Before the Volcano Erupted

The Ancient Cerén Village in Central America

EDITED BY PAYSON SHEETS

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THE ANCIENT CERÉN VILLAGE IN CENTRAL AMERICA

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Dedicated to the life,
accomplishments,
and humanity
of our friend and colleague

VÍCTOR MANUEL MURCIA,

of Chalchuapa, El Salvador

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Preface

Payson Sheets

As with many archaeological sites, the Cerén site was discovered by accident, as a bulldozer was flattening a hill for a construction project. It took a couple years to realize what was there, but now the site is a World Heritage Site (listed with the United Nations) and well protected and curated by the government of El Salvador. It is to the officials of the Ministry of Education, and particularly of CONCULTURA (Consejo Nacional para la Cultura y el Arte), that we owe a great debt of gratitude for their dedication to the conservation of the site. They have also led the way to opening the site for public visitation. A nongovernmental organization called the Patronato Pro-Patrimonio Cultural has been of great assistance in training guides and designing the part of the site open to public access. The Patronato officials have been very helpful to the project as well.

The Museo Nacional David J. Guzmán has been highly professional in its care and curation of the great numbers of artifacts that have come from Cerén. The Jardín Botánico La Laguna has been helpful in the temporary storage of plant casts as well as assisting in field identification of plants found at the site.

The U.S. National Science Foundation has been supportive in providing funding for the major field seasons with grant no. 9006482 and others. The Committee for Research and Exploration of the National Geographic Society has awarded grants for other field seasons. The support of these institutions is greatly appreciated. The University of Colorado has assisted with supplementary grants and awards. The current participation of the Getty Conservation Institute in assisting with the monitoring of on-site conditions and the creation of a management plan for the region is appreciated.

A hearty "muchísimas gracias" is expressed to the crew of Salvadoran workers from Chalchuapa and Joya de Cerén who have learned such fine excavation and conservation techniques. It is an honor to work with such qualified and dedicated people.

The research reported herein is the result of the hard work of the professional staff of the Cerén Research Project. Their wide span of disciplines ranges from archaeology to volcanology and includes geophysics, ethnobotany, ceramics, and other specialties. It is difficult to express in words my appreciation for their dedication to the site, trying to understand what happened some 1,400 years ago in a village in southern Mesoamerica.

The authors of these chapters have tried to keep their words to a minimum, and to include only illustrations that are absolutely necessary, in order to keep printing costs, and thus the price to the public, reasonable. The data-rich and illustration-rich materials, as well as the full text of all reports written to cover each season's research, are available on the CD-ROM *An Interactive Guide to Ancient Cerén: Before the Volcano Erupted* by Jen S. Lewin, Mark A. Ehrhardt, Mark D. Gross, and Payson Sheets and at the Cerén Internet website (URL http://ceren.colorado.edu). Readers desiring more information or illustrations are encouraged to access one of these sources.

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Introduction

Payson Sheets, with an Appendix by Brian R. McKee

This chapter begins with consideration of the natural and cultural environments of the site, and then turns to the theoretical context within which the research is being conducted. That discussion is followed by a brief history of the property on which the site has been located over the past three decades, up to the present. Next follows a description of the multidisciplinary and interdisciplinary research project, in which archaeology, ethnobotany, volcanology, and geophysics are integrated with architectural and objects conservation, site and regional master planning, and outreach and educational efforts. The cooperative efforts of the Salvadoran government, particularly CONCULTURA within the Ministry of Education, and of the nongovernmental organization Patronato Pro-Patrimonio Cultural are then described. That is followed by an overview of the organization of the book and how the chapters integrate with the wealth of data, text, pre-eruption site reconstruction, and images available on the CD-ROM *An Interactive Guide to Ancient Cerén: Before the Volcano Erupted* and the Cerén website (the URL address is http://ceren.colorado.edu). The text and illustrations of this book have been deliberately kept to a minimum to keep costs down, but an abundance of illustrations and detailed data are available on the CD-ROM and the website.

The Natural Environment

The Cerén site is located in the northern end of the broad Zapotitán Valley in what is now El Salvador (Fig. 1.1). The site's elevation is 450 m, which combined with the 14°N latitude and topography gives the area a tropical monsoon climate (Sheets 1992a). The area receives 1,700 ± 300 mm of precipitation per year; thus dryland maize agriculture is generally quite productive. However, some years have either too much or too little rainfall, and traditional agriculturalists that are not irrigating their fields today must have ways to adjust to that range. Fully 96% of the rain falls in the rainy season from May through October, and the dry season is hot and very dry.

