

Marble sources and artifacts from the Ulúa valley, Honduras

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Abstract This study is the first geochemical study of marble from Mesoamerica, demonstrating that individual marble sources may be identified by their physical and/or chemical characteristics. Stable isotope and petrographic results from limestone and marble sources located in Honduras and Ulúa style marble vases are presented.

In Honduras the procurement of marble for artifact production began in the Early Formative period (ca. 1600–900 BC) and reached its height during the Late Classic period (ca. AD 600–900). The marble vessels from the Ulúa valley are arguably the most intricate of all stone vessels from Mesoamerica. Our preliminary results suggest that a more detailed investigation of marble procurement strategies and the exchange of these unique marble vessels with the regions of Costa Rica, Nicaragua, Guatemala, and Belize is now feasible and will contribute to our understanding of internal and external social, economic, and political organization in this region, and of the emergence of a local elite during the transition from the Late Classic to the Terminal Classic period (AD 600–1000).

INTRODUCTION

The Ulúa valley, a very large and fertile plain, is located in northwestern Honduras (Figs 1 and 2). Elaborate, decorated marble vases from this region primarily date to the Late Classic and the Terminal Classic periods (Table 1), a time of social reorganization. Determining the sources and distribution of marble used to produce Ulúa marble style vases contributes to our understanding of internal and external social, economic, and political organization in this region, and of the emergence of a local elite during the transition from the Late Classic to the Terminal Classic period. This paper explores the role of these vessels in local Ulúan culture by investigating contemporary settlement patterns (Figs 3 and 4) and communication routes in relationship to the local geology, the location of limestone and marble sources, and the geochemical analyses of these sources.

Knowledge of the marble sources can provide (1) a greater understanding about local procurement strategies allowing us to understand better the social significance of

the vessels; (2) information on exchange systems of the time; and (3) a geological provenance for the vessels. Demonstrating the feasibility of marble sourcing will open up a new area of inquiry into Mesoamerican research which will complement studies on turquoise, jade, obsidian, and ceramics. This research is expected to lead to significant research efforts on the available corpus of marble artifacts and to fieldwork directed at the recovery of evidence of a local Ulúan elite during the Late Classic and Terminal Classic periods.

ARCHAEOLOGICAL BACKGROUND

For over a century, Ulúa marble style vases have been regarded as the most likely markers of elite status produced in the valley from AD 700 to AD 1000 (Gordon, 1920, 1921; Stone, 1938; Strong, 1948; Joyce, 1986; Henderson, 1992a; Schaffer, 1992a). They represent a change in the Ulúan iconographic tradition, expressed on a new medium, marble, suggesting a shift in ideology. Compositionally, the scenes on the vases are relatively standardized. The defining stylistic imagery is a series of volutes that wrap around the exterior of the object framed by upper and, often, lower borders. Depending on the size of the vase, profile and central figures may be part of the iconographic program. In general there are two forms: cylindrical vessels with ring bases (Fig. 5) and tripod drum vases (Figs 6 and 7).¹ Cylinders without

Table 1 Chronological periods for Mesoamerica and the Ulúa valley.

Period	Mesoamerica	Ulúa valley
1100	Early Post Classic	Botija
900	Terminal Classic	Santiago
600	Late Classic	Late Ulúa
AD 300	Early Classic	Early Ulúa Late Chamelecon

MARBLE SOURCES AND ARTIFACTS FROM THE ULÚA VALLEY, HONDURAS



Figure 1 Mesoamerica and Central America: major areas and sites mentioned in text.

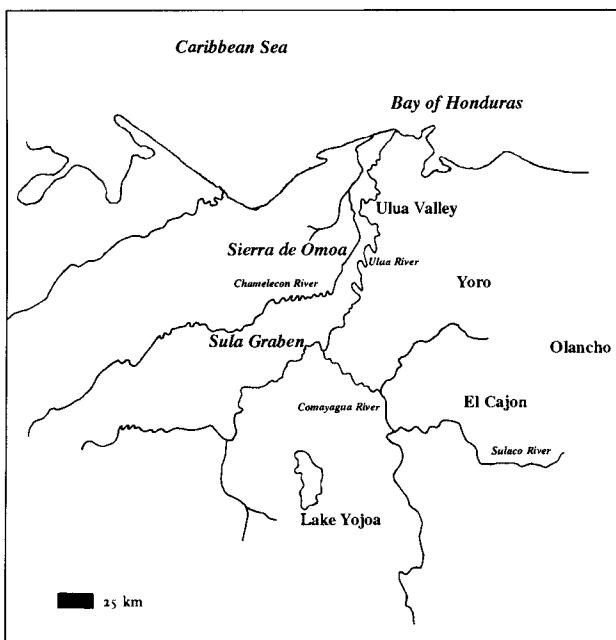


Figure 2 The Ulúa Valley and neighboring regions in Honduras.

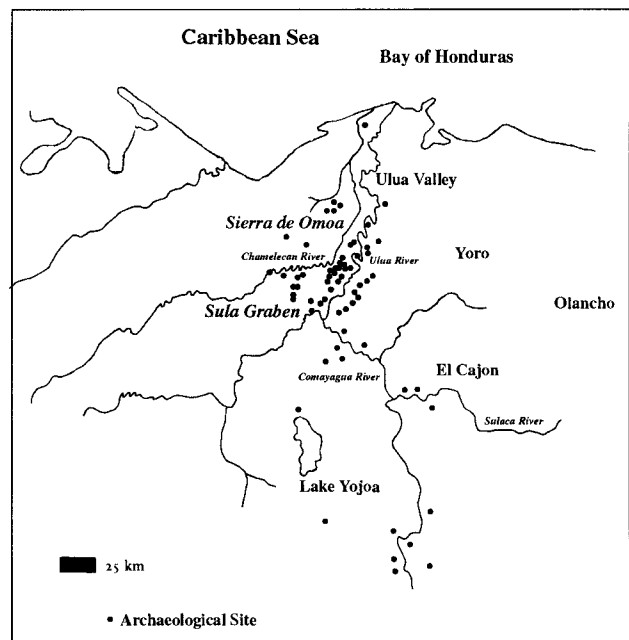


Figure 3 Late Classic archaeological sites in the Ulúa valley area.

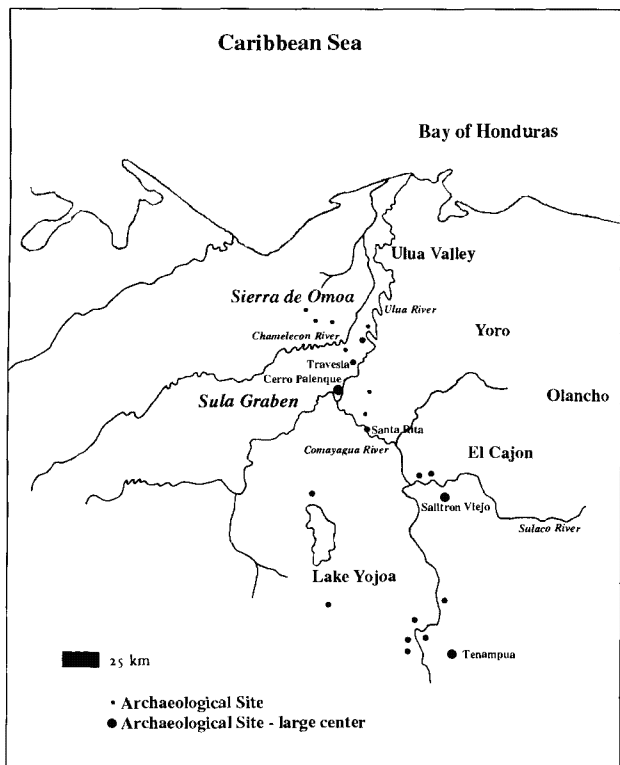


Figure 4 Terminal Classic archaeological sites in the Ulúa valley area.

