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Determining the Chronological Significance of an Ulúa-style Marble Vase from Northwest Honduras

Research Year: 2007
Culture: Lenca
Chronology: Classic
Location: Palmarejo Valley, Northwest Honduras
Site: Site X

Table of Contents

Submitted 05/23/2007 by:
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Abstract

Through AMS radiocarbon analysis, this FAMSI-funded research project dated five charcoal samples associated with an Ulúa-style marble vase that was recently unearthed during the excavation of a burial at a prehispanic site in the Palmarejo Valley of northwest Honduras. The goal of this effort was to determine the chronological significance of the vase. Four specimens from immediately below and adjacent to the vase yielded a range of dates (cal AD 595 ± 55, 615 ± 45, 625 ± 45, 705 ± 65; all dates represent two-sigma calibration) largely from the beginning of the Late Classic period. One specimen in direct association with the human remains was dated to cal AD 495 ± 85, indicating that the cached vase was added to the mortuary assemblage approximately a century after the initial burial. This research is significant because no complete Ulúa-style marble vase has ever been excavated in situ with modern archaeological techniques. As a result, little is known about when these objects were manufactured and used during the first millennium AD and how these objects functioned in ancient Mesoamerican societies. This research therefore makes an important contribution to our understanding of the use and meaning of Ulúa-style marble vases in southern Mesoamerica.

Resumen

Mediante un análisis de radiocarbono AMS, este proyecto de investigación patrocinado por FAMSI, tuvo la oportunidad de establecer las fechas de cinco muestras de carbón vegetal asociadas con un vaso de mármol estilo Ulúa, recientemente desenterrado durante la excavación de un entierro en un sitio prehispánico en el valle de Palmarejo al noroeste de Honduras. El objetivo de este esfuerzo era el determinar el significado cronológico de este vaso. Cuatro muestras tomadas inmediatamente debajo y adyacente al vaso proveyeron una serie de fechas (cal. d.C. 595 ± 55, 615 ± 45, 625 ± 45, 705 ± 65; todas las fechas representan calibración dos-sigma) que datan principalmente del principio del período Clásico tardío. Un espécimen en directa asociación con los restos humanos proveyó una fecha acreedor de cal. d.C. 495 ± 85, sugiriendo que el vaso fue añadido al ensamblaje funerario aproximadamente un siglo después del entierro inicial. Esta investigación es significativa, ya que nunca antes un vaso de mármol del estilo Ulúa había sido encontrado *in situ* utilizando técnicas arqueológicas modernas. Como resultado, poco se conoce acerca de cuando estos objetos fueron fabricados y como fueron usados durante el primer milenio d.C. y la función de estos en las sociedades antiguas mesoamericanas. Es por estas razones que esta investigación hace una importante contribución a nuestra compresión del uso y el significado de los vasos de mármol del estilo Ulúa en el sur de Mesoamérica.

Introduction

Sometime during the first millennium AD, highly skilled artisans in the Ulúa Valley of northwest Honduras manufactured elaborate and intricately carved vessels made of white marble (Gordon 1920, 1921; Luke 2002; Luke and Tykot 2002; Stone 1938). These containers, representing both cylinders and drums, were decorated with sculpted scrolls or volutes that wrap around the exterior and frame zoomorphic or anthropomorphic figures emerging from opposite sides of the vase to form lugs or handles (for examples, see Luke 2003). The entire scene is often framed by a border of repeating geometric designs, including scales, voussures (repeating half-moon shapes), interlocking keys, and circles with a central dot. Vases thought to be earlier in date have simple design schemes with bird, bat, or monkey handles, while varieties thought to be later in date have more complex design programs and feline or composite feline/serpent handles (Luke 2002). Many, but not all, vases have ring or tripod supports, which are also variably decorated with incised patterns.

These marble containers were used in a variety of contexts, including dedicatory caches and mortuary programs, and were distributed widely across southeastern Mesoamerica and into the central Maya lowlands. Most examples come from looted collections or were excavated before the advent of modern archaeological techniques. Less than half of the 166 vases known to reside in museums and repositories have secure proveniences (Luke et al. 2006:19). Marble fragments and a few whole vases have been found in association with polychrome pottery diagnostic of the Late Classic period, ca. AD 650-850. However, the precise dating of these objects remains unclear.

Much of our knowledge of the dating of Ulúa-style marble vases is based on relative ceramic chronology, mainly cross-ties with seriated pottery assemblages. Luke (2002; Luke et al. 2003) has created a testable chronology of Ulúa-style marble vases based on their distribution and association with Ulúa polychrome pottery. According to Luke (2002), vases with bird, bat, and monkey handles (ca. AD 650-750) appear to predate those with feline and serpent characteristics (ca. AD 750-850). Evidence in support of this hypothesis includes stylistic similarities with bird and bat designs found on early Late Classic Lug Head Ulúa maroon polychromes, specifically Bombero and Paloma varieties from the western Ulúa Valley (Joyce 1993) and from the Copán region (Viel 1978). Marble vases with feline characteristics are found mainly in the central Maya lowlands in late Late Classic contexts, ca. AD 800-850 (e.g., Kidder 1947:36-37; Pendergast 1990:236-238; Thompson 1939:167).

Ulúa-style marble vases and vase fragments have been recovered from royal tombs in the Maya lowlands at Altun Ha, Uaxactún, San José, and Chac Balam on Ambergris Caye, as well as from various locales in the Guanacaste region of Costa Rica, including Ortega, Nacascolo, Vidor, and Iguanita (see Luke 2006 for a review of the evidence). In Honduras, marble vases have been found in high concentrations in the Ulúa Valley (specifically, at Travesía, Santa Ana, La Mora, and Peor es Nada; Luke n.d.) and in cached deposits and tombs at Copán, El Abra, Salitron Viejo, Tenampua, Yarumela, and, most recently, at a site in the Palmarejo Valley (Davis-Salazar et al. 2007). This last find is particularly significant because the vase was excavated in situ along with 30 charcoal samples. With funding from FAMSI for AMS radiocarbon dating services, we obtained the first set of absolute dates for an Ulúa-style marble vase.

The dates constitute the first series of chronometric dates to be run on organic materials associated with Ulúa marble vases. The results are significant on a number of levels. First, the results contribute to a much needed calibrated radiocarbon chronology for Ulúa marble vases. Second, seriation-based temporal phases of specific ceramic types commonly associated with Ulúa-style marble vases, such as certain varieties of Ulúa polychromes, may now be evaluated with absolute date ranges. Third, the development of a radiocarbon-based chronology for the Palmarejo Valley provides vital information for dating other sites in the area. Finally, the carbon-14 dates can assist with the establishment of chronologies that are being developed in other regions, including the adjacent Naco Valley. By using this comparative method, for example, assumptions based on the uniformity of Naco and Ulúa ceramic chronologies across multiple regions (e.g., Joyce 1993; Urban 1993) may now be explored with absolute dates.

The Site X Ulúa-style Marble Vase

The archaeological site (Site X)—whose name we are withholding until our investigations are completed—that yielded the marble vase is part of the Palmarejo Valley, located immediately to the east of the larger and archaeologically better known Naco Valley in northwestern Honduras (Figure 1). The Palmarejo Valley is composed of 96 settlements of varying size and shape arranged into five spatially discrete communities (Figure 2), all of which appear to have been occupied primarily during the Classic period, ca. AD 300-900, based on surface-visible ceramic assemblages (Wells et al. 2004). Most of these sites represent households and farmsteads. Based on the distribution of field houses (single, low-lying buildings located at least 100 m away from residential settlement) and the arrangement of modern agricultural fields and quebradas (seasonal streams), all of the communities appear to have been variously engaged in agricultural pursuits.