The average annual temperature is 24°C (75°F), with December the coolest month (mean 22°C [67°F]) and April the hottest month (26°C [83°F]). The temperature fluctuation from daytime to nighttime is greater than the seasonal fluctuation, and even in April the nights are comfortable. Markgraf (1989) found no evidence of significant climatic change within the past 3,000 years in Central America, but separating the climatic component from human impact on the environment is difficult. Thus, for our purposes here, we will take the present climate as a reasonable approximation of the climate during the mid-Classic Period.

Daugherty (1969) reconstructed the native climax vegetation of the Zapotitán Valley. Along the rivers and around the big lake in the center of the valley were gallery forests, composed of many different species, that had access to groundwater and thus remained green even at the height of the dry season. Over most of the rest of the valley were less dense forests of deciduous trees that would largely shed their leaves at the height of the dry season, but would remain lush for most of the year. Human impact on the natural vegetation must have been considerable by the Classic Period but not as great as it is in the valley today.

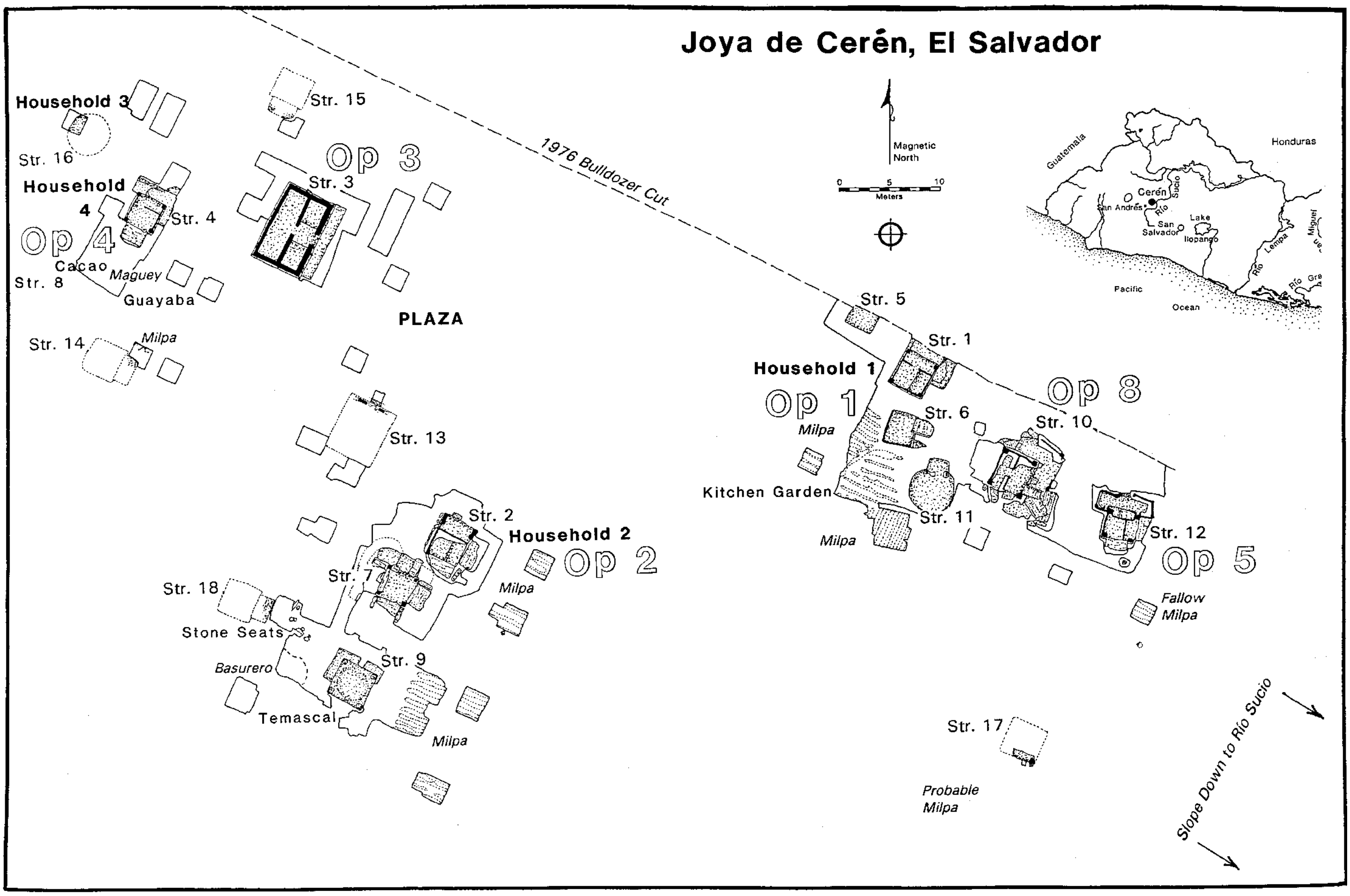


FIGURE 1.1. Map of the Cerén site, with operation and household numbers identified, and agricultural fields around them. The lines around the structures and agricultural fields are limits of excavations. Operation 1 includes all four buildings of Household 1. The two religious buildings, Structures 10 and 12, are in Operations 8 and 5 respectively. Operation 2 includes two household buildings of Household 2 and the sweat bath (Structure 9). Operation 3 includes Structure 3, and Operation 4 includes Structure 4 and the specialized gardens and orchard around it. The inset map shows the location of the Cerén site within western El Salvador.

The area has been and continues to be very active volcanically, with volcanoes ringing the valley, dominated by the San Salvador volcano complex on the eastern side and the Santa Ana volcano complex on the western side. Even major volcanoes are strikingly recent; Izalco Volcano was born in 1770 and continued erupting until 1965. The area was active in the Pliocene and Pleistocene, with the cataclysmic Coatepeque eruption (sometime between 10,000 and 40,000 years ago) conceivably affecting early human populations. The huge Ilopango eruption (Sheets 1983) about 1,800 years ago[1] devastated the valley by covering it with a blanket of sterile, white acidic ash from 1 to 5 m deep, which wiped out flora, fauna, and people. The archaeological record indicates a century or two of weathering