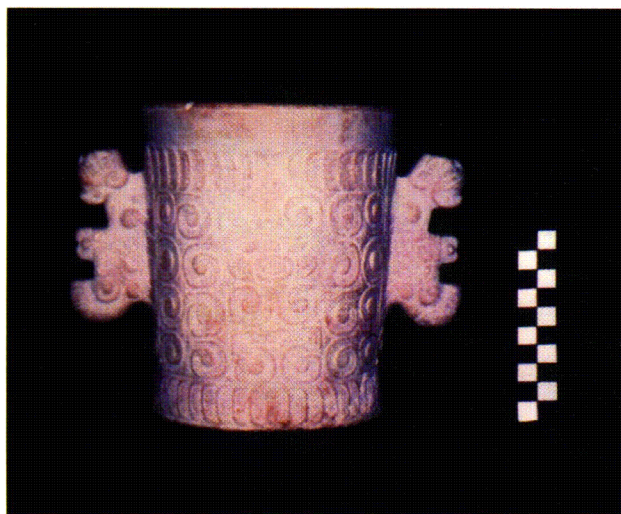


Figure 5 Cylindrical marble vase (National Museum in Tegucigalpa, Honduras).

handles and one-handed dishes are less common (Luke, 1999). Both forms tend to have dual, anthropomorphic, lug handles.

The Ulúa valley is located on the southeastern Mesoamerican frontier. Studies directed at exploring the nature of interaction between the valley and areas to the north and south have focused on how to think about this region in relationship to the Maya world (Henderson, 1997, 1992a; Robinson, 1987; Joyce, 1986; Sheptak, 1987). The



Figure 6 Drum tripod marble vase (Middle American Research Institute, Tulane University).

architectural features and the artifacts, such as Ulúa style polychrome ceramics, demonstrate shared Mesoamerican characteristics as well as traditions with deep local roots (Joyce, 1991; 1993). The marble vessels are perhaps the best evidence for non-Maya artifacts as well as the most likely evidence of a social elite in this region. Although the iconography on the vessels shares Mesoamerican symbolism, the overall form and style is unique to the Ulúa valley (Luke, 1999). The circulation of the Ulúa marbles in the Maya lowlands and in Costa Rica attests to the highly diverse exchange mechanisms operating throughout Mesoamerica and Central America.

There are approximately 130 known whole marble vessels, and about 50 fragments, in museum and private collections, while more continue to be uncovered during archaeological excavations. Based on the archaeological data, vessels occur mainly at large sites, as excavations of residential sites have not recovered any marble vessel remains. This is in strong contrast to Ulúa style polychrome vases, which are found in high status as well as domestic contexts (Joyce, 1991). Ulúa style marble vases have been found in association with caches, mounds, and plaza groups as well as with putative elite goods such as jade and gold figurines (Henderson, 1992a; Hendon and Lopiparo, 1999;



Figure 7 Drum tripod marble vase (Middle American Research Institute, Tulane University).

Hirth and Hirth, 1993; Middle American Research Institute (MARI)). They often appear together with small ceramic imitations of the vessels (Stone, 1938; Strong *et al.*, 1936), and with Late Classic polychromes (Henderson, 1992a; Stone, 1972). Vases have been found in the Ulúa valley at the sites of Travesía (Stone, 1938; American Museum of Natural History; MARI), Puerto Escondido (Dúron, pers. comm., 1996), Santa Ana (MARI), San Juan Farm (MARI), Mopala Farm (Cleveland Museum of Art), and Peor es Nada (Stone, 1972), and in neighboring regions at the sites of El Abra (Nakamura, 1987), Tenampúa (Comayagua Museum), Yarumela (Stone, 1957), Salitrón Viejo (Hirth, 1988), the Río España region (MARI) and Orica (Municipal collections). Furthermore, numerous small ceramic imitations have been found at Las Flores Bolsa, Santa Rita, and sites located at the northern end of Lake Yojoa (Strong *et al.*, 1936); on the Bay Islands (Strong, 1935); and larger imitations are found in the department of Olancho (Stone, 1941). Ceramic imitations are not found outside of Honduras. These marble vessels have been excavated in the Maya Lowlands at the sites of Altun Há, San José, and Uaxactun (Pendergast, 1967; Thompson, 1939; Kidder, 1947), Chac Balam on Ambergris Cay (Garber, pers. comm.), in the region of Somoto, Nicaragua (Espinoza Perez *et al.*, 1996), and in Nicoya-Guanacaste, Costa Rica at the sites of Ortega, Vidor, and Nacascolo (Stone, 1972, 1977; Ferrero, 1981). These factors make the vessels extremely important for understanding the development of social and political organization in the valley as well as the larger sociopolitical landscape of interaction for the people of this region.

GEOLOGY

Regions in the Lower Ulúa, Chamelecon, and Comayagua river valleys were surveyed during two field seasons, January 1996 and January 2000; the regions of Lake Yojoa, Yoro, and Olancho were visited as well, but the survey did not concentrate in these regions.²

Honduras is part of the Chortis block, which is separated from the Mayan block on the north by the Motagua-Chixoy-Polochic and the Cayaman Trough faults (Donnelly *et al.*, 1990; Evlir, 1974; Gordon, 1992, 1994; Scott and Finch, 1999). The Chortis block includes all of Honduras and El Salvador, southeastern Guatemala, and the greater part of Nicaragua; the Mayan block includes northern Guatemala, Belize, the Yucatan, and Mexico west of the Isthmus of Tehuantepec.

The geology of the Ulúa valley is extremely varied (Williams and McBirney, 1969). The younger formations in the southern regions of the valley are divided from the older igneous and metamorphic formations in the north by the Chamelecon fault (Donnelly *et al.*, 1990). These include Paleozoic granites, diorites, and metamorphic rocks: gneisses, schists, and marbles (Williams and McBirney, 1969: 5). A broad belt of Quaternary volcanoes extends from central Honduras northward to the Ulúa valley where it meets the Sula graben, a series of east-west detached valleys that create numerous fractures and faults (Williams

and McBirney, 1969: 63, 73–5). In the southern regions of the valley there are areas of exposed vesicular lava. Areas of volcanic rhyolite tuff define the southeastern and southwestern edges. Along the southwestern margin of the valley Cretaceous limestones and redbeds predominate; Cretaceous limestones, dolomites, and shales comprise the southern region of the Montaña de Comayagua. Current research suggests that Cretaceous limestone on the southwestern slope of the Ulúa valley may have metamorphosed into marble about 40 million years ago when the Mayan block moved (Gordon, pers. comm.). This would have resulted in isolated outcrops of marble that may have been quarried in antiquity for the raw material used to produce Ulúa marble style vases. Subsequent and modern quarry activity has completely depleted these sources.

Marble, metamorphosed limestone, is a crystalline rock composed of grains of calcite or dolomite. Fourteen marble and limestone sources were located and sampled in Honduras (Fig. 8) (Luke, 1997). Based on petrographic studies, Ulúa marble style vases are marble rather than limestone, quartz, alabaster, or travertine (Luke *et al.*, 2000). In many cases marble deposits have been exhausted due to modern-day quarrying activity leaving only limestone deposits. Therefore, samples were collected from both marble and limestone sources.

