his associates concentrated much of their efforts on the investigation of monumental architecture in the civic-ceremonial core of the site, located in what is now the northern portion of the Lamanai Archaeological Reserve (Pendergast 1981). Some archaeological work was also conducted on the two Spanish mission churches, located south of the Preclassic and Classic Period civic-ceremonial center.

In addition, an important Early-Middle Postclassic structure group (N10-1, N10-2 and N10-4), perhaps the civic-ceremonial center at Lamanai during this time, was investigated near the shore of the lagoon. It was during the excavation of these structures that a number of copper and copper-tin/copper-arsenic bronze artifacts first came to light. Pyriform and globular bells, cutwork finger rings, bell-headed pins, and elaborate button-like ornaments were among the 25 copper and bronze objects recovered during the excavation of Structures N10-2 and N10-4 (see Figures 2 & 3). All were recovered in burial contexts, interred with individuals that had enjoyed some degree of prominence in Lamanai's Postclassic society (Simmons, Pendergast and Graham n.d).

Figure 2
LA 68/3. Finger ring recovered from Burial N10-4/2, ca. 13th – late 15th or possibly early 16th century A.D.

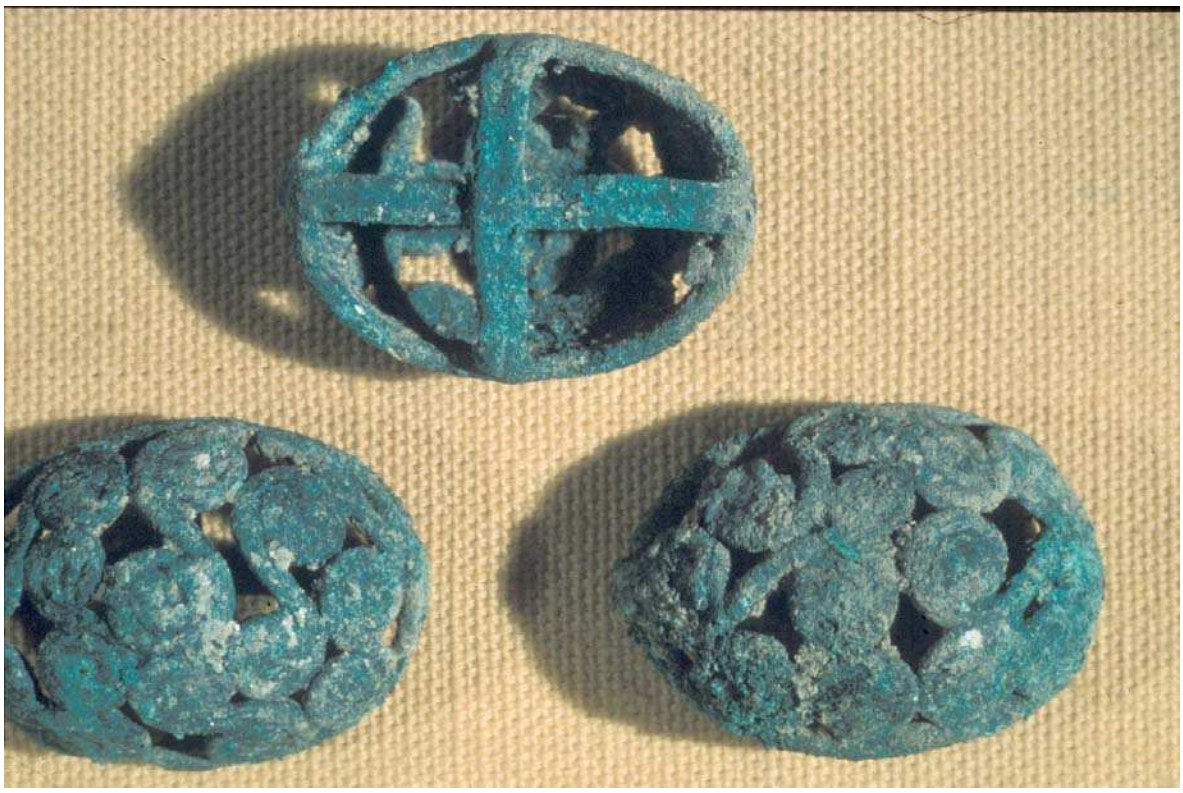

Figure 3
LA 69/8a-g. Elaborate, S-scroll false wirework copper ornaments recovered with Burial N10-4/3, ca. 13th – late 15th or possibly early 16th century A.D.

In the latter stages of the ROM project, areas to the south, comprising the Late Postclassic and Spanish Colonial Period zone, were the focus of investigations (Pendergast 1991, 1993). An extensive structure identification and mapping project, led by Dr. Stan Loten and Mr. Claude Belanger, was undertaken at the inception of the ROM project in 1974, and continued throughout the term of Pendergast's investigations at Lamanai. Over 940 structures were identified and mapped during this time (Pendergast, personal communication 2000).

The ROM project was very successful in identifying the occupation history of the site, the construction sequences of numerous monumental architectural remains, the vast array of both locally produced and imported material culture, and the importance of the site as a locus of Maya political and economic life in northern Belize for many centuries. Pendergast demonstrated that Lamanai had developed into an important social and economic center, encouraged in large part by the emergence of powerful elites, by Late Preclassic times. The results of his investigations at the site indicated that Lamanai continued to prosper and develop into a prominent Maya center during the Classic Period (Pendergast 1981).

Perhaps most surprising was the realization that Lamanai had not been completely abandoned in the ninth and tenth centuries AD as so many other neighboring sites in the Southern Lowland area had been. Instead of evidence of decline and decay, Pendergast and his associates found that Lamanai continued to be a vibrant, dynamic community up through the time of initial Spanish contact and into the mid-seventeenth century. New building construction projects in Terminal Classic times resulted in the creation of the ballcourt (Strs. N10-40 & N10-41) and the refurbishment of portions of Structure N10-9, an important temple that probably was the center of Maya ritual life at Lamanai during Terminal Classic and Early Postclassic times (Pendergast 1981).

Public works projects in Early and Middle Postclassic times, albeit smaller in scale than those in preceding centuries, resulted in the construction of Strs. N10-2 and N10-4. Robust trade in commodities such as copper with peoples both within and outside the Maya area was also evident, as were indications that political leadership was still strong and steady throughout Postclassic times (Pendergast 1991). The final years of the ROM project were focused on investigations of areas in the heart of the Terminal Postclassic and Spanish Colonial Period community. Chief among the areas investigated were the Structure N11-4 group, and Structure N11-18. These were investigated by Pendergast and his associates in 1983 and 1984 (Pendergast 1984).

1999 - The first field season of the Maya Archaeometallurgy Project

The results of the first full season of the Maya Archaeometallurgy Project, which took place in June and July 1999, have already been discussed in detail (Simmons 1999). The 1999 field season was supported by the H. John Heinz Fund Grant Program for Latin American Archaeology. The following is a summary overview of the 1999 season, particularly the work around Structure N11-18, so that the larger context of investigations in the area that was the focus of work in 2001 and 2002 can be more easily understood.

During the 1999 season the goals of the MAP included surveying a large area of the Terminal Postclassic-Spanish Colonial occupation zone and identifying possible areas of Maya metal production. Slightly more than half of the 1999 field season was spent conducting a survey over a substantial area of the N12 and N13 grid block at Lamanai. Much of the metal that was found appears to be British sheet pieces of copper associated with the failed late 19th century sugarcane operation (Pendergast 1981). However, the areas in which several other notable copper objects were recovered, including a 500g oblong, roughly rectangular copper object were found, await further investigation.

Another prominent goal of the work in 1999 was to re-locate Str. N11-18, the principal Terminal Postclassic Period structure at Lamanai (Pendergast 1991). The results of excavations in 1984 at this important structure provided sufficient research grounds for relocating the structure, the area around which had long-since been overgrown in thick, very dense secondary forest growth complete with all manner of nearly impenetrable vines, brush and small to medium sized trees.

Given the ephemeral nature of the architectural remains of Structure N11-18 (see Pendergast 1984), its relocation was a fairly challenging endeavor, particularly since none of the facing stones that form its most prominent architectural components rise more than roughly 15 cms above the existing ground surface. In addition, the extremely dense, secondary bush in the area made spotting the inconspicuous structural remains difficult as well. Nevertheless, Structure N11-18 was relocated during the last half of the 1999 field season. Metal detector survey was conducted in previously unexcavated areas around the structure, predominantly on its northern side (Simmons 1999).

The Terminal Postclassic-Spanish Colonial Period occupation zone at Lamanai also happened to be the locus of intensive occupation by Guatemalan and Salvadoran refugees who had fled the political turmoil in their countries during late 1983 and early 1984. Unfortunately, the Guatemalan and Salvadoran refugees who settled in this archaeologically fascinating area of the site were prodigious consumers of canned meat products, the now-buried metal containers for which quite effectively preclude any successful magnetic-based differentiation between Terminal Postclassic and Spanish Colonial Period Maya copper artifacts and that mid-1980's refuse.

Two 1x1 m excavation units were placed in the extensive midden deposit abutting that portion of the structure that had been identified as the north wall (Simmons 1999). This midden had first been identified during testing in the mid-1980's and had yielded a number of copper artifacts, among a great many other types of Terminal Postclassic Maya artifacts Pendergast (1984). Testing in this midden in 1999 was aimed at identifying various magnetic anomalies identified during metal detector survey of the area (Simmons 1999). Bells comprised the majority of the copper artifacts recovered from the midden testing in 1999, but several other metal artifacts were recovered as well (Table 1).

Table 1. Summary of Copper and other Metal Objects Recovered during 1999

Artifact Type	Small Find Numbers	Total
Cu artifacts		
Bells	Whole: LA 1232/1, 1234/1	2
	Miscast: LA 1238/1, 1240/1, 1242/1, 1243/1, 1244/1, 1246/1	6
Sheet	LA 1241/1	1
Ring	LA 1230/1	1
		10
Unidentified Metal		
Needle	LA 1236/1	1
Total metal artifacts recovered in 1999	-	**11**

2001 - The second field season of the Maya Archaeometallurgy Project

The principal aim of the 2001 season was to continue architectural clearing of previously unknown portions of Str. N11-18 in order to explore possible copper production areas associated with the structure. Another aim was to work toward completing the architectural documentation of this important Contact Period structure, believed by Pendergast (1985) to be the residence of the principal Colonial Period Maya authority at Lamanai, the cacique. The areas investigated in 2001 included sections of the building located both to the east and to the north of the area excavated by the ROM in 1983. The 2001 MAP investigations at Str. N11-18 lasted a total of eight weeks, from May to August 2001.

The results of investigations in 2001 suggested that either Str. N11-18 extended further east and north of the northern and easternmost areas of the building exposed by Dr. Pendergast and his associates (Simmons and Howard 2003: Figure 3) or that another structure was constructed immediately adjacent to (northeast of) Str. N11-18. Given the very close proximity of architectural features identified in 2001, it is likely that these features represent some kind of addition to the structure. This addition probably had a perishable roof, was open on its sides, and had identical floor ballast and retaining stones as those excavated by Pendergast in 1984 (see below).

Although a copper production area was not found during the 2001 field season, more copper objects, including evidence for on-site productive activities in the form of mis-cast copper bells, were recovered in both midden and floor ballast deposits (Table 2). Five of the eight copper artifacts recovered during the 2001 season were production failures, mis-cast during lost-wax casting activities (see Simmons and Howard 2003: Figures 43-45). The presence of these artifacts lends further support to the idea that copper production was taking place at Lamanai, probably in the immediate vicinity of Str. N11-18.

Table 2. Summary of Copper Objects Recovered during 2001

Artifact Type	Small Find Numbers	Total
Bells	Whole: LA 1578/1	1
	Miscast: LA 1580/19, LA 1580/20, LA 1576/10, LA 1566/1	4
Needles	Whole: LA 1581/25	1
	Miscast: LA 1580/18	1
Fishhook	LA 1575/2	1
	Total	**8**

Excavations in 2001 also resulted in further delineating architectural features of Str. N11-18. Specifically, several lines of vertically set cut limestone blocks, identical in form and aligned similarly to vertically set stones identified at Str. N11-18 by Pendergast in 1984, were identified in 2001. Lines A, C & E were found to be oriented roughly parallel (on an approximate N-S azimuth) to the easternmost line of vertically set stones identified in 1984 (Simmons and Howard 2003:15). Lines A and B were found to intersect these N-S stone alignments at roughly right angles, forming square-shaped architectural features. In addition to the lines of vertically set limestone block a line of large, flat limestone slabs, some evidently modified, were found beneath Line D, oriented at approximately the same azimuth (Simmons and Howard 2003: Figures 21-23). Roughly between 5-10 cms. of lighter brown soil was found immediately beneath Line D, separating these two architectural features. This deposit of dense silty clay appears on stratigraphic as well as artifactual grounds to pre-date other construction features identified in this particular area, making it likely that the linear limestone slab feature pre-dates the use of Str. N11-18.

Concentrations of fist sized and slightly larger pieces of unmodified limestone and soil were found associated with the square alignments of vertically set limestone blocks in 2001. The presence of Cib and Yglesias ceramic bowl fragments mixed in with this rubble and soil matrix suggests that this material was used as construction fill that was brought in by the Maya sometime during Terminal Postclassic/Spanish Colonial times. Specifically, these deposits most likely represent floor ballast material that was used to create elevated platforms retained by the facing stones identified as Lines A-F (Simmons and Howard 2003: Figure 3).

Testing conducted west of Str. N11-18 and north of Str. N11-3 (Simmons and Howard 2003:Figure 4) established the horizontal and vertical extent of midden deposits extending north of Str. N11-3. This large midden north of Str. N11-3 had been tested by Pendergast (1984) in trenching north of Str. N11-3, an important Late Postclassic and Contact Period building that probably pre-dates the construction of Str. N11-18. Our intent in 2001 was to test the expansive 'off-platform' area located immediately to the north of Str. N11-3 for evidence of copper production.

Following re-clearing of secondary growth that had returned after initial clearing of the area in 1999, metal detector survey was conducted in this area at the beginning of the 2001 season using the same Garrett Master Hunter metal detector with a 12" Crossfire II searchcoil. The results of the metal detector survey suggested that copper objects might be present in several 'off-platform' areas north of Str. N11-3. The excavation of two 2 m^2 blocks as well as a 4 x 2.5 m area produced several copper objects, including a complete fish hook (Simmons and Howard 2003: Figure 38).

Excavations north of Str. N11-3 also yielded evidence of perishable structures that dated to the Spanish contact period. These structures lacked the substantial stone rubble and earth platforms that were typical of others structures dating to this period, but several burials were recovered in association with what must have been at least one rather small and barely discernable structure. Several possible post features, seen as cylindrical

depressions in the limestone bedrock, were recorded in this area. One of the burials was a flexed human interment while the other appears to have been that of a dog, located approximately 60 cms. southwest of the human burial (Simmons and Howard 2003:19-25). Stratigraphically it appears that both burials were interred by excavations through the upper dark midden deposit and the underlying lighter brown, densely packed silty clay.

Since the midden deposit dates to Terminal Postclassic-Spanish Colonial times these burials, and presumably the perishable residence with which they were associated, are contemporaneous with the occupation of Str. N11-18. Again, very little 'off-platform' testing was conducted at Lamanai during the twelve-year ROM project directed by Dr. Pendergast. These finds are therefore notable for several reasons, not the least of which is that future investigations in areas of the Spanish zone having no discernable above-ground architectural remains can nonetheless be rewarding, particularly since they might yield evidence of various aspects of Maya domestic life at the site during the time of Spanish contact.

2002 - The Third Field Season of the Maya Archaeometallurgy Project

The third field season of the MAP again centered on the area of Str. N11-18. This was a comparatively short, four-week project that included excavations both at Str. N11-18 and preliminary testing of a previously unrecorded structure located approximately 12 meters north of Str. N11-18, designated Str. N11-27 (Simmons and Howard 2003). Excavations continued to the north and east of the areas investigated at Str. N11-18 in 2001 (Simmons and Howard 2003: Figure 3).

Additional floor ballast deposits were encountered immediately east of the areas around Str. N11-18 investigated by Pendergast in 1984. It appears that these deposits are associated with a structure that was either attached or located immediately north and east of Str. N11-18. Most likely the floor ballast material, comprised of earth and limestone rubble retained by vertically set limestone blocks, represents a structural addition to Str. N11-18 (see above discussion).

In addition to the work conducted at Str. N11-18, excavations were also expanded at nearby Str. N11-27, which is located approximately 12-15 meters north of Str. N11-18. This apparently small structure was identified during clearing of brush and other secondary growth in the latter part of the 2002 field season. The structure was not recorded by Pendergast during his investigations in this particular area of the site in 1984. This is likely because no structural remains were initially visible above ground after clearing of the area, either in 1984 or in 2002. Once the leaf litter had been removed in 2002, however, several stones that appeared to have been modified were noted in this area.

Faint magnetic anomalies were noted during the metal detector survey conducted in this particular area, which appears topographically as a low rise that slopes to the east, toward the lagoon (topographic map in preparation). These faint anomalies usually

signal the presence of more deeply buried (not near-surficial) metal objects. Usually the modern (1980's) aluminum tins and other metal (usually steel) refuse present in the area (see above discussion) produce fairly strong magnetic anomalies that are easily identified by the metal detector and verified with limited probing of the ground surface by MAP team members.

Excavations at Str. N11-27 in 2002 consisted of the removal of approximately 25 cms. of dark silty loam in a 2 m^2 area that appeared to represent the approximate mid-point of the low topographic rise. A total of five copper prills and a probable copper bell clapper were recovered in this 2 m^2 area (Table 3), confirming our suspicions of this area based on the results of metal detector survey. These copper artifacts were recovered from floor ballast deposits consisting of soil mixed with mostly fist-sized limestone rubble. The presence of this material and associated artifacts confirmed that this low topographic rise was indeed a Maya structure. The recovery of Yglesias sherds in the platform construction fill indicates a late occupation date of somewhere after approximately AD 1450 (Graham 1987, 2004).

Table 3. Summary of Copper Objects Recovered during 2002

Artifact Type	Small Find Numbers	Total
Bells	Whole: LA 2070/5, LA 2044/4	2
Bell clapper	LA 2081/2	1
Prills	LA 2081/1, LA 2096/1, LA 2096/2, LA 2106/1, LA 2106/2	5
	Total	**8**

In addition to the 2 m^2 area excavated at the high point of this particular topographic rise, a 1x 3 m trench was excavated 4 meters east of the 2 m^2 unit in an attempt to locate additional structural remains that would help delineate Str. N11-27. Substantially high densities of rubble core, comprised of generally larger than fist-sized stones, were encountered in this trench up to roughly 40 cms. below the present ground surface. Artifact densities were generally low throughout the E-W length and depth of the trench. No vertically set or other possible facing or platform retaining stones were identified in this trench, however, suggesting that we had not reached the eastern 'edge' of this platform. No additional work was conducted in this area in 2002.

In sum, the results of MAP investigations in 2002 included identification of a structure immediately north of the principal Spanish Contact Period residence, Str. N11-18. This newly recorded structure, N11-27, was tentatively found to date to at least the earlier period of occupation of Str. N11-18 based on the presence of Yglesias pottery sherds. No Spanish or other European cultural materials was recovered during limited

testing of this structure in 2002, thus it is uncertain if the structure was in use after first Spanish contact at Lamanai, which probably occurred sometime after 1544. Although only limited testing of Str. N11-27 was conducted in 2002, the recovery of clear evidence of copper production in the form of five (and possibly six) copper prills was quite encouraging, and provided the impetus for future testing of the structure in following field seasons.

2004 - The Fourth Field Season of the Maya Archaeometallurgy Project

The 2004 MAP field season at Lamanai lasted six weeks, with four of those (from May 12 to June 9) being part of the field school for UNCW archaeology students. The research goals for the 2004 field season were to 1) continue the process of completing the architectural documentation of Str. N11-27 through horizontal exposure of construction features, 2) search for additional evidence of metalworking activities, specifically the production of copper and bronze objects, in and around Str. N11-27 and 3) document the spatial and functional relationships between Structures N11-18 and N11-27 and Maya copper production activities.

Horizontal or block excavation was the primary method of subsurface investigation conducted in 2004. In addition, some limited trenching was undertaken in 2004 for the purposes delineating architectural features of Str. N11-27 and identifying possible midden deposits that might yield the same kinds of copper production failures (such as mis-cast bells) and raw materials (such as copper pigs and scrap sheet pieces) found in the north side midden of Str. N11-18. Most excavation blocks measured $2m^2$; trenches varied in total length but measured .50 m in width.

During 2004 the MAP investigations were designated Op 04-02 and Str. N11-27 was the focus of these investigations. The 'Sub-op" designation has not been used in the past at Lamanai, although 'Operation' is a designation used for specific investigations undertaken in various parts of the site. In general, the field and lab methods used to conduct the 2004 Field School excavations are those designed and currently utilized by the Lamanai Archaeological Project (LAP). Archaeological investigations of Lamanai by David Pendergast began in 1974 and Elizabeth Graham became the Principal Investigator in 1996.

In terms of the research conducted during 2004 there were several noteworthy achievements. First, we were able to more fully define the horizontal extent of one of Str. N11-27, possibly an outbuilding of the kind Farris (1984:178-179) mentions as typically associated with the residences of Maya *caciques*. With few exceptions, these buildings, and indeed those of Maya Contact Period *caciques*, have not been studied extensively in the Lowland Maya area. Positive identification of these structures in the future will provide information on the architectural and functional nature of these buildings.

In the case of Str. N11-27 at Lamanai, only a portion of the building was investigated completely. The north wall was defined as a line of unmodified limestone

rocks, as were portions of the west wall. While the north wall was completely exposed during 2004, both the east and west walls of the small structure were only partially cleared (Simmons 2004: Figure 3). That portion of the west wall that was exposed appears to have been comprised of the same small, unmodified limestone rocks that made up the north wall. But on the east side the rocks were found abutting much larger limestone boulders, only the western edges of which were exposed in 2004 (Simmons 2004:19). Interior flooring was made up of masses of small to fist-sized pieces of limestone and earth that were presumably packed down to create internal flooring for the structure. This construction technique has been noted at nearby Structure N11-18 and at various structures at the site of Tipu, located in the Cayo District of Belize (Graham 1991; Graham and Bennett 1989; Pendergast et al. 1993: Simmons and Howard 2002).

A human burial (N11-27/1) was encountered during excavations at Str. N11-27 in 2004. Found in a flexed position near the northeast corner of the structure, the human remains were found to be in a fairly poor state of preservation. A partial crypt, consisting of a single course of limestone rocks, some of which had been modifies, was found to the north, south and east sides of the burial (Simmons 2004:Figures 16 & 17). No grave good were found with the individual, and it was not possible to identify the age at death or sex of the individual with any degree of certainty.

For the purposes of our research on the nature of Maya copper metallurgy at Lamanai several important steps were taken during 2004. First, the recovery of two more copper prills and three sheet copper fragments provides additional evidence of on-site Maya metallurgy (Table 4). The recovery of these small artifacts adds to the corpus of copper objects that can be chemically analysed for manufacturing characteristics. Presently Dr. Aaron Shugar is completing an analysis of copper objects recovered from the north Side midden of Str. N11-18, and his report on the results of these analyses is forthcoming. Using analytical techniques such as laser ablation inductively coupled plasma mass spectrometry (LA-ICP), light optical microscopy (LOM), and scanning electron microscopy (SEM), Dr. Shugar's findings add further weight to the idea that the Maya at Lamanai were actively engaged in copper production activities during Spanish colonial times, and probably earlier.

Table 4. Summary of Copper Objects Recovered during 2004

Artifact Type	Small Find Numbers	Total
Prills	LA 2909/6, LA 2936/7	2
Scrap pieces	LA 2909/7, LA 2924/12, LA 2932/1	3
	Total	**5**

The continued absence of copper artifacts of European design, form and chemical composition adds strength to the idea that the Maya of Lamanai developed the technology of copper metallurgy prior to the arrival of the Spanish in Yucatan (Simmons 2005; Simmons, Pendergast and Graham n.d.). The recovery of the seven copper prills in contexts that likely pre-date Spanish contact can be taken as tentative evidence to support this idea as well. Undoubtedly much more work must be done in order for us to be confident in identifying copper metallurgy as an indigenous Maya technological innovation, and not one that was introduced by the Spanish after contact.

It is very clear, however, that archaeological investigations conducted during 2004 provided further compelling evidence that Str. N11-18 and its immediate environs, including Str. N11-27, were very likely a locus for copper production, the technology for which was very new to the Maya. The productive nature of this technology has not yet been documented in the Maya area, and although to date no production features have been identified, the recovery of mis-cast copper objects and production debris, specifically the prills and scrap sheet pieces recovered in 2004, strongly suggests that we are closer than ever to identifying the locus or loci of copper production at the site.

In addition, the strength of the association between the contact period occupants of Strs. N11-18 and N11-27 and copper metallurgy seems to be growing based on information derived during MAP excavations in 2001, 2002 and 2004. Excavations during the first two seasons were focused on the north end of Str. N11-18, and roughly half (8 of 15) of the copper artifacts we recovered there were either production failures or production debris. Thus far all five of the copper artifacts recovered from excavations at nearby Str. N11-27 are production debris. This trend continued in 2005 with the recovery of several more copper artifacts that represent production materials (see below).

Research Goals and Methods for the 2005 Field Season

The focus of MAP (Maya Archaeometallurgy Project) research at Lamanai in 2005 was the area located north of the Spanish mission churches (Figure 4). Specifically, MAP investigations were continued in the area of Str. N11-18, described by Pendergast (1993:118) as the residence of an important member of Lamanai's contact period community, probably the *cacique* or "local Indian ruler" (Farriss 1984:540). A total of 92 of the 180 (51%) of the copper and alloyed copper artifacts thus far recovered from Lamanai have come from Str. N11-18 and its immediate environs. Almost all of the remaining 88 copper objects come from Early Postclassic elite burial contexts, and none of these objects were manufactured on site (Hosler 1994; Hosler and Mcfarland 1996). Most significantly, as mentioned above three copper ingots or pigs have been found in the immediate vicinity of Str. N11-18, as well as a number of mis-cast copper bells, scrap pieces and prills. These constitute rather strong evidence for on-site copper production at in the vicinity of Str. N11-18 and Str. N11-27, which may be an outbuilding of Str. N11-18. To date this is the best evidence we have of indigenous metal working in the entire Maya area.

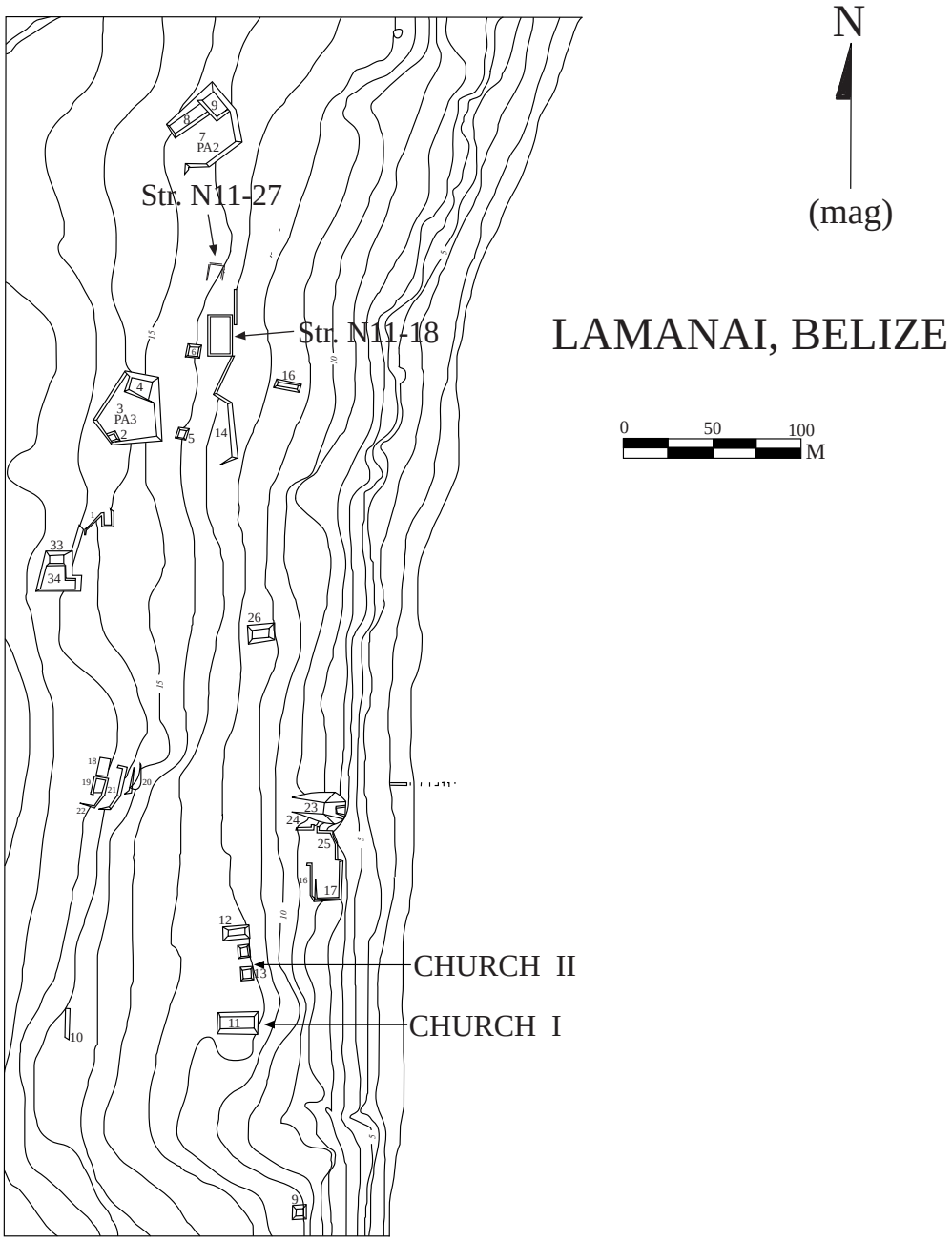

Figure 4

Site Plan, N11 Grid Block
Lamanai, Belize

Two specific areas were the focus of fieldwork during the 2005 MAP season at Lamanai. These were the area immediately north of Structure N11-18, the '*cacique's* house' and Structure N11-27, located approximately 15 meters north of the '*cacique's* house.' A substantial portion of the relatively small (4 x 5 m) residential building, Structure N11-27, was excavated in 2004 (Simmons 2004 and see above summary). But at the end of the 2004 field season we had not completely defined the southern extent of this small structure.

Excavations in 2005 were aimed at delineating the southern extent of Structure N11-27, specifically locating and documenting what we expected to be a southern platform face. Our expectation was that a southern platform face, consisting of a single line of unmodified limestone rocks, would be similar to those encountered on the north and east sides of the structure (see Simmons 2004:34). The east platform face appeared to be made of much larger, unmodified limestone rocks, which were essentially small limestone boulders, designated Line C (Simmons 2004). Against the west face of these large stones had been placed some smaller stones of the type used in the construction of the north and west platform faces, suggesting that Structure N11-27 was constructed sometime after Line C.