were necessary before soils and plants recovered sufficiently to support human reoccupation. The Cerén site was one of the pioneering communities reoccupying the valley, but it existed there for perhaps only a century before it was entombed by the Loma Caldera eruption. In contrast to the earlier great eruptions, the Loma Caldera eruption affected only the few square kilometers surrounding the vent. Some time around A.D. 1000, San Salvador Volcano erupted and deposited a thick wet blanket of ash over a moderately large territory. In the historic period, the latest eruption to deposit airfall volcanic ash over the valley was the A.D. 1658 eruption of Playón Volcano. Since that time, the most common eruptions have been lava flows that covered a few square kilometers at various times. Much of the reason for the high fertility of the soils in the valley is that they are volcanically derived in an area with sufficient moisture for exuberant plant growth.

The Cultural Environment

The southeastern portion of Mesoamerica, otherwise known as the Southeastern Maya periphery, encompasses the present country of El Salvador and western Honduras. Archaeological research began more than a century and a half ago in this zone with the work of Stephens and Catherwood. More recent research is summarized by Healy (1984) and Sheets (1984), and in the volumes edited by Urban and Schortman (1986), Pahl (1987), and Robinson (1987). Of course, most research has been in elite contexts, but there has been a steady growth of interest in commoners in the past couple decades, a topic developed in the next section.

Within the Zapotitán Valley of El Salvador, the earliest serious archaeological research was the excavations at Campana San Andrés, the largest site in the valley and certainly the religious, economic, and political center of Classic Period society. Unfortunately, that research is published only in four short preliminary reports and summarized in Longyear (1944: 10).

It is difficult to study ethnicity at sites without hieroglyphics in southern Mesoamerica, and the ethnicity of Classic Period residents of the Zapotitán Valley is not clear. They certainly had Maya-related architecture and artifacts, but the language they spoke in the Preclassic and Classic Periods is unknown. The multiple structures with specialized uses per household, the pervasiveness of Copador ceramics in commoner and elite contexts, the "flint" (really chert) eccentric and jades at San Andrés were all clearly Maya in derivation, but the lack of hieroglyphics in the Zapotitán Valley and the lack of household shrines at Cerén may reflect a non-Maya or frontier Maya background with significant acculturation to Maya architecture and artifacts.