Based on geological information, the field sampling concentrated along the western and southeastern edges of the Ulúa valley. The regions of Yoro, Lake Yojoa, and Olancho were visited in order to sample sources to verify that marble from these regions was not used. The sampling focused on local and light colored sources as the majority of the known vessels tend to be made from rose or blue veined ivory, tan, white and light gray marble, the typical colors of marble found in the Ulúa valley (Luke, 1997).³

SAMPLING AND METHODS

Marble studies in the Mediterranean regions suggest that combinations of physical and chemical characteristics may be unique to individual marble sources, thus allowing the identification of the origin of archaeological artifacts made from marble from these sources (see papers in Herz and Waelkens, 1988; True and Podany, 1990; Waelkens *et al.*, 1992; Maniatis *et al.*, 1995; Schvoerer, 1999). While various methods have been applied to characterizing marble sources, analysis of the stable carbon and oxygen isotope ratios in marble has proved to be a very effective technique, although some sources may have overlapping isotope ratios (Herz, 1992). Additional methods including petrographic and elemental analysis may help differentiate sources with overlapping isotope ratios. A multi-method approach using stable isotope analysis in conjunction with petrography, X-ray diffraction, cathodoluminescence, and trace element analysis has been successfully applied to Mediterranean marble sources and artifacts, and we have employed a similar approach here to the initial analysis of Honduran marbles. Especially critical in our case is the need to be minimally destructive to the marble vessels (see van der

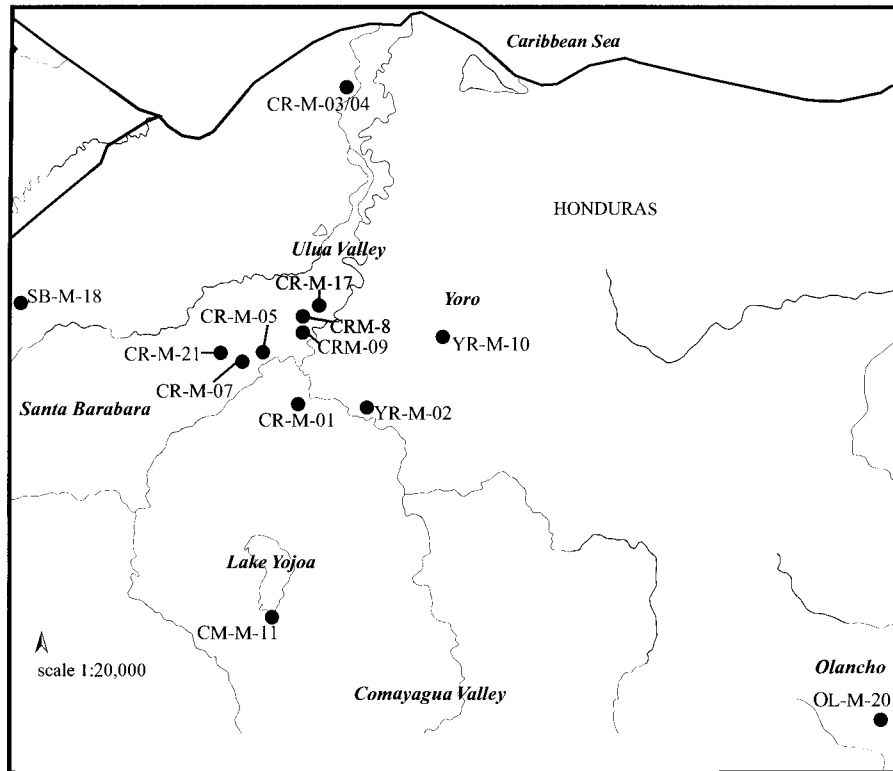


Figure 8 Location of marble and limestone sources in Honduras.

Merwe *et al.*, 1995; 1999; Moens *et al.*, 1992; and others), which makes stable isotope analysis a preferred method, as the sample size is very small.

This study of marble from the Ulúa valley in Honduras – the first attempt to source marbles in the New World – investigates whether stable isotope and petrographic analysis

are effective methods for sourcing marble in Mesoamerica. Stable carbon and oxygen isotope ratios were determined for 241 samples from 14 marble and limestone sources from Honduras to determine homogeneity within each source and heterogeneity among sources.⁴ All samples were taken from fresh exposures to avoid possible isotope alteration from weathering processes (see Tykot *et al.*, 1999). An isotope ratio mass spectrometer using a carbonate autosampler was used to measure the carbon and oxygen ratios.

A total of 41 thin sections from ten marble and limestone quarries were analyzed using petrography (Luke *et al.*, 2000). Analyses focused on rock type, crystal structure, accessory minerals, and fossil identification.

Table 2 Macroscopic and petrographic analyses of quarry samples.

Quarry	Macroscopic analysis	Petrographic analysis ⁶
CR-M-1	Light tan with pink veins, fine grained	Limestone
YR-M-2	Light gray-tan with blue and pink veins, fine grained	Limestone
CR-M-3/4	Light gray with blue veins, medium to large grains	Marble
CR-M-5	Light tan-white with pink veins, fine grained	Limestone
CR-M-7	Light tan-white with pink veins, fine grained	Limestone
CR-M-8	Gray with blue veins, fine grained	Limestone
CR-M-9	Light tan, fine grained	Limestone
YR-M-10	Dark gray, fine grained	Limestone
CM-M-11	Dark gray, fine grained	Limestone
CR-M-14	White-tan, medium to fine grained	not studied
CR-M-17	White-gray, medium to fine grained	not studied
SB-M-18	White-gray with blue veins and gray striations, large-medium grained	not studied
OL-M-20	White with pink clouds, large-medium grained	not studied
CR-M-21	White, large-medium grained	not studied

RESULTS

MACROSCOPIC AND PETROGRAPHIC RESULTS (TABLE 2)

The petrographic results indicate two major groups of carbonate rocks: light gray marble from the northern sources (CR-M- 3/4) and gray-tan limestone from the southern outcrops.⁵ The limestone facies from all sources are similar and are diagnostic of the Cretaceous Atima Formation, which from its fossils dates to between 112 and 97 MY (Luke *et al.*, 2000).

Results from a set of 13 Ulúa style marble sherds indicate that the vases are produced from pure marble. None of the

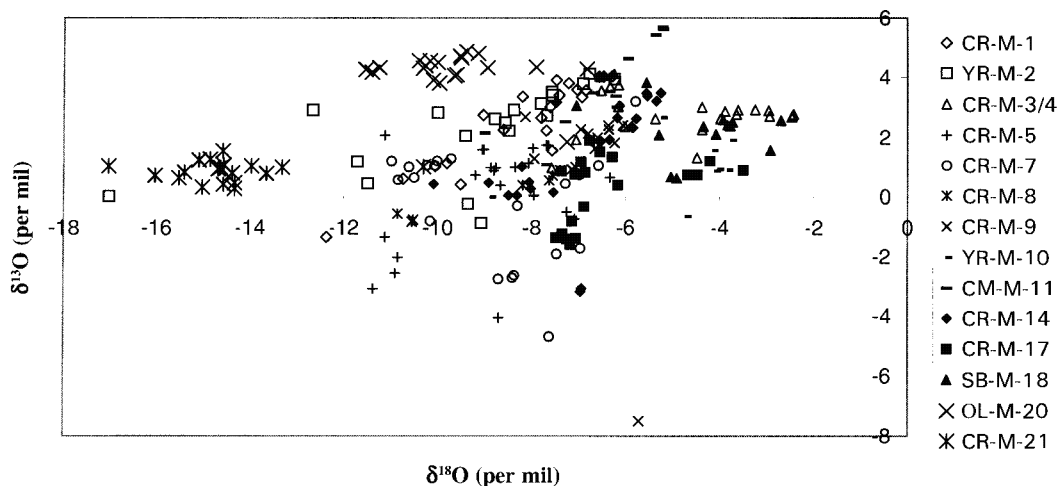


Figure 9 Stable isotope data of 14 quarries.

vases match the northern sources. The vases consist of finer calcite crystals than the very coarse crystalline calcite inclusions found in the northern quarries (Luke *et al.*, 2000). It is believed that the vases are from marble outcrops that once existed on the western and southern edges of the valley, now depleted.⁷ The white color of the marble used to produce the vases rules out CR-M-8, YR-M-10, and CM-M-11 as possible sources because they are gray limestone.

STABLE ISOTOPE RESULTS (FIG. 9)

The precise measurements of the carbon and oxygen isotope ratios in the quarry samples indicate that individual sources have mostly homogenous isotopic compositions. While not all of the sources have unique isotopic signatures, most sources with overlapping signatures can be differentiated based on macroscopic and petrographic characteristics.