Therefore, a main goal of the 2005 field season was to complete the architectural documentation of Structure N11-27 by defining both the southern and eastern walls of the structure, and further examine the relationship between Line C and Structure N11-27. A related goal was to expose that portion of Line C that was appeared, based on surface indications, to extend to the south from the area of Structure N11-27 toward Structure N11-18, the *cacique's* house. Specifically, this line of very large stones appeared to represent the remains of a structure that had not been previously identified in the area of the *cacique's* house. The placement of excavation units around several of these large stones in the area just north of Structure N11-18 was aimed at exposing these stones for the purpose of architectural documentation of this prominent feature, Line C. In addition, we hoped to gain some understanding of the construction history of this particular feature and how its use might be related to contact period activities at Structures N11-18 and N11-27.

Another goal of the 2005 Maya Archaeometallurgy Project was to complete the chemical compositional analyses of a select group of copper artifacts that had been recovered during the first field season of the MAP. Dr. Aaron Shugar of the Smithsonian Center for Materials Research and Education (SCMRE) has recently completed these analyses and his report comprises Appendix 6 of this report. Using analytical techniques such as laser ablation inductively coupled plasma mass spectrometry (LA-ICP), light optical microscopy (LOM), and scanning electron microscopy (SEM), Dr. Shugar's findings add further weight to the idea that the Maya at Lamanai were actively engaged in copper production activities during Spanish colonial times, and probably earlier.

Field Methods

During the 2005 field school season a total of 9 units were systematically excavated, covering a total area of 25.5 square meters. Unit dimensions varied but all measured between 1 to 2 meters square in area. Excavation units were tied into a horizontal grid system that has as its benchmark (0, 0) point the northeast corner of Structure N11-3. Therefore, all excavation units situated north and east of the northeast corner of Structure N11-3 were given a N/E coordinate. No excavations were conducted south of Str. N11-18 in 2005. Excavation unit coordinates were referenced using the grid coordinate of the southwest corner of each unit.

Vertical elevations were taken from several temporary datum points, all of which were established from either one of our two permanent, concrete benchmarks. One of these is situated near the northeast corner of Str. N11-18, serving as the vertical datum for excavations in the area of Strs N11-18 and N11-27; its elevation above mean lagoon level is 14.50m amll or 'above mean lagoon level.' This designation, above mean lagoon level (amll) has been used throughout the Lamanai Archaeological Project as a standard vertical reference designation (Simmons and Howard 2003).

All lots within the units were trowelled and any visible cultural material was hand collected in a zinc tray. All soil excavated during the 2005 field season was screened through ¼" metal mesh, and soil color descriptions were based on the Munsell Soil Color Chart. Artifact trays were transported to the laboratory for processing. Students enrolled in the Lamanai Archaeological Project's field school generally carried out the majority of the fieldwork with help from four local field assistants from Indian Church.

Excavations followed natural stratigraphic deposits in 2005. If discrete soil deposits exceeded 20 cm in depth then arbitrary 5, 10 or 20 cm levels were excavated within those deposits in order to maintain some horizontal control over the locations of artifacts within those strata. All excavated cultural material, including modern refuse, was collected in the field for processing in the archaeology laboratory. Once counted and briefly described in the laboratory, however, modern trash was discarded.

The field school curriculum dictates that the first week of the course be reserved for introductions to Maya archaeology, archaeology at the site of Lamanai and in our specific research area, and the methods utilized by the LAP. As a result, excavations did not begin until the second week of the program. Required fieldwork for participants includes tape and compass mapping, leveling with the transit and level, detailed archaeological note taking, plan and profile drawing, soil description and excavation techniques. Laboratory work for field school students is described below.

Excavations in 2005 were concentrated in one specific area of Structure N11-27 (Figure 4). As discussed below, excavations were conducted in this area to delineate the architectural features of this structure and investigate the presence of any possible copper production areas associated with this structure. A total of 49 separate lots were excavated at Structure N11-27 and its immediate environs during the 2005 field season (Table 5).

Table 5. Description of Field and Laboratory Recording Procedures*

LAP System	2005 Field Season designations used	Description
OPERATION	OP 05-01	OP indicates an operation, the 05 indicates the year in which the operation was assigned and carried out. The second number is assigned in chronological order and indicates the number of operations that have been assigned that year. For 2005 the field school excavation was the 1st operation assigned. Each distinct area under investigation is assigned a separate operation that will track all lot numbers, burials, vessels, et al that are assigned for that project.
LOTS	LA 2939 – LA 2986 49 total lots assigned in 2005	Lot numbers are then assigned and numbered sequentially within each operation. A lot is a distinct area under investigation and can include, but is not limited to, an architectural feature, a 10-20 cm (or other) arbitrary level of soil, or any other significant deposit. A lot form is filled out (Appendix 1) for each distinct area under investigation and provides information such as thickness of deposit, date of deposit, and relationship to datum and/or surface. A master list of lots is maintained for reference and to aide in assignment of open lot numbers.
SMALL FINDS	LA 2939/1 – LA 2986/1 153 total Small Finds recovered in 2005	Culturally and/or temporally significant artifacts, termed small finds, are pulled from their lot and given a distinct catalog number. For example, a copper bell was recovered which has a catalog number of LA 2966/12; it was the twelfth significant (diagnostic) find in lot LA 2966. Attribute analyses are conducted and a separate form is completed for each small find that contains information such as the dimension, weight, provenience, and illustration (Appendix 1). A master small find list is maintained for reference and ease in assignment of catalog numbers. All small finds are labeled and stored in the secure bodega at Lamanai.
BURIALS	LA N11-27/2 1 burial identified in 2005	Burial control numbers have typically been assigned according to the structure number, Burial N11-27/2 is the second burial recovered from Structure N11-27. There are detailed field and laboratory forms that require all human remains to be systematically recorded. All relevant lots are recorded.

* Copies of all Operations forms, Lot Record forms, Small Finds forms are found in Appendix 1.

Laboratory Methods

All excavated cultural material was transported in zinc trays from the field to the on-site laboratory at the Lamanai Archaeological Reserve where the artifacts were washed, dried, sorted, and analyzed. The LAP procedures include sorting all washed artifacts by material, with the intent being that artifacts permanently stored by material makes them easier to locate for future analysis. It is during this phase that culturally and/or temporally significant finds, termed Small Finds, are separated from other cultural material in their respective lots. Each Small Find is designated by its Lot number and a specific catalog number, such as a copper bell recovered in 2005, designated LA 2966/12. A corresponding analysis form is filled out for each Small Find recovered at Lamanai (see Appendix 1).

Although Lot and Operation Records are considered field forms they are completed while laboratory processing is taking place. Also, during laboratory processing Lot and Small Finds Records are entered into LAP's archaeological database software program, *Superbase*. Both Lot Record and Small Finds summary information Table 5. Description of Field and Laboratory Recording Procedures are presented in Appendix 2 and Appendix 3, respectively. Other cultural material that is not considered a Small Find, such as ceramic sherds, chert flakes, obsidian blades, bone, and shell, were sorted by lot and counted and recorded on the LAP Artifact Count Form (Appendix 4). The importance of proper laboratory processing is stressed to all students and each participant in LAP's field school is required to complete every step of laboratory processing in order to expose them to these procedures as well as assist with assuring that all initial lab work is completed for each season. The material is well labeled and stored in secure plastic packing boxes with snap-tight lids at the on-site bodega in the Lamanai Archaeological Reserve.

Research Results from the 2005 MAP Field Season

The following section presents a summary of the results of excavations at Structure N11-27, the primary focus of archaeological investigations in 2005. Another focus of work during the 2005 field season involved laser transit mapping of the areas investigated in 2001, 2002, 2004 and 2005. The data collected during this mapping are still being processed so that a digitized version of a site plan for this particular area is in preparation. This section of the preliminary report is organized into three sections. The first section addresses the results of field investigations at Structure N11-27, specifically the architectural features encountered. The next section presents a discussion of stratigraphic deposits found both within and immediately adjacent to the structure. A preliminary discussion of the types of cultural material encountered during excavations at Structure N11-27 will also be presented in this second section of the report. The last section of the research results from the 2005 MAP field season focuses on dating, and preliminary assessments of dates of occupation of Structure N11-27 and the adjacent linear stone feature, designated Line C, encountered to its east will be offered.

Excavations at Structure N11-27

Structure N11-27 was likely a pole and thatch structure that covered a raised earth and stone platform. The platform was elevated roughly 20-30 cms. above the Late Postclassic-Spanish Colonial Period ground surface and was faced with at least three, and possibly four, lines of irregular, apparently unmodified limestone rocks, the most prominent of which was Line C (Figure 5). Archaeological investigations began at Str. N11-27 in 2002 but were very limited in scope, consisting of a single $2m^2$ excavation unit (see above discussion). Excavations were expanded at Str. N11-27 in 2004, largely because strong evidence of copper metallurgy was found during 2002. The evidence was in the form of five copper prills, which are by-products of melting and casting activities. Both the 2004 and 2005 excavations were aimed at identifying additional evidence of copper metallurgy at this small structure that appears, at least spatially and temporally, to be related to nearby Structure N11-18. We therefore expected to recover additional evidence of how this small structure may have been used, particularly with regard to copper production activities, and assess how it might have been associated with nearby Structure N11-18. Investigations in 2005 were also aimed at completing the architectural recordation of this structure, as this was not accomplished by the end of the 2004 season.

An excavation unit measuring 2.25 m x 2 m (N-S x E-W) was located at N27.0 E 37.5 to expose the line of stones (Line C) that formed the eastern platform face of Structure N11-27 (Figure 5). Immediately to the north (at N29.25 E 37.5) another 2.25 m x 2 m (N-S x E-W) excavation unit was situated to complete the exposure of the eastern platform face of the structure and link with excavations completed at the juncture of Lines A & C in 2004 (Simmons 2004:Figure 3). Excavations in these two units succeeded in exposing all of Line C, which forms the eastern face of what is likely the first stage of construction of the Structure N12-27 platform. Line C is an alignment of large limestone boulders measuring on average between 80-100 cms. in length (along their long axis) by roughly 75-90 cms. in width (short axis) and 35-45 cms. in thickness. The feature has an azimuth of 10^o east of magnetic north.

Linear Limestone Boulder Feature - Line C (North Section)

By the end of the 2005 field season a total of 10 large limestone rocks were exposed in Line C, which appears to extend at least 15m in total length. The sides and surfaces of these stones were completely exposed in both the northern and southern areas excavated in 2005. Only the surfaces of the stones that appeared in between these excavation areas were exposed by the close of the 2005 field season. In other words, the surfaces of at least five stones were exposed in between the northern and southern excavation areas in 2005, but these stones were not mapped due to time restrictions at the end of the field season. The large stones of Line C that were completely exposed, however, all appear to have been modified, especially on their western faces, where any protrusions of rock were carefully chipped away to create an even, uniformly flat face.

Each of the stones is a very hard, dense limestone. They were carefully fitted together to minimize gaps created by the irregular shapes of the stones (Figure 6). Gaps present in between the large stones were filled or 'chinked' with smaller stones to plug

Figure 5
Str. N11-27 excavated areas, 2004 & 2005
Operations 04-02 & 05-01, Lamanai, Belize

Figure 6

Line C, forming the eastern platform face of Structure N11-27, Lamanai, Belize. Note the uniform western face of the large stones. Densely packed floor ballast is seen on the left (east) side of Line C. Larger floor ballast or core stones (removed) were found on the right (west) side of the stones in what was likely the interior of Str. N11-27. A few of the stones of Line A, the northern platform face of the structure, are seen at the bottom edge of the image. Str. N11-27 facing stones were placed against the west (right) faces of the northernmost (bottom) two large limestone rocks near the juncture of Lines A and C. Burial N11-27/1, backfilled, and associated crypt stones are located just to the right of those particular facing stones abutting Line C. Note north arrow in upper left of image.

spaces left after the large rocks were fitted into place. Of the two faces of the linear stone feature the western face is clearly the most 'finished.' There was no evidence, however, that either of the two faces had been plastered, painted or finished in any other way. In contrast to the treatment of the west face of the feature, the east face as a whole was quite irregular in form, with evidence of only minor (or no) modifications to each stone. In addition, on the east face of the feature large gaps were present in between each of the large limestone rocks (Figure 7).

At this point it is unclear how this particular feature may have functioned. It is possible it represents a face of what would likely be a rather substantial earth and stone platform based on the very large size of the stones themselves. Line C may form the western platform face of a structure not yet identified, the largest portion of which lies to the east of the area we excavated in 2004 and 2005. It seems less likely that the feature functioned as some kind of walkway or stone pathway because of its direct association with what is probably compacted floor ballast material (earth mixed with small fist-sized and slightly larger stones). It is possible that the very large limestone rocks are part of a larger structure that on stratigraphic grounds pre-dates the construction of both Structures N11-27 and N11-18.

Excavations undertaken immediately east of Line C revealed that the feature had been constructed atop earth and dense accumulations of limestone rock (Figures 8 & 9). The soil matrix was very dense and compacted, and very few artifacts were found. Artifacts were generally few in number in Lots LA 2952, 2959, 2963 and 2977, all excavated immediately east of Line C. Ceramic sherds that were recovered were fairly weathered, with eroded surfaces and generally undistinguishable in terms of their temporal affiliation. Initial observations in the field suggest that many are likely Classic period sherds, but formal analyses have not yet been completed on the ceramic materials recovered from these or other lots excavated in 2005.

Interestingly, a small side-notched projectile point was recovered roughly 25 cms. below the present ground surface in the densely compacted soil with many small stones that made up Lot LA 2959. Small side notched projectile points began to be produced in quantity during the Late Postclassic Period and their production and use extended well beyond Spanish Colonial times (Simmons 2002). It is possible that this deposit of very compact stones and earth represents material that was brought in during the second construction episode when the elevated platform of Structure N11-27 was expanded to the east (see below discussion).

Several lines of evidence suggested that Line C pre-dated the construction of Structure N11-27. The first of these was the immense size of the stones and the overall energy that must have been invested in the construction of this feature. Stones of this immense size are atypical of Late Postclassic construction, as is the relative amount of effort that would have been required in the creation of this feature (Pendergast et al. 1993). Generally, platform facing stones that are part of structures dating to Late Postclassic and Spanish Colonial times in Belize are roughly square or rectangular in shape and are set vertically into the ground, on their short edge.

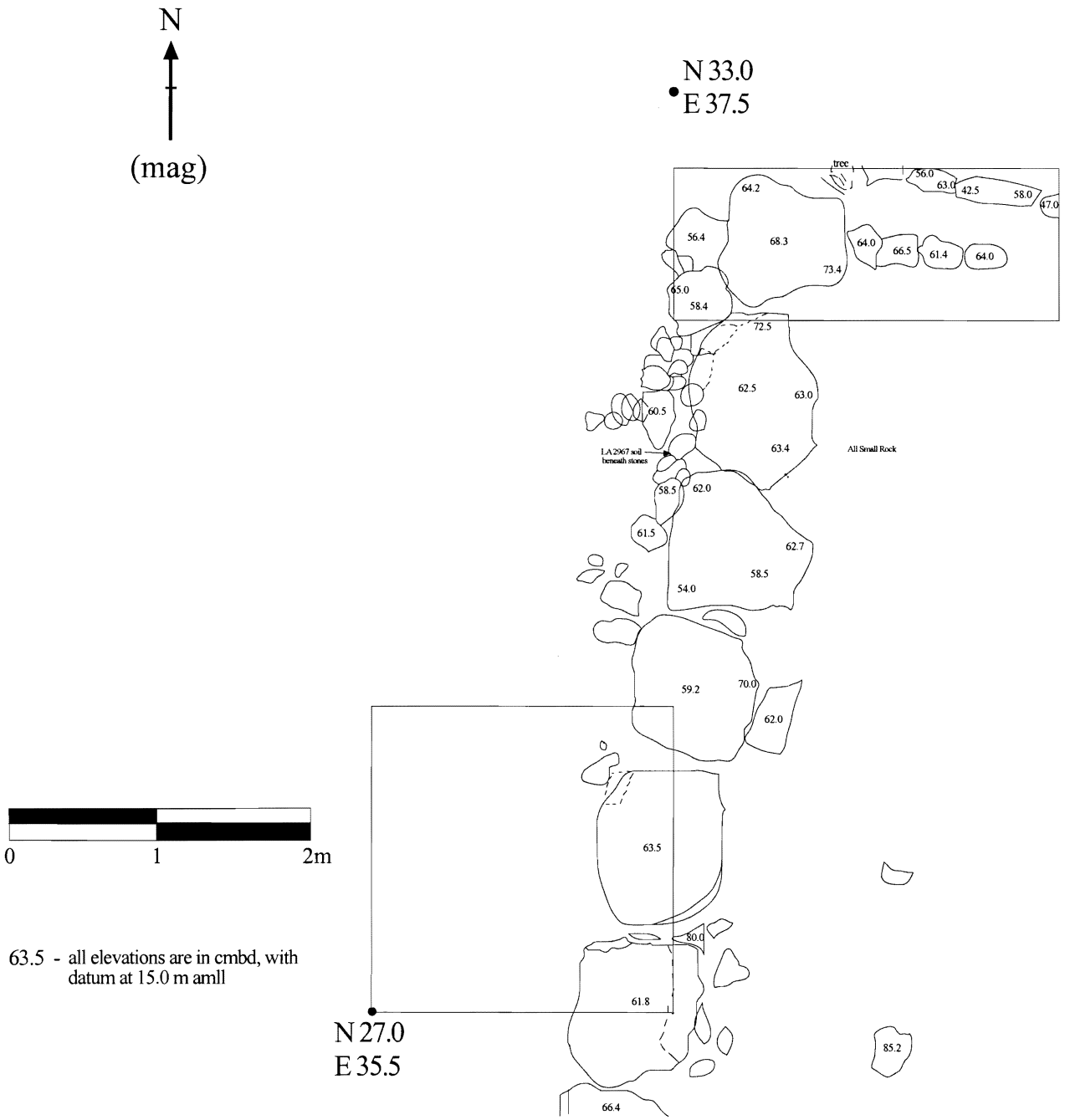

Figure 7
Line C stones, northern section

Figure 8
Material underlying the east face of Line C stones. Note how tightly compacted the small to fist-sized limestone rocks are and the comparatively small amount of soil around those small stones. What appears to have been floor ballast was found overlying the stones of Lines C, suggesting that the residents of Structure N11-27 initially abutted their elevated platform against the west face of those very large stones then later expanded the platform to effectively cover the limestone rocks of Line C.

Lines of limestone blocks set 'on edge' (rather than on their broad, flat surfaces) at nearby Structure N11-18 are identical to those identified in late deposits elsewhere at Lamanai (Pendergast 1986b) and appear to be fairly common Late Postclassic-Spanish Colonial Period architectural features. These "typical vertically set facing stones" (Pendergast 1986b:241) retaining earth and rubble fill are also found at several other Maya sites in northern and western Belize with similar late occupation components. These sites include nearby Chau Hiix (Andres and Pyburn 2004) and Progresso Lagoon (Oland 2002, 2005; Masson 1997, 2000) as well as Santa Rita Corozal (Chase and Chase 1988), and Tipu (Graham 1991; Graham and Bennett 1989). Indeed, the presence of vertically set stones as facings for low platforms is likely indicative of fifteenth-century or later Maya architecture in Belize (Pendergast et al. 1993:70).

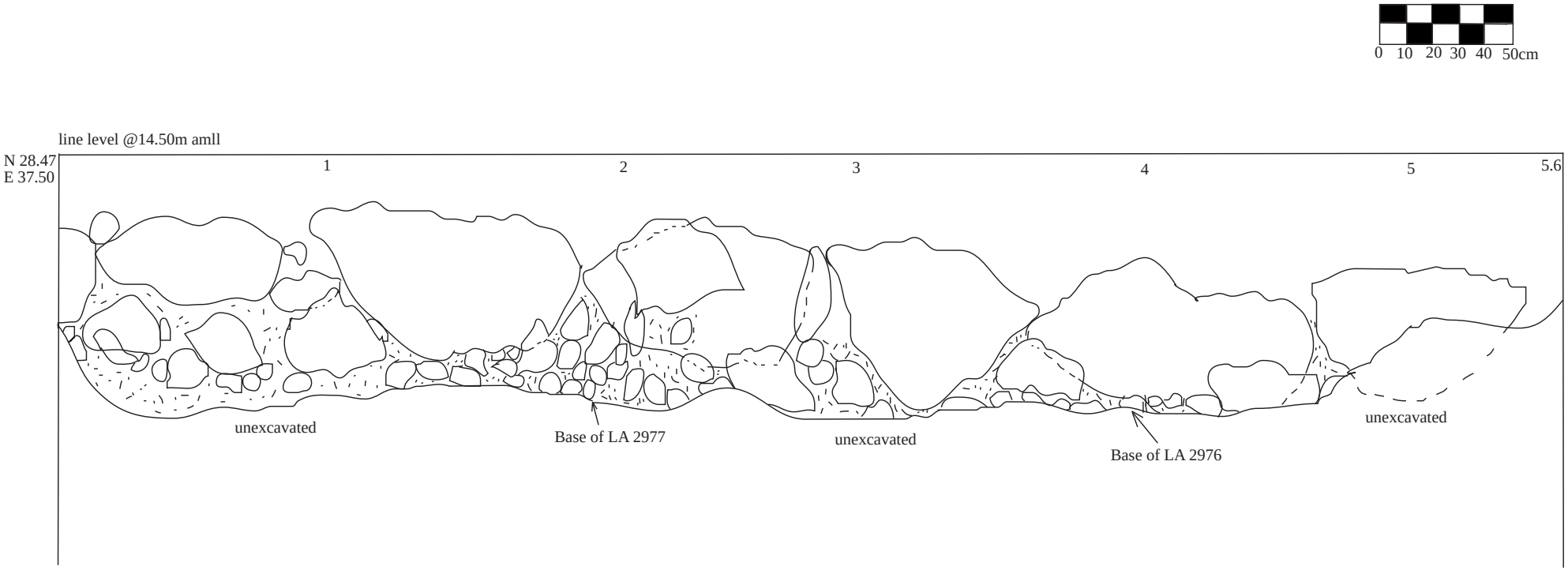

Figure 9
Profile of East Face of Line C

Also, if the line of large stones was laid as a platform face for Structure N11-27 there would have been no need to carefully prepare the west face of each stone by painstakingly chipping, pounding and pecking each to form a flat, uniform surface. The west face of these huge stones was effectively covered by earth and stone ballast material during the first stage of construction of Structure N12-17. This initial stage of building also entailed abutting smaller stones against the west face of the northernmost two stones of Line C. It appears that this was done in order to 'square off' the northeast corner of the platform, i.e., where Lines A and C intersect (Figures 6 & 7). These abutting stones each measured between roughly 20-40 cms. in diameter and were mixed with some earth when they were placed against the west face of Line C. The cluster of stones as a whole was aligned so that its intersection with Line A helped to create a roughly 90^{o} angle for the northeast corner of the platform of the structure (Figure 6). This corner right angle (or very nearly 90^{o} angle) recorded at the northeast corner of the original Structure N11-27 platform mirrors what was observed at the northwest corner of the platform, where Lines A and B intersect to form a nearly right angle (Figure 5).

Construction History of Structure N11-27

It is logical to assume that the material used for the construction of this small platform was obtained from nearby sources in order to minimize the effort expended on the construction of the building. Earth and limestone rocks were excavated by the contact period residents of the site, some or all of whom may have been related to Lamanai's *cacique*, and this material was heaped into a low pile that was spread flat and packed down in place, creating a platform measuring roughly 20-30 cms. in height. Presumably vertical posts were set into the ground, most likely near the corners of the platform where Lines B and C intersect with Line A, to serve as supports for a palm thatch roof. Based on the ceramic and lithic types recovered from floor ballast deposits, it appears that this first stage of construction occurred sometime in the late 15^{th} or early 16^{th} centuries.

At some point after this time Structure N11-27 may have been enlarged by a construction effort that involved expansion of its platform. This expansion effort presumably included enlargement of the pole and thatch superstructure as well, but no evidence of post features from either phase of construction was found during either of the last two field seasons. After this second phase of construction Line C would not have been visible to residents of the community or others since this work entailed covering the large stones of the feature with earth and stone floor ballast material. In other words, when Str. N11-27 was enlarged the stones of Line C were covered by the rocks and earth that made up the floor ballast of the expanded platform of the structure. Therefore, Line C and the larger platform of which it probably was a part could not have been in use at the same time Structure N11-27 was occupied.

Although the eastern extent of Structure N11-27 is not known at this point it is possible to describe certain architectural components of the building's first phase of construction. It appears that irregularly shaped pieces of limestone were selected as platform facing stones (Figure 5). These stones varied greatly in size from larger stones

that measured between 40-50 cms. in length and small limestone rocks measuring only 15-25 cms. in length, all having slightly smaller relative widths and thicknesses. As mentioned above, the southern face of the Structure N11-27 has not yet been identified, but it is likely it lies somewhere between the N 17.0 and N 26.5 grid lines, or between roughly .5 and 9m south of the southernmost limit of our excavations at the structure in 2005. The stones that comprised the north and west platform faces, Lines A and B, respectively, did not appear to have been very carefully or tightly fitted together, and no modifications in the way of pecking or chipping were observed on any of the stones (Figure 10). Again, the very large stones of Line C formed the eastern platform face of what was likely one of the first phases of construction of Structure N11-27.

Floor ballast deposits comprised of small to fist-sized stones mixed with earth extended to approximately 20-30 cms. below the existing ground surface (Lots LA 2951, 2952, 2956, 2959, 2962 & 2963). Both in 2004 and in 2005 Yglesias ceramic sherds were recovered during excavations of this ballast material. Graham (1987:91-95) notes that while the exact temporal periods for the Yglesias phase are not clear (and indeed, they remain unclear even almost 20 years after Graham's publication) the phase is tentatively dated to the period from AD 1450-1700. Therefore, it is clear that Structure N11-27 and nearby N11-18, the *cacique's* house, are coeval. In addition to the Yglesias sherds in construction fill several small side-notched projectile points were recovered from these same floor ballast deposits in both structures.

The upper, floor ballast lots excavated in Structure N11-27 were found to be only slightly disturbed as a result of various activities by the Guatemalan and Salvadoran refugees that settled in this particular area of the site in 1983 and 1984 (Pendergast 1985). Pieces of modern plastic, metal cans (particularly aluminum sausage tins), glass rum and beer bottles, clothing, vinyl flooring, and a multitude of other 1980's materials are typically present in the upper 10-15 cms. of the lots we excavated in the area. Although some modern material was recovered in Lots LA 2941, 2969 and 2971, which represent the upper 10 cm lots excavated along the east and west sides of Line B (the west platform face) of Structure N11-27, very little evidence of disturbance was encountered.

Structure N11-27 appears on architectural and stratigraphic grounds to have undergone at least two separate construction episodes, and possibly three. As noted previously (Simmons 2004:36) a plaster floor, only remnants of which were *in situ*, was identified in 2004. This flooring, measuring no more than roughly 90 x 140 cms. in area, was found immediately around Burial N11-27/1. No evidence of intact plaster flooring was found in excavations outside the immediate area of Burial N11-27/1. Stratigraphically, the plaster floor and the burial itself were covered by earth and fist-sized limestone pieces representing floor ballast deposited during a later construction episode. It was probably during this episode that the platform facing stones (Lines A and B, and possibly Line C) were laid as retaining walls for the earth and stone platform. The results of excavations in 2005 suggest that additional floor ballast material, including small stones and earth that was presumably tamped down to create a compact surface, was laid atop the large stones of Line C, effectively covering them completely. A thin deposit of PAA (post abandonment accumulation) covered this last construction phase.

Figure 10

This image shows the surface of Lots LA 2970 (right) and LA 2971 (left) as well as the southern portion exposed of Line B, seen immediately left (east of) the prominent tree root in the center of the image. Lot LA 2971, seen left of Line B, is a portion of the floor ballast deposits from Structure N11-27. Floor ballast was comprised of small to fist-sized pieces of limestone in a dark silty loam matrix. Lot LA 2970, located outside (west or to the right in this image) of the Line B platform face of the structure was comprised of dark silty loam with very few rocks. Clearly, Line B delineates the east face of the Structure N11-27 platform. Ballast deposits were found beginning at roughly 5-10 cms. below the existing ground surface in Structure N11-27. Floor ballast extended below Lot LA 2971 and well into the next lot, LA 2973.

Burial N11-27/2

Further excavations along the far western edge of the Structure N11-27 platform revealed the second human burial encountered thus far. The individual was interred just beneath the earthen floor of the building in the floor ballast deposits described above. Clearing of PAA deposits, i.e., the upper +/- 10 cms. of soil (Lot LA 2971) along the east face of Line B revealed the typical compacted earth and small to fist-sized stones that were found throughout the structure platform.

Directly below this PAA deposit was found what appeared to represent redeposited floor ballast material, which was excavated as Lot LA 2973. These small stones and compacted earth covered the entire burial, and extended into the next 10 cm lot below LA 2973, which was designated LA 2979. Lot LA 2981 was assigned for the skeletal material, although all of the skeletal material encountered in 2005 was left *in situ* (Figure 11).

No crypt was found associated with the skeletal remains of Burial N11-27/2. Instead, the stones of Line B may have been used as a crude crypt outline of sorts, although we did not encounter any stones that might reasonably be considered to be part of a crypt to the north of the individual. Our excavations in 2005 ended immediately east of the skeletal remains (at the East 27.0 grid line) and, as a result, we do not know if any stones that may have been used to outline the burial are present to the east of where we ended our excavations during the 2005 field season. Figure 12 shows the relationship between the burial, Line B, and the edge of our excavation unit (at N 26.5 E 27.0).

The individual appears to be resting on either their back or back/left side with their head to the south. Unfortunately, the skeletal material is in an advanced state of deterioration, and this poor preservation made it impossible to determine the age or sex of the individual. It is possible, however, to comment on the disposition of the skeletal material in terms of its positioning. The left arm was found to the west of the chest cavity, extended straight with the hand to the south. The legs of the individual are both bent, knees to the west (Figure 12). The skeletal remains were not exhumed. Instead, the skeletal material was exposed and recorded *in* situ. Once these tasks were completed the skeletal material was re-buried.

The three artifacts recovered in burial fill that were directly associated with the skeletal remains are worth mention here. The first is a small copper prill identical to those that were recovered in association with Burial N11-27/1. Prills are by-products of casting metal, and the results of preliminary chemical compositional analyses indicate that the Structure N11-27 prills are copper (Aaron Shugar, personal communication 2005). This particular prill (LA 2981/2), which measures approximately 3 mm in diameter, was found near the skull of Burial N11-27/2. Figure 13 shows the prill *in situ*. All 9 of the prills that have been recovered thus far at Structure N11-27 have been found in either burial fill or in the floor ballast deposits of this structure. The burial fill of both burials likely represents redeposited floor ballast material that was excavated to provide a place for the interment and then backfilled atop the two individuals after they had been laid to rest.