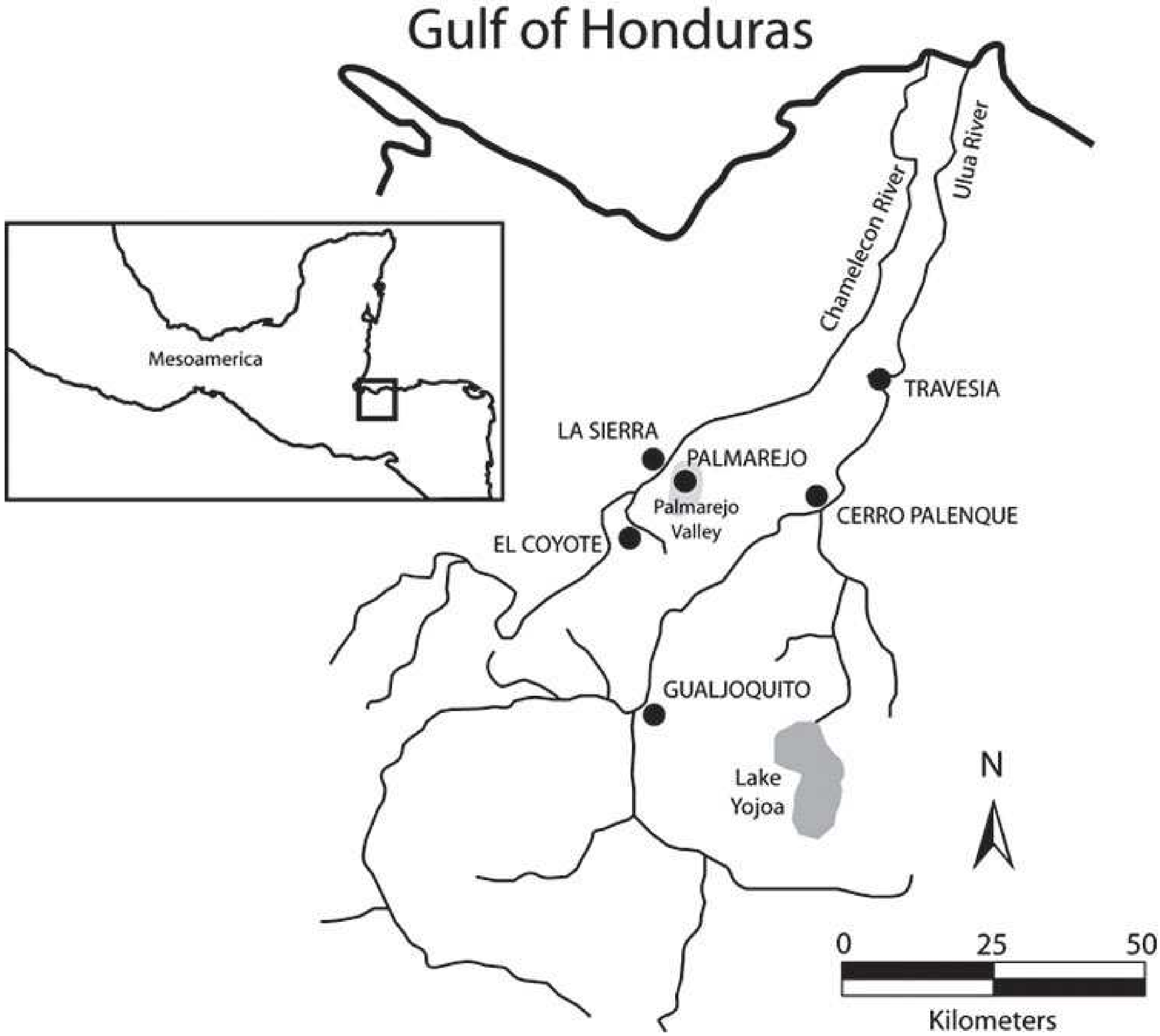

Figure 1. Northwest Honduras, showing the Palmarejo Valley.

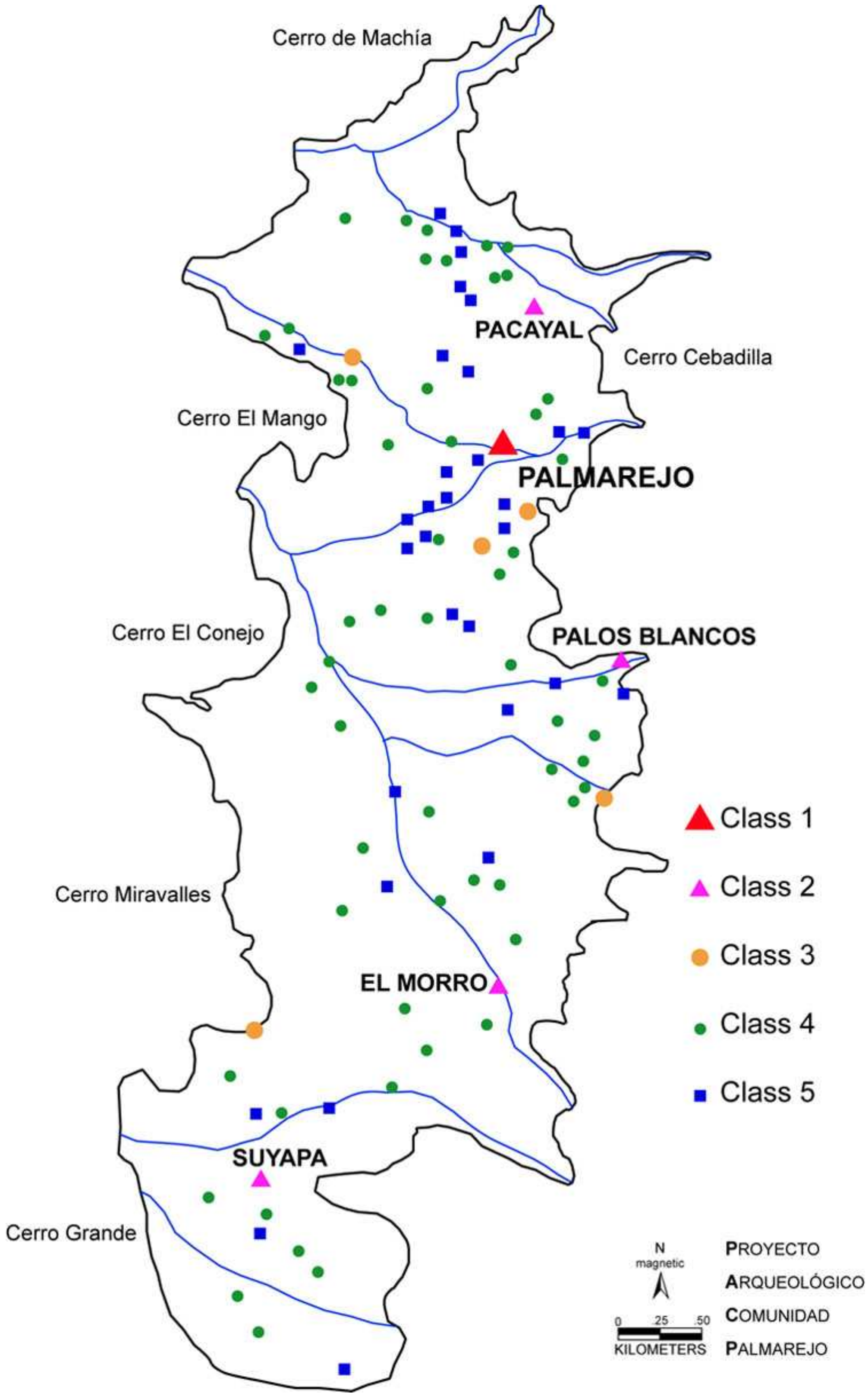

Figure 2. Archaeological sites in the Palmarejo Valley, Honduras.