Sources of cream and tan limestone with rose veins, and white and light gray limestone are abundant and easily accessible in the valley (CR-M-1, CR-M-5, CR-M-7, CR-M-9, CR-M-14, CR-M-17, CR-M-21, YR-M-2). Sources of tan and white limestone with rose veins are located on the western slope (CR-M-5, CR-M-7, CR-M-9, CR-M-14, CR-M-17, CR-M-21), the southeastern edge (YR-M-2), and in small isolated hills on the southern valley floor (CR-M-1). The two southern sources (CR-M-1 and YR-M-2) have a very similar physical appearance and have overlapping isotopic values. The boundaries of the southeastern source are more clearly defined than those of the south central source, suggesting that this geologic resource may have been more obvious than the less clearly bounded south central source in antiquity. Future statistical analyses may show that CR-M-1 and 2, CR-M-5, 7, 9, 14, and CR-M-21 have diagnostic isotopic signatures. Finally, one marble source from Olancho (OL-M-20) clusters independently from the other sources.

The petrographic results are not able to distinguish among these sources. However, the dating of the limestone to the Cretaceous period is very helpful. It suggests that limestone

outcrops along the western edge may have been metamorphosed 40 million years ago. As long as no further alteration of these limestones occurred prior to this event, the isotope signatures of the limestone quarries should be similar to the subsequent metamorphosed limestone, that is, marble.

Sources located on the western slope (CR-M-5, CR-M-7, CR-M-9, CR-M-14, CR-M-17, and CR-M-21) (Fig. 10), similar in appearance to one another and to the south central and southeastern sources (CR-M-1 and YR-M-2) (Figs 11



Figure 10 Quarry CR-M-5.



Figure 11 Quarry YR-M-2.



Figure 12 Quarry YR-M-2.

and 12), may be distinguished from the latter group by their isotopic values (Figs 13 and 14). The data demonstrate that stable isotope values appear to be able to distinguish between limestone sources found on the southeastern and western slopes of the valley. Future statistical analyses may provide a more specific geographical provenance for sources used to produce vases.

Two northern sources (CR-M-3, CR-M-4),⁸ one source located in the central valley (CR-M-17), and one source in the Chamelecon river basin (SB-M-18) have overlapping isotopic values (Fig. 15). The central source can be distinguished from northern white marble sources as it is tan limestone. The Chamelecon source is a white marble with very diagnostic gray striations.

Stable isotope analysis indicates that local sources were used for the production of Ulúa marble vessels. Samples were taken from three marble fragments housed at MARI, Tulane University. Two fragments are from Olancho, both from the Río España region (Fig. 16). The third is from the

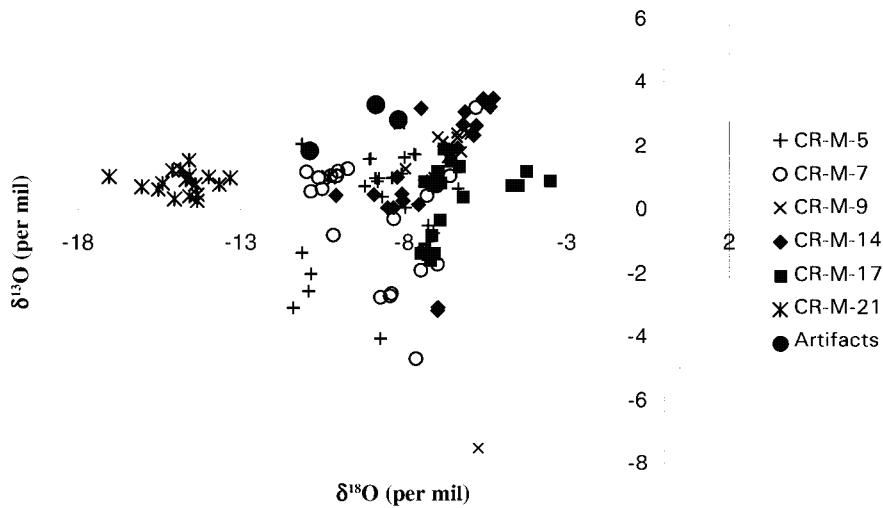


Figure 13 Stable isotope data of sources on the western slope and three marble vessels.

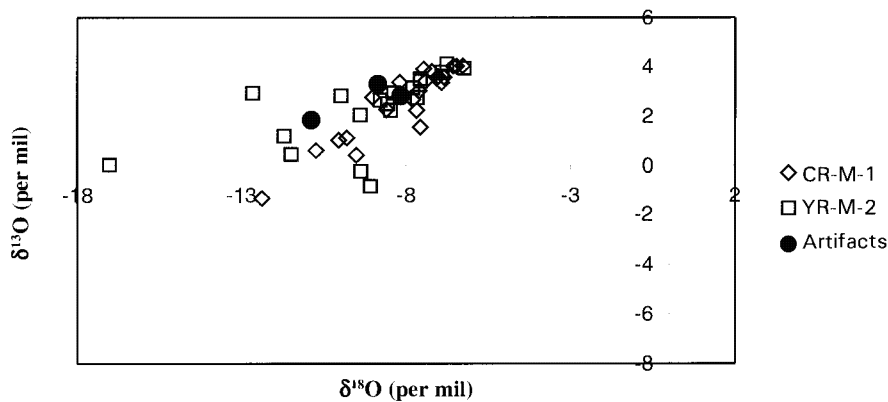


Figure 14 Stable isotope data of CR-M-1, YR-M-2, and three marble vessels.

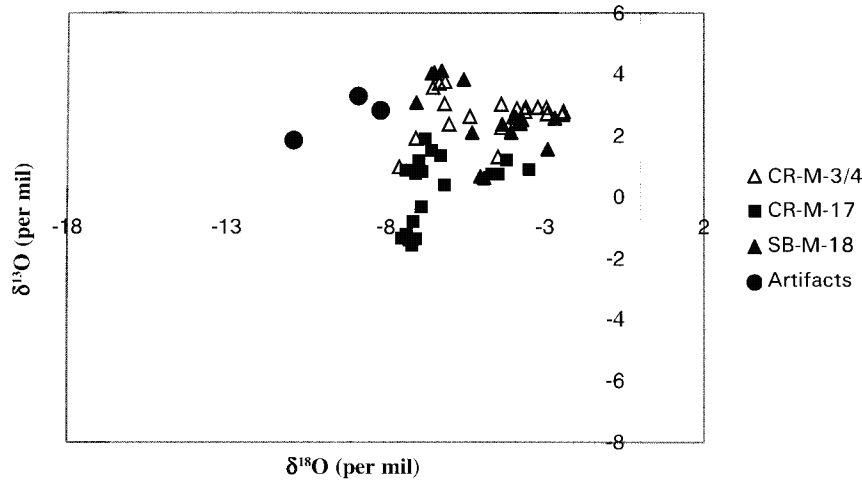


Figure 15 Stable isotope data of CR-M-3/4, CR-M-17, SB-M-18, and three marble vessels.



Figure 16 Fragment of marble vase (Middle American Research Institute, Tulane University).

banks of the Chamelecon.⁹ The results indicate that the south central and southeastern sources (CR-M-1 and YR-M-2) could have been used to produce these artifacts, whose compositions fall within the range of these sources (Fig. 13).