Black (1983) described the settlement system in the valley contemporary with Cerén as a hierarchy from the large primary regional center of San Andrés to the isolated hamlet. Below San Andrés in the hierarchy were secondary regional centers with substantial pyramidal architecture, followed by large villages with ritual construction (smaller pyramids), large to small villages, and hamlets. Cerén fits well in this hierarchy as a medium-sized village. The production and distribution of obsidian implements was found to be quite sensitive to the settlement hierarchy, reflecting variation in access to long-distance traded commodities, craft specialization, and other factors (Sheets 1983). Population density in the Middle Classic Period was relatively high in the basin area around Lake Zapotitán and along the river courses, estimated by Black (1983: 82) at 165–440 people/km^2, but much lower in hilly and mountainous areas, for an overall regional population density of 70–180 people/km^2. The valley is thus intermediate between the exceptionally high densities of the Southern Maya lowlands and the Intermediate Area to the southeast.

The Theoretical Context

The theoretical context within which the Cerén Research Project has been conducted is household archaeology, focusing on the household as the domestic coresidential social and adaptive unit intermediate between the individual and the neighborhood. One reason for the strength and success of household archaeology is the breadth of its origins in settlement archaeology (Willey et al. 1965; Chang 1968), ethnography (Wilk 1988; Wisdom 1940), ethnoarchaeology (Kramer 1982b; Wauchope 1938), and cognate social sciences (Arnould 1986). It is now a field with ethnographic sophistication, improving field techniques (Hayden and Cannon 1984), and an emerging corpus of appropriate methods and theory (Netting, Wilk, and Arnould 1984; Wilk and Rathje 1982; Santley and Hirth 1993; Ringle and Andrews 1983; Wilk and Ashmore 1988).

Considerable household archaeology has been conducted in Oaxaca (Flannery 1976; Marcus 1989) and at Copán (Webster and Gonlin 1988), among other areas. The commoners living in the Copán area but at a distance from the big Copán site lived in very basic housing (Webster, Gonlin, and Sheets 1997). Housing closer to the site center was more formal and substantial, with rectangular substructures, terraces, and interior benches (some of which had niches). Cerén is most similar to the middle range of Copán residences.

Craft specialization is one among many means of production, and archaeologists have studied production and specialization most successfully in civilizations and in regions. Generally, the nature of preservation at most archaeological sites limits the extent to which production and specialization can be studied within a community and especially within a particular household. The exceptional preservation at Cerén permits a detailed study of household production and specialization, and even exploring possible service relationships between households and nearby institutions or specialized structures within the community. It also provides the opportunity to study exchanges between households within the community and craft production to exchange for distant items in the regional economy.

Wilk and Rathje (1982) certainly were correct in stating that households in sedentary societies were immersed in material culture. Even that observation did not prepare us for the astounding total of over seventy ceramic vessels per household at Cerén.

Each Cerén household is examined here for its artifacts, architecture, activity areas, food and craft production, and storage. As households did not exist in isolation, the relationships of each household to the community and the possible service relationships that each had to specialized facilities, such as a feasting structure and a communal sweat bath, are explored. Each household overproduced at least one craft or commodity and used that for exchange within the community and to obtain long-distance traded items that generally were produced by specialists, such as obsidian tools, hematite pigments, and jade axes.

FIGURE 1.2. The earthen columns and floor of Structure 1 in the bulldozer cut in 1978, during first recording. Below the structure is the fertile Preclassic soil, buried by white Ilopango volcanic ash in about A.D. 200. Weathering allowed for human reoccupation a couple of centuries later; the pits on the lower left are borrow pits for house construction. The alternating steam explosion layers (lighter colored) and direct airfall layers (darker) from the Loma Caldera eruption in about A.D. 600 buried the building and site deeply.

The Recent History of the Property and the Site

The property that includes the Cerén site has been in Salvadoran federal governmental hands for the past few decades. The northern part of the site belonged to the Instituto Regulador de Abastecimientos (IRA; Food Regulation Institute), which began constructing a grain storage silo complex in 1976 and made first contact with the site by means of a bulldozer blade. The Instituto Salvadoreño de Transformación Agraria (Salvadoran Agrarian Reform Institute) owned the adjacent southern part of the site. Both parts were transferred to the Ministry of Education in 1992 and are officially a National Archaeological Monument.