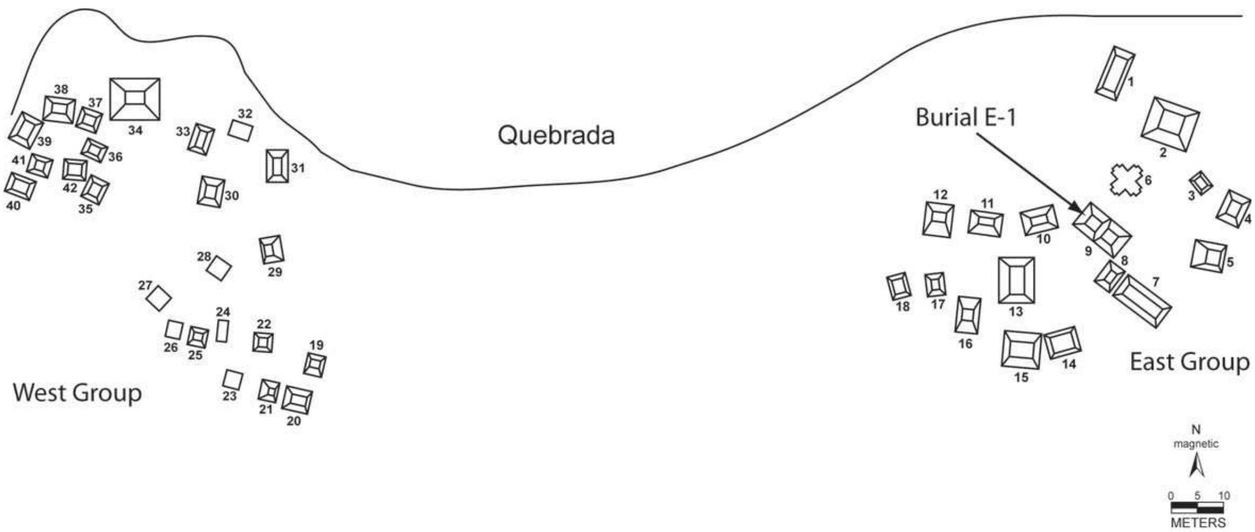

Figure 3. Plan view of Site X, showing the location of Structure 9 and Burial E-1.

Site X is one of the largest in the valley (Figure 3). This community has 42 buildings divided in two groups, both of which skirt the southern edge of an ancient quebrada. During excavation of one of the buildings (Structure 9), an elite residential structure, we encountered a burial (Burial E-1) containing the remains of a single adult (sex indeterminate) in a flexed position, oriented east-to-west with the face looking to the south (Figure 4). The burial was placed into the basal terrace of the edifice, and is thus likely associated with the building's initial construction. Thanks to funding from the National Geographic Society and the University of South Florida, excavation of the burial, as well as the building that contained the deposit, has been completed along with a bioarchaeological analysis of the human remains (Davis-Salazar et al. 2005; Novotny 2006; Wells et al. 2006).

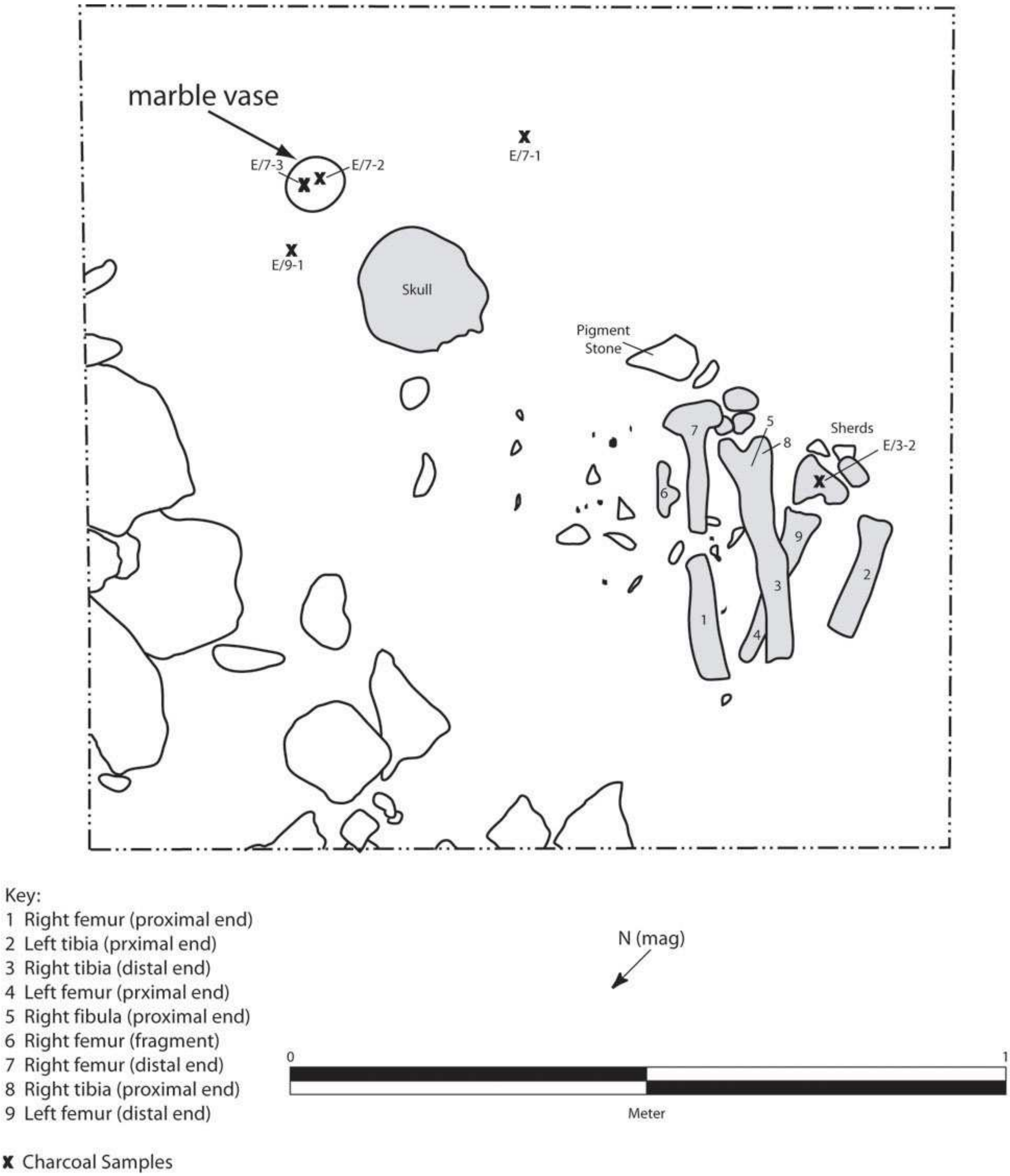

Figure 4. Plan view of Burial E-1 at Site X, showing the location of the marble vase and the charcoal samples dated.

Figure 5. Ulúa-style marble vase from Site X: photos (upper) by Karla L. Davis-Salazar, and drawings (lower) by José H. Espinoza R.

The Ulúa-style marble vase was found immediately to the east of the top of the skull and over a burned patch of soil containing numerous charcoal fragments (Figure 5). Other burned patches of soil were found alongside the body, also containing charcoal deposits. The vase is 8.1 cm in diameter and 6.7 cm in height. It has a cylindrical form with two handles each in the shape of a head of a leaf-nosed bat (*Phyllostomidae*), similar to the main element of the Copán emblem glyph (*zotz*). The body of the vase is decorated with volutes and capped with a band of overlapping serpent scales. Pollen analysis (Stuart 2007) of the vase's contents suggests that the vessel once contained a beverage composed mostly of maize (*Zea mays*), such as corn gruel (e.g., *atole*). Several grains whose morphology is consistent with pollen of false ipecac (*Psychotria emetica*) and cacao (*Theobroma cacao*) were found nearby (Stuart 2007).

Analytical Methods

Radiocarbon dating is by far the most widely used method of chronometric dating available (Bowman and Leese 1995). An historical perspective on the development of the technique is outlined by Taylor (1987, 1995; see also Libby 1955). The analysis provides a means of dating organic remains independent of artifacts and local stratigraphic sequences by measuring the decay of the radioactive isotope, ^{14}C, which decays in once-living organisms at a known constant rate (thereby reducing the original quantity by half every 5,730 ± 40 years). Measuring the decreasing concentration of ^{14}C in a sample provides an estimated date at which the organism died.

The radiocarbon in a sample may be counted in two different ways: either by liquid scintillation counting or by accelerator mass spectrometry (AMS). The former (often referred to as the "conventional radiocarbon method") involves the counting of particles emitted in the slow radioactive decay of ^{14}C, and requires several grams of carbon to produce a date. The latter technique employs a particle accelerator to separate carbon isotopes and count directly the ^{14}C atoms in the sample, requiring only one milligram of carbon. Since the samples from Site X consist of a few milligrams each, we used AMS dating, which has the added advantage of higher accuracy and precision compared to the conventional method.