Figure 11
Overview of Burial N11-27/2 after excavation. Top of image is to the south. Line B, the western face of the Structure N11-27, is shown to the right of the burial, labeled Burial 1 as the first burial encountered in 2005. The burial was found below Lots LA 2971 and LA 2973, roughly 20-25 cms. below the existing ground surface. Platform ballast stones were found directly atop the skeletal remains. The left humerous of the individual is located just left of the menu board, which lies just to the south (above in the image) of the stump of a small tree. A small axe of green/blue stone (LA 2981/1), weighing 229 grams, was found just above and slightly to the left (east) of the skull. A large ceramic sherd, broken into eight pieces, can be seen lying in the pelvic area of the individual, next to the east wall of the excavation unit.

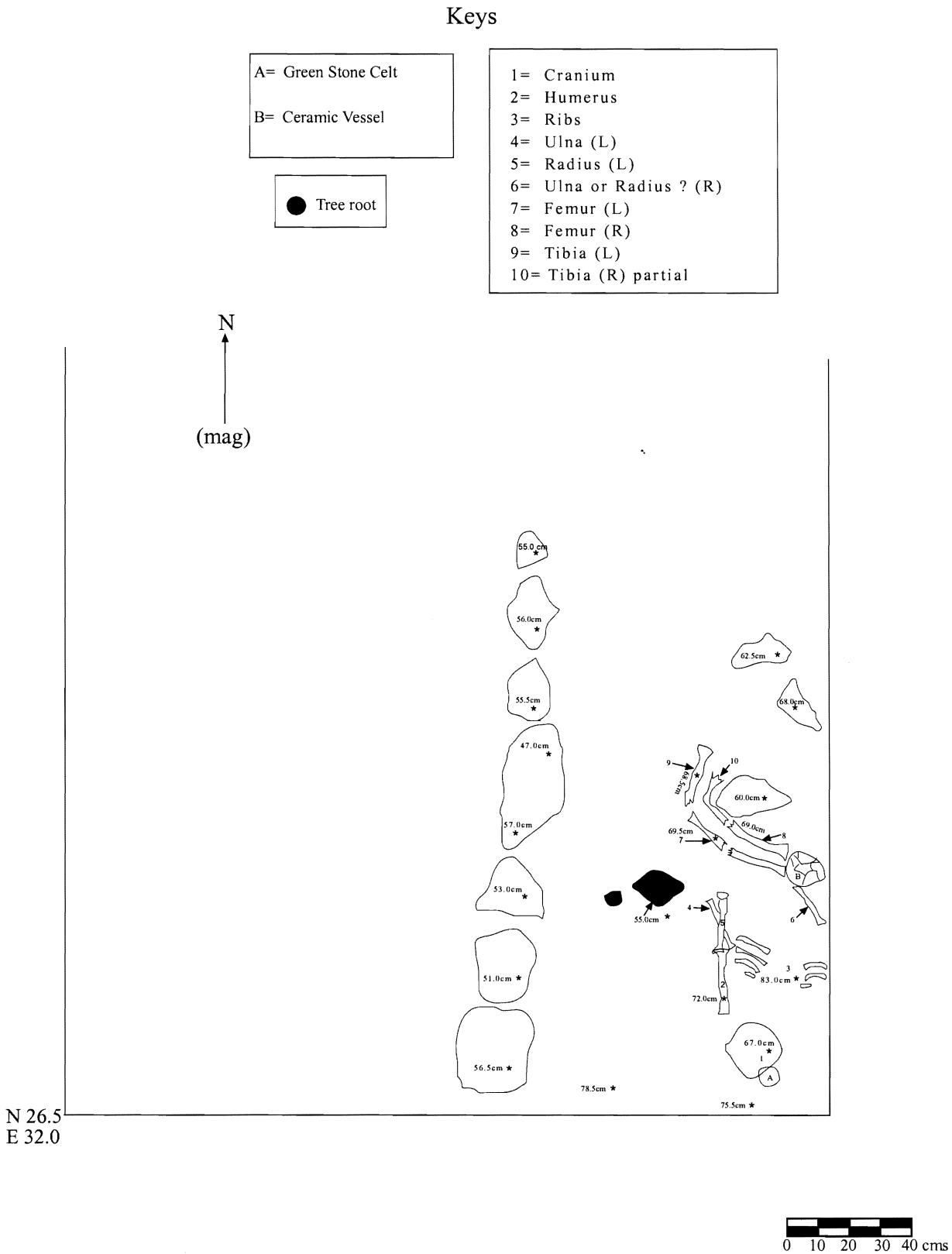

Figure 12

Plan view drawing of Burial N11-27/2 and southern portion of Line B

Figure 13
Copper prill *in situ*. The prill, LA 2981/2, was found directly above the ceramic sherds in the pelvic area of Burial N11-27/2. It is shown in this image as the dark gray sphere located next to the tip of the dental instrument.

Another artifact found in association with Burial N11-27/2 was a large (229 g) blue/green stone in the shape of a celt or axe. This object had been placed next to the head of the individual and was found in contact with the skull just slightly to the east (left of) the top of the skull. The celt/axe measures 7.0 cm in length, 5.9 cm in width and 3.0 cm in thickness, and was oriented with its poll or butt end to the east and its very dulled bit to the west. The poll of the celt/axe was fairly rounded in form, and showed some evidence of past use in percussion activities of some sort. The bit was very slightly tapered and, as mentioned above, quite dull to the point that the edge itself was rounded through either wear, incomplete grinding, or both. The material from which this tool was produced is unknown at present, although field observations suggest it may be diorite, a plutonic stone commonly found in the Maya Mountains of Belize (Bateson and Hall 1977; Cornec 2003). Figure 14 shows the axe head *in situ*.

The only other artifacts recovered with Burial N11-27 were 11 ceramic sherds, found in the right pelvic area of the individual (Figures 11 & 12). The sherds all fit

Figure 14
Close-up of head and thoracic region of Burial N11-27/2. The blue-green stone celt/axe head (LA 2981/1) is seen adjacent to the skull in upper left of image. Note the poor overall preservation of the skeletal material.

together, and evidently are part of a large body sherd that was interred with the individual. At present the ceramic type of the sherds is unknown, although the paste and surface treatment is consistent with those of the Yglesias type reported by Graham (1987).

Excavations West of Structure N11-27

Additional structural remains that likely represent a portion of Structure N11-27 were found roughly 4.5 m west of Line C (Figure 5). A $1m^2$ excavation unit was placed in an area located approximately 7 m north of Structure N11-18 in 2004 at N 23.5 E 30.5 (Simmons 2004:39). Medium-large sized unmodified limestone rocks that might represent structural core material were found in this unit, but no evidence of any platform facings, post features or other structural remains were encountered in either 2004 or in 2005.

Excavations were expanded in this particular area in 2005 in order to determine how these structural remains may have been associated with those of nearby Structure N11-27. A $1m^2$ excavation unit was placed to the immediate north of the original (2004) excavation unit, and a 1x2 m excavation unit was placed immediately to the west, with the entire area forming a $2m^2$ excavation pit (Figure 5). Excavations in both of these areas (N 22.5 E 29.5 and N 22.5 E 30.5) revealed additional deposits of earth mixed with small to fist-sized stones of the kind found in Structure N11-27 described above. It should be noted that in all cases, throughout the area of the excavated platform of Structure N11-27, relatively few artifacts were encountered in these floor ballast deposits.

By far, the bulk of the material excavated in the upper 20-25 cms. of the Structure N11-27 platform was stone, and most of this was rather soft to moderately dense, unmodified pieces of limestone. This was likewise the case in the area we tested to the west of Structure N11-27 in 2005. Very dense accumulations of stone were found in the $2m^2$ area, and in general relatively few artifacts were recovered from these deposits (Lots LA 2942, 2943, 2946, 2947, 2953 and 2955). Excavations in Lot LA 2968, the fifth 10 cm lot excavated in the $2m^2$ area located at N 22.5 E 29.5, resulted in the recovery of two sherds that were distinctly Yglesias in form. One of these was recovered at 41 cmbs. while the other was recovered 44 cmbs; both were found in the loose, pale brown (10YR6/3) powdery, very fine silt that was found directly overlying culturally sterile marl/decomposing bedrock.

In sum, this area located southwest of the main area excavated in 2004 and 2005 may represent a portion of Structure N11-27 that extends into the area we had thought was 'between' structures N11-18 to the south and N11-27 to the north. It also might represent the remains of an as yet unidentified structure. Since we have not identified the southern platform face of Structure N11-27 either scenario seems equally likely. The presence of Yglesias sherds below the level of the small to fist-sized stones that were found in the first (uppermost) four lots suggests that if this area does represent a western extension of the main platform of Structure N11-27 then its construction is contemporaneous with that of the main platform. On the other hand, if these stone and earth platform remains represent a second structure then that structure is coeval with

Structures N11-18 & N11-27. In that case it is possible that the three structures comprise a portion of what has been termed a 'house lot' in Maya studies (Becker 2004; Hutson et al. 2004; Kunen 2001; Lohse and Findlay 2000; Lohse and Valdez 2004).

Excavations South of Structure N11-27

In 2005 two adjacent $2m^2$ excavation units were placed along the southern portion of Line C, the large alignment of limestone boulders described above. The purpose of excavations in this area was to 1) determine the northern extent of the substantial Spanish contact period midden deposit that was found abutting the north platform face of Structure N11-18 and 2) investigate the architectural characteristics of this large feature outside the area of Structure N11-27. The information gained from excavations in this area helped us to reach these goals, but as is the case in a great many archaeological endeavors, excavations also succeeded in raising more questions than they answered.

Linear Limestone Boulder Feature – Line C (South Section) & Midden

The northern of the two $2m^2$ excavation units was placed at N 19.0 E 35.5, very close to the area where the surfaces of two very large limestone rocks were exposed at ground surface. The sizes and alignment of these stones was similar to those observed for the very large limestone rocks found in the northern of the two excavation areas in 2005. It appeared that these stones were possibly a southern extension of the Line C stones that formed the eastern platform face of Structure N11-27 to the north. Excavation of Lot LA 2945, in the $2m^2$ excavation unit immediately to the south (at N 17.0 E 35.5) revealed a third very large stone in line with those identified in the adjacent unit to the north. But as Figure 15 shows, a prominent gap was found in Line C, coinciding with the area between roughly N 18.40 to N 19.20.

A total of seven 10 cm lots were excavated east of the Line C stones in the northern of the two 2 m^2 excavation units (at N 19.0 E 35.5). These were LA 2944, 2948, 2954, 2965, 2974, 2975 and 2983. To the west of these large stones three lots were excavated – LA 2944, LA 2958 and LA 2964. The uppermost 10 cm lot in this unit, LA 2944, was characterized as a PAA (Post abandonment accumulation) deposit, and few stones were encountered in this lot. But directly below LA 2944 numerous small and fist-sized stones of the kind we have identified as floor ballast deposits began to appear. The smaller stones of Lot LA 2948 continued into the lot below, LA 2954, but larger stones (ca. 15-25 cm in diameter) were found lying in a semi-circular pattern immediately east of the southern (smaller) of the two large stones (Figure 15). Soil and cultural material excavated inside (west of) this small semi-circular arrangement of stones was part of Lot LA 2961, which was a slightly darker colored, less clayey soil than the soil of Lot LA 2954.

In the 2 m^2 excavation unit located just to the south at N 17.0 E 35.5 the upper soil deposit, LA 2945, was identified as PAA. The lots immediately below that, however, were assessed as midden, with high numbers of ceramic and lithic artifacts, Small Finds, and fairly well preserved and abundant faunal material, including bones and

Figure 15
Base of Lots LA 2954 (right) and LA 2960 (left), located east of (below) the southern extension of Line C. Note the unorganized masses of limestone rock just east (below in image) of Line C. Also note the gap in Line C, and the generally disturbed appearance of stones in the 2 x 2 m excavation unit to the south (left in image). The western (upper) edge of the large limestone rocks of Line C shown at the right of this image appear to have been modified as evidenced by the very straight edge and tight fit between them. In this southern (left) excavation unit Lots LA 2960 and the lots immediately above it, LA 2944 & LA 2948, as well as the lot below it, LA 2966, were part of the large midden deposit lying immediately north of Structure N11-18, the *cacique's* house.

freshwater and marine shells (see Appendices 3, 4, 5 & 7). Culturally diagnostic Small Finds recovered in Lots LA 2954, 2960 and 2966 included Yglesias ceramic sherds and small side-notched and un-notched projectile points. The combined total of ceramic sherds for these three lots was 866. Lithics (chert and obsidian) numbered 174 and bone and bone fragments totaled 813 for the three lots combined. Clearly, large amounts of material were being discarded by the residents of Structure N11-18 during contact times. Preliminary assessments of the faunal assemblage from excavations in 2001, 2002, 2004 and 2005 at Structure N11-18 indicate that residents of the *cacique's* house had access to a fairly wide range of animal foods. Higher frequencies of large mammal

bones (deer and peccary) have been found at Structure N11-18 than in any other household at Lamanai studied to date. This point is noteworthy, as is the comparatively high frequency of turkey skeletal elements recovered from the north side midden of the *cacique's* house (see Appendix 7). Stanchly (personal communication 2005) suggests that ritual feasting may have been taking place during Spanish contact times at Structure N11-18.

Excavations in the 2 x 4 meter area at N 17.0 E 35.5 revealed a number of stones that were larger in size than those typically contained in floor ballast deposits situated immediately east of the large stones of Line C (Figure 16). These were in a semi-organized grouping just east of the Line C stones, but their purpose, if any, is unkown at present. Lot LA 2954, the lot in which these stones appeared in the excavation unit at N19.0 E 35.5 was clearly midden material. LA 2954 was characterized as a very dark (10YR 3/1) silty loam in which abundant artifacts were found. Appendix 4 shows that 256 ceramic sherds, 36 pieces of chert, 7 pieces of obsidian and 126 bones or bone fragments were recovered from this lot. Four date seed or notched sherd net sinkers were also recovered in LA 2954. In comparison, the lot that was stratigraphically comparable to LA 2954 in the adjacent 2 m^2 unit immediately to the south, LA 2960, contained 347 ceramic sherds, 74 pieces of chert, no obsidian, and 350 bones or bone fragments. Chert bifaces, perforated bone beads, small side-notched projectile points, informal chert and obsidian flake tools and jadeite and oliva shell ornaments were some of the 12 Small Finds recovered in Lot LA 2960.

Some of the first deposits of refuse that were discarded by the residents of Structure N11-18 were found in Lot LA 2966, which was located between 30-40 cms. below the existing ground surface in the 2 m^2 unit located at N 17.0 E 35.5 (Figures 16 & 17). This 10 cm lot contained 263 ceramic sherds, 46 pieces of chert, 11 pieces of obsidian, 337 bones or bone fragments and the largest number of Small Finds (35; 23% of the153 total Small Finds) encountered in any of the 49 lots excavated during the 2005 field season. The presence of Yglesias ceramic sherds and small side-notched points in this midden lot confirms it's Late Postclassic or later date of deposition.

The midden deposit was found throughout the 2 x 2 m excavation unit at N 17.0 E 35.5. But further excavations in the northern, adjacent excavation unit at N 19.0 E 35.5 revealed the northern extent of this midden deposit. In the area between N 19.70 and N 19.75 the soil color began to change from a 10YR 4/1 to a slightly darker 10YR 3/1 just east of Line C in the 2 m^2 unit located at N 19.0 E 35.5. The change was noted at 95-96 cmbd. in Lot LA 2965 in the area of stones located immediately east of the northern of the two very large limestone rocks in unit N 19.0 E 35.5 (Figure 18).

It is not known if or how the stones shown in Figure 16 to the east (right) of Line C may have been related to either midden deposition of other activities that took place at nearby Structure N11-18 during Spanish colonial times. These stones, measuring roughly 15-25 cms. in maximum length and around 10-20 cms. in width on average, were designated Line D, and may represent a northern extension of an as yet unidentified structure or feature of some kind that lies south of this excavation area.

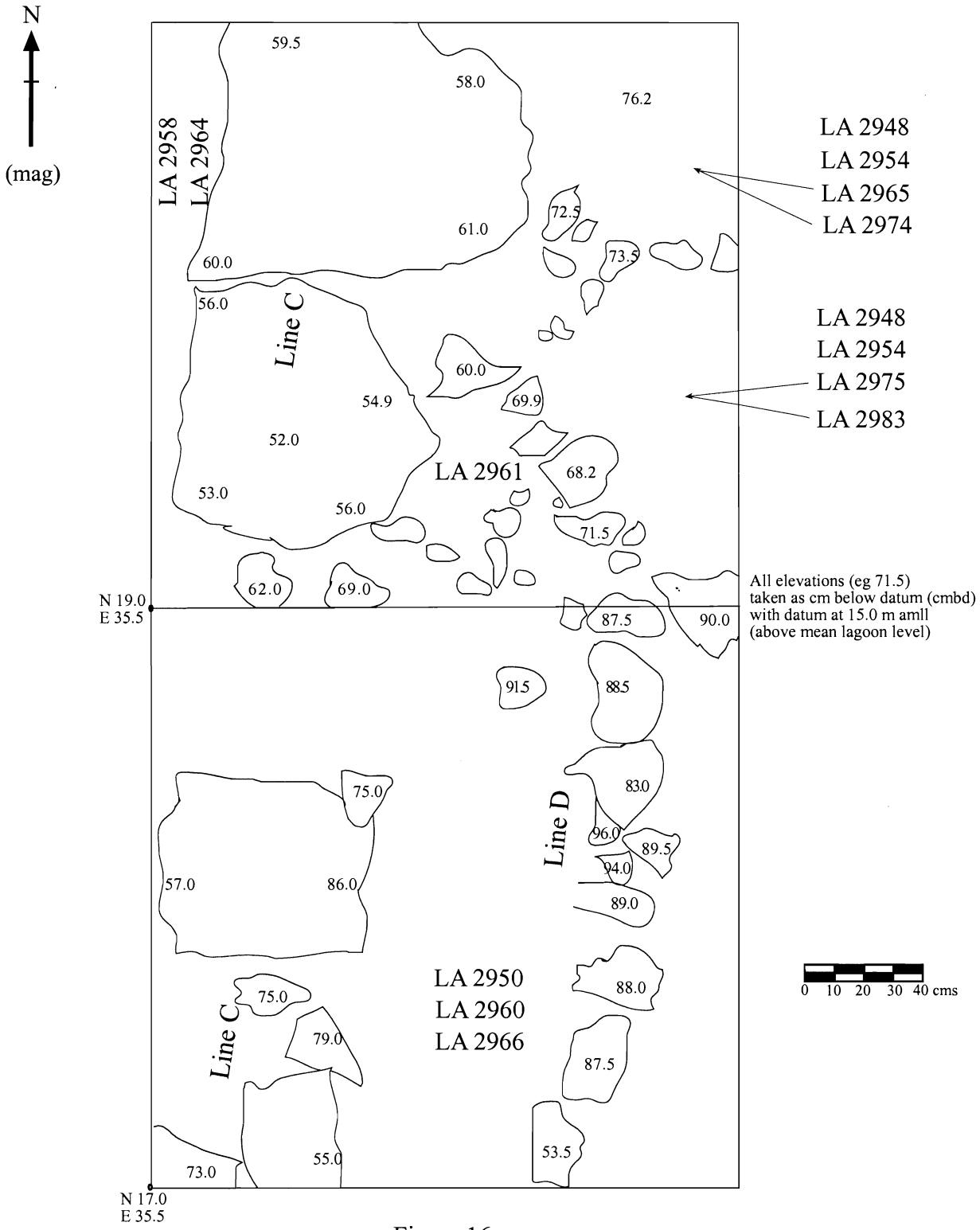

Figure 16

Lines C and D in 2 x4 m excavation unit situated at N 17.0 E 35.5. Lind D appears to extend in a fairly straight line from the south to connect with Line C in unit N 19.0 E 35.5. The Spanish Contact Period midden deposit associated with nearby Structure N11-18 was found in Lots LA 2948, 2954, 2965 (upper portion) and 2975 in unit N 19.0 E 35.5. This late midden deposit was found in Lots LA 2950, 2960 and 2966 in unit N 17.0 E 35.5, extending to approximately 95cm below datum (datum at 15.0 m amll). In the northern excavation unit (at N 19.0 E 35.5) Lot LA 2954 was overlying LA 2965 & 2974 north of the small E-W oriented stones and Lots LA2965, 2975 & 2983 south of those stones. Lots are shown above and below one another relative to their stratigraphic positions.

Figure 17

Southern segment of Line C, the long linear feature of very large limestone rocks investigated in 2004 and 2005. Line D stones, oriented roughly N-S, are shown in the southern (top in image) of the two 2 x 2 m excavation units, located at N 17.0 E 35.5. This image shows the base of Lots LA 2966 (top of image), LA 2983 (middle of image) and LA 2974 (bottom of image). Note the differences in soil color between LA 2966, near the base of the Spanish contact period midden, and LA 2983, just north of (below in image) the north arrow. This area appears to mark the northern extent of the large midden abutting the north face of the Structure N11-18 platform.

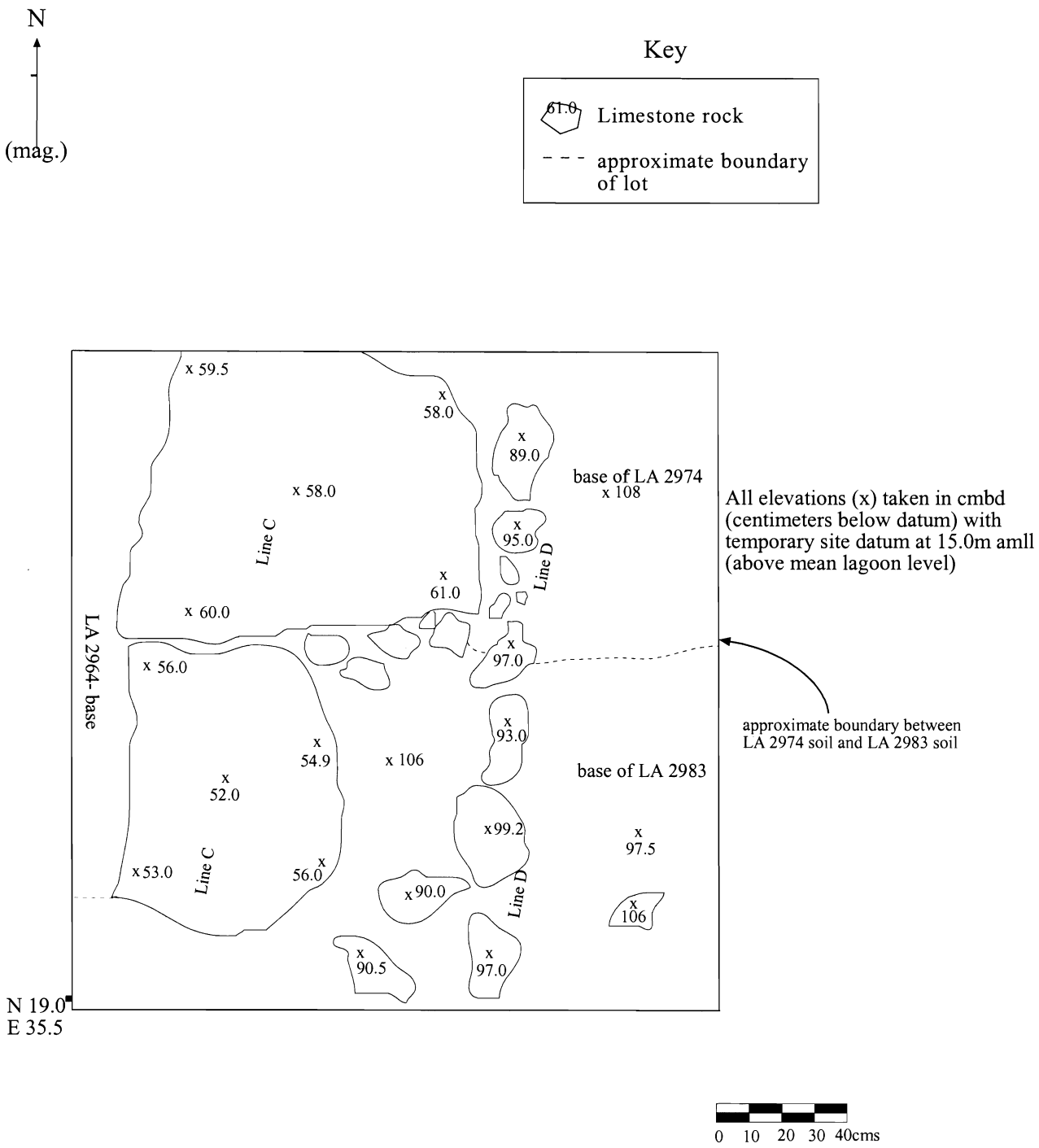

Figure 18

Lines C and D, Excavation Unit N 19.0 E 35.5. The midden deposit associated with nearby Structure N11-18 was found overlying Lot LA 2983.

The deepest lots excavated east of the Line C stones in unit N 19.0 E 35.5 were LA 2974, 2975 and 2983. Only a very narrow area could be excavated west of the large stones of Line C, and this soil (Lots LA 2958 and LA 2964) was a dark (10YR 3/1) silty loam that may have been a part of the larger midden deposit but so little was excavated its composition is unclear at this point. The northernmost of these lots, LA 2974 (shown at bottom of Figure 17 and top of Figure 18) may represent an occupational surface of the kind we have documented elsewhere in the area (Simmons and Howard 2003:59; Simmons 2004:39). This dark brown (7.5YR 3/2) sticky clay is well-compacted throughout the areas we have investigated north of Structures N11-3, N11-18 and in the immediate vicinity of Structure N11-27. Artifact densities in the lots of this stratum, which appears to directly overlie the crumbling marl and limestone bedrock throughout, are considerably lower than those in the PAA deposit and, most certainly, those of the Spanish contact period midden.

Lots LA 2975 and 2983 were situated immediately south of LA 2974 and a line of small stones (see Figure 18) extending in an east-west orientation from Line C to the east edge of the excavation unit at N 19.0 E 35.5. Lot LA 2975 appears to represent the base, or earliest deposit, of midden material in this particular area, as does its equivalent lot immediate south, LA 2966. Yglesias ceramic sherds were found in both of these lots. Lot LA 2983, directly below Lot LA 2975, has a completely different character in that it is a lighter brown (7.5YR 3/2) sticky clay that is equivalent to the lot to its immediate north, LA 2974. Both may represent an earlier, possibly Classic Period, occupational surface. Ceramic sherds that appear on stylistic and morphological grounds to be Preclassic in date were recovered in Lot LA 2983.

In summary, excavations in this 2 x 4 m area proved very useful in delineating both the northern extent and total depth of the large midden associated with Structure N11-18. At least one portion of this midden appears to extent to roughly 9.5 m north of the north platform face of the *cacique's* house. It's depth in this particular area is roughly 45-50 cms. below the existing ground surface. It may extend deeper, below the base of Lot LA 2966, but due to time constraints we were not able to explore it's depth in this area any further. To the north, though, in unit N 19.0 E 35.5 it was possible to identify the base of the midden, which appears to be directly overlying an older occupational surface that dates to Classic times. Late and Terminal Classic Period occupation has already been identified in this particular area of the site in the form of very well-preserved household midden deposits (Simmons and Howard 2003).

The function of the long, linear feature comprised of massive limestone rocks designated Line C is difficult to determine. The stones that were exposed in these two southern 2 m^2 excavation units were, undoubtedly, part of the same feature that was documented at Structure N11-27 to the north. At that structure the carefully prepared limestone blocks were incorporated into the architecture of the platform of that building. Indeed, it appears that the residents of Structure N11-27 made good use of an existing substantial feature, the stones of Line C, by abutting the earth and stone platform of their building against those massive stones (see above discussion).

To the south, in units N 17.0 E 35.5 and N 19.0 E 35.5, there are only faint suggestions that other structural remains are associated with the large stones of Line C. One of these is Line D, which is made of the same smaller stones that delineate the north and west platform faces of Structure N11-27 to the north. But the limitations of a 2 x 4 m excavation block are rather obvious with regard to the amount of information that may be conveyed regarding horizontal relationships that might exist between features. It is possible that broad areal exposures in this particular area would reveal other structural remains or features that might be related to activities that were taking place at nearby Structures N11-18 and N11-27. We can say that the matrix of highly compacted earth and small to fist-sized stones found abutting the east face of the Line C stones in the northern of the 2005 excavation areas is absent along the east face of the Line C stones in this southern excavation block. To the north, the existence of this material, which appears to represent a highly compacted platform ballast, might signal the presence of structural remains to the east of Structure N11-27 (see above discussion). But to the south there is little evidence at this point that additional structural remains exist to the east.

Stratigraphy, Artifacts and Dating

Cultural deposits at Lamanai do not have great depth due to the presence of limestone bedrock within generally 1-2 meters below the existing ground surface. As a result, the stratigraphic profile observed in most areas of the site is fairly shallow, overall. While bedrock was not encountered during the 2005 field season in any of the three excavation areas discussed above, white marl deposits were encountered in the western 2 x 2 m unit situated at N 22.5 E 29.5.

The soil strata encountered in 2005 were similar to those recorded throughout the areas we have investigated over the last several field seasons north of Structures N11-3 and N11-18 (Simmons and Howard 2003; Simmons 2004. In the extramural areas of Structure N11-27 Post Abandonment Accumulation (PAA) made up the uppermost soil deposit. This soil was characterized as a very dark brown (10YR 2/1 or 3/1) silty loam with varying densities of cultural material. Very few pieces of limestone of any size were noted in this PAA deposit, although some modern material was present. Likewise, little evidence of disturbance, other than the modern pieces of bottle glass and plastic, was observed.