After the site was declared a National Archaeological Monument by the Salvadoran government, it was nominated for, and achieved World Heritage Site status by the United Nations (UNESCO) in 1993. The site and museum have been open to the public since 1993 and continue to receive a few thousand visitors per week.

The Research Project

The Cerén site and the surrounding territory were buried so rapidly and deeply by the Loma Caldera eruption at about A.D. 600 that they were forgotten and left untouched for centuries. In 1976 that abruptly changed during the bulldozing for the IRA grain storage silos. When the bulldozer operator encountered earthen architecture and ceramic artifacts, he stopped, notified the Museo Nacional David J. Guzmán (MNDG), and waited three days until the museum archaeologist inspected the site. The archaeologist stated that the site must be recent, because of its exceptional preservation, and the bulldozing should continue. We estimate that at least a dozen buildings were destroyed, but much of the site remained intact to the south and west. When I visited the site 2 years after the bulldozing, the floors of Structures 1 and 5 were visible in the bulldozer cut (Fig. 1.2). I too shared the initial impression of recency, but could only find Classic Period artifacts, and so submitted preserved roofing thatch for radiocarbon dating. The numerous samples yielded a composite C14 date of A.D. 590 ± 90 (Sheets 1983). The dating was substantiated and refined by Dan Wolfman (personal communication 1990), who used archaeomagnetism to date the eruption to between A.D. 585 and 600 (2-sigma range). As noted by Sheets (1992a) and Conyers (1996), the numerous seasonally sensitive plants preserved at the site indicate the eruption probably occurred in August. Further, the positions and conditions of artifacts indicate the eruption probably occurred in the early evening, after dinner was served but before the dishes were washed, likely between 6:00 and 7:00 P.M. Ironically, we are able to date the larger time category, the year, less precisely than the finer time categories, the month and time of day.

Zier (1983) described the 1978 excavations in Structures 1 and 5, adjoining areas, and two test pits that found a fallowed maize field and a maize field that had been harvested and recently replanted with the second crop. Supported by the National Geographic Society, geophysical explorations with ground-penetrating radar, resistivity, and seismic refraction were conducted during the succeeding two field seasons, in 1979 and 1980, in which anomalies were recorded and some were confirmed as Classic Period structures (Sheets et al. 1985). The Salvadoran civil war became too intense for sustained fieldwork for most of the 1980s, but we did return for research seasons in 1989, 1990–1991, 1992, 1993, and 1996, supported by the National Science Foundation and the University of Colorado. The Committee on Research and Exploration of the National Geographic Society is funding current research. The research has been overtly multidisciplinary and interdisciplinary, integrating archaeology with volcanology, ethnobotany, geophysics, and a conservation program that focuses on vegetation, architecture, and artifacts within the Classic Period landscape. Those endeavors are integrated with an educational outreach program that includes an on-site museum, trained guides, and educational paths that provide public access for viewing most excavated structures and the agricultural fields around them. Master plans for regional and site management are under development, with the assistance of the Getty Conservation Institute.

This Book, the Website, and the CD-ROM

If we published a detailed printed site report, with the full range of archaeological, volcanological, ethnobotanical, and geophysical research results, along with architectural and artifactual conservation, the cost would be prohibitive. Therefore, what is printed here represents the cream of the research results in each category, with the data for each season and discipline available on the Internet at the website (URL http://ceren.colorado.edu) and also available on the CD-ROM *An Interactive Guide to Ancient Cerén: Before the Volcano Erupted.* Thus, we believe this represents the best solution to the problems of data and interpretation availability, soaring printing costs, and the need to share a great amount of research data from a variety of disciplines at the Cerén site.

This volume begins with volcanology, geophysics, and paleoethnobotany in Part I. This is followed by Part II, which examines the four households excavated to date, one fully excavated and the others in varying stages of completion. The excavations at Cerén must be done with great care and are integrated with conservation, with an objects conservator present during all excavations, so that the result is very cautious research and thus a small sample. Only some 900 m^2 of the village have been excavated to date. The special buildings in the Cerén village are then presented in Part III. They include a civic complex, a sweat bath, a religious association, and a structure in which we believe a woman shaman practiced. Following, in Part IV, are chapters on artifacts, including ceramics, chipped stone, groundstone, bone and shell, and organic artifacts. Part V, the final section of this volume, covers topics such as conservation, agriculture, household production and specialization, an ethnographic overview of the present town of Joya de Cerén, and a summary and conclusions.