The identification of sources for these marble artifacts adds to our understanding of regional interaction and trade during the Late Classic and Terminal Classic periods. The sources located in the central valley and on the western slope are located in proximity to Travesía and Cerro Palenque, large centers during the Late Classic and Terminal Classic periods, respectively (Figs 3 and 4). The sources located in the southeast and northwest are located on strategic routes to the Pacific coast and the Caribbean coast. These sources are a light tan with rose veins or white with blue veins, respectively. The results from the analysis of the three MARI fragments suggest that sources used to produce these vessels are located in the southeastern regions of the Ulúa valley. Marble fragments from Salitrón Viejo, Yarumela (Joesink Mandeville, pers. comm.), Comayagua river (Genova collections), and Tenampúa (Comayagua Museum), located southeast of the Ulúa valley, indicate that

vessels circulated in this region. Fragments from the region of Olancho (MARI), located in the east, and vessels from Nicoya-Guanacaste, Costa Rica and Somoto, Nicaragua suggest that a southeastern source may have been located along an access route to the Comayagua and Choluteca drainage basins, important southern exchange corridors. Yet, distribution of marble artifacts from the Ulúa valley proper, the Bay Islands, Ambergris Cay, and from areas in the Maya Lowlands suggests a northern interaction network.

Given the abundance of limestone and marble in the valley, the sources chosen may have been convenient locations located on communication routes linking the valley with other regions to the north and south, maximizing transport efficiency, or may have been located near prominent sites, maximizing control over procurement and production. Alternatively, the sources used may have been selected for material and aesthetic characteristics. Although procurement systems may have been based on exchange routes, it is likely that only the finished products were exchanged outside of the valley. The results presented here confirm that the southeastern sources, located along exchange routes as well as near prominent sites, were used to produce at least three vessels. Future results from additional vases will allow more concrete interpretations to be made.

THE SOCIAL AND ECONOMIC IMPORTANCE OF THE MARBLES IN THE ULÚA VALLEY

Determining the sources used to produce the vessels, the distribution of marble vessels in Mesoamerica, and the cultural meaning of the vessels is significant for several reasons: (1) the production of the marble vases in the Ulúa valley occurred at a time of social reorganization and the emergence of an elite class. The marbles are the most significance evidence of a high status group during the Late

Classic and Terminal Classic periods indicating dramatic changes in social and political structures; (2) the distribution of these vases illustrates the role that the Ulúa valley played in wider processes of sociopolitical interaction and economic networks across Mesoamerica and Central America; (3) the technology used to produce these vases and the technical choices (both the material constraints and the cultural conditions influencing such choices) remain unstudied despite over 100 years of archaeological knowledge of these vessels; and (4) until now, the origin of the raw materials used to manufacture marble artifacts in Honduras has been unknown. The source identification of individual vessels will provide data concerning valley-wide procurement systems.

The Late Classic to the Terminal Classic period was a time of widespread changes across Mesoamerica (Sabloff and Henderson, 1993), and, not surprisingly, major changes took place in the Ulúa valley and other regions in Honduras during this period. The Ulúa valley reached its height during the Late Classic, with sites evenly distributed throughout the valley (Fig. 3) (Joyce, 1991: 25; Henderson, 1984, 1992b). The Terminal Classic period is characterized by a shift in settlement patterns to a more centralized system with the development of several large sites. Moreover, these sites tend to be located in defensible locations, such as hilltops and ridges, particularly the sites of Tenampúa in the Comayagua valley and Cerro Palenque in the Ulúa valley (Fig. 4) (Joyce, 1991; Dixon, 1989: 264). It is during this transition period that the marble vessels are believed to have been produced.

Multiple ethnic groups lived in the Ulúa valley and neighboring regions during this period (Stone, 1957; Joyce, 1984; Henderson, 1992a). Based on the ceramic evidence of polychrome traditions, the Ulúa valley and the neighboring regions of Comayagua, El Cajón, and Lake Yojoa all had separate social and political spheres of organization (Henderson *et al.*, 1993; Hirth, 1988; Joyce, 1984, 1991, 1993; Robinson, 1982, 1987; Hasemann, 1987). The Ulúa valley had close ties with the Central Maya regions, particularly Belize, as studies of polychrome ceramics have documented systems of communication operating between the two regions (Joyce, 1986, 1987; Sheptak, 1987).¹⁰ Close ties between Comayagua, Lake Yojoa, and El Cajón are also documented by Ulúa style polychromes in these regions. Yet, these southern areas show stronger ties with Nicaragua and Nicoya-Guanacaste, Costa Rica (Hirth, 1988; Dixon, 1989). Unlike the Caribbean exchange route, Ulúa style polychromes from Honduras are not found in the south, but local imitations of these ceramics are found (Joyce, 1993). Marble vessels reported from all of these regions indicate a system of multiple exchange networks and most likely a more complex system of social and political relationships, perhaps even a common local inter-elite network among neighboring regions.

The changes in settlement patterns in the valley as well as the production and distribution of marble vessels indicate that this region participated in expanding interaction networks, along both Pacific and Caribbean corridors (Joyce, 1986). Marble vessel fragments from the sites of San José (Thompson, 1939) and Altun Há (Pendergast, 1967) in

Belize, Uaxactun (Kidder, 1947) in the Guatemalan Lowlands, Chac Balam on Ambergris Cay (Garber, pers. comm.), and the numerous examples of imitation marble vessels on the Bay Islands (Strong, 1935) illustrate that the Ulúa valley participated in the Caribbean cultural corridor interacting with the Maya world. Marbles from the region of Olancho, the sites of Tenampúa and Salitrón Viejo in Honduras, the Pacific Coast of Nicaragua, and the Nicoya-Guanacaste region of Costa Rica illustrate the Pacific cultural corridor connection. This evidence of marble vessels represents a broadening of inter-regional exchange as well as social relationships.

Further isotopic analyses will provide data about whether specific vessel forms were made from particular marble sources. This may provide more information concerning the role of production at certain communities as well as whether certain sources were chosen for physical/mechanical properties, or as a result of particular social connections.

Long-distance trading networks must be thought of in terms of social, economic and political processes (Renfrew, 1975: 4; Hirth, 1992; Renfrew and Cherry, 1986; McNany, 1993; Aubert, 1993; Cline, 1996; Keswani, 1996; Åström and Herscher, 1996). This heterogeneous model of exchange includes documenting the emergence of social status and connections within economic networks. Systems of long-distance trade that moved goods, particularly luxury goods such as the marble vessels, were linked directly to the maintenance of social alliances rather than purely the accumulation of economic wealth. By examining the exchange routes used to circulate the vessels as well as the local systems for marble procurement, we can better understand the nature of Late Classic and Terminal Classic networks of elite relationships between local centers and Maya polities to the north, and Nicaraguan and Costa Rican groups to the south.

It is significant that radical changes took place in the Ulúa valley as well as across Mesoamerica and Central America during the period when the vessels were produced. The decline of Ulúa polychromes, which were used by all social classes (Joyce, 1986), as well as shifts in settlement patterns indicate dramatic changes in valley-wide sociopolitical organization. Cacao, an extremely valued commodity in ancient Mesoamerica, was grown intensively along the Pacific Coast, in the Gulf Coast regions, and in the Ulúa valley (Millon, 1955). Exchange routes along the Pacific coast corridor lessened with the decline of Teotihuacan (Cheek, 1977; Becker, 1983; Santley, 1983), which would have created a higher demand for cacao from other regions. Conquest documents reveal that the Ulúa region produced some of the finest cacao in Mesoamerica (Bergmann, 1969). During the Late Classic period, the Ulúa valley may have become a major cacao exporter with elite groups controlling cacao production and ultimately developing more complex systems of social stratification. The marbles are one indicator of this elite presence. The circulation of the marbles, cacao, and other goods regulated and expanded foreign social as well as economic relations.

Marble is abundant in the region, yet it is likely that certain marble sources were preferred over others and access to

these sources controlled. Based on studies of ceramics and obsidian, access to resources may have been controlled by a group of elite and/or dictated by strategic exchange routes as well as influenced by shifts in sociopolitical and economic structures (Joyce, 1986; Henderson, 1992b: 166; Hirth, 1988, 1992). Given the multiple social and exchange systems operating in the region, it is likely that heterogeneous procurement systems were employed for marble extraction. We anticipate that future data will show simultaneous operation of several independent, but overlapping procurement systems. The stable isotope data of the three fragments from MARI indicate that one marble source is located in the southeastern part of the Ulúa valley. Based on petrographic analyses other sources were used to produce vessels suggesting several production centers and indicating that heterogeneous exchange systems facilitated the movement of marble.