Away from structural remains, in the 2 x 4 m excavation block located at N 17.0 E 35.5, the PAA was underlain by a dark (10YR 3/1) very dark gray silty loam with abundant artifacts. The midden varied from roughly 35-45 cms. in depth in this particular area, and has been described above. What seems fairly clear given the lack of evidence for disturbance is that the stones underlying the midden deposit, designated Line D (see Figure) pre-date the deposition of the household refuse that originated from Structure N11-18 and probably N11-27 as well. But the difference in the age of each may not be so great. At this point we are not certain of how long the midden was used, including when rubbish began to be deposited in the area and at what point in time household trash

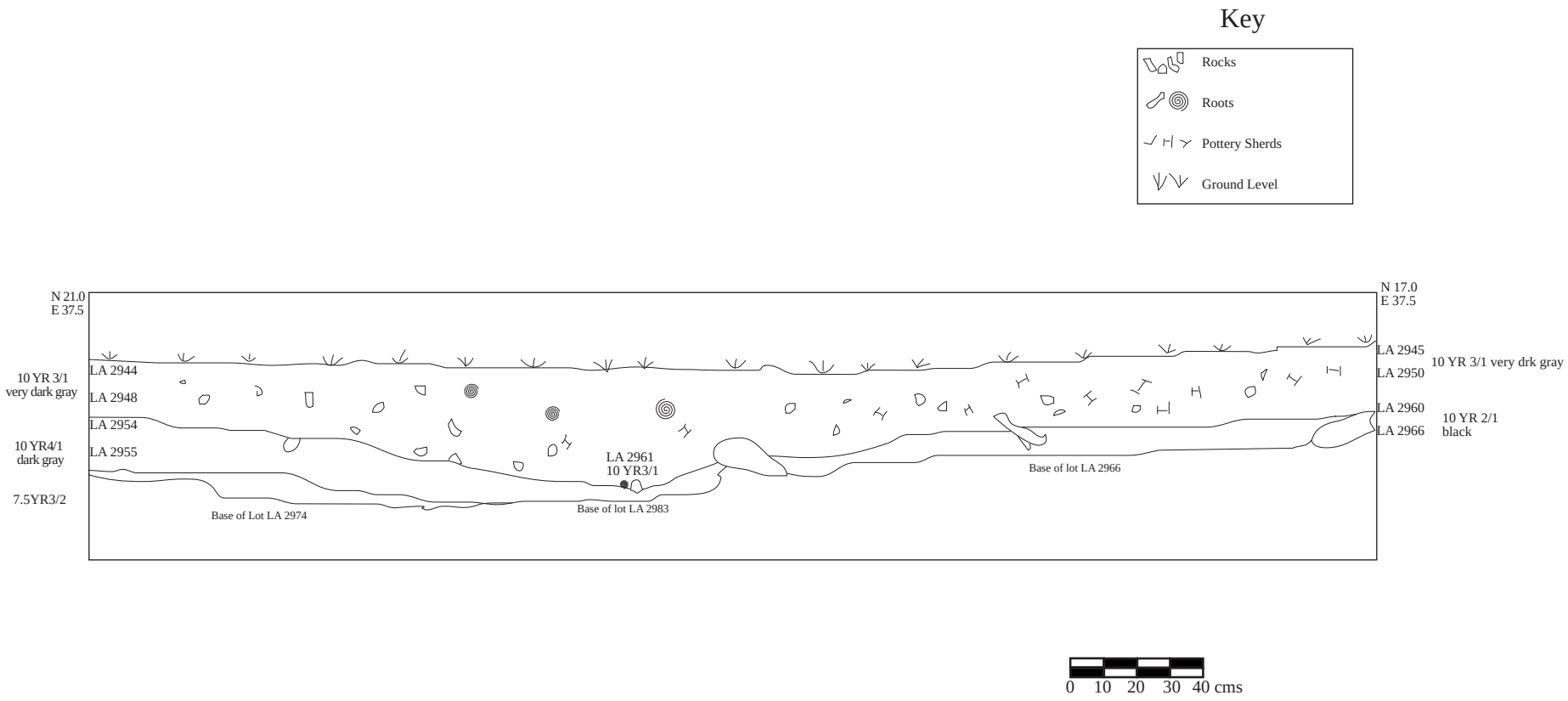

Figure 19

East Wall Profile from N 17.0 E 37.5 to N 21.0 E 37.5

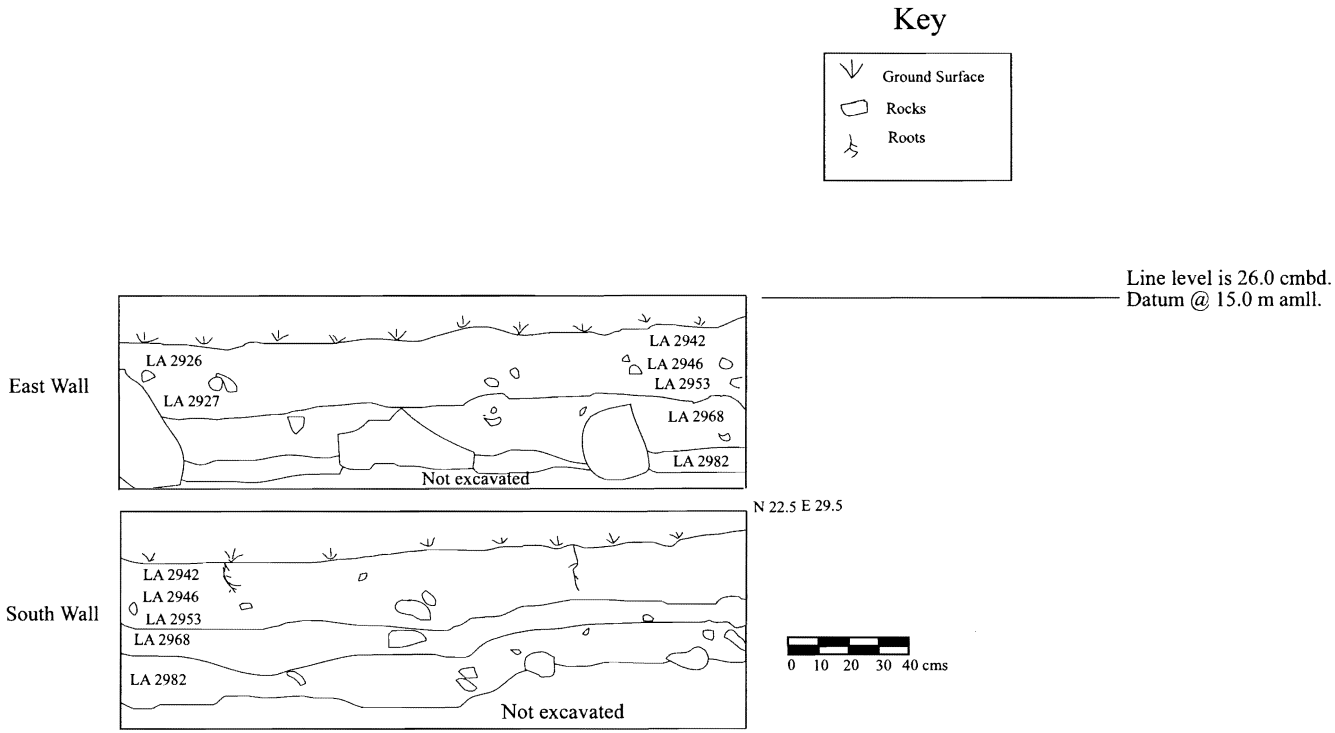

Figure 20

East and South Walls of 2x2 m unit
located at N 23.5 E 29.5 (SW Corner)

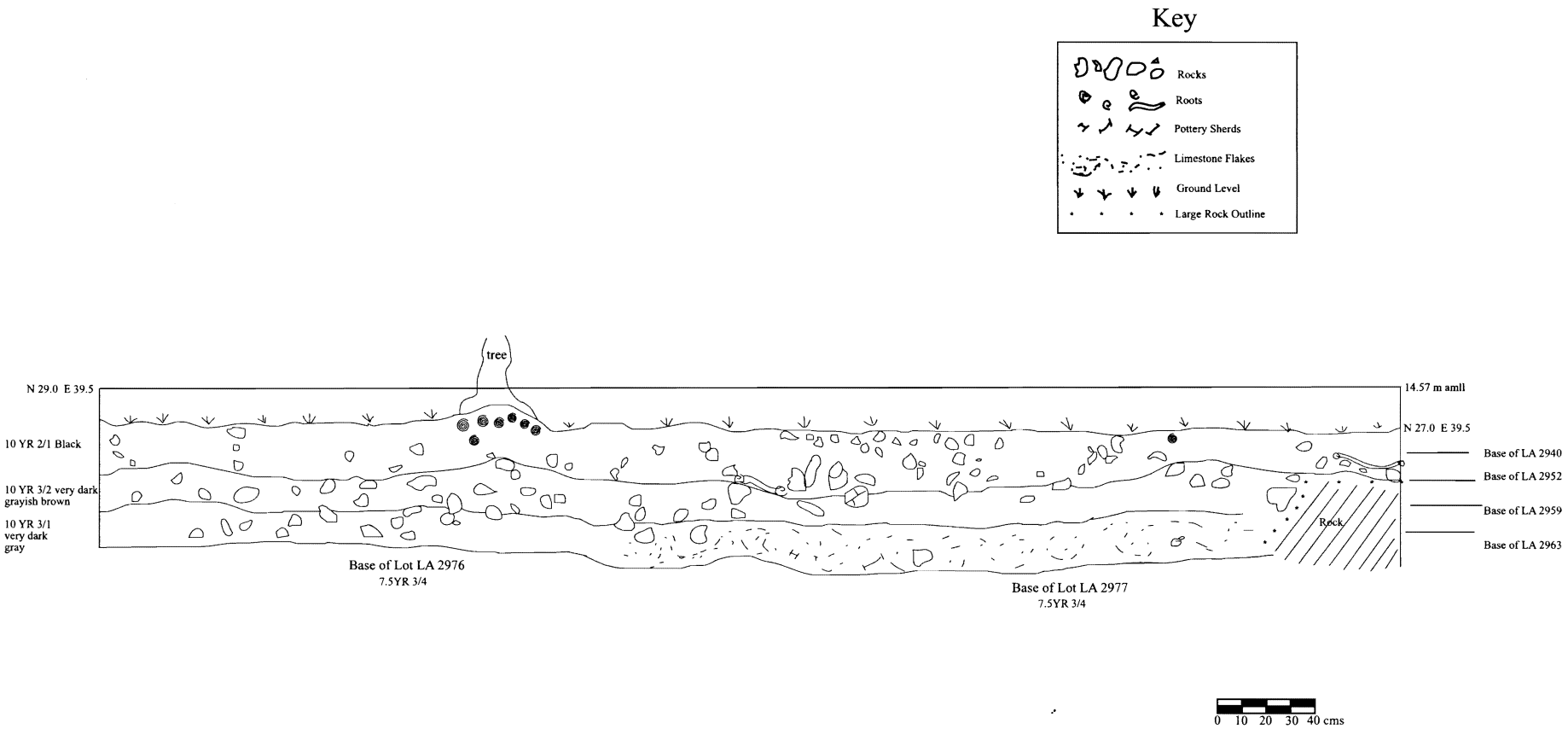

Figure 21

East Wall Profile from N 27.0 E 39.5 to N 29.0 E 39.5

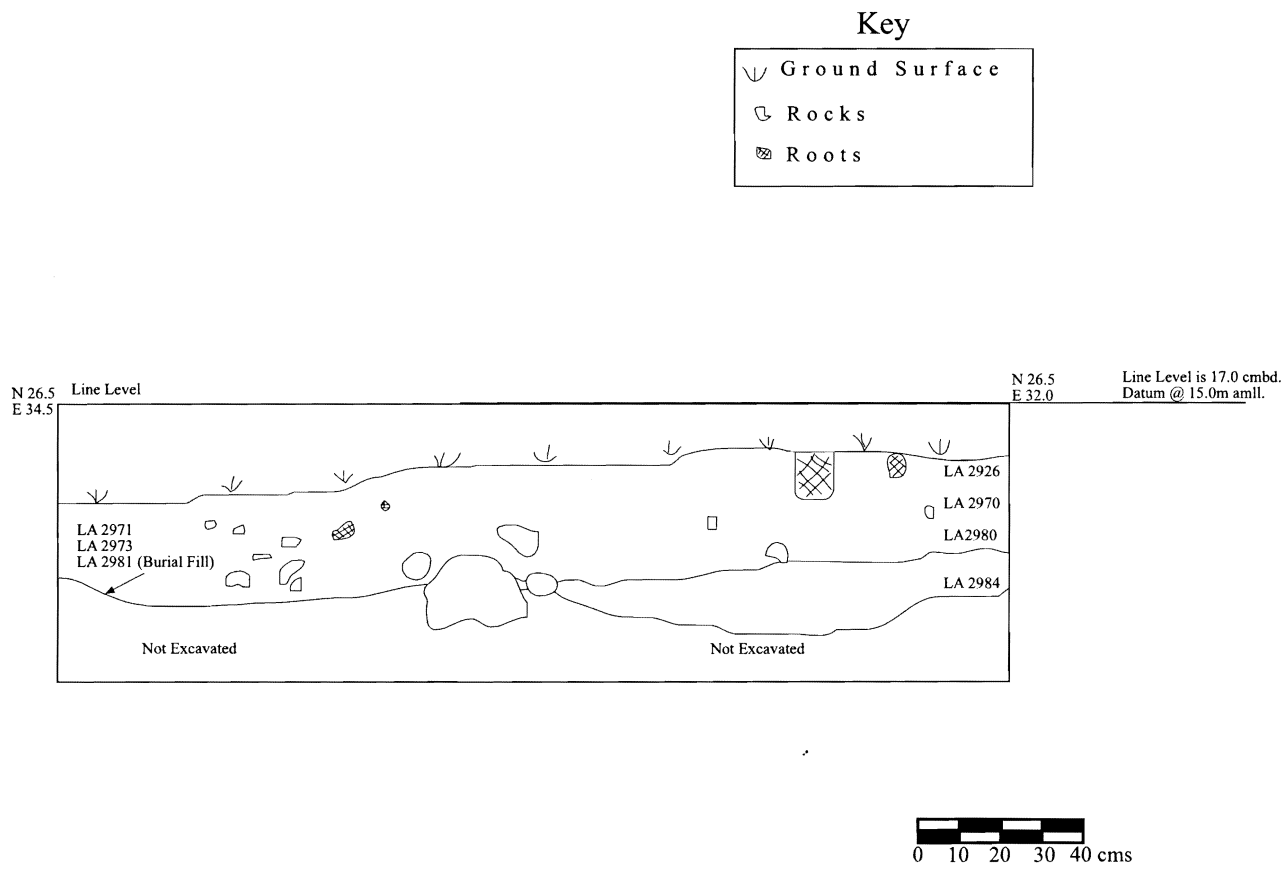

Figure 22

South Wall Profile from N 26.5 E 32.0 to N 26.5 E 34.5

was no longer being deposited in the area. Given the homogeneous nature of the midden it may not have been used as such for more than several decades. Unfortunately, the temporal resolution afforded by the ceramic assemblage is not yet so well-refined as to enable us to make any kinds of definitive statements regarding such points.

In areas away from the 2 x 4 meter excavation block discussed above the soil deposit identified below the PAA deposit in Op 05-01 is a dark brown (7.5YR 3/2) sticky silt with some clay that measures between roughly 10-20 cms. in thickness (Figures 19-22). This deposit may well represent an occupation surface of sorts, but this is not entirely clear at this point. It is well-compacted across Op 05-01 and artifact densities in the lots of this stratum are considerably lower than those of the upper PAA stratum. Generally speaking, the artifacts encountered in this stratum appear to be more poorly preserved than those found in the upper stratum, the post abandonment accumulation soil. Ceramic artifacts were generally weathered and eroded in appearance, with only vestiges of slip adhering to their surfaces. In addition, most sherds were lying flat or horizontally in this soil, as if they had been lying on some kind of occupation surface. Faunal preservation is not nearly as good, with many fewer bones and much smaller fragments of bones present than in the PAA deposit.

The overall condition of the artifacts recovered from this stratum suggests that they were exposed to weathering agents, specifically sun and rain, and their generally small size might be a result of trampling over a period of time. These lines of evidence suggest that this compacted brown silty clay soil may represent an occupation surface that pre-dates the intensive use of this area of the site in Late Postclassic and early Spanish Colonial times. Given that Terminal Classic Period midden deposits have been identified in this area of the site (Simmons and Howard 2003:31-32) it is not surprising that cultural material was found at depths of up to 50 cms. below the present ground surface.

The deepest soil stratum encountered in Op 05-01 was a brown (7.5YR 3/4) silty clay that was sticky, very compacted and at times difficult to excavate. This was true of the area excavated immediately east of the Line C stones in the northern part of the excavation area (Figure 5). Highly compacted light colored soil, 7.5YR 3/2 or ¾, along with many small and fist-sized stones, was found in this particular area (Lots LA 2951, 2952, 2956, 2959 2962 & 2963). In this area few artifacts, mostly ceramic sherds, were recovered from this soil. Nearly all of the artifacts were small to medium-sized and badly weathered. Chert flakes were generally small and were often patinated, although chert artifacts represented more than just a modest percentage of the total amount of cultural material recovered in these lots (Appendix 4). As mentioned above, bedrock was not encountered in any area of Op 05-01.

Artifact densities were predictably highest in the midden lots, which were LA 2948, 2950, 2954, 2960, 2965, 2966, 2974 & 2975 (Appendix 4). The lower portions (7-10 cms.) of Lots LA 2944 and LA 2945, overlying Lots LA 2948 and LA 2950, respectively, also likely comprise midden from the occupation of the cacique's house and nearby Structure N11-27. Lot LA 2944 had the highest number of artifacts for any lot

excavated in 2005 with 975. Lots LA 2945, 2960 and 2966 had 757, 793 and 707 artifacts each, respectively. Bone counts were comparatively high in each lot, averaging 193 for the midden lots excavated. A great many of the bones in each of these lots was fragmentary; very few whole bones were encountered. But the relative percentage of bone to total numbers of artifacts recovered in the 'heart' of the Terminal Postclassic-Spanish Colonial Period midden that was likely used by both the residents of Structures N11-18 and N11-27 supports the idea that feasting may have been one of the activities that took place at the *cacique's* house during this period. Faunal material comprises 44.1% of all of the cultural material in Lot LA 2960 and nearly half (47.6%) of all of the artifacts encountered in Lot LA 2966.

Dating

In-depth analyses of artifacts recovered during the past four field seasons are scheduled for the summer of 2007. No field work is planned for that summer so that detailed analyses of various artifact classes, including ceramics, can be conducted. The results of such analyses will greatly enhance our ability to make more meaningful statements regarding the nature of the various assemblages, and how the data derived from these bears on the research questions discussed above. As discussed previously (Simmons 2004:44) the question of dating, however, is complicated by the similarities that exist between the Terminal Postclassic and Spanish Colonial Period Maya ceramic assemblages (Graham 1987). The degree of temporal resolution that is afforded (or not) by the ceramic artifacts from these periods at Lamanai has been discussed above and elsewhere (Pendergast 1991:348).

Specifically, the presence of Yglesias ceramic sherds in deposits that contain Spanish ceramic and glass objects indicates that although this ceramic tradition began in Terminal Postclassic times, Yglesias vessels continued to be produced throughout the Spanish Colonial Period (Graham 1987:91-95; Pendergast 1991:348). This continuity in ceramic vessel form and technology parallels that seen in the lithic assemblage from Late Postclassic and Spanish Colonial times, making temporal separation of the two periods difficult in the absence of Spanish or other European artifact types (Simmons 2002:66). The presence of European objects in post abandonment accumulation and midden elsewhere in this area of the site is indicative of Spanish Colonial Period occupation of nearby Str. N11-18 (Simmons and Howard 2003). But no European material was recovered in PAA or other deposits during the 2005 field season at Str. N11-27.

Obviously, the absence of objects of European manufacture does not preclude the possibility of post-contact occupation of Str. N11-27. The decidedly non-Christian position of the human interment at Str. N11-27, as mentioned above, does argue against occupation of the structure during at least the Spanish Contact Period. Yet, again, without objects of European manufacture in either associated midden deposits (which we have not yet identified) and/or floor ballast we cannot be certain that Str. N11-27 was occupied during Spanish Colonial times. It is hoped that charcoal samples obtained from

floor ballast deposits during the 2004 field season might provide some temporal clarity regarding this important question.

Certain architectural characteristics of Str. N11-27 may yield clues regarding its periods of occupation, particularly in light of what is seen at this and other Belizean sites having very late occupation components. No lines of vertically set stones were present at Str. N11-27. As mentioned above, this particular construction technique appears commonly at several Belizean sites occupied during Terminal Postclassic-Spanish Colonial times, and may, in fact, be a temporally diagnostic architectural feature of this period. Again, the absence of these particular architectural features does not preclude the possibility that Str. N11-27 was occupied during the 16th and 17th centuries. At this point, it seems most likely to have been.

Stabilization of the Architectural Remains of Structure N11-27

Following the completion of archaeological investigations in 2005 the fairly shallow architectural features encountered in the northern, southern and western areas investigated were covered in plastic tarps and heavy plastic sheeting and partially backfilled. The platform facing stones encountered at Structure N11-27 and south and west of the building were covered and screened soil was banked against each face of these stones atop the tarps. In fact, where *any* architectural remains were encountered in Op 05-01 plastic tarps or heavy grade plastic sheeting were used to cover those remains and screened soil was placed atop the tarps or sheeting.

This method was used as a short-term solution for protecting the architectural remains; it is not intended as a permanent method of architectural stabilization and preservation. It is, however, both effective and useful considering that the documentation of this area is not yet complete. It is very likely that additional architectural remains, including other architectural elements of Structure N11-27 will be encountered in this area. In order to understand the spatial and (hopefully) functional relationships between new architectural features and those that were documented in 2005 it is important to be able to re-expose, if need be, previously identified architectural features. In this way it is possible to document the full spatial relationships between all these features, which will greatly facilitate their interpretation.

Lightly backfilled with screened soil and covered with heavy, industrial grade protective tarps and plastic, the architectural remains recorded in 2002 and 2004 were found to be in very good condition when we returned in 2005. The methods of stabilization used in previous field seasons have proved to be very effective in preventing any kind of collapse of architectural features, and in fact worked well to prohibit damage from plant roots as well. At present no portion of Structure N11-27 excavated during the 2005 field season is unstable or threatened by adverse deterioration caused by archaeological investigations.

Once the investigation of this area has been completed we will consult with individuals at the Institute of Archaeology, NICH, to develop a long-term stabilization

and preservation plan for Structures N11-18 and N11-27. This may include backfilling the shallow deposits with screened soil, which would, it has been shown, protect the vertically set stones by keeping them in place. It might also be possible to include this important structure in tourism development plans for the site. In that case some reconstruction work might be contemplated so that visitors to the site can understand the architectural components and features of the building more fully.

Copper Production at Structure N11-27: The Evidence from 2005

To our knowledge, more copper and alloyed copper artifacts have been recovered in controlled archaeological excavations from Lamanai than from any other Maya site in the Southern Lowland area (Simmons, Pendergast and Graham n.d.). Two copper objects were recovered during the 2005 field season (Table 6). To date, a total of 182 copper artifacts have been recovered at Lamanai (Table 7). Most of these (64%) have been recovered at or in the immediate vicinity of Structures N11-18 and N11-27. The majority of the remaining copper artifacts were recovered in association with burials in Structures N10-2 and N10-4 (discussed above).

The advent of this technology at Lamanai and in the Maya area as a whole is unknown at this point (see above discussion). But at present we have quite compelling evidence for copper production activities at Lamanai in the immediate vicinity of Structures N11-18 & N11-27. This evidence consists of three copper ingots or pigs (LA 858/11, 881/1 and 908/1); several small pieces of scrap copper (LA 1241/1, LA 2909/7, LA 2924/12 & LA 2932/1); an apparently mis-cast needle (LA 1580/18), and several dozen mis-cast bells that represent production failures. In addition, seven very small copper pellets (LA 2081/1, 2096/1, 2096/1, 2106/1, 2106/2, LA 2909/6, LA 2937/7 and LA 2981/2), almost certainly representing prills, were recovered in 2002, 2004 and 2005 at Structure N11-27. Although no production features have been found as yet, these last artifacts add considerable weight to the hypothesis that copper production, specifically melting and casting activities, were taking place at or very near Structure N11-27.

More than two-thirds of the copper objects that have been recovered at Structure N11-18 have been described by Hosler (1985, 1994, 1995) as status display objects, including a variety of types of bells, tweezers, and rings. Figure 13 shows one of the very small copper prills that were recovered in the fill of Burial N11-27/2 in 2005. It is unclear at this point why the majority of the copper prills recovered thus far from Structure N11-27 have come from burial fill deposits. The burial fill appears to represent redeposited floor ballast identical to the kind documented throughout Structure N12-27 and in the area immediately north and east of Structure N11-18 (Simmons and Howard 2003; Simmons 2004). It seems reasonable to conclude that the earth and stone used for construction of the Structure N11-27 platform originated from somewhere in the immediate vicinity. If this is the case then the copper production activities that produced the prills most likely occurred somewhere close to the area we have been investigating. Future investigations in this area of the site will hopefully yield additional evidence of copper metallurgy at Lamanai and clarify our understanding of the roles coppersmiths played in the political economy of Lamanai during a critical period of cultural transition.

Table 6. Summary of Copper Objects Recovered during 2005

Artifact Type	Small Find Numbers	Total
Prill	LA 2981/2	1
Bell	LA 2966/12	1
	Total	**2**

Table 7. Summary of Copper Artifact Types from Lamanai

Object Type	Number	Percentage of Assemblage
Bells (whole & mis-cast frags)	76	41.7
Bell clappers	1	0.5
Celt/chisel/axe	22	12.2
Ring	14	7.7
Ornamnent	12	6.6
Sheet fragments	8	4.4
Needles	10	5.5
Ingot/pig	8	4.4
Prill	8	4.4
Fish hook	5	2.7
Tweezers	4	2.2
Pins	4	2.2
Bell-head pin	2	1.1
Pin head	2	1.1
Tinkler	1	0.5
Pig or chisel/axe blank	1	0.5
Oblong strip	1	0.5
Unidentified	1	0.5
Chunk	2	1.1
TOTAL	**182**	**100**

* totals up to end of 2005 field season

Summary & Conclusions

The first three field seasons of the Maya Archaeometallurgy Project at Lamanai have been successful in terms of both teaching and research. During the 2001 and 2002 field seasons a total of thirty-eight students, including three Belizeans, were trained in archaeological field and laboratory methods at Lamanai. In 2004 a total of 14 students from a variety of US universities, completed the field school in archaeology at Lamanai. The same number of students attended the field school in 2005 and one of these was a Belizean student. After successfully completing the field school all of these students, with the exception of those that chose not to do so, received academic credits for the field school in archaeology from their home universities.

In terms of the research conducted during 2005 there were several noteworthy achievements. First, we were able to more fully define the horizontal extent of Structure N11-27, possibly an outbuilding of the kind Farris (1984:178-179) mentions as typically associated with the residences of Maya *caciques*. With few exceptions, these buildings, and indeed those of Maya Contact Period *caciques*, have not been studied extensively in the Lowland Maya area. Further delineation of this structure, specifically identification of the south platform face, will provide additional information on the architectural and functional nature of these buildings. In addition, given the presence of copper production debris in and immediately around the building it is possible that further exploration of the structure will yield important information on Maya copper production, particularly the organizational structure of this specialized craft activity. We may also gain much needed information on the timing of the advent of Maya experimentation with copper production in the Lowland Area. Since this is still an unresolved question, any information that might be available on dating the beginnings of this new technology would be quite valuable, indeed.

For the purposes of our research on the nature of Maya copper metallurgy at Lamanai several important steps were taken during 2005. First, the recovery of another copper prill provides additional evidence of on-site Maya metallurgy. The copper bell recovered from Lot LA 2966, in the basal portion of the midden associated with Structure N11-18 and possibly also with Structure N11-27 further increases our curiosity regarding recycling of copper objects at the site. Specifically, the results of chemical compositional analyses by both Drs. Dorothy Hosler and Aaron Shugar (see Appendix 7 of this report) indicate that the Maya of Lamanai were actively engaged in melting objects that had been imported from places in West Mexico and lower Central America in the 13th and 14th centuries and recasting them into other forms at the point of Spanish Contact (Hosler 1994:214; Simmons 2005:236). So naturally it is puzzling to us why a number of copper artifacts, including the copper bell recovered in 2005 (LA 2966/12), were discarded with other household refuse while others were recycled by Lamanai's coppersmiths into new forms, such as the axes and ingots found at Structure N11-18.

The continued absence of copper artifacts of European design, form and chemical composition adds strength to the idea that the Maya of Lamanai developed the technology of copper metallurgy prior to the arrival of the Spanish in Yucatan (Simmons 2001, 2005; Simmons, Pendergast and Graham n.d.). The recovery of the eight copper

prills in contexts that likely pre-date Spanish contact can be taken as tentative evidence to support this idea as well. Undoubtedly much more work must be done in order for us to be confident in identifying copper metallurgy as an indigenous Maya technological innovation, and not one that was introduced by the Spanish after contact.

It is very clear, however, that archaeological investigations conducted during the last four field seasons have provided further compelling evidence that Structures N11-18 and N11-27 and their immediate environs were likely loci for copper production, the technology for which had to have still been relatively new to the Maya at the time of Spanish contact. The productive nature of this technology has not yet been documented in the Maya area, and although to date no production features have been identified, the recovery of mis-cast copper objects and production debris, specifically the prills and scrap sheet pieces recovered during the last two field seasons, strongly suggests that we are closer than ever to identifying the locus or loci of copper production at the site.

In addition, the strength of the association between the contact period occupants of Strs. N11-18 and N11-27 and copper metallurgy seems to be growing based on information derived during MAP excavations in 2001, 2002, 2004 and 2005. Excavations during the first two seasons were focused on the north end of Structure N11-18, and just over half (9 of 17) of the copper artifacts we recovered there were either production failures or production debris. Thus far all six of the copper artifacts recovered from excavations at nearby Structure N11-27 are production debris. The combined copper artifact total from the last four field seasons is a small sample, admittedly, but as our investigations in this area continue in future years we will be in a better position to more fully assess the nature of this apparent association. The area to the east of our 2005 horizontal exposure may represent a part of Structure N11-27, or another, very closely situated building. This is an area we will look forward to investigating in coming field seasons.