Data Collection and Sampling

Radiocarbon dating requires individual specimens to be selected from larger aggregates and then subsamples to be taken from those specimens (see Orton 2000:177-184; e.g., Buck and Christen 1998). The initial selection of a single specimen from an aggregate is needed because deposits can be very large, and the analytical techniques can be very expensive or very time consuming. Subsampling the specimen is important because a sample cannot be repeatedly studied. Special care is needed under these circumstances to ensure that the sample is actually related to the behavior studied—for example, that the piece of charcoal is contemporary with the feature within which it is found, and for which it has been used to date. Thus, we used Cowgill's (1964) advice and sampled all (or most) of the material from the marble vase deposit rather than an array of materials from multiple contexts.

Our FAMSI-funded dating project analyzed five specimens from the same context of the burial at Site X. We feel that this number of samples is critically important, because the trend of the samples can provide a general estimate of the actual date of deposition and can allow for the identification and removal of outliers (Stuiver and Suess 1966). Outliers, that is, dates that lie outside one or two standard deviations from the midpoint of the overall range of dates, likely represent possible errors (e.g., from environmental contamination or improper processing in the field or laboratory) rather than true age measurements (see Buck et al. 1994; Christen and Buck 1998).

We did not date composite samples (i.e., those aggregated from multiple contexts). Only whole pieces larger than 0.5 cm^3 were submitted for dating. Great care was taken in collecting and packing the samples in order to avoid contamination by more recent carbon. For each sample, clean trowels were used to avoid cross contamination between samples. The samples were stored in chemically neutral materials (polyethylene bags) to avoid picking up new ^{14}C from the packaging. The packaging was airtight to avoid contact with atmospheric ^{14}C. Also, the stratigraphic context of each specimen was examined carefully to determine that a carbon sample location was not contaminated by carbon from a later or an earlier period. All samples were submitted to Beta Analytic (http://radiocarbon.com) of Miami, Florida—the same laboratory that has been used since 1995 to analyze charcoal samples from the Naco Valley.

Data Analysis and Interpretation

Since the amount of radiocarbon in the atmosphere has varied over time, radiocarbon ages must be converted into actual calendar years by calibration. Radiocarbon measurements made on the yearly growth rings of long-lived bristlecone pines and European oaks (e.g., Stuiver and Becker 1986; Stuiver and Pearson 1986) provide an annual record of the varying concentrations of ^{14}C in the Earth's atmosphere over the past four millennia. These data make it possible to account for slight variations in the atmospheric concentration of ^{14}C and thus to construct a calibration curve that translates "radiocarbon ages" (those determined using only a simple calculation based on radioactive half-life) into true calendar ages.

For the interpretation of radiocarbon dates, we followed the practice established by Dean (1991). His determinations are calibrated and each date is expressed as a range of calendar years referring to one-sigma intervals. In this approach, little importance is given to the midpoint of the determination, because once a radiocarbon date is calibrated, the probability curve for the determination is no longer normally distributed around the midpoint and there is no way of expressing the statistical meaning of the midpoint. The dates were calibrated initially using the new computer software program, IntCal04 (Reimer et al. 2004), based on the new high-precision calibration curve, which has an estimated error of less than 20 years.

The results are shown in Table 1. All dates are significantly different ($X^2 = 9.49$, $df = 4$) at the 0.05 level. The intercepts on the calibration curve appear in Figure 6, Figure 7, Figure 8, Figure 9, and Figure 10. The calendar calibrations were computed using the Pretoria Calibration Procedure (Vogel et al. 1993), which uses splines through the tree-ring data (from oak, sequoia, and fir up to ca. 10,000 BP) as calibration curves. A composite view of the probability curves for all dates appear in Figure 11. These curves are important because, as single values, intercepts with the calibration curve are sometimes not very useful for describing the entire probability distribution function. For example, in this case, the mean probabilities for samples E/7-1 (Beta-228167) and E/7-3 (Beta-228169) fall where the probability is especially low.

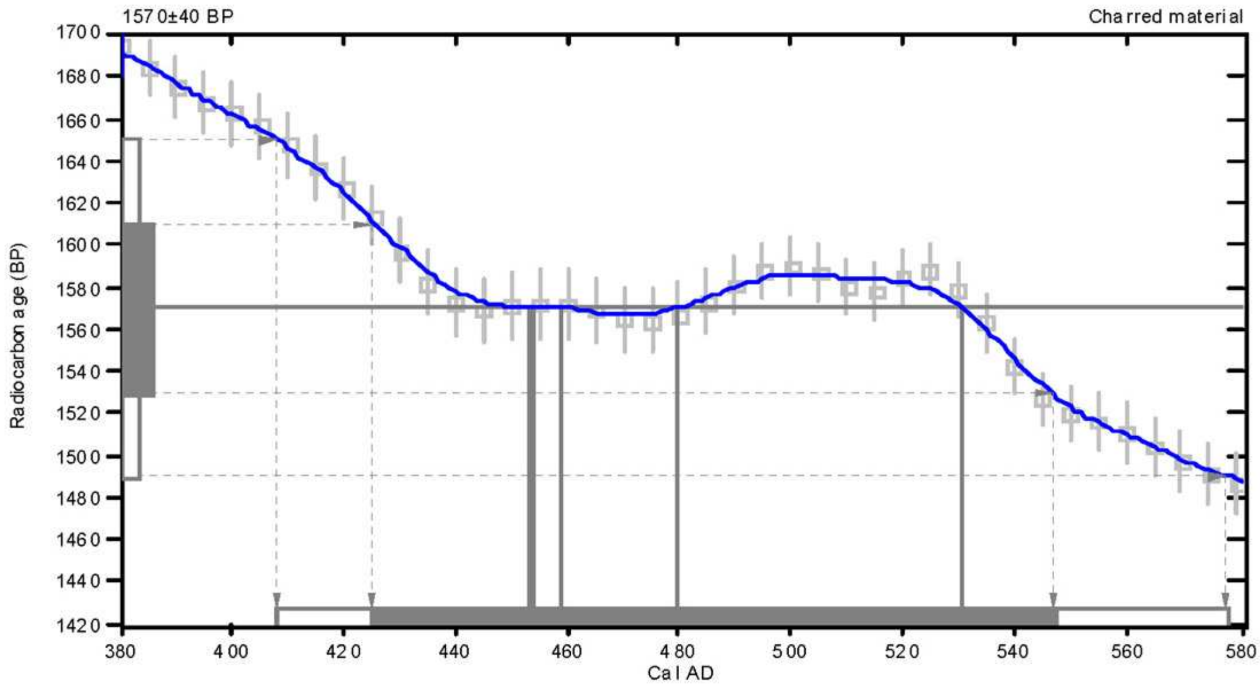

Figure 6. Calibration of radiocarbon age to calendar years for PACP Sample No. E/3-2 (Beta-228166) provided by Beta Analytic, Inc.