Table 1.1 presents each Cerén structure excavated, or at least partially excavated, together with its Operation number and the interpretation of its function or functions. To date we have completely excavated eleven buildings, and have excavated portions of seven others. Using geophysical techniques, particularly ground-penetrating radar but also resistivity and two other techniques, we have detected numerous other anomalies, most of which probably will turn out to be structures. As the buildings are excavated and their artifacts are analyzed, the functions of the buildings become clear, and we can begin to see groupings. Four buildings of Household 1 have been excavated, including a domicile (for sleeping, eating, and various daytime activities), a storehouse, a kitchen, and a ramada-style building that occasionally was used for chipped stone tool maintenance, among other functions (Structures 1, 6, 11, and 5, respectively). Two buildings of Household 2 have been excavated, the domicile and the storehouse (Structures 2 and 7). The kitchen has yet to be excavated, and we do not know if Structure 18 is a part of this household. Only a part of the kitchen of Household 3 is known (Structure 16). The storehouse of Household 4 has been

TABLE 1.1. Operation Numbers, Structure Numbers, and Functions of Structures at Cerén

Operation No.	*Structure No.*	*Function*
1	1	Domicile (living, crafts, sleeping) of Household 1
1	5	Some stone working, Household 1
1	6	Storehouse of Household 1
1	11	Kitchen of Household 1
2	2	Domicile of Household 2
2	7	Storehouse of Household 2
2	9	Sweatbath (temascal)
3	3	Special, probably civic
4	4	Storehouse, agave working, Household 4
5	12	Divination, probably by a woman
6	none	2 large test pits north of Structure 4
7	13	Special, probably civic
7	14	Unexcavated; bajareque, probably a household building
7	15	Unexcavated, bajareque, probably a household building
7	16	Slightly excavated, a kitchen, Household 3
8	10	Building for ceremonial feasting
9	17	Slightly excavated, corner of platform and earthen column

excavated, and it is a storehouse and much more (Structure 4). The maguey (*Agave americana*) garden south of the building produced fiber for about a dozen households; the leaves were depulped to liberate the fibers using Structure 4's northeast corner pole.

In the center of the site is a civic complex made of a constructed flat plaza surrounded by buildings. The large Structure 3 defines its west end and may have been used for ajudication of disputes, based upon the large benches perhaps symbolizing the authority of the village elders seated upon them. A similarly imposing building (Structure 13) is on the plaza's south side, and judging from the tiny portion excavated, it is loaded with artifacts. Radar has apparently detected two buildings on the east side of the plaza, and a person who witnessed the 1976 bulldozing claimed to have seen a similar large building to the north of the plaza, but we have no way to confirm this.

To the south of Household 2 is a large sweat bath, Structure 9, sufficient to seat almost a dozen people and thus probably a neighborhood or community facility. A thatched roof protected its elegant earthen dome. It is likely that Household 2 residents maintained the structure and perhaps the functioning of the sweat bath with firewood and water, but we have no direct evidence of that possible service relationship other than the large number of vessels in Structure 7 that could have stored water.

Two religious buildings are located at the topographically highest location of the site, overlooking the river. The structure closest to Household 1 clearly supported ceremonial feasting, with the sacred artifacts (e.g., deer skull headdress, obsidian blade with human hemoglobin residues, alligator vessel with achiote seeds for red pigment) stored in the innermost two rooms. The outer enclosure was for temporary food storage, processing, and disbursement to ceremony participants. There are strong indications that Household 1 had a service relationship to the feasting building. It appears a ritual was in progress or had just been completed at the time of the eruption, perhaps the Maya *cuch,* a ritual focusing on the first maize harvest, deer, and the fertility of nature (Brown 1996). The other religious building appears to have been where a diviner, apparently a woman, practiced. Unlike all other buildings at the site, both religious buildings were painted white with some red hematite decoration, and both were oriented away from the standard 30° east-of-north architectural and agricultural orientation.

One of the exceptional aspects of Cerén is the preservation of thatched roofs by the rapid tephra deposition. It is unprecedented for an archaeological site in the humid tropics to have thatched roofs preserved. The number of mice in the thatch is directly proportional to the quantity of food stored in buildings, with storehouses having about six each, other household buildings a few, and the sweat bath, civic building, and workshop roofs none at all.