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Appendix 1

Field and Laboratory forms used by the MAP and LAP at Lamanai

Lamanai Archaeological Project **LOT RECORD** **FOR LOT NUMBER:**

SITE:		**YEAR EXCAVATED:**
Operation:		**Assessment:** **1)**
Structure:		**2)**
Lot(s) Above: **Lot(s) Below:**		**Associated Lot:** **Equivalent Lot(s):**
Thickness of Deposit:	**Area:**	**Volume:**
Grid Reference:		
Date of Deposit?		
Screened? ☐ **Quantity:** **Screen Size:**		
Float? ☐ **Quantity:**		
Photos:		
Datum Point(s):	**Relationship to Datum and/or Surface (Vertical):**	
	Relationship to Datum (Horizontal):	
Location of Drawings & Field Notes:		
Soil Description (Munsell):		
Evidence of Disturbance?:		
Other Observations/Artifacts/Notes etc.:		

Entered by & Date:_____

Computer Entered by & Date:_____

Lamanai Archaeological Project

SMALL FINDS RECORD **LOT/CATALOGUE NUMBER:**

SITE:	**YEAR EXCAVATED:**	
PROVENIENCE:		
Structure:	Burial No:	
Cache No:	Assessment 1): 2):	
Grid Reference:		
CHARACTERISTICS:		
Material:	Category (e.g., use/function):	
Description (1st level):	Type (specialization):	
Description continued:		
2nd level:	3rd level:	4th level:
REMARKS:		
DIMENSIONS:		
Length:	Thickness:	
Width:	Diameter:	
Weight: Other Dimensions? (SPECIFY):		
WHOLE	**FRAGMENTARY less than 50%**	**FRAGMENTARY more than 50%**
Illustrate? ☐	**Photo? ☐**	**Float? ☐** **Screen? ☐**
ILLUSTRATION:		

Entered by & Date: _____

Computer Entered by & Date _____

LAMANAI ARCHAEOLOGICAL PROJECT
SMALL FINDS RECORD

LOT # ________________

LOT/SMALL FIND #	**DESCRIPTION**

LOT # ________________

LOT/SMALL FIND #	**DESCRIPTION**

LOT # ________________

LOT/SMALL FIND #	**DESCRIPTION**

LOT # ________________

LOT/SMALL FIND #	**DESCRIPTION**

PHOTOGRAPH RECORD

Lamanai Archaeological Project

SITE:			YEAR:
FILM:	ASA:	CAMERA:	ROLL #:

FRAME:	STR./OP.	SUBJECT :	LOT:	LOOKING:	DATE:

DATE_____ **LAP ARTIFACT COUNT SHEET** LOT#_____

Sherds:	**Chert:**	**Bone:**
Notched Sherds:	**Obsidian:**	**Shell:**
Perforated Sherds:	**Ground Stone:**	**Teeth:**
Other Worked Sherds:	**Granite:**	**Charcoal:**
Spindle Whorls:	**Slate:**	**Limestone (artifact):**
Date Seed Sinkers:	**Basalt:**	**Daub:**
Metal:	**Pyrite:**	**Stucco:**
Silver:	**Hematite:**	**Mudstone:**
Copper:	**Quartzite:**	**Jade:**
Bronze:	**Rock Crystal:**	**Pearls:**
Iron:	**Sandstone:**	**Turquoise:**
Brass:	**Metamorphic:**	**Coral:**
Gold:	**Plastic:**	**Foreign Stone:**
Special ceramics:	**Glass:**	**Small Finds:**

DATE_____ **LAP ARTIFACT WEIGHT SHEET** LOT#_____

Sherds:	**Chert:**	**Bone:**
Notched Sherds:	**Obsidian:**	**Shell:**
Perforated Sherds:	**Ground Stone:**	**Teeth:**
Other Worked Sherds:	**Granite:**	**Charcoal:**
Spindle Whorls:	**Slate:**	**Limestone (artifact):**
Date Seed Sinkers:	**Basalt:**	**Daub:**
Metal:	**Pyrite:**	**Stucco:**
Silver:	**Hematite:**	**Mudstone:**
Copper:	**Quartzite:**	**Jade:**
Bronze:	**Rock Crystal:**	**Pearls:**
Iron:	**Sandstone:**	**Turquoise:**
Brass:	**Metamorphic:**	**Coral:**
Gold:	**Plastic:**	**Foreign Stone:**
Special Ceramics:	**Glass:**	**Small Finds:**

Appendix 2

Summary of Lots Excavated, Operation 05-01, 2005 MAP Field Season

Summary of Lots Excavated, OP 05-01, Lamanai, Belize

Number	Area	Lot Description
LA 2939		2.25 x 1.25 x .10m; N29.25 E 37.5; PAA.
LA 2940	N11-27	2.25 x 1.5 x .10m; N27 E. 37.5; PAA.
LA 2941	N11-27	1 x 1x .10m; N 28 E 33.5; PAA.
LA 2942	N11-27	1 x 1x .10m; N 22.5 E 30.5; PAA.
LA 2943	N11-27	2 x 1 x .10m; N 23.5 E 29.5; PAA.
LA 2944	N11-27	2 x 2 x .10m; N19 E 35.5; PAA.
LA 2945	N11-27	2 x 2 x .10m; N 17 E 35.5; PAA
LA 2946	N11-27	1 x 1 x .10m; N 22.5 E 30.5; 10YR 3/1; Ballast
LA 2947	N11-27	1 x 2 x .10m; N 23.5 E 29.5; 10YR 3/1; Ballast
LA 2948	N11-27	2 x 2 x .10m; N19.0 E 35.5; 10 YR 3/1; N/A
LA2949	N11-27	1 x 1 x .10m; N 28.0 E 29.57; 10YR/ 3/1; PAA
LA 2950	N11-27	2 x 2 x .10m; N 17.0 E 35.5; 10YR 2/1; Primary Midden 1
LA 2951	N11-27	2 x 2 x .10m; N29.25 E 37.5; Darker soil in upper lot; Upper Portion PAA / Lower Ballast
LA 2952	N11-27	2.25 x 1.5 x .10m; N 27 E 37.5; N/A ; Upper Portion – PAA / Lower – Ballast
LA 2953	N11-27	2 x 2 x .10m; N 22.5 E 30.5; N/A ; Ballast
LA 2954	N11-27	2 x 2 x .10m; N 19.0 E 35.5; 10YR 3/1; Midden 1
LA 2955	N11-27	1 x 2 x .10ml; N 23.5 E 29.5; N/A; Ballast
LA 2956	N11-27	2.25 x 1.5 x .10; N29.25 E 37.5; N/A; Ballast
LA 2957	N11-27	1 x 1 x .10 N 28.0 E 34.0; N/A; Ballast
LA 2958	N11-27	2 x 2 x .10 N 19 E 35.5; N/A; PAA
LA 2959	N11-27	2.25 x 1.5 x .10; N 27 E. 37.5; Silty Clay matrix between stones; Ballast/Core
LA 2960	N11-27	2 x 2 x .10m ; N 17.0 E 35.5; 10YR 2/1 (sticky organic black to brown); Midden 1
LA 2961	N11-27	(area within semi-circular stone feature east of very large stone slabs); N 19.0 E 35.5; Slightly darker colored, less clayey solid of LA2954; Midden 1
LA 2962	N11-27	2.25 x 1.5 x .10m; N 29.25 E 37.5; Soil in this area is compact and light colored due to being in close proximity to so much limestone
LA 2963	N11-27	2.25 x 1.5 x .10m; N 27.0 E 37.5; Very compact soil mixed in with large amount of limestone. ; Core/Ballast
LA 2964	N11-27	157cm x 30 ->10(s); N19 E 35.5; N/A; PAA
LA 2965	N11-27	1 x 2.0 x .10m; N 19.0 E 35.5 ; 10 YR 4/1 ; N/A
LA 2966	N11-27	2.0 x 2.0 x .10m; N 17.0 E 35.5; 10 YR 2/1; Midden
LA 2967	N11-27	2.0 x 2.0 x .10m; N 31.5 E 37.5; N/A; Northern most exposure of Line C
LA 2968	N11-27	2 x 2 x .10m; N 23.5 E 30.5; N/A; Ballast
LA 2969	N11-27	2.0 x 1.5 x .10m; N 26.5 E 32.0; N/A;
LA 2970	N11-27	2.0 x 1.5 x .10m; N 26.5 E 32.0; N/A; Large fist sized stones beginning to appear along the eastern edge of the excavation unit.
LA 2971	N11-27	1.5 x 1.0 x .10m; N 26.5 E 34.0; N/A;
LA 2972	N11-27	54.5 x 47.0 x 10cm; N 31.0 E 35.2; Soil Matrix surrounding human bone
LA 2973	N11-27	1.5 x 1.0 x .10m; N 26.5 E 34.0; To surface of stones.

Summary of Lots Excavated, OP 05-01, Lamanai, Belize (continued)

Number	Area	Lot Description
LA 2974	N11-27	1 x 2.0 x .10m; N 19.0 E 35.5; Lot below LA2965;
LA 2975	N11-27	1 x 2.0 x .10m; N 19.0 E 35.5; Lot below LA2965.
LA 2976	N11-27	2.25 x 1.5 x .10m; N 29.25 E 37.5; Lot below LA2962; area east of Line C
LA 2977	N11-27	2.25 x 1.5 x .10m; N 27.0 E 37.5; Lot below 2963; area east of Line C (below core?)
LA 2978	N11-27	2.0 x 2.0 x .10m; N 17.0 E 35.5; Lot below 2966; area west of stone slab Line C
LA 2979	N11-27	1.5 x 1.0 x .10m; 1.5 x 1.0 x .10m; N 26.5 E 34.0; Lot below LA 2973
LA 2980	N11-27	2 x 1.5 x .10m; 2.0 x 1.5 x .10m; N 26.5 E 32.0; N/A; Lot below LA 2970
LA 2981	N11-27	N/A; N 26.5 E 34.80; Burial Fill, Burial 1
LA 2982	N11-27	2.0 x 1.0 x .10m; 2 x 2 x .10m; N 23.5 E 30.5; Core / Construction effort
LA 2983	N11-27	1 x 2.0 x .10m; N 19.0 E 35.5; Area in southern 2/3 of unit
LA 2984	N11-27	2 x 1.5 x .10m; 2.0 x 1.5 x .10m; N 26.5 E 32.0; N/A; PAA
LA 2985	N11-27	Burial 1/ Skeletal Remains
LA 2986	N11-27	PNK – Field School N11-27 Area

Appendix 3

Small Finds Recovered from Op 05-01, 2005 MAP Field Season

LAMANAI ARCHAEOLOGICAL PROJECT
Maya Archaeometallurgy Project

Small Finds Record
OP 05-01 2005 Field School

LA 2935 (continued from 2004 field season)

Lot/Small Find #	**Description**
1. LA 2935/1	Ceramic bead
2. LA 2935/2	Chert drill
3. LA 2935/3	Chert projectile point
4. LA 2935/4	Obsidian blade

LA 2939 (continued from 2004 field season)

Lot/Small Find #	**Description**
1. LA2939/1*	Core
2. LA2939/2*	Ceramic Bead
3. LA2939/3*	Ceramic Rattle
4. LA2939/4*	Rattle
5. LA2939/5*	Slag
6. LA 2939/1	Chert biface
7. LA 2939/2	Worked shell adornment
8. LA 2939/3	Chert biface
9. LA 2939/4	Chert informal tool
10. LA 2939/5	Chert biface

***** Artifact recovered in 2004

LA 2940

Lot/Small Find #	**Description**
1. LA 2940/1	Chert biface
2. LA 2940/2	Chert biface
3. LA 2940/3	Chert biface
4. LA 2940/4	Bone spindle whorl
5. LA 2940/5	Kaolin pipe fragment
6. LA 2940/6	Chert small side notched-point
7. LA 2940/7	Chalcedony small side-notched point
8. LA 2940/8	Chert biface

LA 2941

Lot/Small Find #	**Description**
1. LA 2941/1	Limestone bark beater
2. LA 2941/2	Stemmed chert biface
3. LA 2941/3	Chert drill

Lot LA 2942

Lot/Small Find #	Description
1. LA 2942/1	Chert biface

LA 2943

Lot/Small Find #	Description
1. LA 2943/1	Chert biface
2. LA 2943/2	Chert biface

LA 2944

Lot/Small Find #	Description
1. LA 2944/1	Small side-notched chert point
2. LA 2944/2	Small side-notched chert point
3. LA 2944/3	Ceramic Bead
4. LA 2943/4	Bone spindle whorl
5. LA 2944/5	Small side-notched chert point
6. LA 2944/6	Ceramic net sinker (notched sherd)
7. LA 2944/7	Ceramic net sinker (notched sherd)
8. LA 2944/8	Chert biface

LA 2945

Lot/Small Find #	Description
1. LA2945/1	Shell bead
2. LA 2945/2	Small side-notched chert point
3. LA 2945/3	Small un-notched chert point
4. LA 2945/4	Ceramic incensario? bird head
5. LA 2945/5	Small side-notched chert point
6. LA 2945/6	Small side-notched chert point
7. LA 2945/7	Small un-notched chert projectile point

LA 2946

Lot/Small Find #	Description
1. LA2946/1	Small side-notched chert projectile point

LA 2947

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2948

Lot/Small Find #	Description
1. LA 2948/1	Chert projectile point fragment
2. LA 2948/2	Small side-notched chert projectile point
3. LA 2948/3	Chert biface fragment

LA 2949

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2950

Lot/Small Find #	Description
1. LA 2950/1	Chert Biface
2. LA 2950/2	Side-notched biface fragment
3. LA 2950/3	Shell bead
4. LA 2950/4	Chert informal tool
5. LA 2950/5	Ceramic bead fragment
6. LA 2950/6	Bone spindle whorl
7. LA 2950/7	Greenstone axe fragment

LA 2951

Lot/Small Find #	Description
1. LA2951/1	Bone spindle whorl fragment

LA 2952

Lot/Small Find #	Description
1. LA2952/1	Perforated stone bead
2. LA2952/2	Perforated ceramic bead
3. LA2952/3	Date seed ceramic net sinker
4. LA 2952/4	Chert biface fragment

LA 2953

Lot/Small Find #	Description
1. LA 2953/1	Perforated shark tooth adornment
2. LA 2953/2	Bone bead

Lot LA 2954

Lot/Small Find #	Description
1. LA 2954/1	Date seed net sinker
2. LA 2954/2	Notched ceramic sherd net sinker
3. LA 2954/3	Notched ceramic sherd net sinker
4. LA 2954/4	Notched ceramic sherd net sinker

LA 2955

Lot/Small Find #	Description
1. LA 2955/1	Ceramic bead
2. LA 2955/2	Ceramic bead

LA 2956

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2957

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2958

Lot/Small Find #	Description
1. LA 2958/1	Small biface fragment

LA 2959

Lot/Small Find #	Description
1. LA 2959/1	Small side-notched chert point
2. LA 2959/2	Small side-notched chert point

LA 2960

Lot/Small Find #	Description
1. LA 2960/1	Jadeite groundstone fragment
2. LA 2960/2	Perforated oliva shell adornment
3. LA 2960/3	Small side-notched chert projectile point
4. LA 2960/4	Perforated ceramic bead
5. LA 2960/5	Small obsidian projectile point fragment
6. LA 2960/6	Ceramic bead fragment
7. LA 2960/7	Ceramic bead
8. LA 2960/8	Small side-notched chert projectile point
9. LA 2960/9	Informal chert flake tool
10.LA 2960/10	Informal obsidian blade tool
11.LA 2960/11	Perforated bone bead
12.LA 2960/12	Chert biface fragment
13.LA 2960/13	Chert biface

LA 2961

Lot/Small Find #	Description
1. LA2961/1	Perforated shell adornment
2. LA2961/2	Small side-notched obsidian projectile point
3. LA 2961/3	Chert biface
4. LA 2961/4	Ceramic date seed net sinker

LA 2962

Lot/Small Find #	Description
1. LA 2962/1	Notched ceramic sherd net sinker
2. LA 2962/2	Chert biface
3. LA 2962/3	Small side-notched chert projectile point

LA 2963

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2964

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2965

Lot/Small Find #	Description
1. LA2965/1	Small side-notched chert projectile point
2. LA2965/2	Ceramic bead

LA 2966

Lot/Small Find #	Description
1. LA 2966/1	Historic metal (steel) object
2. LA 2966/2	Modified oliva shell adornment
3. LA 2966/3	Perforated shell bead
4. LA 2966/4	Chert biface fragment
5. LA 2966/5	Ceramic bead
6. LA 2966/6	Perforated ceramic bead
7. LA 2966/7	Chert biface fragment
8. LA 2966/8	Informal chert uniface
9. LA 2966/9	Small un-notched chert projectile point
10.LA2966/10	Chert biface
11.LA2966/11	Chert biface fragment
12.LA2966/12	Pyriform copper bell
13.LA2966/13	Ceramic bead fragment
14.LA 2966/14	Perforated shell bead fragment
15.LA 2966/15	Notched ceramic sherd net sinker
16.LA 2966/16	Perforated ceramic bead
17.LA 2966/17	Modified shell bead
18.LA 2966/18	Informal obsidian biface
19.LA 2966/19	Small side-notched obsidian projectile point
20.LA 2966/20	Stemmed chert biface
21.LA 2966/21	Small side-notched chert projectile point
22.LA 2966/22	Perforated shell bead
23.LA 2966/23	Small side-notched chert projectile point
24.LA 2966/24	Small side-notched chert projectile point
25.LA 2966/25	Chert uniface
26.LA 2966/26	Small side-notched chert projectile point
27.LA 2966/27	Chert biface
28.LA 2966/28	Small side-notched chert projectile point
29.LA 2966/29	Perforated ceramic bead
30.LA 2966/30	Date seed ceramic net sinker
31.LA 2966/31	Perforated ceramic bead

32.LA 2966/32 Perforated ceramic bead
33.LA 2966/33 Perforated shell bead
34.LA 2966/34 Obsidian biface
35.LA 2966/35 Small side-notched chert projectile point

LA 2967

Lot/Small Find #	Description
1. LA2967/1	Chert biface
2. LA2967/2	Chert biface
3. LA2967/3	Chert biface

LA 2968

Lot/Small Find #	Description
1. LA2968/1	Chert biface

LA 2969

Lot/Small Find #	Description
1. LA2929/1	Possible hematite
2. LA 2969/2	Worked greenstone

LA 2970

Lot/Small Find #	Description
1. LA2970/1	Perforated ceramic bead
2. LA2970/2	Date seed ceramic net sinker
3. LA2970/3	Notched ceramic sherd net sinker
4. LA2970/4	Small side-notched chert projectile point fragment
5. LA2970/5	Perforated oliva? shell bead adornment

LA 2971

Lot/Small Find #	Description
1. LA2971/1	Chert biface (SSNP fragment?)

LA 2972

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2973

Lot/Small Find #	Description
1. LA 2973/1	Date seed ceramic net sinker
2. LA 2973/2	Utilized obsidian blade
3. LA 2973/3	Groundstone slate fragment
4. LA 2973/4	Chert biface
5. LA 2973/5	Perforated shell bead adornment

LA 2974

Lot/Small Find #	Description
1. LA2974/1	Incised bone (adornment?)

LA 2975

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2976

Lot/Small Find #	Description
1. LA2976/1	Chert Biface

LA 2977

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2978

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2979

Lot/Small Find #	Description
1. LA 2979/1	Chert biface

LA 2980

Lot/Small Find #	Description
1. LA 2980/1	Chert biface

LA 2981

Lot/Small Find #	Description
1. LA 2981/1	Metamorphic stone celt/biface
2. LA 2981/2	Copper prill

LA 2982

Lot/Small Find #	Description
NO SMALL FINDS	

LA 2983

Lot/Small Find #	Description
1. LA 2983/1	Small stemmed biface
2. LA 2983/2	Chert uniface

LA 2986

Lot/Small Find #	Description
1. LA 2986/1	Chert hammerstone

Summary of Artifact Counts by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize

Lot Number **Material Type**

	Ceramic sherds	Chert	Bone	Obsidian	Shell	Stucco/ Plaster	Charcoal Samples	Historic Artifacts	Special Ceramics	Small Finds	Quartz/ Quartzite	Teeth	Copper	Slate	Metamorphic	Hematite	Total Artifact Count
LA 2935	51	13	6	0	1	0	2	0	0	4	0	0	0	0	0	0	77
LA 2939	219	57	41	4	0	2	0	1	1	10	6	0	0	0	0	0	341
LA 2940	270	46	96	3	1	0	0	0	10	8	0	1	0	0	0	0	435
LA 2941	19	9	12	0	0	0	0	6	0	3	0	0	0	0	0	0	49
LA 2942	36	5	50	1	0	0	0	2	0	1	0	1	0	0	0	0	96
LA 2943	50	13	62	0	1	0	0	0	0	2	0	0	0	0	0	0	128
LA 2944	599	80	258	3	13	0	2	2	7	8	2	1	0	0	0	0	975
LA 2945	421	87	209	11	7	0	0	13	2	7	0	0	0	0	0	0	757
LA 2946	85	13	138	1	1	0	0	0	0	1	0	0	0	0	0	0	239
LA 2947	122	20	153	1	3	0	0	1	0	0	0	0	0	0	0	0	300
LA 2948	212	20	153	1	3	0	0	1	0	3	0	0	0	0	0	0	393
LA 2949	34	29	70	0	4	0	0	40	0	0	0	0	0	0	0	0	177
LA 2950	234	55	169	4	9	0	0	2	3	7	0	1	0	0	1	0	485
LA 2951	42	15	2	0	1	0	0	1	0	1	0	0	0	0	0	0	62
LA 2952	225	36	36	3	3	0	1	1	0	4	4	0	0	0	0	0	313
LA 2953	84	14	167	1	1	0	0	0	0	2	0	3	0	0	0	0	272
LA 2954	256	36	126	7	1	0	0	0	0	4	0	0	0	0	0	0	430
LA 2955	73	11	71	0	1	0	0	0	2	2	0	0	0	0	0	0	160
LA 2956	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103

Summary of Artifact Counts by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize (cont'd)

	Ceramic sherds	Chert	Bone	Obsidian	Shell	Daub	Charcoal Samples	Historic Artifacts	Special Ceramics	Small Finds	Quartz/ Quartzite	Teeth	Copper	Slate	Metamorphic	Hematite	Total Artifact Count
LA 2957	228	52	47	7	12	0	0	0	0	0	0	0	0	1	1	0	348
LA 2958	36	1	10	1	1	0	0	0	0	1	0	0	0	0	0	0	50
LA 2959	79	12	0	1	0	0	0	0	3	2	1	0	0	0	0	0	98
LA 2960	347	74	350	0	1	0	1	1	3	13	0	1	0	0	2	0	793
LA 2961	24	1	10	1	1	0	0	0	0	4	1	0	0	0	0	0	42
LA 2962	25	0	0	1	0	0	0	0	0	3	0	0	0	0	0	1	30
LA 2963	95	9	1	3	5	0	0	0	0	0	0	0	0	0	0	1	114
LA 2964	114	17	11	1	2	0	0	0	0	0	0	0	0	0	0	0	145
LA 2965	12	12	15	1	3	0	0	0	0	2	0	0	0	0	0	0	45
LA 2966	263	46	337	11	3	0	2	1	8	35	0	0	1	0	0	0	707
LA 2967	70	8	2	0	0	0	0	0	1	3	5	0	0	0	0	0	89
LA 2968	9	3	0	1	0	0	3	0	0	1	0	0	0	0	0	0	17
LA 2969	26	13	21	4	0	0	0	0	6	2	0	0	0	1	1	1	75
LA 2970	86	40	42	6	1	0	0	0	1	5	0	0	0	0	0	0	181
LA 2971	45	2	20	0	0	2	0	0	0	1	0	0	0	0	0	0	70
LA 2972	6	0	37	0	0	0	1	0	0	0	0	0	0	0	0	0	44
LA 2973	56	2	37	1	0	0	0	0	0	5	0	0	0	0	0	0	101
LA 2974	12	3	2	0	0	0	0	0	0	1	0	1	0	0	0	0	19
LA 2975	11	0	24	1	0	0	1	0	1	0	0	1	0	0	0	0	39
LA 2976	9	14	0	1	0	0	1	0	0	1	0	0	0	0	0	0	26

Summary of Artifact Counts by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize (cont'd)

	Ceramic sherds	Chert	Bone	Obsidian	Shell	Daub	Charcoal Samples	Historic Artifacts	Special Ceramics	Small Finds	Quartz/ Quartzite	Teeth	Copper	Slate	Metamorphic	Hematite	Total Artifact Count
LA 2978	35	0	6	1	0	0	1	0	0	0	0	0	0	0	0	0	43
LA 2979	42	10	5	0	1	0	0	0	0	1	1	0	0	0	0	0	60
LA 2980	68	3	29	5	1	0	0	0	0	1	0	0	0	0	0	0	107
LA 2981	14	19	0	0	0	0	1	0	0	2	0	0	1	0	0	0	37
LA 2983	26	2	15	1	0	0	0	0	0	2	0	1	0	0	0	0	47
LA 2985	0	0	72	0	0	0	0	0	0	0	0	7	0	0	0	0	79
LA 2986	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Grand Total	4873	902	2912	88	81	4	16	259	48	153	20	18	2	2	5	3	9199

Appendix 5

Summary of Counts of Weights by Type Recovered in 2005, Operation 05-01

Summary of Artifact Weights by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize

Lot Number **Material Type** (all weights in grams)

	Ceramic sherds	Chert	Bone	Obsidian	Shell	Daub	Charcoal Samples	Historic Artifacts	Special Ceramics	Small Finds	Quartz/ Quartzite	Teeth	Copper	Slate	Metamorphic	Hematite	Total Weight of Artifacts
LA 2935	365	174	19	1	1	0	<1	0	0	4	0	0	0	0	0	0	564
LA 2939	1,460	715	109	0	0	0	0	1	0	320	73	0	0	0	0	0	2678
LA 2940	2,141	56	146	<1	0	0	0	1	104	94	0	<1	0	0	0	0	2542
LA 2941	102	35	25	0	0	0	0	0	0	54	0	0	0	0	0	0	216
LA 2942	156	4	55	0	0	0	0	0	0	1	0	1	0	0	0	0	217
LA 2943	268	20	88	0	3	0	0	0	0	<1	0	0	0	0	0	0	379
LA 2944	3,362	192	373	<1	<1	0	<1	17	52	57	0	0	0	0	0	0	4053
LA 2945	2,323	188	262	8	17	0	0	0	6	3	0	0	0	0	0	0	2807
LA 2946	707	36	188	<1	<1	0	0	0	0	0	0	0	0	0	0	0	931
LA 2947	1,228	203	359	<1	1	0	0	0	0	1	0	0	0	0	0	0	1792
LA 2948	1,655	242	334	<1	0	0	0	0	21	0	0	3	0	0	0	0	2255
LA 2949	298	102	88	0	2	0	0	2	0	0	0	0	0	0	0	0	492
LA 2950	1,236	129	358	1	3	0	0	2	242	25	0	1	0	0	9	0	2006
LA 2951	309	160	5	0	5	0	0	4	0	2	0	0	0	0	0	0	485
LA 2952	1,948	79	108	2	2	0	<1	<1	0	24	23	0	0	0	0	0	2186
LA 2953	657	30	287	<1	3	0	0	0	0	3	0	0	0	0	0	0	980
LA 2954	2,507	102	223	2	<1	0	0	0	0	25	0	0	0	0	0	0	2859
LA 2955	907	121	372	0	<1	0	0	0	37	5	0	0	0	0	0	0	1442
LA 2956	804	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	882

Summary of Artifact Weights by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize (cont'd)

	Ceramic sherds	Chert	Bone	Obsidian	Shell	Daub	Charcoal Samples	Historic Artifacts	Special Ceramics	Small Finds	Quartz/ Quartzite	Teeth	Copper	Slate	Metamorphic	Hematite	Total Weight of Artifacts
LA 2957	664	15	13	<1	0	0	0	1	0	0	0	0	0	0	0	0	693
LA 2958	151	7	12	0	<1	0	0	0	40	0	0	0	0	0	0	0	210
LA 2959	893	49	0	<1	0	0	0	0	35	2	39	0	0	0	0	0	1018
LA 2960	3,506	251	680	0	2	0	0	26	48	27	0	1	0	0	0	0	4541
LA 2961	205	4	18	0	<1	0	0	1	0	5	0	0	0	0	0	0	233
LA 2962	307	0	0	1	0	0	0	0	0	258	0	0	0	0	0	0	566
LA 2963	721	60	<1	2	4	0	0	0	0	0	0	0	0	0	0	2	789
LA 2964	977	81	31	1	3	0	0	0	0	0	0	0	0	0	0	0	1093
LA 2965	173	43	7	4	3	0	0	0	7	4	0	0	0	0	0	0	241
LA 2966	5,100	104	165	<1	0	0	<1	0	95	270	0	0	0	0	0	0	5734
LA 2967	424	68	<1	0	0	0	0	0	11	169	0	0	0	0	0	0	672
LA 2968	117	15	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	132
LA 2969	317	43	107	2	0	0	0	0	147	9	0	0	0	0	1	1	627
LA 2970	1,103	325	230	2	2	0	0	0	19	13	0	0	0	0	0	0	1694
LA 2971	409	4	66	0	0	14	0	0	0	1	0	<1	0	0	0	0	494
LA 2972	54	0	14	0	0	0	<1	0	0	0	0	0	0	0	0	0	68
LA 2973	425	3	103	<1	0	0	0	0	0	138	0	0	0	0	0	0	669
LA 2974	368	25	7	0	0	0	0	0	0	<1	0	1	0	0	0	0	401
LA 2975	109	0	77	1	0	0	0	0	11	0	0	1	0	0	0	0	199

Summary of Artifact Weights by Lot, 2005 Field Season, OP 05-01, Lamanai, Belize (cont'd)

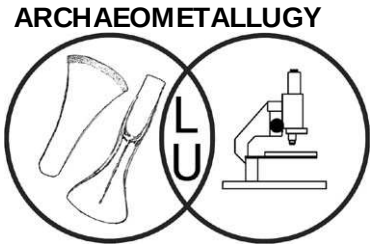
LA 2976	78	37	0	1	0	0	1	0	0	29	0	0	0	0	0	0	146
LA 2977	477	59	0	0	4	0	0	0	0	0	0	0	0	0	0	0	540
LA 2978	266	0	31	3	0	0	<1	0	0	0	0	0	0	0	0	0	300
LA 2979	422	122	15	0	<1	0	0	0	0	20	<1	0	0	0	0	0	579
LA 2980	915	18	85	3	6	0	0	0	0	38	0	0	0	0	0	0	1065
LA 2981	224	216	0	0	0	0	<1	0	0	229	0	0	0	0	0	0	669
LA 2982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA 2983	713	14	26	0	0	0	0	0	0	19	1	<1	0	0	0	0	773
LA 2984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LA 2985	75	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	81
LA 2986	26	0	3	0	0	0	0	0	199	352	0	0	0	0	0	0	580

Appendix 6

Metallurgical Investigation of Metal Artifacts from Lamanai, Belize

by

Aaron N. Shugar, Ph.D.



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Metallurgical Investigation of Metal Artifacts from Lamanai, Belize

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Metallurgical Investigation of Metal Artifacts from Lamanai, Belize

Technical investigations were performed on a collection of 19 metal artifacts collected during recent excavation at Lamanai by Prof. S. Simmons (see Table 3). Two main questions were addressed in the analysis; 1 what was the method of manufacture for the individual artifacts?; 2 what was the chemical composition of the artifacts? This second query attempted to address the possibility that Lamanai was a metal production center where off-cast and mis-cast items could be re-melted and cast into usable more functional objects. The analysis was carried out at Lehigh University, Archaeometallurgy Laboratory and at the Smithsonian Center for Materials Research and Education.

The collection can be generally separated into two groups based on simple visual assessment. The first group consists of what we will call sheet metal (samples LA 1131/1, LA 1134/1, LA 1136/1, and LA 1179/1). It is relatively thick and in most cases the sheet has round or square punch holes in one direction on the sheet. There is no evidence of this type of metal form from other Maya sites and it is anticipated that these sheets are modern.

Figure 1: Sample LA1131/1 – Sheet metal with round punch holes.