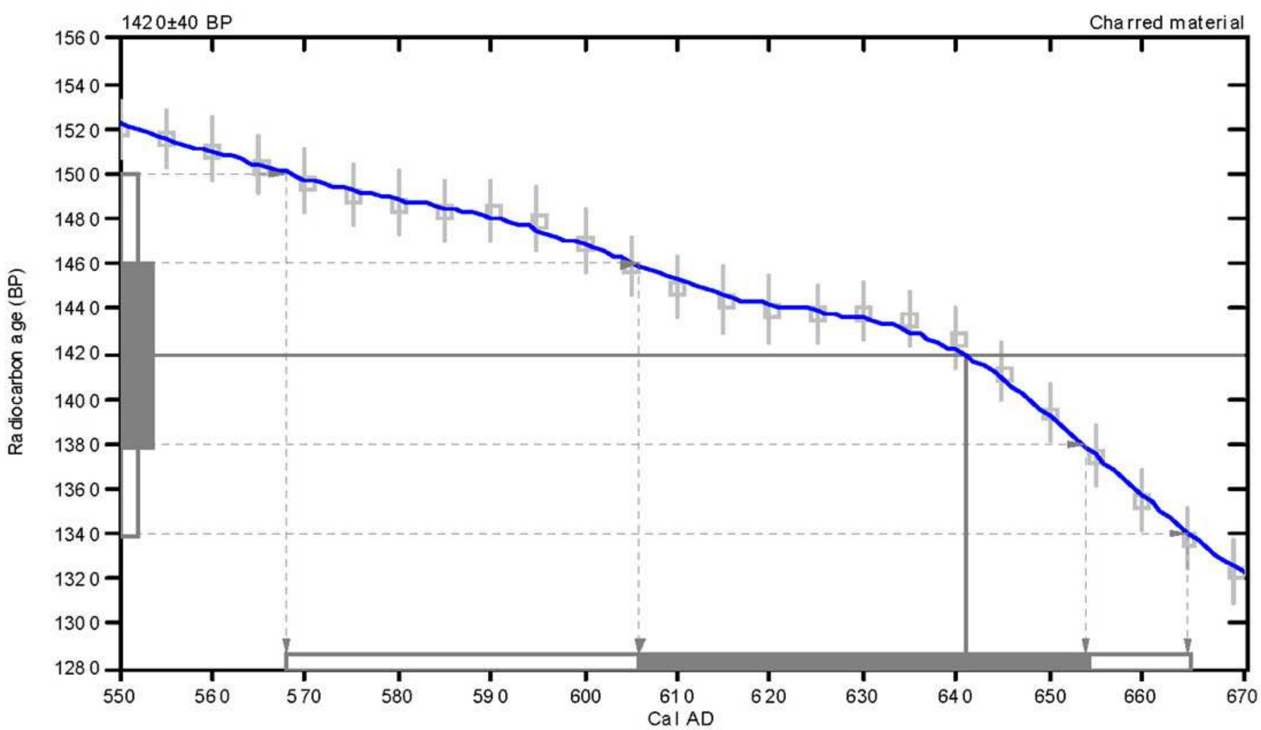

Figure 7. Calibration of radiocarbon age to calendar years for PACP Sample No. E/7-1 (Beta-228167) provided by Beta Analytic, Inc.

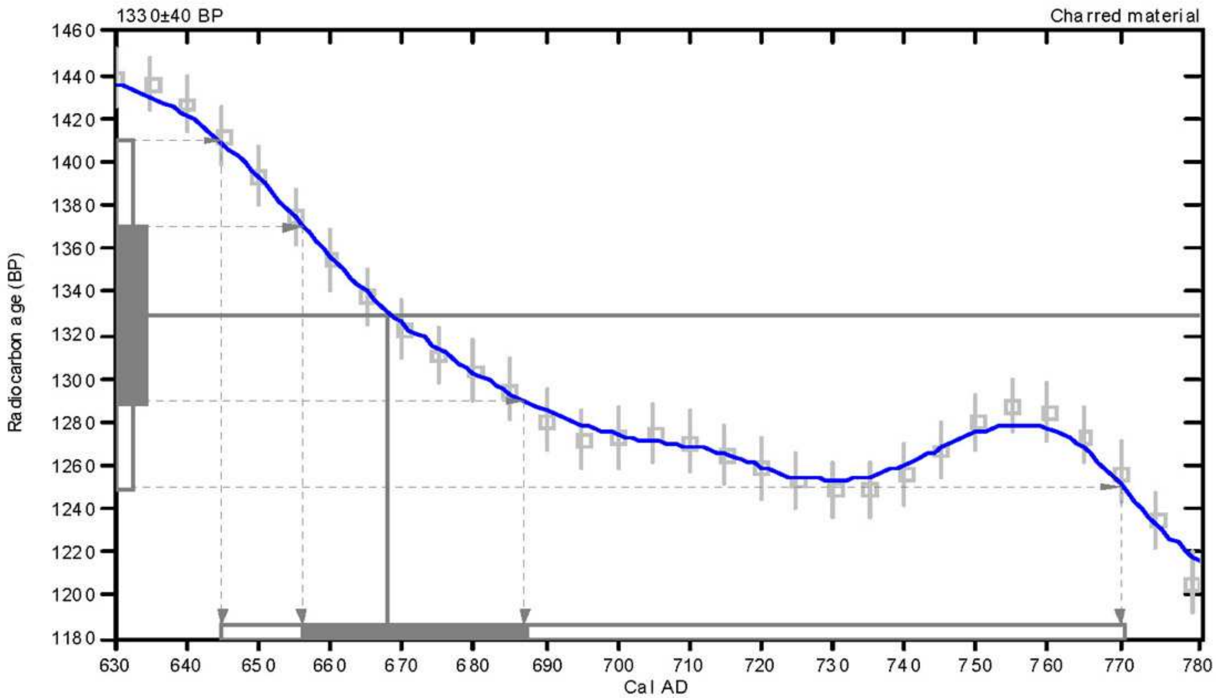

Figure 8. Calibration of radiocarbon age to calendar years for PACP Sample No. E/7-2 (Beta-228168) provided by Beta Analytic, Inc.

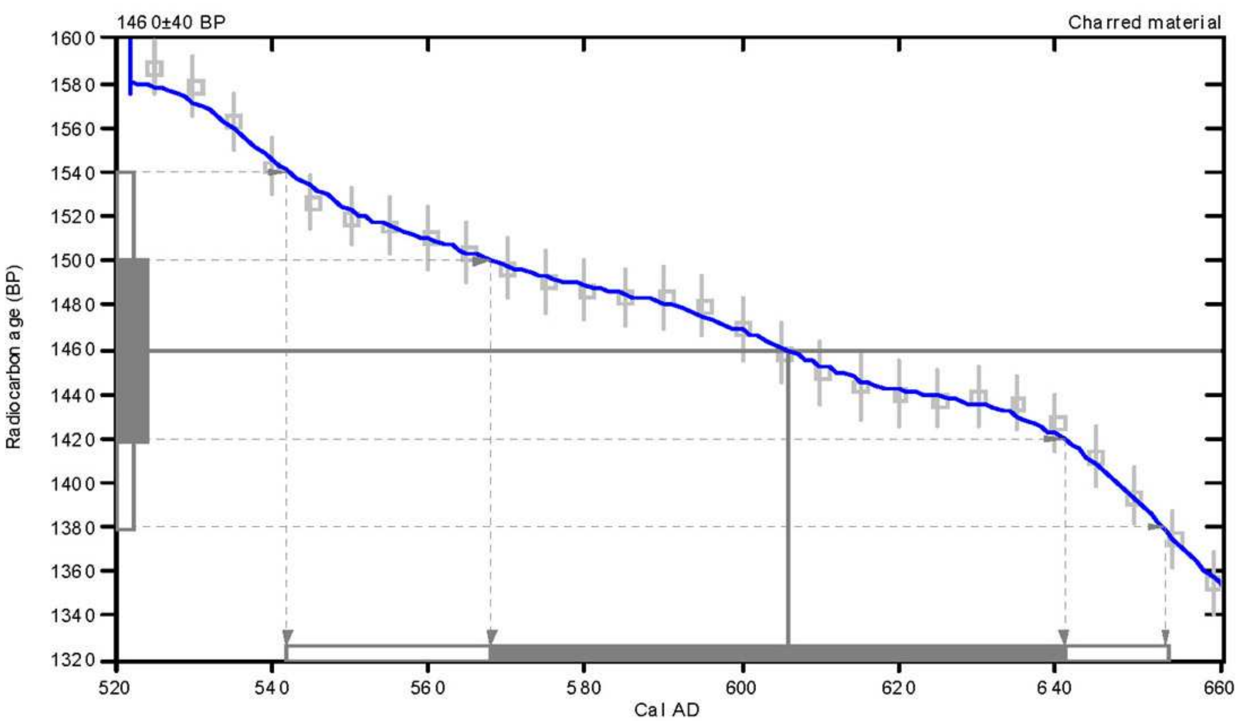

Figure 9. Calibration of radiocarbon age to calendar years for PACP Sample No. E/7-3 (Beta-228169) provided by Beta Analytic, Inc.