Given their elaborate forms, designs, and rarity, the vessels were high status goods (Henderson, 1992a); therefore, the study of these artifacts is important for documenting the development of social differentiation in the valley and how high status is signified through their form and iconography. As other studies have shown (Kubler, 1969; Helms, 1987), iconography can shed light on internal sociopolitical relationships. The iconography on the vessels represents a local identity separate from the neighboring Maya areas. The outer surface of the vessels is sculpted in an elaborate design of volutes. In addition to volutes, frontal and profile supernatural figures and animal forms such as jaguars are portrayed on the larger vessels, and the mat motif is occasionally used. This representational imagery, associated with high status throughout Mesoamerica (Joyce, 1993), is incorporated into the local Ulúa marble composition suggesting that the vessels are associated with power and the emergence of an elite group.

This new iconography may represent a common ideology that formed the basis for the interaction of inter-elite groups across multiple political and social boundaries. As society developed in complexity, a more centralized ideology appears to have developed replacing kin-based groups and ethnic enclaves. In fact, this ideology may have been capable of integrating culturally heterogeneous groups into a common sociopolitical system with common goals (Joyce, 1991: 119). The marbles represent a visual medium through which social links and power were expressed and maintained.

The marble vessels may illustrate patron-client relationships operating in the valley. The larger vessels were used primarily by elites and the smaller marbles and the ceramic miniatures were used as gifts to clients in neighboring communities indicating valley-wide alliances. The location of marbles outside the valley attests to a system of social alliances or social currency between elites. Vessels from Uaxactun, San José, Altun Há, Salitrón Viejo, Tenampúa, and Costa Rica include large cylindrical vessels, the most intricate of all the forms, suggesting that certain forms may have symbolized greater status and that regional elites exchanged luxury goods such as marble vases as well as polychromes and cacao.

Unfortunately, many of the vessels have been looted from their respective archaeological contexts. Without

secure provenance it is difficult to understand the function of these vessels. Based on the vessels found outside the Ulúa valley, it is clear that only large, elaborate vessels were exchanged with outside cultural groups. It is likely that the large vessels were associated with elites within the valley as well as outside the valley, but it is unclear to what extent the function and symbol of the vases transcended cultural boundaries.

As this study has shown it is possible to attribute marble vases to sources using both stable isotope and petrographic analysis. Future work may indicate that vase production and circulation correlates to ceramic and settlement patterns linking the central and northern Ulúa valley with the Maya Lowlands and the southern regions with Nicaragua and Costa Rica. This research allows us to place the Ulúa valley in the context of greater Middle America and demonstrates that people living in the Ulúa valley interacted with the Maya world as well as with Lower Central America.

CONCLUSIONS

Marble vessels are viewed as the only material that unambiguously stems from a social elite, and understanding their production and circulation is thus central to any investigation of the local context. Compositional analysis of marble allows models to be considered on the scale of the individual site as consumer of marble and the individual quarry as producer of marble. Beyond the Ulúa valley, marble vessels circulated extremely widely, again apparently among local elites. The research provides a greater understanding of the social and economic interaction spheres of the Late Classic and Terminal Classic periods in the Ulúa valley and regions to the north and south. Future compositional analyses will allow for the identification of patterned variation in the extra-regional circulation of vessels. Technological analyses will contribute to our understanding of the practices that altered the marble physically, perhaps signaling different uses within and outside their apparent area of manufacture. The Honduran marble-carving tradition is the only marble-working in the Americas and has the potential to contribute to the more established study of the use of marble in other world areas, especially the Mediterranean, by providing a comparative case that is clearly independent in its origin and development. Finally, future studies of other stoneworking traditions in Mesoamerica, particularly Maya alabaster and Yucatan tecali vases, will provide further evidence of the importance of stone vases in ancient Mesoamerican societies (Luke *et al.*, 2000).

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REFERENCES

- Åström, P. and Herscher, E. (eds) 1996. *Late Bronze Age Settlement in Cyprus: Function and Relationship*. Studies in Mediterranean Archaeology and Literature 126. Jonsared: Paul Astrom's Forlag.
- Aubert, M. 1993. *The Phoenicians and the West: Politics, Colonies and Trade*. Translated by Mary Turton. Cambridge: Cambridge University Press.
- Barbin, V., Ramseyer, K., Decrouez, D., Burns, S.J., Chamay, J., and Maier, J.L. 1992. Cathodoluminescence of white marbles: an overview. *Archaeometry* 34: 175–83.
- Becker, M.J. 1983. Kings and classicism: political change in the Maya lowlands during the Classic Period. In A.G. Miller (ed.), *Highland-Lowland Interaction in Mesoamerica: Interdisciplinary Approaches*: 159–200. Washington, DC: Dumbarton Oaks Research Library.
- Bergmann, John F. 1969. The distribution of cacao cultivation in Pre-Columbian America. *Annals of the Association of the American Geographers* 59 (1): 85–96.
- Cheek, C.D. 1977. Teotihuacán Influence at Kaminaljuyú. In W.T. Sanders and J.W. Michels (eds), *Teotihuacán and Kaminaljuyú: A Study in Culture Contact*: 441–52. University Park: Pennsylvania State University Press.
- Clark, J.E. and Blake, M. 1993. The power of prestige: competitive generosity and the emergence of rank societies in lowland Mesoamerica. In E.M. Brumfiel and J.W. Fox (eds), *Factional Competition and Political Development in the New World*: 17–30. Cambridge: Cambridge University Press.
- Cline, E.H. 1994. *Sailing the Wine-Dark Sea: International Trade and the Late Bronze Age Aegean*. Oxford, England: Tempvs Reparatum.
- de Waal, D.M. 1995. New world marble vessels from pre-Columbian Honduras: a review. In Y. Maniatis, N. Herz, and Y. Basiakos (eds), *The Study of Marble and other Stones Used in Antiquity*: 259–63. Asmosia III Athens: Transactions of the 3rd International Symposium of the Association for the Study of Marble and Other Stones used in Antiquity. London: Archetype.
- Dixon, B.M. 1989. A preliminary settlement pattern study of a prehistoric cultural corridor: the Comayagua Valley, Honduras. *Journal of Field Archaeology* 16: 257–72.
- Donnelly, T.W., Horne, G.S., Finch, R.C., and Lopez-Ramos, E. 1991. Northern Central America: the Maya and Chortis blocks. In G. Dengo and J.E. Case (eds), *The Geology of North America: The Caribbean Region*, vol. 4: 37–76. Boulder, CO: Geological Society of America.
- Easby, E. 1993. The beginning of Classic Maya jade carving in the southeast. In F.W. Lange (ed.), *Precolumbian Jade*: 133–40. Salt Lake City: University of Utah Press.
- Elvir, A.R. 1974. *Mapa geológico de la República de Honduras, primera edición*, I: 500,000. Tegucigalpa: Instituto Geográfico Nacional de Honduras.
- Espinoza Perez, E., Fletcher, L., and Salgado Galeano, R. 1996. *Arqueología de las Segovias: una secuencia cultural preliminar*. Managua, Nicaragua: Instituto Nicaraguense de Cultura: Organizacion de los Estados Americanos.
- Ferrero, L. 1981. *Costa Rica PreColumbina*. Costa Rica: Editorial Costa Rica, San Jose.
- Gordon, G.B. 1920. A marble vase from the Ulúa River, Honduras. *Art and Archaeology* 9: 141–5.
- Gordon, G.B. 1921. The Ulua marble vases. *The Museum Journal/University of Pennsylvania* 12 (1): 53–74.
- Gordon, M.B. 1992. Northern Central America: the Chortis Block. In G.E.G. Westermann (ed.), *The Jurassic of the Circum-Pacific World and Regional Geology* 3: 107–13. New York: Cambridge University Press.
- Gordon, M.B. 1994. Evolution of Neogene microtectonic phases on the Chortis Block (Northern Central America). *Geological Society of America Abstracts with Programs* 26 (7): 74.
- Hasemann, G. 1987. Late Classic settlement on the Sulaco River, Central Honduras. In R.D. Drennan and C.A. Uribe (eds), *Chiefdoms in the Americas*: 85–103. London: University Press of America.
- Helms, M.W. 1987. Art styles and interaction spheres in Central America and the Caribbean: polished black wood in the Greater Antilles. In R.D. Drennan and C.A. Uribe (eds), *Chiefdoms in the Americas*: 67–84. London: University Press of America.
- Henderson, J.S. 1984. *Archaeology in Northwestern Honduras: Interim Reports of the Proyecto Arqueológico Sula*, vol. 1. Ithaca: Cornell University, Archaeology and Latin American Studies Program.
- Henderson, J.S. 1992a. Elites and ethnicity along the southeastern fringe of Mesoamerica. In D.Z. Chase and A.F. Chase (eds), *Mesoamerican Elites: An Archaeological Assessment*: 157–68. Norman: University of Oklahoma Press.
- Henderson, J.S. 1992b. Variations on a theme: a frontier view of Maya civilization. In E.C. Danien and R.J. Sharer (eds), *New Themes on the Ancient Maya*: 161–71. Philadelphia: The University Museum, University of Pennsylvania.
- Henderson, J.S. 1997. The land of Ulúa and the Maya world. Paper presented at the Maya weekend at University of California, Los Angeles.
- Henderson, J.S., Beaudry-Corbett, M., Caputi, P., Joyce, R.A., Robinson, E.J., and Wonderley, A. 1993. Lower Ulúa region. In J.S. Henderson and M. Beaudry-Corbett (eds), *Pottery of Prehistoric Honduras*: 65–135. Los Angeles: Institute of Archaeology University of California, Monograph 35.
- Hendon, J. and Lopiparo, J. 1999. Investigaciones recientes en Cerro Palenque, Cortes, Honduras. Paper presented al Seminario de antropología de Honduras: Dr. George Hasemann, Julio del año 1999.
- Herz, N. 1992. Provenance determination of Neolithic to Classical Mediterranean marbles by stable isotopes. *Archaeometry* 34: 185–194.
- Herz, N. and Waelkens, M. (eds) 1988. *Classical Marble: Geochemistry, Technology and Trade*. NATO ASI Series E, vol. 153. Dordrecht: Kluwer Academic Publishers.
- Hirth, K.G. 1988. Beyond the Maya frontier: cultural interaction and syncretism along the Central Honduras corridor. In E.H. Boone and G.R. Willey (eds), *The Southeast Classic Maya Zone*: 297–334. Washington, DC: Dumbarton Oaks Research Library.