The second group consists of more traditional period artifacts including various shaped bells; globular (LA 1242/1 and LA 1246/1), pear (LA 1232/1, LA 1234/1, LA 1238/1, LA 1240/1, LA 1243/1, LA 1244/1-shell fragment), a small piece of thin sheet metal (LA

1241/1), and axe blade fragment (LA 1153/1), an awl (LA 1236/1), an ingot or axe blank (LA 1149/1), a ring (LA 1230/1), and a lump of what appeared to be lead (LA 1137/1).

Figures 2: An example of a globular bell (LA 1242/1), slightly crushed and twisted. Note the down sprue still attached to the suspension loop (scale in cm).

.Figure 3: A copper ring (LA 1230/1) with hatching decoration on either side (Scale in cm).

Methodology of Investigation

The methods of investigation consisted of three main techniques, Light Optical Microscopy (LOM), Scanning Electron Microscopy (SEM) and Laser Ablation Inductive Coupled Plasma Spectrometry (LA-ICP). Following is a brief description of those techniques and the sampling technique used.

Visual Examination and Analysis by Light Optical Microscopy (LOM)

Optical microscopy was used for preliminary investigation of all mounted samples. The methods used in the fabrication of metal artifacts are best investigated by metallographic examination of polished etched surfaces (Tite 1972). Information obtained can indicate the formation methodology, i.e., the method of casting as well as the subsequent mechanical and thermal treatment to which the artifact was subjected. In this case it will be possible to tell if the objects were made through lost wax casting or by sheet hammering and jointing. Any additional phases present in the samples due to alloying (such as using tin or arsenic alloys) can also be identified and marked for chemical identification by SEM.

Microanalysis by Electron Microscopy – Scanning Electron Microscopy – Electron Dispersive Spectroscopy (SEM-EDS)

Electron microanalysis is a well established method for determining quantitative elemental composition of materials. The SEM-EDS is used extensively by archaeologists requiring detailed quantitative compositional analyses of minute spatial areas in all materials (detection limits for many elements is in the order of magnitude of 100 ppm for the SEM-EDS). The technique can provide chemical composition of individual phases within the metal (inclusion seen in the metal under LOM) and can be a powerful tool in determining changes in chemistry on a small scale. SEM-EDS analysis will be performed on all the mounted samples. The SEM housed at SCMRE is a JEOL JXA – 840a Electron Probe Microanalyzer with a Noran EDS system.

Bulk Chemical Analysis by Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS)

Inductively coupled plasma spectrometry (ICP) is a well established technique of conducting bulk quantitative chemical analysis of archaeological samples (Goffer 1980). A good review of ICP use in archaeometallurgy is provided by (Young, Budd et al. 1997).

The LA-ICP-MS works by using a high powered laser to ablate, or burn, part of the sample away (the area removed is about a 10 micron hole which is barely visible to the human eye). The ablated material can then be measured in the LA-ICP-MS providing chemical compositional data. The overall precision and accuracy of LA-ICP-MS is very high and it is considered a slightly better alternative to comparable methods such as atomic absorption or neutron activation (Segal, Kloner et al. 1994). The data from the analyzed samples can be compared to see if all the objects were processed from the same

metal, determine relationships to local ore sources (i.e. provenancing the raw materials used to make the metal), and to compare to the analyzed metal artifacts found throughout Mesoamerica. The LA-ICP-MS used is a Perkin Elmer PE SCIEX ELAN 6000 with a CEIAC LSX-200 laser ablation system.

Where there have been several papers published dealing with methodologies of performing LA-ICP on archaeological samples, very little work has been done to date on metal artifacts. We have been working on developing new methods for the analysis of metals using LA-ICP dealing with the specific problems associated with fractionation effects of copper alloys (see Russo *et al,* 2002 for more details concerning fractionation).

Sampling

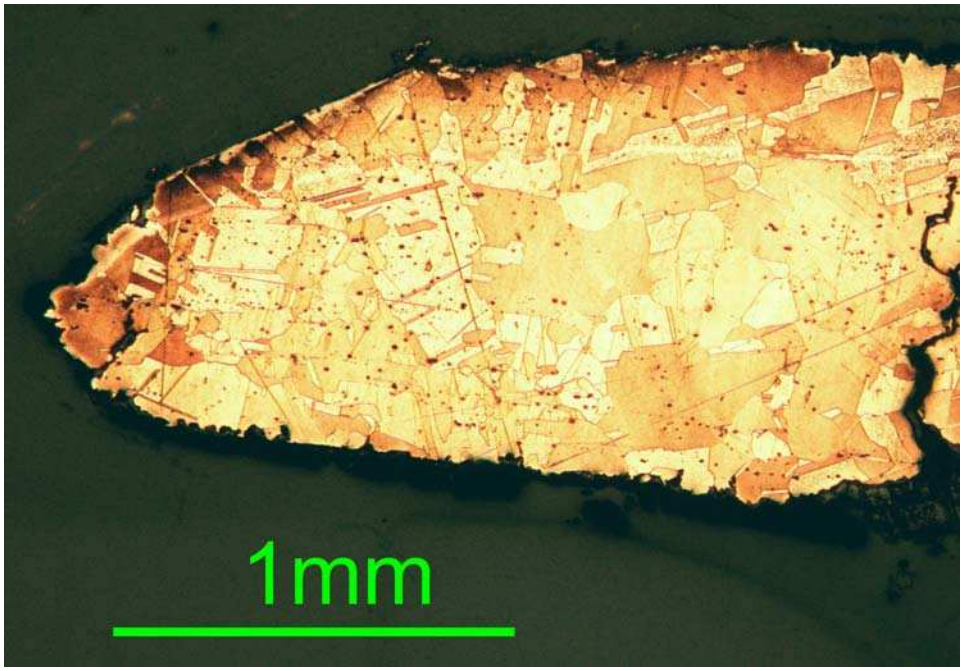
The research undertaken required physical samples of the objects be taken for analysis. There were two main types of sampling required. For both optical microscopy and scanning electron microscopy the sampling procedure was the same. The standard size required for analysis is relatively small. A sample the size of a grain of rice or half a grain will be sufficient to obtain good metallographic results but samples of a slightly larger size, half the size of a small pea, can provide more detail. Where deemed appropriate by both Prof. Simmons and myself, samples were cut from the individual artifacts to be mounted for metallographic investigation. The objects were prioritized and samples were cut using a diamond jewelers saw with a 3/0 kerf. Samples were then mounted in epoxy resin and ground and polished using standard metallographic preparation techniques.

Only objects that are small enough to fit into the chamber (~ 6 cm diameter) of the LA-ICP-MS will be selected for this bulk elemental compositional analysis. In addition, the samples removed for optical microscopy and SEM can be analyzed by LA-ICP-MS as well. The sample size ablated from the sample is minute at 100 microns (a micron is 1/1000 of cm, 100 microns is about 1/10 mm). The small hole is bored into the sample using a laser attached to the machine. This is a destructive technique but the hole that is made is so small it is barely visible to the naked eye.

Results of Analysis

Sheet metal

Three of the five sheet metal samples were investigated. All three (LA 1131/1, LA 1134/1 and LA 1136/1) all showed similar qualities. They were all worked and annealed and finally worked again for final shaping. The degree of working was slightly different in each sample. Sample LA 1131/1 was worked less than sample LA 1134 but distinct annealing twins and worked annealing twins were visible. In addition, the inclusions present in the metal are all copper oxides.



Figures 4: Sample LA 1131/1 etched in ferric chloride showing relatively large grains with annealing twins. Twins are bent near edges indicative of final working.

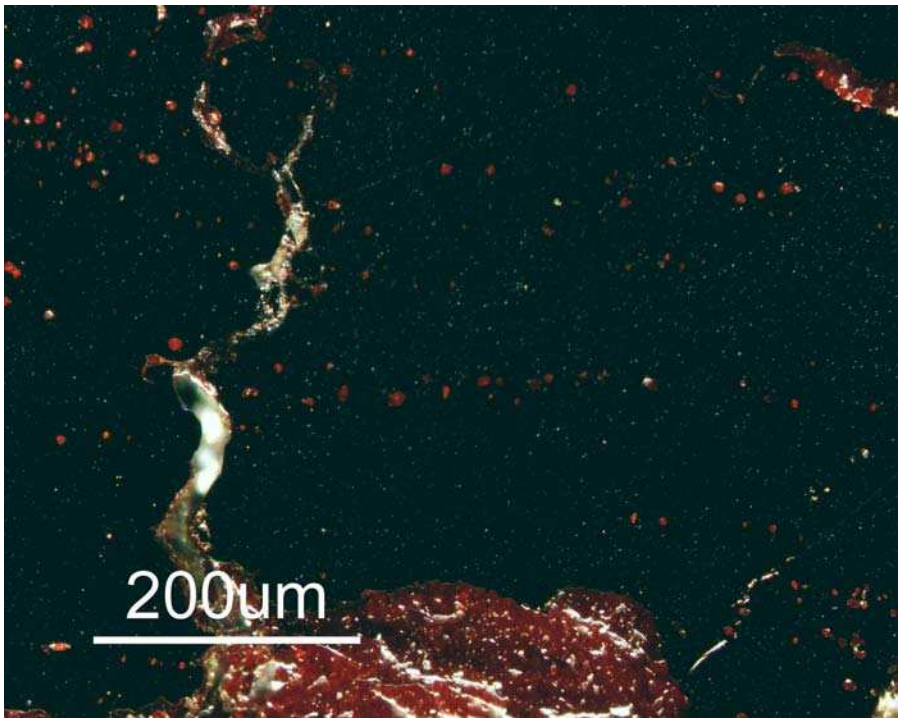


Figure 5: Sample LA 1131/1 under cross polarizers. The small black dots are copper oxide inclusions visible as red dots.

Sample LA 1134/1 was more heavily worked and has much smaller equiaxed grains with heavy annealing twins and extensive working.

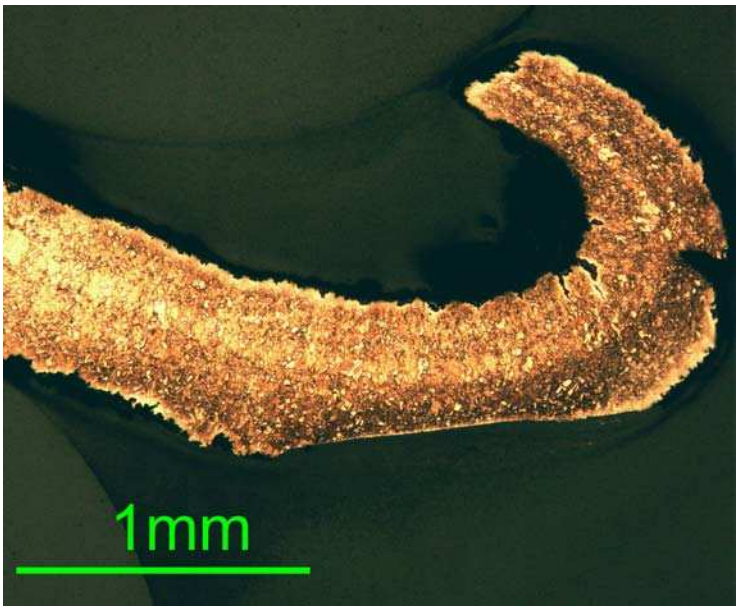
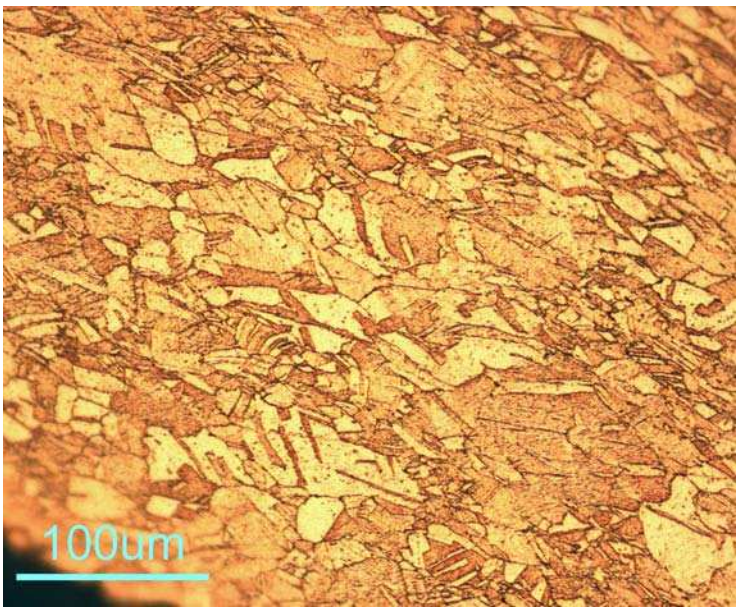


Figure 6: Extensive working can be seen in the etched sample (LA 1134/1) the visible bands are indications of this heavy working under low magnification.



Figures 7: (sample LA 1134/1) Under high magnification you can see small grains which are a result of several annealing processes. The bent annealing twins are indicative of cold working as a final step.

The LA-ICP-MS data of these sheet metals offer a consistent picture. The compositions are relatively pure copper with little if any purposeful additions. The only sample that

showed any indication of a possible alloying (and very slim indication at that) is sample LA 1136/1, a disc shaped piece of sheet metal with 0.235% As. This amount of arsenic (As) is not considered enough to indicate intentional alloying and may be the result of re-melting several other fragments of metal, some of which may have contained Arsenic.

It appears that the sheet metals were heavily worked and shaped prior to the holes being made. The specific purpose of the sheet is unknown and it is likely that they date from the period of British occupation.

Bells

All of the bells examined appear to have been made using the lost wax casting technique. The remainders of down sprues on the suspension loops is a common feature of last wax cast bells in the region. The microstructure of the bells is as expected, large grained with no indication of annealing twins in all the samples but one (see figure 7). Bell LA 1238/1 (sample taken from down sprue) shows signs of annealing and slight working. It is possible that the bell underwent some period f heating which caused the slight annealing twins to be visible. The traces of cold working may be a result of cutting the sample from the bell. Analysis of another sample from the body of the bell would help clarify this issue.

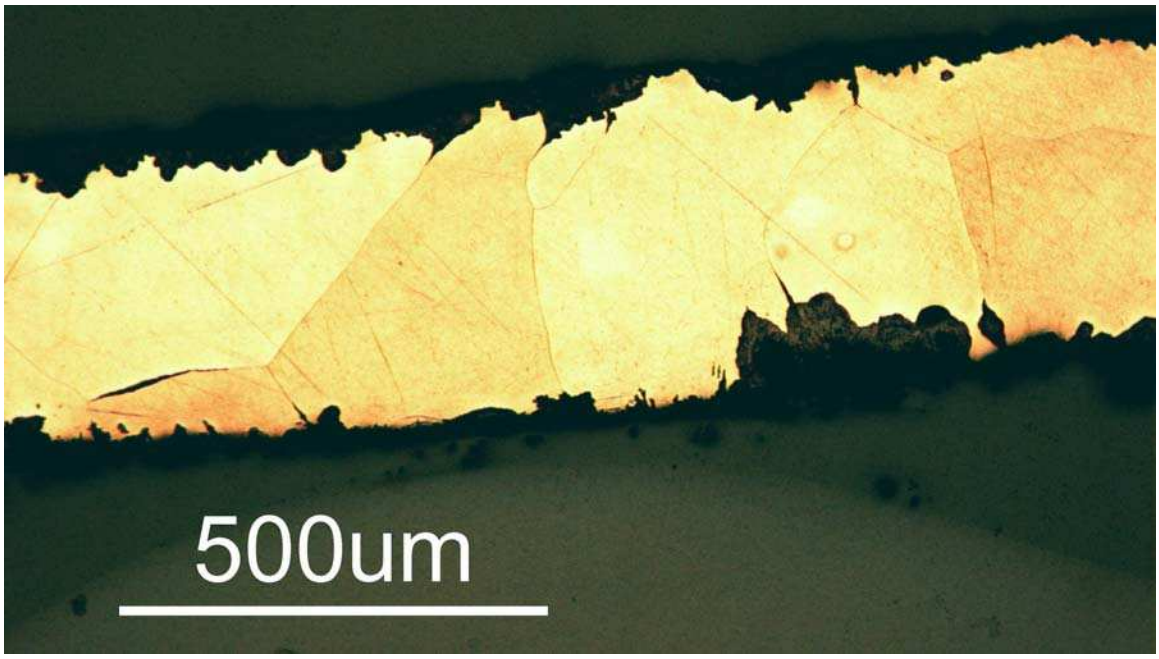


Figure 7: Bell LA 1243/1: Wall sample showing very large grains with few inclusions at grain boundaries.

Figure 8: Bell LA 1238/1: Section at down sprue showing annealing twins and some deformed twins at the edges of the sample which could have resulted from cutting the sample.

From a chemical perspective, all the bells but 2 (LA 1238/1 and LA 1242/1) fall into either Sn rich or As rich types. This is not surprising and matches other data collected from bells in the region (Hosler 1994). The ranges for the Sn rich bells are 0.92 – 1.3% and for the As rich bells the range is 0.65 – 1.25%. The values are not extreme and could be questioned with regard to intentional alloying but should be accepted as accurate and original alloys which have not been remelted, and mixed with other copper alloys. Bells LA 1238/1 and LA 1242/1 have very generic compositions and are mainly pure copper with traces of other elements. It is difficult to say if they are from re-melted metal or if they come from production in which there was little alloying material available.

Axes

Figure 9: Probable axe blank LA 1149/1: partially hammered probable axe blank.

Figure 10: Axe fragment LA 1153/1

The metallography of the probable axe blank (LA 1149/1) shows a partially hammered as cast structure that has been partially annealed. The original dendritic coring is visible in image 12, viewed as darker lines that have been partially distorted by hammering.

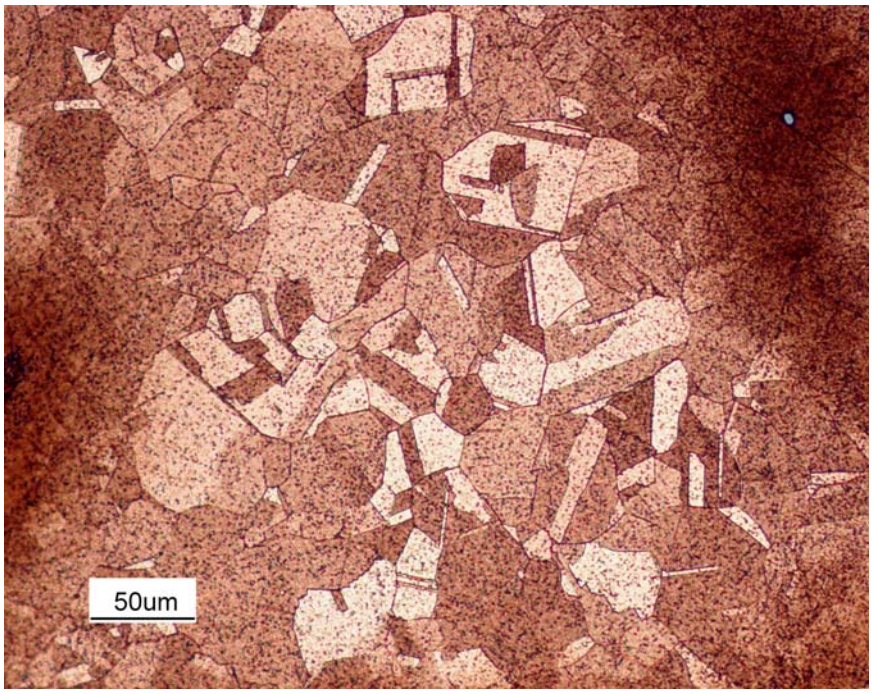


Figure 11: Axe blank (LA 1149/1) showing irregular sized grains with annealing twins indicative of cold working and annealing.

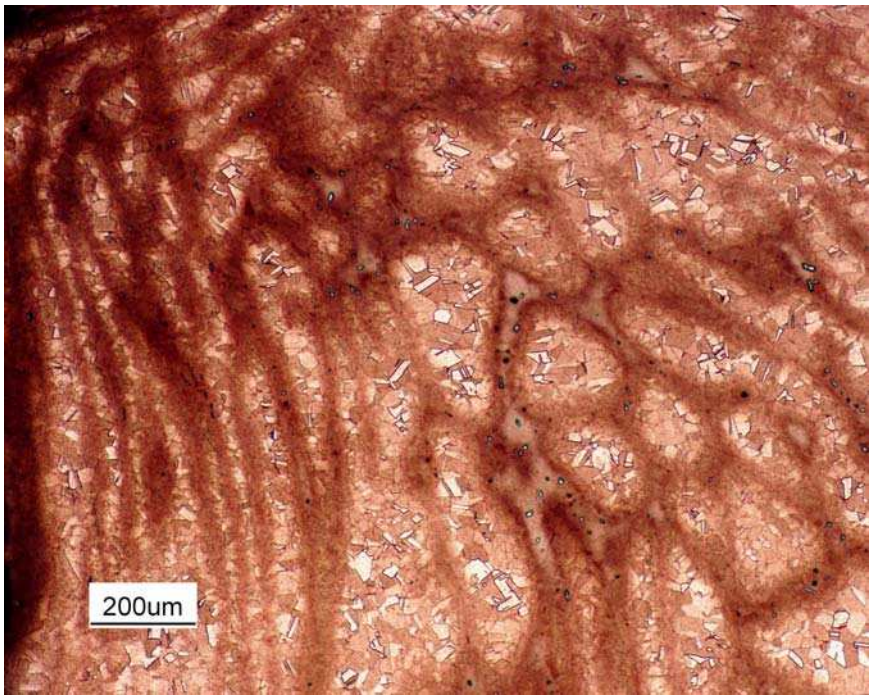
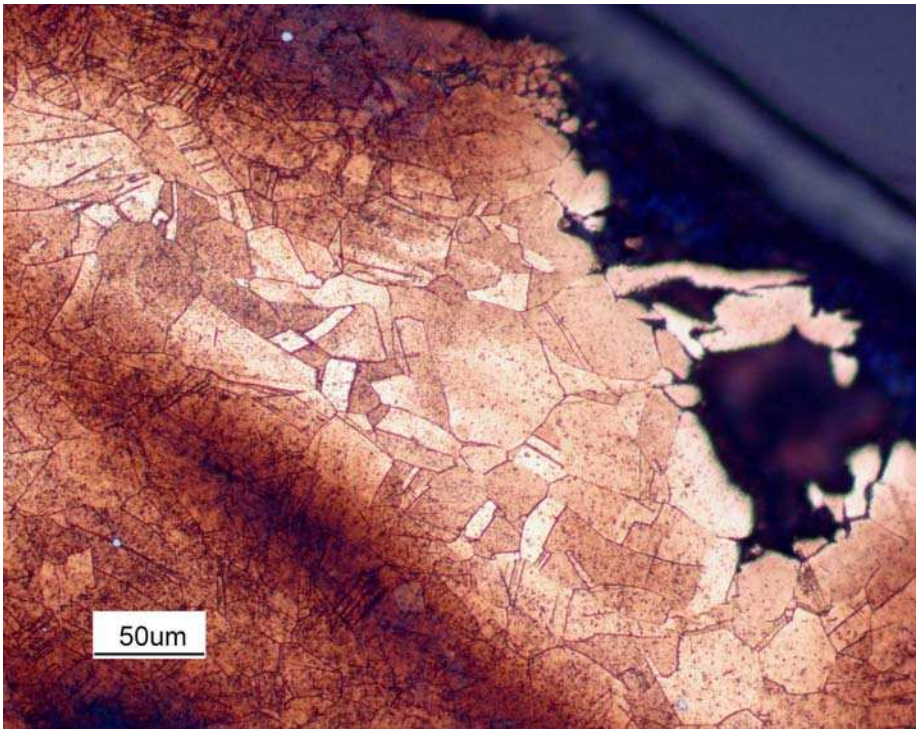


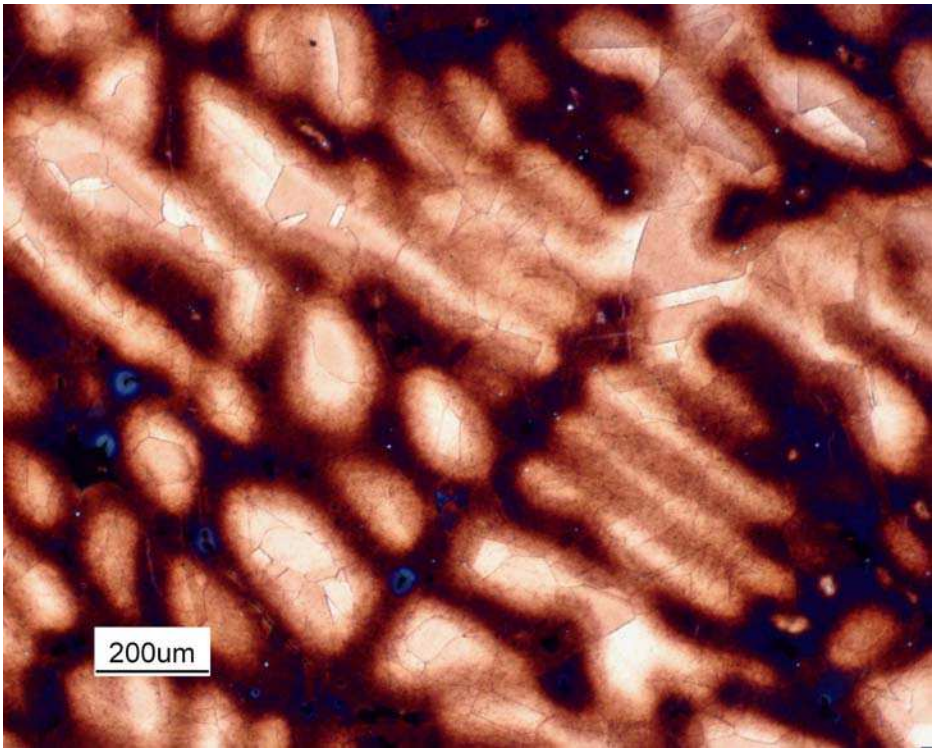
Figure 12: Axe blank (LA 1149/1) The darker lines are remnants of dendritic coring from the as cast state and minimal working at the edges.

The presence of annealing twins indicates that the object was cold worked and annealed but the varied size of the grains (not completely equiaxed) shows that the object has been only partially worked. This is what would be expected of an ingot blank. It would be cast, and if not cast cleanly, would have to be worked into final shape. For some reason this piece was not worked into final shape, possibly because the mass of metal was slightly too large to work (400+grams).

The axe fragment (LA 1153/1) was sampled at the fracture, not the blade. This means that we cannot be sure if the axe was finished for use (a hardened edge) or for ritual purposes.



Figures 13: Axe fragment LA 1153/1 showing irregular sized grains with annealing twins.



Figures 14: Axe fragment LA 1153/1 extensive dendritic coring remnants.

The microstructure of LA 1153/1 shows similar characteristics to the axe blank (1149/1). There are irregular sized grains with annealing twins indicative of partial cold working and annealing, and there are wonderful dendritic coring remnants revealing the original as cast structure (see figures 14).

This type of microstructure found at the center of the axe (at the surface) fits nicely with a worked axe that was well cast into shape. It would require only minimal working of the body to finalize the shape, with more extensive work done at the blade to increase its hardness and sharpness. In this situation, the focus of work would be on the blade and isolated annealing would be all that was needed to continue working the metal into final shape.

The composition of probable axe blank LA 1149/1 is fairly generic with no specific clear alloying visible. Although there are Sn levels at 0.34% and As levels at 0.36%, these values are not considered high enough to be intentional. The blank is most likely from the remelting of a collection of older metal artifacts which have varied amounts alloying. This is consistent with Hosler's finding (1994). The axe fragment (LA 1153/1) has a clear 1.1% composition of Sn which is interesting. The majority of axes analyzed by Hosler from Mexico all have As as their major alloy element (Hosler 1994). The fragmented axe may well be part of a larger collection of broken metals being stored for remelting for casting into alternative shapes. Several other broken axes along with two casting reservoirs have been found near the Spanish church in 2004and they are currently being investigated for their metallography and chemistry (objects 2790/1-7). The report is forthcoming.

Lead

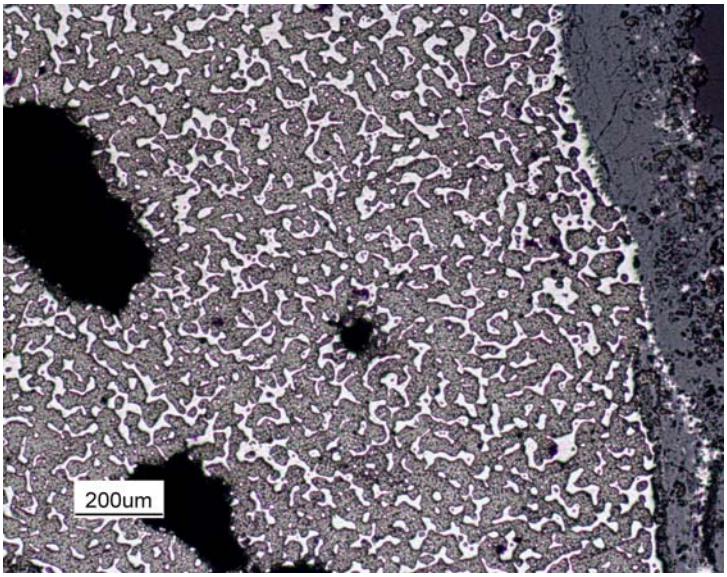
Likely the strangest pieces in the collection are the awl (LA 1236/1) and the lump of metal (LA 1137/1). Both have been examined chemically using LA-ICP but the level of lead was too high for the machine to properly measure.

Figures 15: Lead awl LA 1236/1.

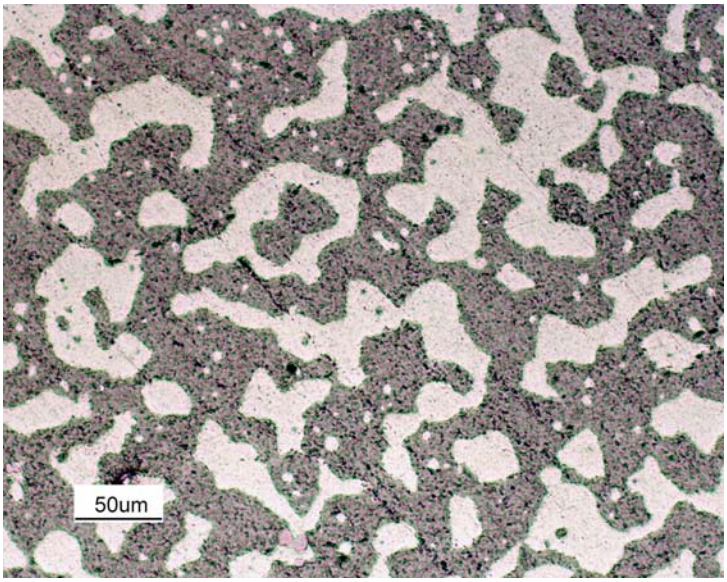
Figures 16: A lump of lead tin solder LA 1137/1.