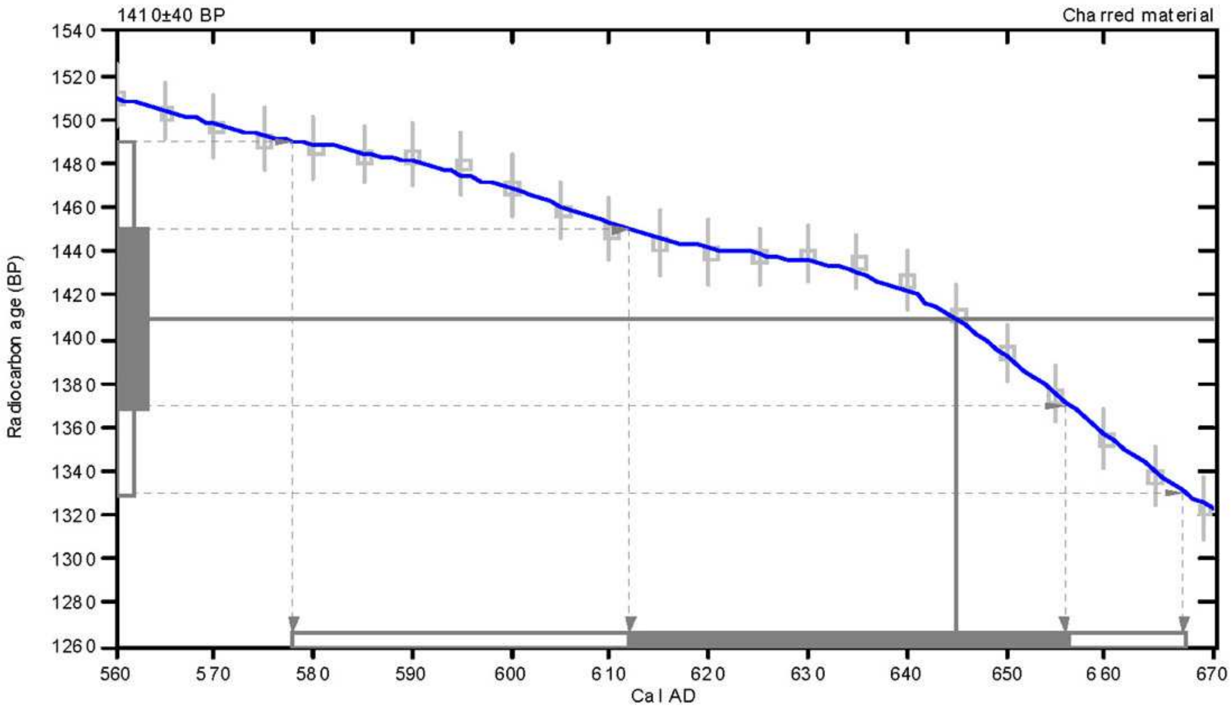

Figure 10. Calibration of radiocarbon age to calendar years for PACP Sample No. E/9-1 (Beta-228170) provided by Beta Analytic, Inc.

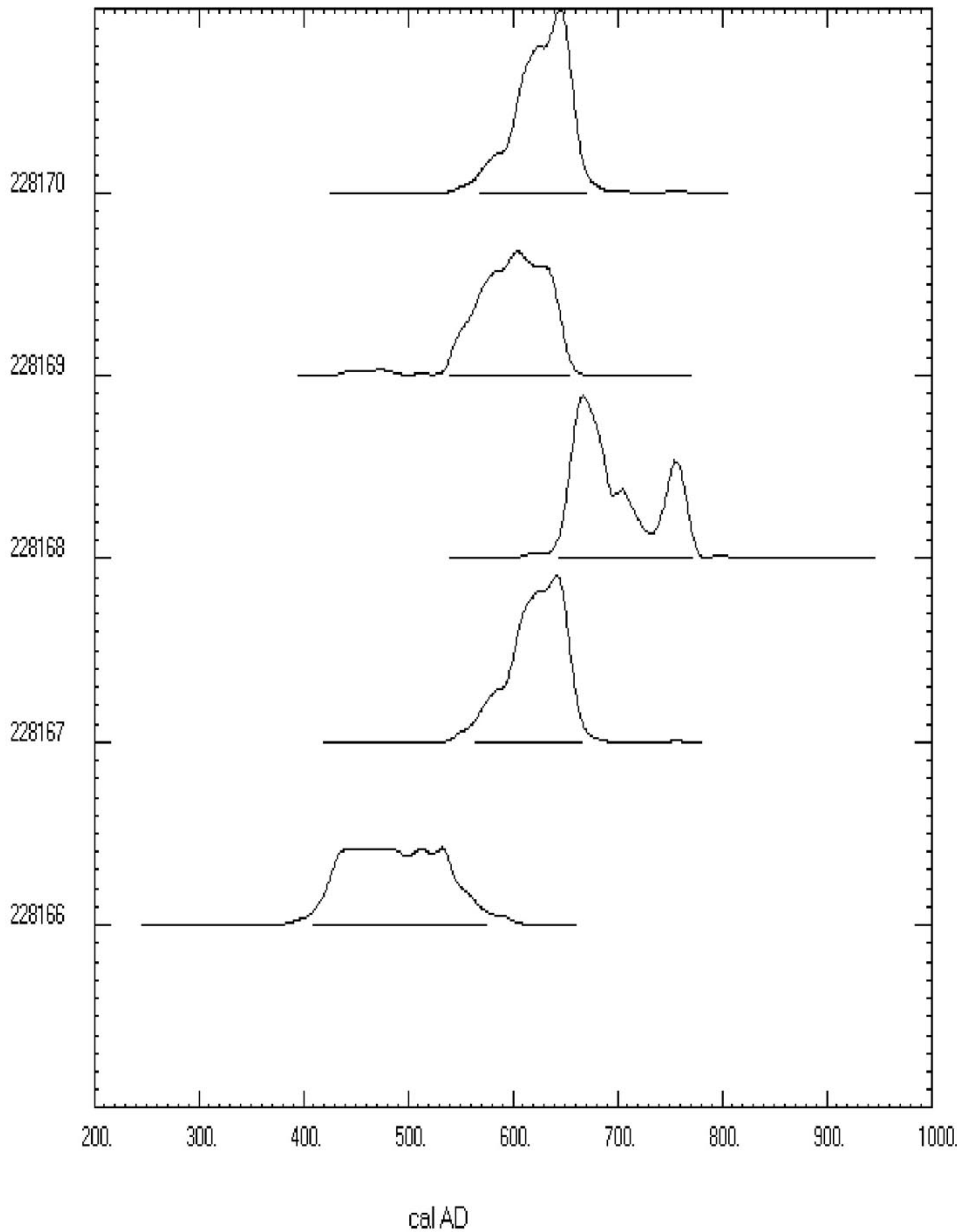

Figure 11. A composite view (produced by CALIB version 5.10) of the probability curves for all calibrated dates (n=5).

Several methods exist for making sense of calibrated dates, including averaging or pooling dates and identifying statistical outliers (e.g., Aitchinson et al. 1991; Buck et al. 1994; Long and Rippeteau 1974; Ward and Wilson 1978). However, central tendencies (i.e., mean values) are not useful for comparing the absolute age of phases, since phases are not single events. Rather, as Eighmy and LaBelle (1996) advocate, it is often more appropriate to determine an age range for them, using Bayesian statistics, for instance (e.g., Buck et al. 1996). They express phase age in terms of a range of dates with a pooled probability between 0.025 and 0.975 (the two-sigma range) or between 0.158 and 0.841 (the one-sigma range). These probability ranges are calculated by pooling the calibrated probability distributions for each sample (such as determined by the IntCal04 software) and standardizing them by the number of radiocarbon determinations used to date the phase (Eighmy and LaBelle 1996:54). The distribution of time interval probabilities produces a histogram reflecting the distribution of pooled (and standardized) probabilities for the phase. The standardization of the distribution (i.e., weighting the "average" or pooled distribution) allows one to compare directly the calibrated phase ages of different phases independent of the number of samples used.

There are a number of on-line software programs, such as BCal (http://bcal.shef.ac.uk) and DateLab (http://www.datelab.org), which make use of Bayesian techniques for calibrating radiocarbon dates using pooled probability distributions. We used CALIB version 5.10, created by M. Stuiver, P.J. Reimer, and R. Reimerthe (http://calib.qub.ac.uk/calib). The program makes the conversion from radiocarbon age to calibrated calendar years by calculating the probability distribution of the sample's true age. Probabilities are ranked and summed to find the 68.3 percent (one-sigma) and 95.4 percent (two-sigma) confidence intervals and the relative areas under the probability curve for the two intervals calculated.