- Hirth, K.G. 1992. Interregional exchange as elite behavior: an evolutionary perspective. In D.Z. Chase and A.F. Chase (eds), *Mesoamerican Elites*: 18–29. Norman: University of Oklahoma Press.
- Hirth, K.G. and Hirth, S.G. 1993. Ancient currency: the style and use of jade and marble carvings in central Honduras. In F.W. Lange (ed.), *Precolumbian Jade*: 173–90. Salt Lake City: University of Utah Press.
- Hosler, D. 1994. *The Sounds and Color of Power*. Cambridge: Massachusetts Institute of Technology.
- Joyce, R. 1983. *Travesía (CR-35): Archaeological Investigations, 1983*. Report submitted to the Proyecto Arqueológico Sula of the Instituto Hondureño de Antropología e Historia. Tegucigalpa, Honduras.
- Joyce, R. 1984. Ceramic traditions and language groups of prehispanic Honduras. *Journal of the Steward Anthropological Society* 15: 158–85.
- Joyce, R. 1986. Terminal Classic interaction on the southeast Maya periphery. *American Antiquity* 51: 313–29.
- Joyce, R. 1987. Intraregional ceramic variation and social class: developmental trajectories of Classic Period ceramic complexes from the Ulúa Valley. In E.J. Robinson (ed.), *Interaction on the Southeast Mesoamerican Frontier: Prehistoric and Historic Honduras and El Salvador*: 280–83. Oxford: BAR International Series 327(ii).
- Joyce, R. 1991. *Cerro Palenque: Power and Identity on the Maya Periphery*. Austin: University of Texas Press.
- Joyce, R. 1993. The construction of the Mesoamerican frontier and the Maya period image of Honduran polychromes. In M.M. Graham (ed.), *Reinterpreting Prehistory of Central America*: 51–102. Nitwot: University Press of Colorado.
- Keswani, P.S. 1996. Hierarchies, heterarchies, and urbanization processes: the view from Bronze Age Cyprus. *Journal of Mediterranean Archaeology* 9: 211–50.
- Kidder, A.V. 1947. *Artifacts of Uaxactun*. Washington, DC: Carnegie Institution of Washington Publication 576.
- Kubler, G. 1969. *Studies in Classic Maya Iconography*. New Haven, Connecticut: Archon Books.
- Lange, F. (ed). 1993. *Precolumbian Jade*. Salt Lake City: University of Utah Press.
- Luke, C. 1997. Elite activity in the Ulúa Valley: the Terminal Classic marble vessels. Paper presented at the 62nd Annual Meeting of the Society for American Archaeology, Nashville, Tenn.
- Luke, C. 1999. Los vasos del mármol: Los períodos Clásico y Clásico Terminal en el valle del Río Ulúa, Honduras. Paper presented at Seminario de antropología de Honduras: Dr. George Hasemann, Julio del año 1999.
- Luke, C. and Tykot, R.H. 2001. Craft specialization in Late Classic Ulúan communities: Ulúa Style marble vases. Paper presented at the 66th Annual Meeting of the Society for American Archaeology, San Francisco, California.
- Luke, C., Tykot, R.H., and Scott, R.W. 2000. A scientific study of marble vases and sources from the Ulúa Valley of Honduras: stable isotope and petrographic analysis. Paper presented at the 32nd International Archaeometry Symposium, Mexico City.
- McAnany, P.A. 1993. The economics of social power and wealth among eighth-century Maya households. In J.A. Sabloff and J.S. Henderson (eds), *Lowland Maya Civilization in the Eighth Century A.D.*: 65–89. Washington, DC: Dumbarton Oaks Research Library.
- Millon, R. 1955. When Money Grew on Trees: A Study of Cacao in Ancient Mesoamerica. Doctoral dissertation, Department of Anthropology, Columbia University.
- Nakamura, S. 1987. Reconocimiento Arqueológico en los valles de la Venta y de Florida. *Yaxkin* 10: 1–37.
- Pendergast, D. 1967. Ocupación Post-Clásica en Altun Ha, Honduras Británica. *Revista Mexicana de Estudios Antropológicos* 21: 213–14.
- Renfrew, C. 1975. Trade as action at a distance: questions of integration and communication. In J. Sabloff and C. Lamberg-Karlovsky (eds), *Ancient Civilization and Trade*: 12–21. Albuquerque: University of New Mexico Press.
- Renfrew, C. and Cherry, J. 1986. Peer polity interaction and socio-political change. In C. Renfrew and J. Cherry (eds), *Peer Polity Interaction and Socio-Political Change*: 1–18. Cambridge: Cambridge University Press.
- Robinson, E.J. 1982. El patrón de asentamiento del sitio Guacamaya. *Yaxkin* 5 (2): 102–5.
- Robinson, E.J. 1987. Sula Valley diachronic regional and interregional interaction: a view from the east side alluvial fans. In E.J. Robinson (ed.), *Interaction on the Southeast Mesoamerican Frontier: Prehistoric and Historic Honduras and El Salvador*: 280–303. Oxford: BAR International Series 327(ii).
- Sabloff, J.A. and Henderson, J.S. (eds) 1993. *Lowland Maya Civilization in the Eighth Century A.D.* Washington, DC: Dumbarton Oaks Research Library.
- Santley, R.S. 1983. Obsidian trade and Teotihuacan influence in Mesoamerica. In A.G. Miller (ed.), *Highland-Lowland Interaction in Mesoamerica: Interdisciplinary Approaches*: 69–124. Washington, DC: Dumbarton Oaks Research Library.
- Schaffer, A.-L. 1992a. *On the Edge of the Maya World*. Exhibition at the Museum of Fine Arts, Houston, Texas.
- Schaffer, A.-L. 1992b. On the edge of the Maya world. *Archaeology* March/April: 50–53.
- Schoerer, M. (ed.) 1999. *Archéomatériaux: Marbres et autres Roches*. Actes de la IV^e Conférence internationale ASMOSIA IV, France, Bordeaux-Talence, 9–13 octobre 1995, Université de Bordeaux 3 / CNRS. Bordeaux: Centre de Recherche en Physique Appliquée à l'Archéologie, Presses Universitaires de Bordeaux.
- Sheptak, R.N. 1987. Interaction between Belize and the Ulúa Valley. In E.J. Robinson (ed.), *Interaction on the Southeast Mesoamerican Frontier: Prehistoric and Historic Honduras and El Salvador*: 247–66. Oxford: BAR International Series 327(ii).
- Spinden, H. 1925. Chorotegan culture area. In *Congres International des Americanistes, 21st session, 2c pt. Goteborg, 1924*: 529–45. Goteborg: Museum.
- Stone, D. 1938. *Masters in Marble*. Vol. 8, Part 1. New Orleans: Tulane University, Middle American Research Series.
- Stone, D. 1941. *Archaeology of the North Coast of Honduras*. Cambridge: Peabody Museum of Archaeology and Ethnology, Harvard University, Vol. 9.
- Stone, D. 1957. *The Archaeology of Central and Southern Honduras*. Cambridge: Peabody Museum of Archaeology and Ethnology, Vol. 29, no. 3.
- Stone, D. 1972. *Pre-Columbian Man Finds Central America*. Cambridge: Peabody Museum Press.
- Stone, D. 1977. *Pre-Columbian Man in Costa Rica*. Cambridge: Peabody Museum Press.
- Strong, D. 1935. *Archaeological Investigations in the Bay Islands, Spanish Honduras*. Washington, DC: Smithsonian Misc. Coll., vol. 92 (14).
- Strong, D. 1948. The archaeology of Honduras. In *Handbook of South American Indians*, vol. 4: 71–120. Washington, DC: United States Government Printing Office.
- Strong, W.D., Kidder, A., and Paul, A.J.D. 1936. *Preliminary Report on the Smithsonian Institution-Harvard University Archaeological Expedition to Northwestern Honduras*.