Another exceptional aspect of Cerén is the preservation of agricultural fields with the plants growing in them. The maize fields are ridged, with clusters of three to five plants germinating in a single planting hole. The plants themselves decomposed within months or perhaps years after being encased in the volcanic ash, but fortunately the ash had enough consistency to preserve the form of a plant as a hollow space for 14 centuries. When we find such cavities, we explore them with fiber-optic proctoscopes and decide on a casting strategy, generally involving dental plaster. The range of species whose form is preserved in volcanic ash is great, and includes maize, beans, chiles, squash, manioc, maguey, various trees such as cacao and guayaba, and a number of palm and deciduous trees.

The Cerén site provides an unusually clear window through which we can view village life in southern Mesoamerica on an August evening some 13 or 14 centuries ago. The chapters in this volume are deliberately limited to the most essential information and interpretations. The wealth of multidisciplinary data and interdisciplinary research upon which they are based is presented via the website and CD-ROM.

Appendix 1A. Radiocarbon Dating and Chronology

Brian McKee

The Cerén site was occupied for a period of several decades to a century or so during the Late Classic Period, and seven samples from the site have been radiocarbon dated. All samples consisted of carbonized construction materials from the structures; five were grass roofing thatch and two were charcoal from posts used in construction.

Dean (1978) provides a useful theoretical framework for dating in archaeology. Two key components to his framework are the dated event and the target event. The dated event is the event dated by chronometric means. For the Cerén samples, the dated events are the death of the grass used for roofing thatch and the growth of the tree rings comprising the wood. The target event is the event to which the date is applied. Two events are targeted in this analysis: the construction and maintenance of the structures, and the eruption of Loma Caldera volcano and accompanying site abandonment. The samples submitted by the project are not appropriate for dating the initial occupation of the site following the Ilopango eruption.

I believe the dated events to be a reasonable proxy for the target events for several reasons. Biological decay is normally very rapid in the wet tropics, largely limiting the "old wood problem," although long-lived species can produce carbon that predates the target event (Schiffer 1986). The wooden posts were probably used in construction soon after the death of the tree, and the grass thatch was probably used within a few days of cutting. Grass thatch roofing must also be replaced every few years in El Salvador, so it is virtually certain that the thatch samples predate the eruption by less than a decade. The wooden posts may predate the eruption by a few more years, but the statistical analysis of radiocarbon dates presented below indicates the difference is not significant.

Table 1.2 and Figure 1.3 show the results of radiocarbon dating of materials from Cerén. Calibration curves are updated every few years, and many previously published dates have been presented using earlier curves or have not been calibrated. To facilitate comparison with other sites, both the uncalibrated and calibrated dates are shown in Table 1.2 and Figure 1.3.

The radiocarbon year estimate, as received from the laboratories, is presented in the column headed "Radiocarbon Age." The dates were calibrated using CALIB version 4.1.2 (Stuiver and Reimer 1993) to apply the INTCAL 98 radiocarbon calibration curve (Stuiver et al. 1998). The intercepts, 1-sigma, and 2-sigma ranges are presented in their respective columns in Table 1.2. One sample (TX-3120) had an anomalously large standard deviation and was ex-

TABLE 1.2. Radiocarbon Dates and Calibrations, Cerén Site

Sample #	*Radiocarbon Age*	*Calibrated Age*	*68.3% Confidence Interval*	*95.4% Confidence Interval*	*Nature of Sample*
TX-3113A	1330 ± 90 BP	AD 675	AD 645–773	AD 552–891	Grass thatch, Structure 1
TX-6601	1350 ± 90 BP	AD 669	AD 631–727, 736–769	AD 542–885	Grass thatch, Structure 2
A-10743	1360 ± 50 BP	AD 665	AD 648–683	AD 610–730, 736–769	Grass thatch, Structure 1
TX-3119A	1420 ± 50 BP	AD 645	AD 607–662	AD 545–680	Wooden post, Structure 1
ELS-40	1440 ± 135 BP	AD 631	AD 449–510, 523–686	AD 342–885	Grass thatch, Structure 1
TX-6600	1520 ± 70 BP	AD 546	437–619	AD 405–658	Grass thatch, Structure 3
TX-3120	1510 ± 390 BP	Not calibrated			Wooden post, Structure 1
Average	1403 ± 28 BP	AD 650	AD 636–660	AD 610–671	Pool of six samples above