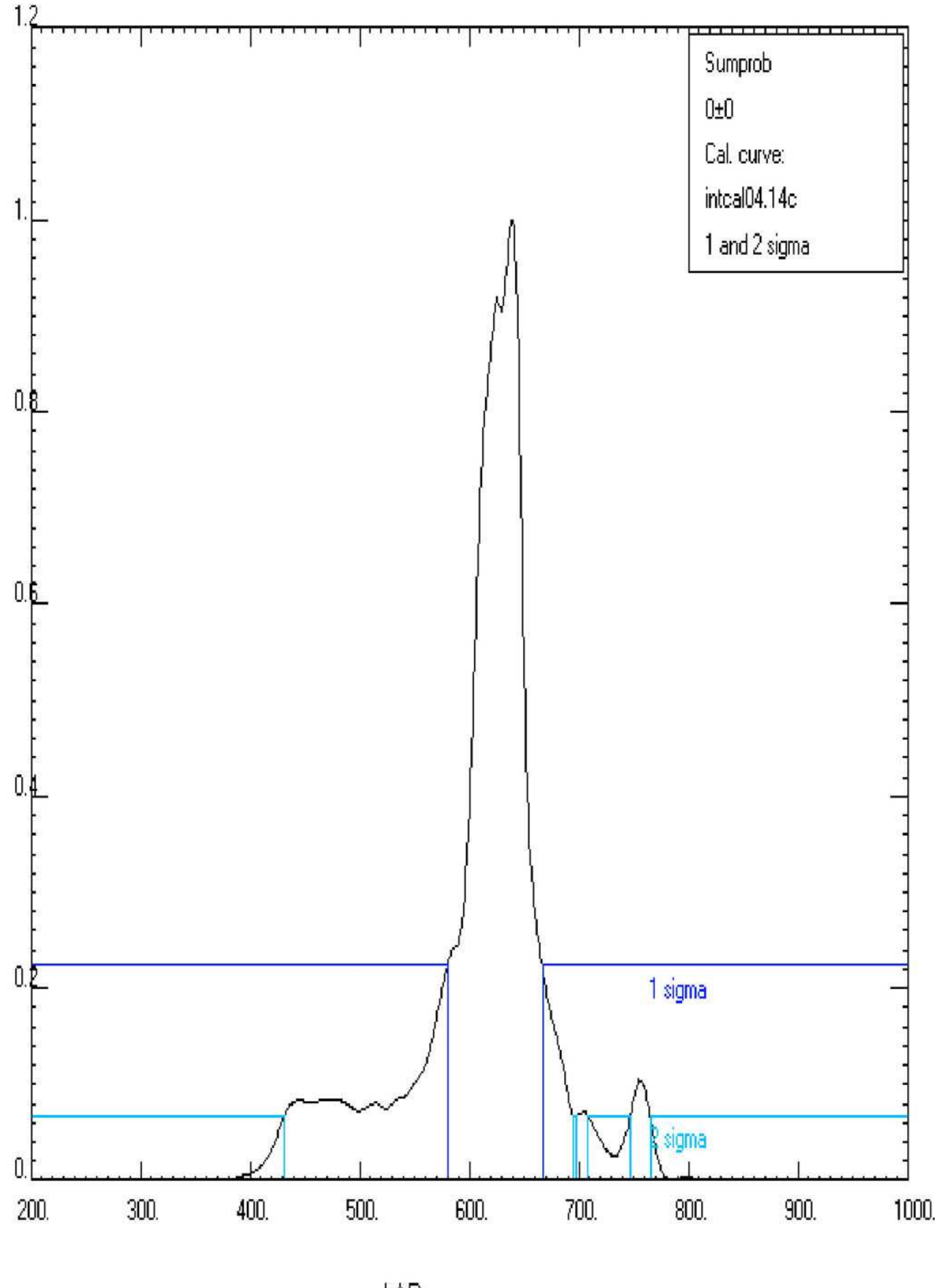

Figure 12. A normalized (p = 1.0) pooled probability date range (showing 1σ and 2σ intervals) for the calibrated dates (n=4) associated with the vase.

Figure 12 shows a normalized (p = 1.0) pooled probability date range for the organic material associated with the vase. The one-sigma range encompasses cal AD 580-670, while the two-sigma range is cal AD 430-765. Both ranges clearly support Luke's chronological assessment (based on her stylistic seriation) of AD 700 ± 50 for this style of vase, although our data suggest the earlier part of the range for this particular vessel. This range places the deposition of the vase sometime at the end of the Early Classic or the beginning of the Late Classic. It also indicates that the vase was placed as an offering in the burial approximately a century after the body was originally interred (cal AD 495 ± 85 or cal AD 410-580). A one-sample Student's t-test (t = 2.15, df = 7, p = 0.07) of the one-sigma range of dates for the vase (cal AD 580-670) compared against the upper limit of the burial date (AD 580) suggests that the two events (burial of the body and interment of the vase) did not occur simultaneously. However, this assessment does not take into account the cultural and natural formation processes of the burial and its contents.

Broader Impacts

An effective Ulúa marble vase radiocarbon chronology from northwest Honduras will help bridge the unfortunate gap that currently exists for the vases, which are currently dated only by ceramic cross-ties and by association with settlement sites that are dated by radiocarbon techniques. By filling this gap, it will be possible for the first time to compare marble vases from multiple contexts directly and help determine the meaning of their stylistic differences. Furthermore, dating the Site X vase has provided an important springboard for exploring important questions about social organization in the Classic period, and can lead to revised insights about the growth and development of complex societies in southeastern Mesoamerica.

Acknowledgments

The University of South Florida (USF) Proyecto Arqueológico Comunidad Palmarejo (PACP) is conducted with the permission of the Instituto Hondureño de Antropología e Historia (IHAH). We appreciate the support and advice of Darío A. Euraque, IHAH Gerente. The PACP is funded by the National Geographic Society, the Foundation for the Advancement of Mesoamerican Studies, Inc., and various granting agencies at USF, including the Office of Research and Scholarship, the Office of Undergraduate Research, the Institute for the Study of Latin America and the Caribbean, and the Dr. Kiran C. Patel Center for Global Solutions. Excavation of the burial and related deposits discussed in this report was supervised by Karla L. Davis-Salazar and José E. Moreno-Cortés (both University of South Florida). Excavation of the associated building was conducted by William A. Klinger (University of South Florida). Bioarchaeological analysis was undertaken by Anna C. Novotny (Arizona State University). Pollen analysis of the vase's contents was performed by Glenn S. L. Stuart (Archaeological Consulting Services). Related geoarchaeological work was carried out by David D. Kuehn (David Kuehn Consulting). We are grateful to Edward M. Schortman and Patricia A. Urban (both Kenyon College) for their assistance, collaboration, and encouragement.

List of Figures

List of Tables

Sources Cited

Aitchinson, T., B. Ottaway, and A. S. Al-Ruzaiza
1991 Summarizing a Group of 14C Dates on the Historical Time Scale: With a Worked Example from the Late Neolithic of Bavaria. *Antiquity* 65:108-116.

Bowman, S. G. E., and M. N. Leese
1995 Radiocarbon Calibration: Current Issues. *American Journal of Archaeology* 99:102-105.

Buck, C. E., and J. A. Christen
1998 A Novel Approach to Selecting Samples for Radiocarbon Dating. *Journal of Archaeological Science* 25:303-310.

Buck, C. E., C. D. Litton, and E. M. Scott
1994 Making the Most of Radiocarbon Dating: Some Statistical Considerations. *Antiquity* 68:252-263.

Buck, C. E., W. G. Cavanagh, and C. D. Litton
1996 *The Bayesian Approach to Interpreting Archaeological Data*. Wiley, Chichester, UK.

Christen, A., and C. E. Buck
1998 Sample Selection in Radiocarbon Dating. *Applied Statistics* 47:543-557.

Cowgill, G. L.
1964 The Selection of Samples from Large Sherd Collections. *American Antiquity* 29:467-473.