- Washington, DC: Smithsonian Miscellaneous Collections, vol. 97 (1).
- Thompson, J.E.S. 1939. *Excavations at San Jose, British Honduras*. Washington, DC: Carnegie Institution Washington, Publication No. 506.
- True, M. and Podany, J. (eds) 1990. *Marble: Art Historical and Scientific Perspectives on Ancient Sculpture*. Malibu: The J. Paul Getty Museum.
- Tykot, R.H., Newman, R., and van der Merwe, N.J. 1999. Weathering surfaces on Classical marble sculptures: isotopic and X-ray diffraction analyses. In M. Schvoerer (ed.), *Archéomatériaux: Marbres et autres Roches: 239-42*. Actes de la IV^e Conférence internationale ASMOSIA IV, France, Bordeaux-Talence, 9-13 octobre 1995, Université de Bordeaux 3 / CNRS, Bordeaux: Centre de Recherche en Physique Appliquée à l'Archéologie, Presses Universitaires de Bordeaux.
- van der Merwe, N.J., Herrmann, J.J. Jr., Tykot, R.H., Newman, R., and Herz, N. 1995. Stable carbon and oxygen isotope source tracing of marble sculptures in the Museum of Fine Arts, Boston, and the Sackler Museum, Harvard. In Y. Maniatis, N. Herz, and Y. Basiakos (eds), *The Study of Marble and Other Stones Used in Antiquity: 187-97*. Asmosia III Athens: Transactions of the 3rd International Symposium of the Association for the Study of Marble and Other Stones used in Antiquity. London: Archetype.
- van der Merwe, N.J., Tykot, R.H., Herrmann, J.J. Jr., and Newman, R. 1999. Isotopic source determination of Greek and Roman marble sculptures in the Museum of Fine Arts, Boston: recent analyses. In M. Schvoerer (ed.), *Archéomatériaux: Marbres et autres Roches: 177-84*. Actes de la IV^e Conférence internationale ASMOSIA IV, France, Bordeaux-Talence, 9-13 octobre 1995, Université de Bordeaux 3 / CNRS, Bordeaux: Centre de Recherche en Physique Appliquée à l'Archéologie, Presses Universitaires de Bordeaux.
- Waelkens, M., Herz, N., and Moens, L. (eds) 1992. *Ancient Stones: Quarrying, Trade and Provenance*. Acta Archaeologica Lovaniensia, Monographiae 4. Leuven: Leuven University Press.
- Williams, H. and McBirney, A.R. 1969. *Volcanic History of Honduras*. Berkeley: University of California Press.
- research in this paper. However, we have not included the additional 70 vases sampled, stylistic analyses of the entire corpus, or interpretations focused on models of craft specialization (see Luke and Tykot, 2001) as this was not the focus of the 1998 paper.
3. A catalogue identification code is assigned to each sample, e.g. CR-M-1-A, which gives the location of the source in Honduras based on regional districts (e.g. YR= Yoro, CM= Comayagua and CR= Cortes; UTM coordinates were noted for all sources), M refers to carbonate rocks, and the number corresponds to the source; the source numbers were assigned as the sources were located.
 4. Prior NAA analyses conducted at Ward Laboratory at Cornell University were inconclusive.
 5. A subset of quarries was studied petrographically. Petrographic studies have not been completed on the most recent samples, quarries, 14, 17, 18, 20, and 21.
 6. Luke conducted petrographic research at the British School of Archaeology, Athens, Greece. Luke used a comparative collection of Greek marbles prepared by Scott Pike. Robert W. Scott conducted a much more detailed petrographic analysis of the quarries and Ulúa style marble fragments. His research is presented in Luke *et al.*, 2000.
 7. See Luke *et al.*, 2000 for a detailed discussion of petrographic and isotope results from this set of sherds.
 8. In 1996, the northern sources were less than 0.5 km apart and based on the overlapping isotope ratios and the petrographic similarities, these outcrops were considered one source. Luke revisited these quarries in 2000 and found that modern-day quarry activity had completely destroyed any natural boundary between the sources.
 9. Given that the Chamelecon river runs through the central part of the Lower Ulúa valley before heading west into the Chamelecon valley, it is not possible to know whether the sherd is from the Ulúa or Chamelecon valley. Ulúa style marble vases are much more abundant in the Ulúa valley, but several examples of marble vases and small ceramic imitations have been excavated in the Chamelecon valley (Strong *et al.*, 1936; Nakamura, 1987; MARI archives).
 10. Ulúa marble vases have never been found at sites in south-eastern Guatemala or El Salvador. Furthermore, they are absent from Copan, which is not surprising given the lack of Copador ceramics found in the Ulúa valley (cf. Joyce, 1986).

NOTES

1. A cylinder is defined as a vessel with a height greater than its width; a drum is defined as a vessel with a width greater than its height.
2. Since the presentation of this research at ASMOSIA V in Boston additional work on artifacts and quarries has been conducted. We have included the recent results of quarry

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