The unique lump of metal (LA 1137/1) is indeed an interesting specimen. It appears to be lead but once we were able to look at it's microstructure it became clear that this must be

a modern artifact. The composition of the lump roughly corresponds to a 70/30 lead tin solder (see figures 17, 18, 19, and 20). This composition is not known to occur in nature and is though to be exclusively man-made.

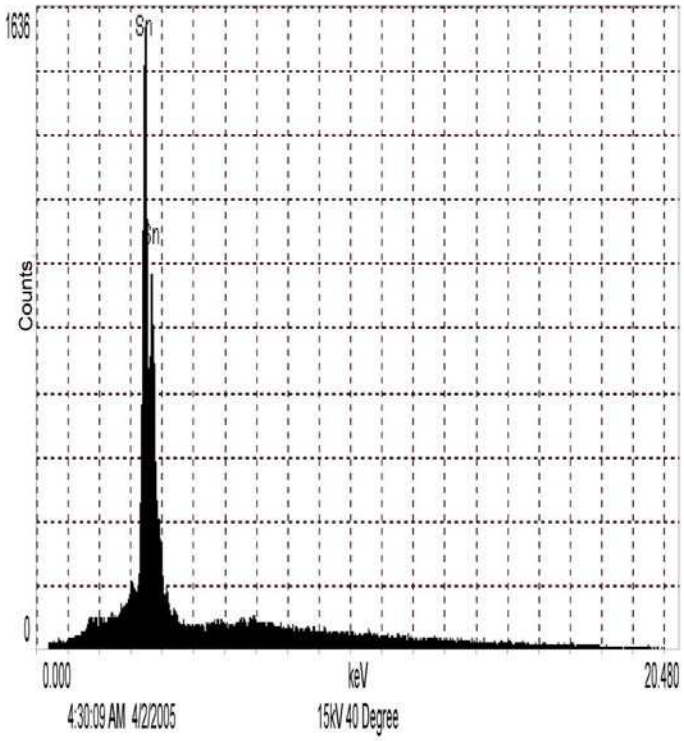


Figures 17: Artifact LA 1137/1: A modern Lead Tin eutectic solder approximately 70/30 ratio based on phase identification using the SEM.

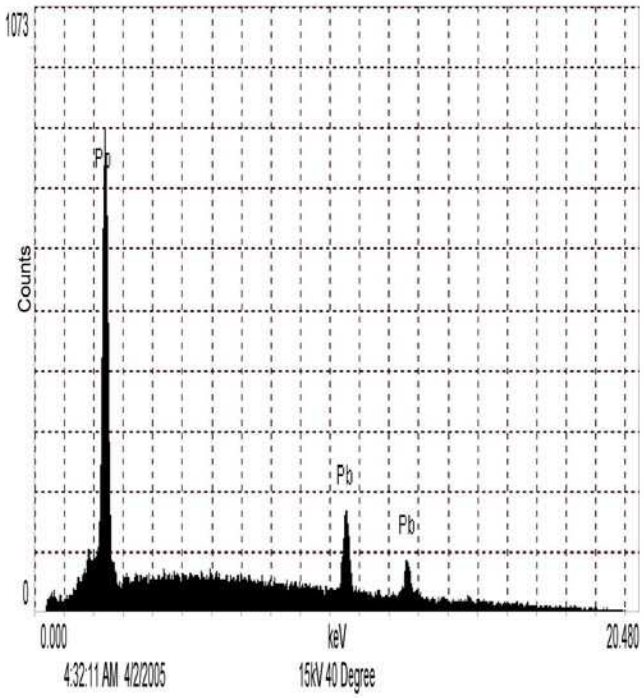


Figures 18: Artifact LA 1137/1: closer look at the lead (light grey) and tin (dark grey) solder.

The lump has a nice clean corrosion layer and has been around for some time. It is likely that this is from early British occupation in the latter half of the nineteenth century.

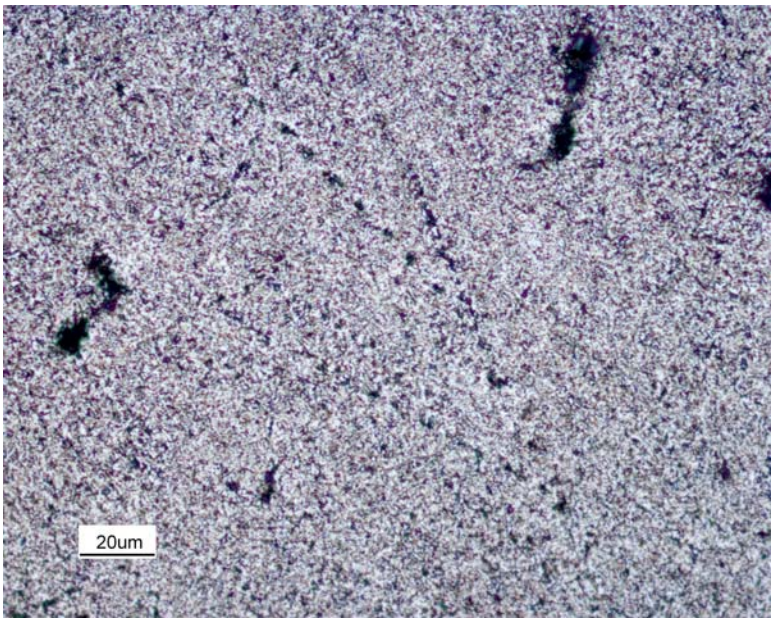


Figures 19: showing the SEM spectra indicating the dark phase as tin (Sn).

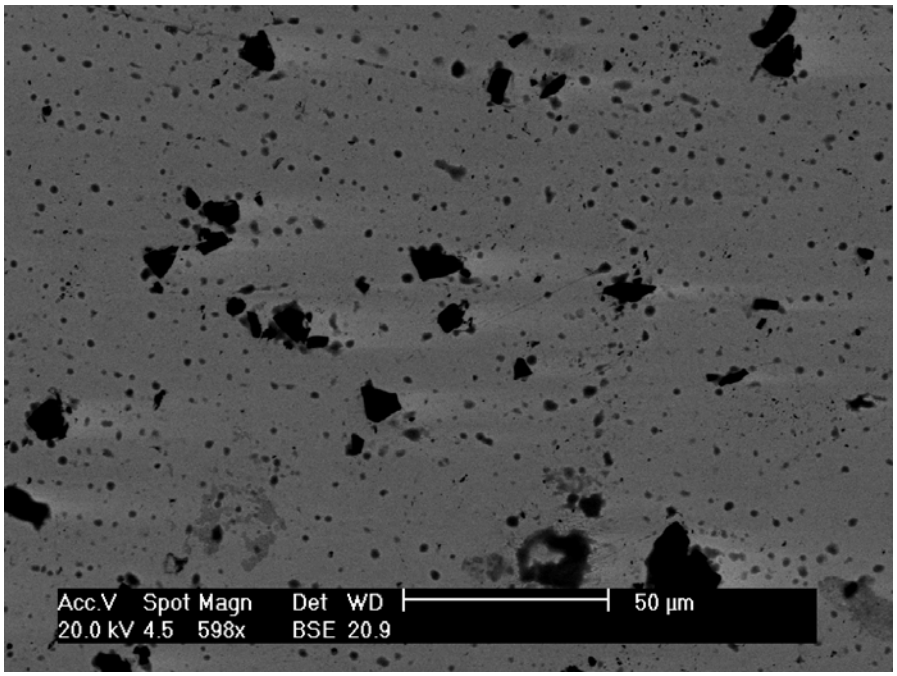


Figures 20: showing the SEM spectra indicating the light phase as lead (Pb).

The awl (LA 1236/1) is a completely lead artifact. There are no known comparable samples of a lead needle or awl and its use remains a mystery (but see Bergsoe (1938) for other pre-Columbian lead artifacts from Ecuador).. The microstructure shows a porous lead. There is no indication of folding the metal into shape and it was likely hammered square from casting.



Figures 21: Awl (LA 1236/1). Light optical image showing the awl being made of pure lead.



Figures 22: Awl (LA 1236/1). The SEM image in backscatter mode showing lead with porosity.

Thin sheet metal

This sample is one of the more interesting in the collection. It is a highly corroded thin fragment of sheet metal which could be a small fragment of tweezers, flat sheet metal used for ornamentation, or some other as yet undiagnosed item. This fragment showed the highest level of working in the collection, even higher than the sheet metal discussed above (Fig 23). The grains are very small and equaixed with heavy twinning. The twins are bent and there are slip lines visible indicating heavy cold working into final shape (Fig 24). This is also supported by the very elongated inclusions in the metal.

Chemically this sample has over a percent of both Sn and As. The alloy, although slight, would be beneficial to the forming of the object, reducing the stress on the metal and improving its malleability during formation. Work done by Lechtman and Klein (Lechtman and Klein 1999) looking at the advantages of using As over Sn in Andean metalworking discuss its better properties in forming sheet metal, with reduced cracking and further working before mechanical failure. Those features are exemplified in this sample.

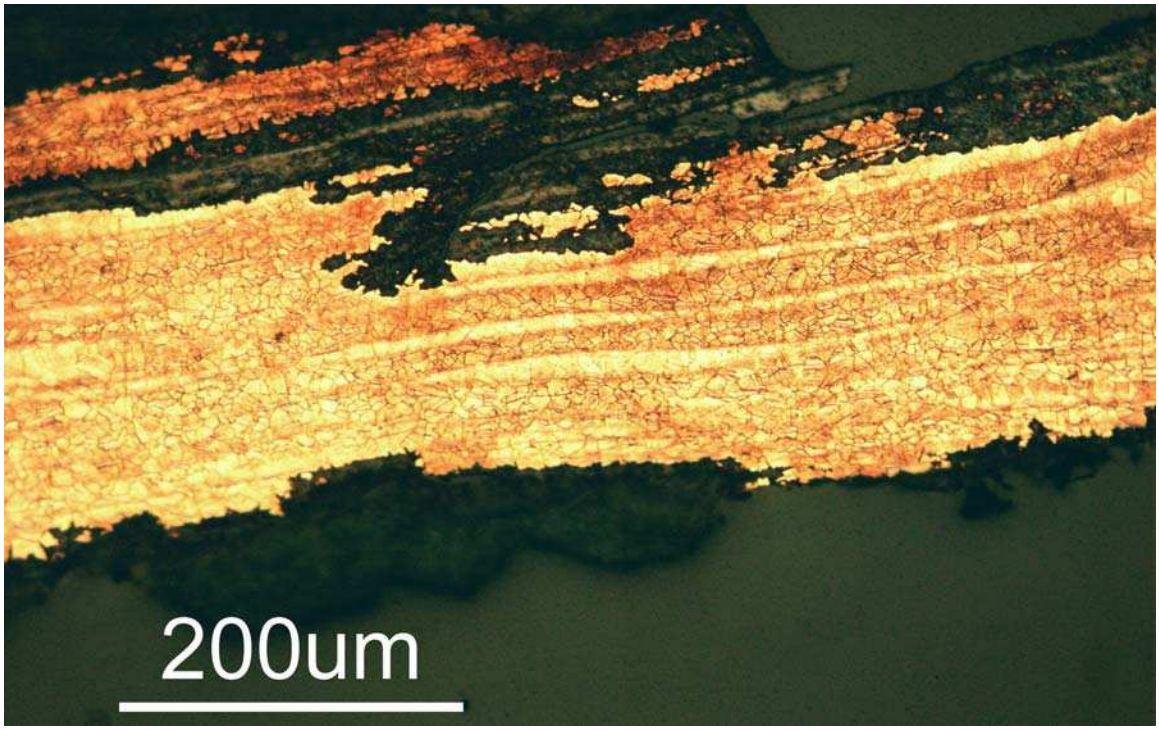


Figure 23: sample LA 1241/1 showing the extended cold working of the sheet. The bands are the result of cold working as the final stage of forming.

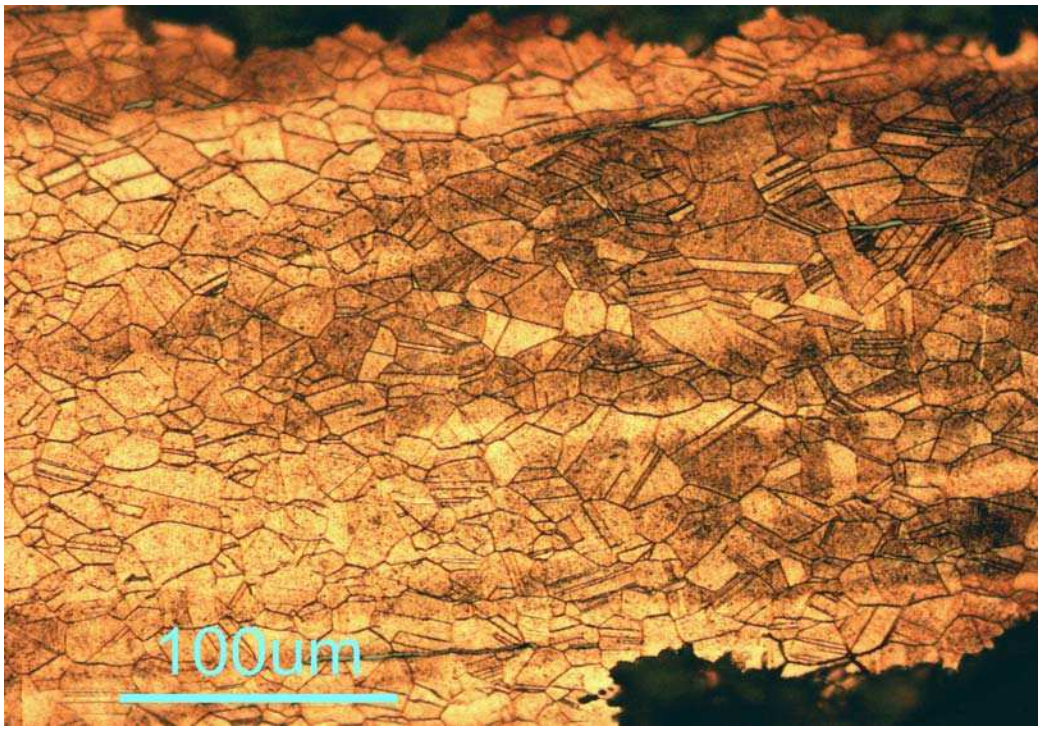


Figure 24: LA 1241/1: image showing the equiaxed grain size and extensive annealing twins. There are also very elongated inclusions in the metal (bluish grey color).

Ring (LA 1230/1)

There was no metallographic analysis done on the ring since it is one of the nicest complete artifacts in the collection.

Figure 25: Close up of ring LA 1230/1 showing the fine hatching incorporated into the lost wax casting. (ring is 2 cm wide)

The ring was analyzed by LA-ICP and it has a distinctive composition of Sn (5.1 %), As (1. 52 %), and Pb (1.6%). This complex alloy would indeed be an excellent choice for casting a ring with such fine hatching detail (Fig 25). The use of Sn, As and Pb help reduce the melting temperature of the metal and allow for longer casting time before solidification, as well as deoxidizing the metal, reducing any impurities present. All three of these elements appear in Maya metallurgy and they appear in high enough values that I am lead to believe that this ring is an original cast object. The fine hatching design appears to be cast into the ring rather than later etched out which fits nicely with the casting technology known for casting bells in the region – lost wax casting.

Discussion

This collection of 19 artifacts from Lamanai that were studied appears to be separable into two main categories: 1) modern metals in the form of punched and rolled sheet and solder, and 2) more traditional stylistic objects related to the Maya culture.
This first group of metal likely arrived with British contact and was deposited on the site during occupation. The Second group really should be divided into two other main categories; First, What appear to be traditional first production artifacts with complex or semi-complex compositions and second, re-melted and recast objects that may well have been produced at Lamanai. The trade and distribution of metal artifacts in the Mayan world is well documented (Bray 1977, Hosler 1994) including the large number of artifacts found at Lamanai. So the finding of several typologically similar bells at Lamanai to those that have been reported in the rest of the Maya world is not that surprising. What may be more interesting to address is three aspects of copper production; 1. Where is the copper coming from that is being used for metal production in the Maya empire, and where are the objects being manufactured?; 2. Is the other group of re-melted and cast objects made at Lamanai?; and 3 What evidence would be needed to confirm localized production at Lamanai?

The question of locating the copper sources for Maya metal production has been addressed by Dorothy Hosler (Hosler 1988, 1990) in looking at the sources in Mexico. What has not been considered to be a viable source based on its mountainous topography is the region between Guatemala and Honduras. There are several copper sources to the southern end of the Maya empire and recently a large source was re-discovered in northern Honduras near the site of El Coyote, which is expected to be the copper source discussed by Blackiston as supplying the copper used to make the bells found in the cave of bells (Blackiston 1910). Bray (1971)states that the high mountain ranges of Honduras may well be the main copper source for the metals produced in the Maya world. Further research, including Lead Isotope Analysis of the metals and the sources, may well provide clear links between the sources and the metal artifacts.

Very few copper production sites have been found in the Maya area, mainly in Mexico with new evidence coming from a copper smelting site at El Manchon, Guerrero, Mexico (Hosler; 2002: http://www.famsi.org/reports/01058/). Until now, there has been no production sites found in Central America at all. But in 2003 a copper production site was excavated at El Coyote, Honduras (Shortman and Urban, pers com; Shugar, 2005). The date of this smelting site is not yet clear but it shows a clear knowledge of metal production in a region closely situated to copper sources. This combined with the

recorded textual evidence of large trade canoes traveling from the coast of Honduras to Belize starts to paint a clearer picture for the production and trade of metal in the region. These canoes were said to hold crucibles and metal for re-melting (Strong (1935:11) discussed Columbus's 4th voyage contact with one of these trade canoes). If this is the case, the main smelting production of metal could have been done near the copper mines in Honduras and Guatemala, and the produced ingots could have been traded with crucibles into the heart of the Maya empire, even to Lamanai directly. The re-melting of the ingots and casting of specific artifacts required could then be done on site in small isolated hearths which would resemble cooking hearths and could easily explain why such copper production centers have not been specifically located to date.

With the information obtained from these artifacts, it is very difficult to say if these particular objects were re-melted and cast at Lamanai. Although the objects clearly appear to be re-melted metal and a mixture of several compositions, the evidence is not strong enough to make a definitive statement. The types of evidence that would help confirm that Lamanai was a center for metal production include; high temperature hearths, copper prills associated with casting, casting molds (lost wax or open molds) crucibles used for re-melting copper, copper scrap or fragments of copper to be re-melted, and remnants of copper casting (i.e. reservoirs or puddling). Several of these, specifically the prills and pieces of scrap copper, have been recovered at Lamanai (Simmons and Howard 2003; this report).

Summary

Nineteen metal artifacts collected during recent excavation at Lamanai were analyzed for their chemical composition and their method of manufacture. Based on the results the artifacts can be separated into two main categories. First, modern metals in the form of punched and rolled sheet and solder, and second, more traditional stylistic objects related to the Maya culture. It is suggested that Lamanai may well be a central location for the re-melting and re-distribution of metal artifacts within the Maya world, but caution is recommended until more substantial evidence is discovered.

	Sheet Metal			Prob / Axe Axe		Bells/Bell Fragments								Ring	Thin Sheet
Element	LA 1131	LA 1134	LA 1136	LA 1149	LA 1153	LA 1232	LA 1234	LA 1238	LA 1240	LA 1242	LA 1243	LA 1244	LA 1246	LA 1230	LA 1241
Al	0.001	0.008				0.001	0.005				0.005		0.010	0.100	
Si				0.025	0.025			0.049	0.059	0.021	0.055	0.052			
P			0.008			0.003	0.108	0.228	0.003	0.016	0.025		0.040	0.250	0.004
Cl															
Fe	0.002	0.001		0.006	0.012	0.036	0.094	0.001	0.019	0.046	0.193	0.076	0.080	0.120	0.059
Ni	0.003		0.018	0.026	0.030	0.024	0.016	0.006	0.002	0.021	0.010	0.007	0.050	0.030	0.010
Zn	0.001			0.003	0.003	0.002	0.003	0.001	0.001	0.006	0.005	0.004	0.007	0.006	0.002
As	0.002	0.001	0.235	0.359	0.485	1.25	0.713	0.325	0.647	0.396	0.543	0.859	0.290	1.52	1.08
Ag	0.019	0.001	0.036	0.155	0.088	0.234	0.175	0.131	0.179	0.429	0.152	0.040			0.137
Sn	0.005	0.001	0.002	0.336	1.11	0.011	0.131	0.117	0.005	0.124	0.916	0.152	1.30	5.10	1.03
Sb	0.034		0.068	0.055	0.079	0.259	0.067	0.047	0.016	0.112	0.145	0.132	0.100	0.300	0.157
Au				0.089	0.006	0.008	0.011			0.001	0.003				0.001
Pb	0.026	0.004	0.028	0.029	0.100	0.007	0.009	0.029	0.005	0.044	0.011	0.022	0.000	1.60	0.032
Bi	0.001			0.004	0.002	0.004	0.020		0.002	0.028	0.002	0.002			0.005
Impurity	0.09	0.02	0.40	1.08	1.93	1.84	1.35	0.93	0.94	1.25	2.07	1.35	1.877	9.026	2.51
Copper	99.91	99.98	99.60	98.92	98.07	98.16	98.65	99.07	99.06	98.75	97.93	98.65	98.12	90.97	97.49

Table 2: LA-ICP data.

	Cu	Sn	As	Fe	S	Si	Ag	Al	Mn	
LA 1131/1 matrix	99.87							0.290		Sheet
LA 1131/1 matrix	99.81					0.330				Metal
Average	99.84					0.330		0.290		
LA 1241/1 matrix	95.35	1.73	2.01	0.370	0.260	0.600				
LA 1241/1 area	97.42	0.980	1.39		0.150	0.150				
LA 1241/1 area	95.53	2.22	2.28							Thin
Average	96.10	1.64	1.89	0.370	0.205	0.375				Sheet
LA 1241/1 inclusion	94.10	1.76	2.27		2.19					
LA 1241/1 inclusion	81.99	0.520		1.70	14.79	0.350				
LA 1243/1 matrix	98.73	0.250	0.480	0.490	0.210			0.450		
LA 1243/1 matrix	99.04	0.490		0.240	0.180			0.230		
LA 1243/1 matrix	98.20	0.910		0.360	0.090		0.520			Bell
Average	98.66	0.550	0.480	0.363	0.160			0.340		Frag
LA 1243/1 inclusion	77.00			1.61	18.97				1.09	
LA 1243/1 inclusion	77.32			2.33	18.21	0.190			1.56	
LA 1244/1 area	98.58	0.350	0.780	0.150		0.250				
LA 1244/1 area	98.18	0.530	1.04	0.290						
Average	98.38	0.440	0.910	0.220		0.250				Bell
LA 1244/1 inclusion	81.23			0.930	19.20				0.310	Frag
LA 1244/1 inclusion	70.63	0.150	0.450	2.96	20.47	0.360			2.11	

Table 1: SEM analysis of bulk areas and of inclusions

Sample #	Material	Description	Weight
1236/1	Lead??	Bent awl, white corrosion layer with intact loop (likely punched) Square section	8.04
1232/1	copper alloy	Mid sized bell, pyrform, narrow loop, with sprue on top, in good condition, largely closed slit.	7.26
1230/1	copper alloy	Ring, likely lost wax casting chevron decor on both edges, likely from casting not added after	4.33
1241/1	copper alloy	Flat sheet fragment, thin.	0.6
1240/1	copper alloy	Large bell, pyrform, loop missing, lower half of one side of bell is missing.	5.87
1131/1	copper alloy	plate with 3 punch holes relatively think and cracking edge	48.43
1238/1	copper alloy	Small pyrform bell large sprue, casting flaw at loop and wall. Slit closed	3.72
1243/1	copper alloy	large pyrfrorm bell, large sprue, one lower wall damaged, partially missing, could be mis-cast or might have been broken after damage. Small mis-cast hole on side of bell	5.61
1244/1	copper alloy	Bell wall, small folded lip on upper edge. Look like good casting	2.2
1234/1	copper alloy	Large bell, pyrform, intact, small sprue, clapper intact	6.21
1246/1	copper alloy	globular bell, sprue present, small holes in one bell wall, nice bending seam on one bell wall that must have been bent out to put clapper in and then bent back	5.41
1242/1	copper alloy	Mashed bell globular has sprue, there is a fold in the metal on one of the bell walls. Was filled with charcoal	5.7
1153/1	copper alloy	axe fragment with blade intact bi-shaped ax,	150.86
1179/1	copper alloy	Sheet metal with 6 square punched perforations. Sharpe edges, two edges folded over.	26.84
1134/1	copper alloy	Sheet metal with one square and one round perforation, sharp edges. Expectation is that it is British, will check for composition to see	7.43
1149/1	copper alloy	ax blank partially worked beginning of folding at rear shows signs of open casting with slight splaying at upper edge	400.74
116/1	copper alloy	Disc with central hole and 3 or 4 cuts around wheel all in same direction notches.	38.67
1137/1	lead/tin solder	Lump of metal likely lead, heavy. Compare to needle for composition	495.95

Table 3: list of samples investigated with detailed description and weights.

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Appendix 7

Preliminary Faunal Observations: Structure N11-18 (Operations 01-05, 02-06, 04-02, and 05-01), Lamanai, Belize

by

Norbert Stanchly

PRELIMINARY FAUNAL OBSERVATIONS: STRUCTURE N11-18 (OPERATIONS 01-5, 02-6, 04-2, AND 05-1), LAMANAI, BELIZE

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INTRODUCTION

A preliminary analysis of the faunal material excavated during excavations associated with the cacique's house (Structure N11-18) indicates procurement of a diverse animal assemblage. Both local and non-local species are present, however, dietary focus appears to be upon locally available aquatic and terrestrial species. To date, 8,954 bone and shell specimens have been examined. Of these, 4,916 (55%) are of reptilian origin, 1,678 (19%) are mammalian, 710 (8%) are fish, 346 (4%) are avian, 125 (1%) are univalve, 20 (>1%) are bivalves, and 1 is a scaphopod.

The 4,916 reptilian specimens were found to include 2,561 representatives of 5 species, as listed below:

Loggerhead Sea Turtle	*Caretta caretta*
Crocodile	*Crocodylus* sp.
Central American River Turtle	*Dermatemys mawii*
Mexican Giant Musk Turtle	*Staurotypus triporcatus*
Slider Turtle	*Trachemys scripta*

The remaining 2,355 reptilian bones or fragments thereof were placed in broader taxonomic groups (families to order).

The 1,678 mammalian specimens include 129 representatives of 9 species, as listed below:

Domestic Cow	*Bos taurus*
Domestic Dog	*Canis familiaris*
Nine-Banded Armadillo	*Dasypus novemcinctus*
Human	*Homo sapiens sapiens*
Red Brocket Deer	*Mazama americana*
White-Tailed Deer	*Odocoileus virginianus*
Hispid Pocket Gopher	*Orthogeomys hispidus*
Baird's Tapir	*Tapirus bairdii*
Jaguar	*Panthera onca*

The remaining 1,549 bones or fragments thereof were placed in broader taxonomic groups (families to order), or, in some cases, designated as from large, large or medium-sized, medium, medium or small-sized, or small mammal species. Large mammals in the area include red brocket and white-tailed deer, tapir, jaguar and puma. Medium-sized species could include opossums, forest rabbit, anteaters, armadillos, paca, agouti, skunks, otter, raccoon, coati, the smaller felids, and peccaries (Savage 1971:78). Small-sized species would include bats, rats and/or mice, and squirrels.

The 710 bony fish specimens include 68 representatives of 2 species:

Blue Catfish	*Ictalurus furcatus*
Bay Snook	*Petenia splendida*

The remaining 642 bones or fragments thereof were placed in broader taxonomic groups (families to order).

None of the 346 bones assigned as bird are identified to species, although several are consistent with turkey in morphology and size.

The 125 shell specimens identified as univalve were found to include 96 representatives of 7 species including:

Helmet Shell	*Cassis* sp. cf. *tuberosa*
Carnivorous Land Snail	*Euglandina* cf. *rosea*
W. Indian Crown Conch	*Melongena melongena*
Florida Tree Snail	*Orthalicus princeps*
Jute	*Pachychilus glaphyrus*
Jute	*Pachychilus indiorum*
Apple Snail	*Pomacea flagellata*

Bivalves include 18 representatives of 3 species:

Freshwater Pearly Mussel	*Nephronaias* sp.
Lucine Clam	*Codakia orbicularis*
Thorny Oyster	Spondylus sp.

One representative of a scaphopod, a tusk shell (*Dentalium* sp.) is present.

THE FAUNAL ASSEMBLAGE

General Observations

A total of 8,954 bone and shell were examined by the author and are the subject of this report. Representatives of three invertebrate and 5 vertebrate classes are noted. Invertebrate identifications include snails or univalves (Class Gastropoda), bivalves (Class Pelecypoda), and tusk shells (Class Scaphopoda). Vertebrate identifications include amphibian (Class Amphibia), bird (Class Aves), mammal (Class Mammalia), bony fish (Class Osteichthyes), and reptile (Class Reptilia) (Table 1). Vertebrates dominate the sample, accounting for 8,808 specimens or 98.4% of the analyzed sample. It should be noted that not all of the invertebrate materials have been examined. The high percentage of vertebrate remains is a bias and will be reduced once the entire invertebrate sample has been examined. Of the 8,954 specimens, a total of 1,157 bone specimens could not be assigned to a zoological class upon initial examination. This number will be reduced with further analysis of the sample.