Davis-Salazar, K. L., E. C. Wells, and J. E. Moreno-Cortés
2007 Balancing Archaeological Responsibilities and Community Commitments: A Case from Honduras. *Journal of Field Archaeology*, in press.

Davis-Salazar, K. L., E. C. Wells, and J. E. Moreno-Cortés
2005 *Proyecto Arqueológico Comunidad Palmarejo: informe preliminar, segunda temporada*. Report submitted to the Instituto Hondureño de Antropología e Historia, Tegucigalpa, Honduras.

Dean, J. S.
1991 Thoughts on Hohokam Chronology. In *Exploring the Hohokam: Prehistoric Desert Peoples of the American Southwest*, edited by G. J. Gumerman, pp. 61-150. University of New Mexico Press, Albuquerque.

Eighmy, J. L., and J. M. LaBelle
1996 Radiocarbon Dating of Twenty-Seven Plains Complexes and Phases. *Plains Anthropologist* 41:53-69.

Gordon, G. B.
1921 The Ulúa Marble Vases. *The Museum Journal* 12:53-74.

1920 A Marble Vase from the Ulúa River, Honduras. *Art and Archaeology* 9:141-45.

Joyce, R. A.
1993 Appendix A: A Key to Ulúa Polychromes. In *Pottery of Prehistoric Honduras: Regional Classification and Analysis*, edited by J. S. Henderson and M. Beauty-Corbett, pp.257-279. Institute of Archaeology, University of California, Los Angeles.

Kidder, A.V.
1947 *Artifacts of Uaxactún*. Publication No. 576. Carnegie Institution of Washington, Washington, DC.

Libby, W. F.
1955 *Radiocarbon Dating*. Second edition. University of Chicago Press, Chicago, Illinois.

Long, A., and R. B. Rippeteau
1974 Testing Contemporaneity and Averaging Radiocarbon Dates. *American Antiquity* 39:205-215.

Luke, C.
n.d. Travesía and the Patronage of Production of Classic Period Ulúa Marble Vases. In *Another Way of Being Maya: Local Practices and History in the Ulúa Valley, Honduras*, edited by R. A. Joyce and J. S. Henderson. University Press of Florida, Gainesville, in press.

2006 Carving Luxury: Late Classic White Stone Vase Traditions in Mesoamerica. In *New Approaches to Old Stones: Recent Studies of Ground Stone Artifacts*, edited by Y. M. Rowan and J. R. Ebeling. Equinox Publishing, London, in press.

2003 *Ulúa-Style Marble Vase Project: Dissemination of Results*. Report submitted to the Foundation for the Advancement of Mesoamerican Studies, Inc.

2002 *Ulúa Style Marble Vases*. Ph.D. dissertation, Cornell University, Ithaca, New York.

Luke, C., and R. H. Tykot
2002 Marble Sources and Artifacts from the Ulúa Valley, Honduras. In *ASMOSIA 5: Interdisciplinary Studies on Ancient Stone*, edited by J. J. Herrmann, N. Herz, and R. Newman, pp. 394-406. Archetype Publications, London.

Luke, C., R. H. Tykot, and R. W. Scott
2006 Petrographic and Stable Isotope Analyses of Late Classic Ulúa Marble Vases and Potential Sources. *Archaeometry* 48:13-29.

Luke, C., R. A. Joyce, J. S. Henderson, and R. H. Tykot
2003 Marble Carving Traditions in Honduras: Formative through Terminal Classic. In *ASMOSIA 6: Interdisciplinary Studies on Ancient Stone*, edited by L. Lazzarini, pp.485-496. Bottega d'Erasmo, Padova, Italy.

Novotny, A. C.
2006 Bioarchaeological Report for the Proyecto Arqueológico Comunidad Palmarejo. Unpublished manuscript on file, Department of Anthropology, University of South Florida, Tampa.

Orton, C.
2000 *Sampling in Archaeology*. Cambridge University Press, Cambridge, UK.

Pendergast, D. M.
1990 *Excavations at Altun Ha, Belize*. Volume 3. Royal Ontario Museum, Ontario, Canada.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. J. H. Bertrand, P. G. Blackwell, C. E. Buck, G. S. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, A. G. Hogg, K. A. Hughen, B. Kromer, F. G. McCormac, S. W. Manning, C. B. Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. S. Talamo, F. W. Taylor, J. van der Plicht, and C. E. Weyhenmeyer
2004 IntCal04: Terrestrial Radiocarbon Age Calibration, 26-0 ka BP. *Radiocarbon* 46:1029-1058.

Stone, D. Z.
1938 *Masters in Marble*. Publication No. 8, Part 1. Middle American Research Institute, Tulane University, New Orleans, Louisiana.

Stuart, G. S. L.
2007 Archaeobotanical Analysis of a Burial in the Palmarejo Valley. Unpublished manuscript on file, Department of Anthropology, University of South Florida, Tampa.

Stuiver, M., and B. Becker
1986 High-precision Decadal Calibration of the Radiocarbon Time Scale, A.D. 1950-2500. *Radiocarbon* 28:863-910.

Stuiver, M., and G. W. Pearson
1986 High-precision Decadal Calibration of the Radiocarbon Time Scale, A.D. 1950-500 B.C. *Radiocarbon* 28:805-838.

Stuiver, M., and H. E. Suess
1966 On the Relationship between Radiocarbon Dates and True Sample Age. *Radiocarbon* 8:534-540.

Taylor, R. E.
1987 *Radiocarbon Dating: An Archaeological Perspective*. Academic Press, Orlando, Florida.

1995 Radiocarbon Dating: The Continuing Revolution. *Evolutionary Anthropology* 4:169-181.

Thompson, J. E. S.
1939 *Excavations at San José, British Honduras*. Publication No. 506. Carnegie Institution of Washington, Washington, DC.

Urban, P. A.
1993 Naco Valley. In *Pottery of Prehistoric Honduras: Regional Classification and Analysis*, edited by J. S. Henderson and M. Beaudry-Corbett, pp. 30-63. Institute of Archaeology, University of California, Los Angeles.

Viel, R.
1978 *Etude de la céramique Ulúa-Yojoa Polychrome (Nord-Ouest de Honduras): Essai d' analyse stylistique du Babilonia*. Ph.D. dissertation, Université René Descartes, Paris.

Vogel, J. C., A. Fuls, and E. Visser
1993 Pretoria Calibration for Short-lived Samples, 1930-3350 BC. *Radiocarbon* 35(1):73-85.

Ward, G. K., and S. R. Wilson
1978 Procedures for Comparing and Combining Radiocarbon Age Determinations: A Critique. *Archaeometry* 20:19-31.

Wells, E. C., K. L. Davis-Salazar, and J. E. Moreno-Cortés
2004 *Proyecto Arqueológico Comunidad Palmarejo: Informe preliminar, primera temporada*. Report submitted to the Instituto Hondureño de Antropología e Historia, Tegucigalpa, Honduras.

Wells, E. C., J. E. Moreno-Cortés, and K. L. Davis-Salazar
2006 *Proyecto Arqueológico Comunidad Palmarejo: Informe preliminar, tercera temporada*. Report submitted to the Instituto Hondureño de Antropología e Historia, Tegucigalpa, Honduras.

Table 1. AMS Radiocarbon Dating of the Ulúa-style Marble Vase from the Palmarejo Valley.

Lab No.	PACP No.	Context	Measured Age (BP)	13C/12C Ratio (o/oo)	Conventional Age (BP)	Cal (BP)	Cal (AD)
Beta-228166	E/3-2	burial	1600 ± 40	-26.7	1570 ± 40	1540-1370	495 ± 85
Beta-228167	E/7-1	near vessel	1400 ± 40	-23.6	1420 ± 40	1380-1280	615 ± 45
Beta-228168	E/7-2	below vessel	1330 ± 40	-25.2	1330 ± 40	1300-1180	705 ± 65
Beta-228169	E/7-3	below vessel	1480 ± 40	-26.5	1460 ± 40	1410-1300	595 ± 55
Beta-228170	E/9-1	near vessel	1410 ± 40	-25.3	1410 ± 40	1370-1280	625 ± 45

Note: measured and conventional ages represent uncalibrated 1σ (p = 0.68) radiocarbon years. Calibrated (Cal) ages are 2σ (p = 0.95).