Table 1: List of Zoological Classes

Class	NISP	% of Assemblage
Invertebrate		
Gastropoda	125	1.40
Pelecypoda	20	0.22
Scaphopoda	1	0.01
Vertebrates		
Amphibia	1	0.01
Osteichthyes	710	7.93
Reptilia	4,916	54.90
Mammalia	1,678	18.74
Aves	346	3.86
Unidentified bone	1,157	12.92
Total	**8,954**	**99.99%**

Table 2: List of Identified Taxa

Taxon	Common Name
Class Amphibia	**Amphibians**
Order Anura	Frogs and Toads
Class Osteichthyes	**Bony Fishes**
Order Siluriformes	
Family Ariidae	Sea Catfishes
Family Ictaluridae	
Ictalurus furcatus	Blue Catfish
Order Perciformes	
Family Carangidae	Jack Fishes
Family Cichlidae	
Petenia splendida	Bay Snook
Class Mammalia	**Mammals**
Order Xenarthra	
Family Dasypodidae	
Dasypus novemcinctus	Nine-Banded Armadillo
Order Primates	
Family Hominidae	
Homo sapiens sapiens	Human
Order Carnivora	
Family Caniidae	
Canis familiaris	Domestic Dog
Family Felidae	
Panthera onca	Jaguar
Order Artiodactyla	
Family Cervidae	
Mazama americana	Red Brocket Deer
Odocoileus virginianus	White-Tailed Deer
Family Tayassuidae	Peccaries
Family Boviidae	
Bos taurus	Domestic Cow
Order Perissodactyla	
Family Tapiridae	
Tapirus bairdii	Baird's Tapir
Order Rodentia	
Family Geomyidae	
Orthogeomys hispidus	Hispid Pocket Gopher
Class Aves	**Birds**
Class Reptilia	**Reptiles**
Order Crocodylia	
Family Crocodylidae	
Crocodylus sp.	Crocodile
Order Testudines	
Family Chelonidae	

Caretta caretta	Loggerhead Sea Turtle
Family Dermatemydidae	
Dermatemys mawii	Central American River Turtle
Family Kinosternidae	
Staurotypus triporcatus	Mexican Giant Musk Turtle
Family Emydidae	
Trachemys scripta	Slider Turtle
Order Squamata	Snakes and Lizards
(Suborder Sauria)	Lizards
Family Iquanidae	Iguanas
Class Pelecypoda	**Bivalves**
Order Unionoida?	
Family Unionidae	
Nephronaias sp.	Freshwater Pearly Mussel
Order ?	
Family Lucinidae	
Codakia orbicularis	Lucine Clam
Order ?	
Family Spondylidae?	
Spondylus sp.	Thorny Oyster
Class Gastropoda	**Univalves**
Order Caenogastropoda	
Family Melongenidae	
Melongena melongena	Crown or Mud Conch
Family Cassidae	
Cassis cf. *tuberosa*	King Helmet
Family Strombidae	
Strombus cf. *gigas*	Queen Conch
Order Sorbeoconcha(?)	
Family Pleuroceridae	
Pachychilus glaphyrus	*Jute*
Pachychilus indiorum	*Jute*
Order Architaenioglossa (?)	
Family Ampullariidae	
Pomacea flagellata	Apple Snail
Order Stylommatophora	
Family Spiraxidae	
Euglandina cf. *rosea*	Rosy Wolf Snail
Family Pupillidae	
Orthalicus cf. *princeps*	Florida Tree Snail
Class Scaphopoda	**Tusk Shells**
Order ?	
Family Dentalia	
Dentalium sp.	Tusk Shell

Account of Reptiles

Reptile, mainly turtle shell, dominates the sample representing approximately 55% of the entire assemblage and 63% of the sample identified to zoological class. Of the 4,916 reptilian specimens, 4,770 are turtle (97%) and include local and Caribbean Sea turtle species (Table 3).

Table 3: List of Reptiles

Zoological Taxon	NISP	% of Reptile
Order Testudines		
Dermatemys mawii	2,475	50.35
Caretta caretta	2	0.04
Staurotypus triporcatus	18	0.37
Trachemys scripta	25	0.51
Family Chelonidae	67	1.36
Family Emydidae	1	0.02
Family Kinosternidae	1	0.02
Unidentified turtle	2,181	44.37
Order Crocodylia		
Crocodylus sp.	41	0.83
Order Squamata		
Family Iguanidae	1	0.02
Suborder Serpentes	1	0.02
Unidentified lizard and/or snake	3	0.06
Unidentified reptile	100	2.03
Total Reptile	**4,916**	**100.00%**

The Central American River Turtle (*Dermatemys mawii*), known locally as *hickatee*, accounts for approximately 50% of all identified reptilian and turtle specimens with 2,475 identified specimens. At least 3 other local turtle species have been identified. A total of 2,520 turtle specimens have been identified to species. The remaining 2,250 turtle specimens include 67 identified as hard-shelled sea turtle (Family Chelonidae), probably loggerhead (*Caretta caretta*), 1 unidentified pond or slider turtle, 1 unidentified mud or musk turtles, and 2,181 identified only as turtle. It is possible that additional species are represented among the unidentified turtle specimens and highly likely that more representatives of those species listed in Table 3 will be present.

A total of 41 crocodilian specimens have been identified. Unfortunately none could be identified to species. Only 2 crocodilian species, the American crocodile (*Crocodylus acutus*) and the Morelet's crocodile (*Crocodylus moreletii*), are present in Belizean waters. The American crocodile inhabits coastal waters while the smaller Morelet's will inhabit freshwater rivers, lakes, and ponds. Osteologically, the 2 species are only distinguishable by the shape of their premaxillary-maxillary suture patterns (Lee 2000:132). Unfortunately none of the specimens from this part of the cranium are present in the sample.

Lizards and snakes account for 5 specimens. One unidentified snake vertebra and one iguanid bone are present. Three specimens are either lizard or snake and require further examination.

A total of 100 specimens could only be identified as reptile. Further analysis of these should reduce this total. It is likely that more representatives of the above taxa (Table 3) will be identified and possible that new taxa will be added to the list of exploited reptiles.

Central American River Turtle (*Dermatemys mawii*) – All of the identified 2,475 *hickatee* bones are shell (carapace or plastron) specimens. Of these, only 19 are assigned to particular shell portions, and include 11 carapace and 8 plastron pieces. A total of 319 specimens show signs of a variety of modifications, both cultural and natural. Heat alteration is present on 309 specimens of whom 16 are calcined shell fragments, and 21 are charred. The remaining 272 specimens show less intense degrees of heat alteration, namely a pattern of "browning" of the shell. Of these, 61% are browned on only the exterior of the shell indicating roasting of these turtles while still in their shells, perhaps on a spit. Some specimens exhibit charring and/or calcinations on both interior and exterior surfaces. This could be indicative of either post-depositional burning of the shells once the meat had been removed. It is possible that many of the charred and calcined shell fragments are the result of purposeful burning of discarded shells. Further taphonomic quantification is necessary to determine if and what proportion of the sample has been heat altered by natural fires versus cultural burning. Other indications of cultural modification of turtle shell include three specimens. One is a fragmentary (4 pieces) perforated disc that resembles a spindle whorl in its outline, i.e. it is perforated with a wide base tapering to a narrow top. The function of these discs is unknown and several have been found in other areas of Lamanai in contexts dating primarily to the Late Postclassic or Early Colonial period (Stanchly, personal observation). The other culturally modified piece is a shell that has a polished exterior surface. Three specimens are green stained, indicating contact with copper objects for prolonged periods of time. The *hickatee* is the largest of all turtle species inhabiting the New River and its associated ponds and lagoons. Modern *hickatee* is believed to vary in size between 400-650 mm (Lee 2000:145), but it is clear that many of the specimens found in archaeological contexts at Lamanai are from much larger individuals.

Slider Turtle (*Trachemys scripta*) – Known locally as *bokatura*, all of the 25 identified specimens are carapace or plastron fragments. At least 8 are carapace portions. None of the specimens show signs of heat alteration or any other modification. This species is primarily aquatic and inhabits rivers and lagoons.

Mexican Giant Musk Turtle (*Staurotypus triporcatus*) – All 18 specimens of this aquatic species are shell. Both plastron and carapace are present. One plastron specimen (a hyoplastron or hypoplastron) is charred. One additional unidentified shell fragment show signs of mild heat alteration.

Loggerhead Sea Turtle (*Caretta caretta*) – Only 2 specimens are positively identified as loggerhead, however, it is possible that an additional 67 identified only as hard-shelled sea turtle, could also be representative of this species. One specimen is a fragment of carapace, the other could not be identified as to carapace or plastron. The loggerhead inhabits mainly shallow coastal waters but is known to enter rivers at considerable distances upstream (Lee 2000:138).

Hard-Shelled Sea Turtles (Family Chelonidae) – Although none of the 67 specimens identified as hard-shelled sea turtle is identified, it is believed that most are loggerhead turtle. The sizes of the fragments suggest that these specimens are from one of the larger 3 species of hard-shelled turtles present in the coastal waters of Belize and Yucatan. These include the loggerhead (*Caretta caretta*), the green turtle (*Chelonia mydas*), and the Hawksbill turtle (*Eretmochelys imbricata*).

Pond or Box Turtle (Family Emydidae) – A complete costal element of an unidentified small to medium emydid was identified. This is either a slider turtle (*Trachemys scripta*) or furrowed wood turtle (*Rhinoclemmys areolata*), also known as black-belly turtle.

Mud or Musk Turtle (Family Kinosternidae) – One carapace (peripheral element) portion from a mud or musk turtle is identified. There are at least 5 species of kinosternids in Belize, including the Mexican Giant Musk turtle. Identification of this specimen to species should be possible with the aid of a complete reference collection of these turtles.

Unidentified Turtle (Order Testudines) – Of the 2,181 specimens, a total of 2,092 or 95% are carapace or plastron shell elements. The remaining 89 specimens include cranial, axial, pectoral and limb elements. Although none are identified to zoological taxon below order, several specimens are likely to represent the following: loggerhead sea turtle, hard-shelled sea turtle (loggerhead or other species), *hickatee*, furrowed wood turtle, *bokatura*, and slider. Modification is present on only 93 specimens. Interestingly, only shell fragments show modifications that include varying forms of heat alteration and cultural modification. Three specimens are perforated discs like those described above. The remaining 90 specimens include shells that are "browned", charred, and calcined. Shell "browning" is the dominant type of heat alteration notes, suggesting roasting of the animals. To date, no patterns of heat alteration (e.g. exterior of shell vs. interior of shell) have been noted for the unidentified turtle remains.

Account of Mammals

Mammal accounts for 1,678 specimens or 18.7% of the total faunal assemblage (Table 1, 4). To date, species identified include locally available indigenous terrestrial game. Two domestic cow bones are identified but are considered to be modern intrusive elements in the sample and are not discussed further. Of the 1,678 specimens a total of 296 are identified to zoological taxon of family or lower. The majority of these (>75%) are artiodactyls including white-tailed deer, red brocket deer, and peccary. All of these are large game species and would have provided large quantities of meat. Small to medium game species present include armadillo and dog. Other food species present in minimal amounts include tapir, pocket gopher, and jaguar.

Table 4: List of Mammals

Zoological Taxon	NISP	% of Mammal
Order Artiodactyla		
Unidentified artiodactyl	60	3.58
Bos taurus	2	0.12
Family Tayassuidae	33	1.97
Family Cervidae	51	3.04
Mazama americana	3	0.18
Odocoileus virginianus	82	4.89
Order Perissodactyla		
Tapirus bairdii	2	0.12
Unidentified perissodactyl	1	0.06
Order Carnivora		
Canis familiaris	5	0.28
Panthera onca	1	0.06
Unidentified carnivore	5	0.28
Order Rodentia		
Orthogeomys hispidus	4	0.24
Unidentified rodent	17	1.01
Order Xenarthra		
Dasypus novemcinctus	26	1.55
Order Primates		
Homo sapiens sapiens	4	0.24
Unidentified mammal	1,382	82.36
Total Mammal	**1,678**	**100.00%**

White-Tailed Deer (*Odocoileus virginianus*) – A total of 82 specimens are identified. It is likely that this number will increase with re-examination of those bones listed only as Order Artiodactyla and Family Cervidae. Some of the unidentified mammal bones may also represent white-tailed deer. This deer species is very common in faunal assemblages throughout the Maya area and was a favourite game meat. A total of 34 specimens are appendage elements and include proximal, mid, and distal phalanges. This accounts for 41.5% of all identified deer bones. However, this should not be interpreted to indicate that "deer foot soup" was the preferred method of preparation of this animal. This high percentage of identified phalanx elements is due to their propensity to survive relatively intact in the archaeological record because of their high density (14 are complete). They are also easily recognizable elements in deer, thus facilitating quick identifications to the species level. Of the remaining 48 specimens, 18 are cranial, 4 are forelimb, 17 are hind limb, and 9 are unidentified limb elements. Cranial elements include one antler and two skull fragments. The remaining 15 cranial elements are teeth. Forelimb elements represented include 2 metacarpal (one immature specimen) and 2 radius specimens. Hind limb elements represented include 6 calcaneum specimens, 3 astragalus specimens, 1 femur fragment from an immature animal, 4 metatarsal fragments, and 3 tibia fragments. The 9 unidentified limb bones are all metacarpal and/or metatarsal elements. Three of these are from immature animals. At least 3 white-tailed deer are present based on the number of right calcaneum specimens identified. Only 3 white-tailed deer specimens show signs of modification. One astragalus has been gnawed by a carnivore, one phalanx shows signs of rodent gnawing, and another phalanx is charred. No cut marks have been noted on the bones.

Red Brocket Deer (*Mazama americana*) – Three specimens have been identified and include one premolar or molar, one left mandible, and a complete distal phalanx. No modifications were noted but the phalanx show signs of weathering.

Unidentified Deer (Family Cervidae) – Of the 51 unidentified deer specimens, 16 are cranial, 3 appendage, 1 axial, 6 hind limb, and 25 identified only as limb bones. The cranial bones include 2 antler fragments and 14 teeth. Appendage bones are all phalanx specimens. One lumbar vertebra fragments represents the axial skeleton. The 6 hind limb specimens are all metatarsals. The unidentified limb bones are all metacarpal and/or metatarsal bones. None of these bones show signs of modification and all are either white-tailed deer or red brocket deer, the only two deer species in Belize.

Peccaries (Family Tayassuidae) – Peccary is represented by 33 specimens although none are identified to specific species. A total of 28 are cranial elements, primarily teeth. At least one tooth is from an immature peccary and one molar is from an old adult based on the amount of wear seen on the tooth crown. The remaining 5 peccary specimens include 2 phalanges, 2 metapodial fragments, and one astragalus fragment. None of the peccary specimens show any signs of modification. Further examination of the peccary bones, particularly the teeth, should lead to identification of specific species represented. There are two species in Belize today, the white-lipped and the collared peccary. Collared peccary is the common species in the reserve today.

Even-Toed Ungulates (Order Artiodactyla) – A total of 60 specimens are identified to this order and all but 3 specimens represent either peccary or deer species. Domestic pig and cow probably account for the remaining 3 specimens. Both cranial and post-cranial elements are represented and 2 are modified. One is a heat-altered specimen while the other is a polished antler tine fragment.

Nine-Banded Armadillo (*Dasypus novemcinctus*) – All but four of the armadillo specimens are dermal plate bones or scutes. The other four specimens include one tibia fragment, 1 calcaneum, and 2 unidentified limb fragments. Only one individual appears to be represented.

Domestic Dog (*Canis familiaris*) – All five dog specimens are cranial elements and include 2 mandible portions and 3 teeth. Only one dog is represented by these elements.

Hispid Pocket Gopher (*Orthogeomys hispidus*) – This burrowing rodent is represented by 4 specimens including 2 complete mandibles and 2 upper incisors.

Baird's Tapir (*Tapirus bairdii*) – The tapir, known in Belize as "mountain cow" is the largest land mammal. Two teeth are identified, a premolar and molar tooth.

Jaguar (*Panthera onca*) – A lower third partial molar of a jaguar is present in the sample.

Rodents (Order Rodentia) – Of the 17 unidentified rodent bones, 9 are probably agouti or paca bones. Elements identified include a partial femur from an immature animal, a tibia, and several other limb and cranial bones. Two of the unidentified rodent bones, a molar and femur, most closely follow those of hispid pocket gopher. The remaining 6 rodent bones are gopher, paca, or agouti tooth and mandible specimens.

Carnivore (Order Carnivora) – A total of 5 unidentified carnivore specimens are present and include cranial and limb bones of medium sized animals. One may be a dog metapodial. All 5 specimens are considered identifiable with comparison to proper reference collections.

Odd-Toed Ungulate (Order Perissodactyla) – One perissodactyl specimen, a molar portion, is probably from a domestic horse. Further analysis is required to accurately identify this tooth.

Unidentified Mammal (Class Mammalia) – A total of 1,382 specimens could not be identified to lower zoological taxon than Class Mammalia. Of these 29 specimens closely follow the following taxa: domestic cow (1), coati (1), tapir (1), human (9), manatee (1), armadillo (5), carnivore (5), rodent (1), and artiodactyls (5). The possible manatee bone is a post-cranial element as yet unidentified that has been carved to resemble a penis. One artiodactyl bone, a humerus, is charred as are 2 skull fragments of what appears to be human bone. The possible coati element is a canine tooth. Most of these 29 elements are considered identifiable. The remaining 1,353 unidentified mammal bones include representatives of small to large animals. Large animals are represented by 64 specimens; medium to large by 745; medium by 14; small to medium by 48; and small animals by 9 specimens. The remainder of specimens could not be assigned to size categories. Body portions represented include: cranial (42), axial (64), pectoral (4), pelvic (4), forelimb (8), hind limb (15), and appendages (13). An additional 29 specimens are identified only as limb fragments. A total of 810 specimens are long bone shaft fragments. Although the majority are probably limb bones (e.g. humerus, radius, femur, etc.) they are simply listed as post-cranial remains until further analysis. Other long bone elements that may be represented include the metacarpals, metatarsals, and rib bones. Indeterminate bone fragments include 355 specimens. Modified bone includes 100 specimens. Of these, 96 exhibit signs of varying degrees of heat alteration including calcined and charred bone. One bone is green stained and one shows evidence of carnivore gnawing. Three bones may possibly be worked but require additional analysis. No cut marks were seen on any of the unidentified mammal bones. In summary, the unidentified mammal bone assemblage is represented primarily by specimens from medium to large animals. This might include dog to deer sized species. Less than 10% show signs of heat alteration associated with cooking practices and no bones exhibit cut marks

associated with butchering. Representation by body portion indicates that mainly limb bones are present. This indicates access to good portions of meat such as leg haunches. Further quantitative analysis of body portion representation is needed to determine if animals were butchered in the immediate vicinity of the cacique's house or elsewhere. Initial observations of the assemblage would seem to suggest that the majority of the butchering took place elsewhere. The relatively low numbers of cranial and axial fragments present in the sample suggests this.

Account of Bony Fishes

Of the 710 fish identifications, 68 represent 2 species, the bay snook and blue catfish (Table 5). A further 10 are sea catfish (Family Ariidae), 9 are jack fish (Family Carangidae), and 6 are unidentified cichlids (Family Cichliidae). Another 41 specimens are identified only to Order Perciformes and 6 as unidentified catfish (Order Siluriformes). All of the unidentified perciform fishes are likely to represent bay snook or other cichlid species and possibly additional jack fish specimens. The list of identified species indicates exploitation of local rivers and of course the New River lagoon. All of the above, except for the jack fish, are present in the New River lagoon. The name sea catfish is somewhat of a misnomer, as several species are found in freshwater including those around Lamanai. The unidentified fish sample of 570 specimens includes 386 vertebrae, 70 cranial elements, and 39 fragments identified only as post-cranial. It is clear from this distribution of body portions that whole fishes were consumed on site.

Table 5: List of Bony Fish

Zoological Taxon	NISP	% of Fish
Order Perciformes		
Petenia splendida	48	6.76
Family Carangidae	9	1.27
Family Cichliidae	6	0.84
Unidentified perciforms	41	5.77
Order Siluriformes		
Ictalurus furcatus	20	2.82
Family Ariidae	10	1.41
Unidentified catfish	6	0.84
Unidentified fish	570	80.28
Total	**710**	**99.99%**

Bay Snook (*Petenia splendida*) – This is the largest of the cichlid species found in Central America. Commonly known as *blanco* in several areas of Central America, it is more commonly referred to as *bocona* by the inhabitants of Indian Church. This name is in reference to the fish' large protractile mouth. It is the skeletal elements of this mouth structure, in particular the premaxilla, that distinguishes the bay snook from all other cichlids, both in morphology and size. Of the 48 bay snook specimens, 26 are premaxilla elements or portions thereof. It is likely that the actual number of bay snook elements present is higher than initial analysis indicates. None of the specimens show signs of modification.

Blue Catfish (*Ictalurus furcatus*) – A total of 20 specimens, all pectoral or dorsal fin spines, are identified. These spines are barbed and are readily identifiable to the only species of this genus present in the area. Like its cousin the channel catfish, this fish can reach lengths in excess of 60 cm.

Sea Catfish (Family Ariidae) – A total of 10 cranial specimens are present. At least one species, the Mayan catfish (*Ariopsis assimilis*), is present in the New River lagoon today. Identification to the species level should be possible for most of the ten specimens with proper reference material.

Jack Fish (Family Carangidae) – All of the 9 specimens are portions of hyperostotic elements, mainly ribs. This feature of "inflated" bone growth is common to many of the jack fishes and is most often seen on the ribs and cleithra. Identification to species may not be possible. Some species of jack are known to travel extremely far up the New River with schools being reported near the toll bridge area south of Orange Walk Town. We cannot know if these fish were procured by the Lamanai Maya from distant coastal waters or inland rivers, or, whether they were traded for.

Cichlids (Family Cichliidae) – All of the 6 unidentified cichlid bones are maxilla portions and at least one of these is likely to represent bay snook. There are at least a dozen cichlid species or more present in the New River lagoon and surrounding waterways. All except the bay snook are considered to be members of one genus, *Cichlasoma* sp.

Catfish (Order Siluriformes) – The 6 unidentified catfish specimens include 5 pectoral or dorsal fin spine fragments. It is possible that these are all blue catfish, however, there are smaller pimelodid catfishes (Family Pimelodidae) with serrated fin spines present in the lagoon and adjacent waters. For example, the Guatemalan chulin (*Rhamdia guatemalensis*) has been taken from nearby Irish Creek. This species of *Rhamdia* is known in Indian Church as *filine*. One cranial fragment is believed to represent a species of sea catfish. This remains to be identified.

Perciform Fishes (Order Perciformes) – Forty of the 41 unidentified specimens are believed to represent either cichlid species or sleepers (Family Eleotridae). It is likely that bay snook is present along with some of the smaller cichlid species. Sleeper fish are known locally as *dormilon* and only one species is known from the lagoon today, the bigmouth sleeper (*Gobiomorus dormitory*). This fish is a bottom dweller and is referred to as a sleeper because of its habit to bury its body in the lagoon body leaving only its eyes protruding. All of the above are cranial elements. One unidentified fragment of hyperostotic bone may be from a jack fish. Only one bone, a dentary fragment possibly from bay snook, is charred. No other signs of modification are present.

Unidentified fish (Class Osteichthyes) – The 570 unidentified fish specimens include 70 cranial, 499 post-cranial, and one unidentified specimen. Post-cranial specimens include 386 vertebrae, of which 1 is calcined. The remaining 113 post-cranial specimens include mainly spines, of which one is calcined. None of the cranial specimens are modified. The remaining indeterminate fragments show no signs of modification either. It is likely that more representatives of the above-identified species are present among these unidentified fish remains.

Account of Birds

None of the 346 bird bone specimens are identified below the zoological taxon of class. However, several are considered to be identifiable with adequate reference collections for comparison. It is likely that turkey is present among the 86 specimens listed as belonging to large bird species. An examination of bird body portions present indicates access to quality portions of meat. No cranial elements are present. Axial bones include 7 vertebrae or portions thereof. A total of 93 specimens are considered to be from limb bones and include 17 forelimb or wing specimens (ulna, humerus, and carpometacarpus). Hind limb or leg bones identified include 18 specimens (femur, tibiotarsus, and tarsometatarsus). A total of 58 specimens are listed simply as "limb" specimens. Unidentified post-cranial specimens include 213 fragments, most believed to be from long bones. It is clear from the distribution of body portions present that the lack of cranial and axial bones and the presence of limb bones indicates access to high quality cuts of meat such as wing and leg portions. None of the specimens show signs of heat alteration. Seven long bone shaft fragments contain traces of medullary bone. This is a diagnostic feature of

female birds and is an indication that these birds were preparing to lay their eggs. Medullary bone is laid down in female bone shafts prior to reproduction. The vast majority of bird bone specimens are from medium to large size birds. The presence of turkey, though not securely identified as yet, is a certainty. Whether or not the turkey bones are those of domesticated animals or the wild ocellated turkey remains to be determined.

Invertebrates

Account of Univalves

Gastropod or univalve specimens account for only 1.4% of the assemblage examined to date. As noted previously not all of the univalve remains have been quantified and examined. We provide only a brief account of those identified to date. Both marine and locally available terrestrial and river snails are identified (Table 6). The majority of the examined sample is local apple snail (*Pomacea flagellata*). These snails are extremely common in the New River lagoon and account for almost 50% of the sample. River snails include at least two species of *jute* and account for another 20% of the sample. Marine shell includes 16 specimens representing at least 3 species. Identified species include the crown or mud conch (*Melongena melongena*) and probably several fragments of a king helmet shell (*Cassis tuberosa*). Conch (Family Strombidae), likely queen conch), is also present. Land snails account for 19 specimens or 15% of the sample. The 2 identified land snails (*Euglandina* sp. and *Orthalicus princeps)* are considered intrusive to the sample and are not discussed further. The *jute* and apple snails likely represent food refuse as these snails are still eaten today by some Maya. The marine shells were most likely traded for, possibly for reasons other than food consumption.

Table 6: List of Univalves

Zoological Taxon	NISP	% of Univalve
Order Caenogastropoda		
Melongena melongena	1	0.8
Cassis sp. cf. *tuberosa*	7	5.6
Strombus sp. cf. *gigas*	1	0.8
Family Strombidae	1	0.8
Order Sorbeoconcha?		
Pachychilus glaphyrus	8	6.4
Pachychilus indiorum	4	3.2
Pachychilus sp.	13	10.4
Order Architaenioglossa?		
Pomacea flagellata	57	45.6
Order Stylommatophora		
Euglandina sp.	11	8.8
Orthalicus princeps	8	6.4
Class Gastropoda		
Unidentified marine gastropod	9	7.2
Unidentified gastropod	5	4.0
Total	**125**	**100.00%**

Apple Snail (*Pomacea flagellata*) – This species accounts for almost 50% of all examined shell. Commonly found in the waters of the New River Lagoon today, they are a frequent guest on the lists of freshwater snails found in Maya faunal assemblages throughout Northern Belize and other areas. This species is found in slow moving rivers and lagoons as well as in stagnant ponds.

Jute (*Pachychilus* spp.) – At least two species of *jute* is present and includes the larger sculptured species *P. glaphyrus*, and the smooth-shelled *P. indiorum*. Several specimens (13) are not

identified to specific species and may represent a third species of *jute*. Two of the 25 *jute* are complete. The remaining specimens show signs of intentional breaking of the spire of the snails for meat extraction.

King Helmet (*Cassis* cf. *tuberosa*) – A total of 7 specimens are present. All are fragmentary lip and/or body pieces and likely represent one individual only. King helmets are the largest of the helmet shells found off the coastal waters of Belize.

Mud or Crown Conch (*Melongena melongena*) – One body fragment of this species is identified. Mud conchs are common finds in Maya faunal assemblages and are present in Postclassic and Colonial period contexts in other areas of the Lamanai site.

Queen Conch (*Strombus* cf. *gigas*) – One specimens of a large conch, most likely queen conch, is present. This is a weathered specimen of the shoulder/columella portion of the conch.

Conch (Family Strombidae) – One unidentified conch shell fragment is present in additional to the queen conch. This specimen is too fragmentary to be identified to specific species.

Class Gastropoda, ?Order Caenogastropoda (Unidentified Marine Shell) – Of the 9 unidentified marine shell specimens, one closely follows that of an olive shell, and another is probably conch (Family Strombidae). The possible olive shell fragment may also be worked and will be re-examined in the future. The remaining 7 marine shell fragments are all from medium to large species and one specimen is heat altered, probably through natural burning.

Account of Bivalves

The 20 identified pelecypod specimens include local river species and marine bivalve species (Table 7). Although only a portion of the shell sample has been examined in detail, a cursory examination of the entire collection indicates that it is unlikely that additional species will be identified.

Table 7: List of Bivalves

Zoological Taxon	NISP	% of Bivalve
Family Lucinidae		
Codakia orbicularis	2	10.0
Family Spondylidae		
Spondylus sp.	2	10.0
Family Unionidae		
Nephronaias sp.	14	70.0
Family Unionidae	1	5.0
Class Pelecypoda		
Unidentified bivalve	1	5.0
Total	**20**	**100.00%**

Freshwater Pearly Mussel (*Nephronaias* sp.) – The 14 specimens of this genus represent at least 3 individuals. These clams are fairly common in Maya faunal assemblages and can be found in local rivers and lagoons, usually under rocks.

Tiger Lucine (*Codakia orbicularis*) – This marine bivalve is represented by 2 fragments. One individual clam is present. The tiger lucine has been found in other Postclassic and Colonial contexts at Lamanai.

Thorny Oyster (*Spondylus* sp.) – Two specimens of this genus are identified. Unfortunately identification to specific Atlantic or Pacific Ocean species is not possible. During the Classic

period, this shell was often found in both modified and unmodified forms in royal tombs. The shell has always been interpreted as a status symbol by Maya archaeologists. Its occurrence within the sample may also be a further indication of the status afforded the residents of the cacique household. However, the occurrence of *Spondylus* in Colonial contexts needs further investigation.

Account of Tusk Shells

One member of the Class Scaphopoda, a piece of dentalium (*Dentalium* sp.) was identified in the sample. Tusk shells have been found in many Maya faunal assemblages and their presence is the sample is not a product of food use but more likely an item brought to the site as an adornment. These shells are naturally perforated at opposite ends and could easily have been worn as beads.

DISCUSSION

Preliminary observations of the faunal assemblage recovered from excavations associated with Structure N11-18 indicate that a wide variety of taxa were exploited as food sources. Several species of mammal, reptile, and fish, account for the vast majority of the sample. Furthermore, it is apparent that residents of this household also had access to good quality cuts of meat. The predominant presence of limb bones of medium to large mammals and birds indicates this and likely represents the privileges held by these residents. It also appears that butchering and preparation of large game was done elsewhere and that fine cuts of meat were brought to the residents of the cacique household.

Although turtles dominate the sample (a Lamanai-wide phenomenon during the Late Postclassic to Colonial period), large mammal species such as white-tailed and brocket deer, peccaries, and tapir, provided ample protein. Medium to large sized birds are also fairly prevalent in the sample accounting for almost 4% of the total assemblage. This percentage of bird remains is almost double that found in other areas of the site, particularly among samples associated with commoner households (N. Stanchly, personal observation). Turkey is almost definitely present, and perhaps in fairly high numbers. Secure identification of turkey, particularly whether wild or domestic turkey is present, remains elusive at this point. Earlier analysis of faunal material by K.Emery (personal communication) from this area indicated that turkey is present in the sample. Among the large mammals, artiodactyls (deer and peccaries) occur in much higher frequencies in the N11-18 assemblage than in other household assemblages at Lamanai. Although full quantification of these differences remains to be completed, it is apparent that the residents of Structure N11-18 had differential access to large game.

It is hoped that future analysis of the material with comparison to skeletal reference collections will add to the species list. Identification of turkey will hopefully be specific enough to be able to distinguish the presence and frequencies of domestic versus wild turkey (ocellated turkey). Domesticated turkey (*Meleagris gallopavo*) is believed to have been introduced from Mexico into the southern Maya Lowlands during the Late Postclassic period. Perhaps the data from Lamanai will be able to expand on our present knowledge of the distribution of domesticated turkey during this period.

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