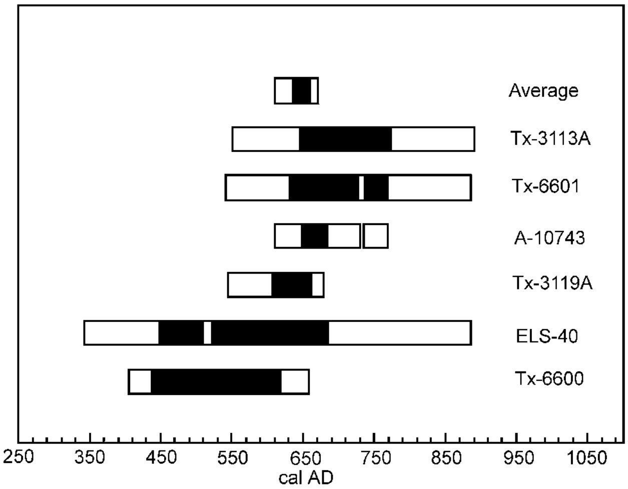


FIGURE 1.3. Graphical representation of the calibrated radiocarbon dates from the Cerén site. The black area of the bars shows the 1-sigma range, while the white area shows the 2-sigma range.

cluded from calibration and averaging. The uncalibrated date is presented in Table 1.2.

We recognized one potential problem in calibrating the Cerén thatch dates. David Lentz has noted the presence of *Trachypogon plumosus,* a C4 photosynthetic pathway plant, in the thatch at Cerén (Lentz et al. 1996). Plants that use a C4 photosynthetic pathway discriminate against the lighter carbon isotope 12C when compared with plants that use a C3 photosynthetic pathway (Van der Merwe 1982). The C4 pathway biases for an increase in the relative proportions of 13C and 14C, and C4 plants give a more recent radiocarbon age than C3 plants of the same age. This difference can be corrected for by applying the D13C value to a sample, but the TX and ELS laboratories do not indicate whether this correction was applied. The Arizona date (A-10743) was corrected for isotopic fractionation. If the TX and ELS dates were not corrected, they should differ from the Arizona date by several centuries, assuming that the samples are the same age. A T-test comparison (Thomas 1986: 249–250) indicated that the dates did not statistically differ. We also applied the D13C value from A-10743 to the other thatch dates to explore the possibility of correcting them, but the resulting calibrations did not pattern and were many centuries too early. For the above reasons, I assumed that the University of Texas Radiocarbon Laboratory applied the D13C correction to the TX dates, and I calibrated and averaged them accordingly.

All dates from Cerén clearly overlap at the 1-sigma level (see Figure 1.3), and that visual impression was confirmed by the T-test. The archaeological data and ethnographic analogy also indicate that the dates are contemporaneous and that the timing of the dated events differs by less than a decade. This demonstrates that the differences among the individual dates result from stochastic variation of isotopic decay and analysis, rather than from differences in the dated events. These reasons justified averaging the dates using a statistical function in the CALIB program. The results of that averaging are presented in Table 1.2 in the row marked "Average," and in Figure 1.3 in the bar marked "Average." The average central intercept is cal A.D. 650, the 1-sigma range is A.D. 636–660, and the 2-sigma range is cal A.D. 610–671. Those ranges are the most precise and accurate approximation for the dating of the final thatching of the roofs of Structures 1, 2, and 3, and for the eruption of Loma Caldera volcano and the abandonment of the Cerén site. The author expresses his thanks to Art MacWilliams, who helped with calibrating the radiocarbon dates and the assessment of the results. A conversation with Steve Kuhn led me to more explicitly justify the averaging of the dates. Mike Schiffer and Art MacWilliams critiqued an earlier version of this appendix. Their comments greatly improved the clarity.

Note

1. Research with Robert Dull and John Southern, too recent to have been included when this was written, indicates that this dating of the Ilopango eruption is too early. New AMS radiocarbon dates indicate the eruption probably occurred in the fifth century, and likely in the early part of that century.

PART ONE

Multidisciplinary Research

This first part of the book, supported by a CD-ROM (*An Interactive Guide to Ancient Cerén: Before the Volcano Erupted*) and website (http://ceren.colorado.edu), is multidisciplinary. The archaeology is introduced in the first chapter, beginning with the Precolumbian village called Cerén that functioned in the southern Maya periphery. It was a village of commoners, and as such in the minds of many students of Mesoamerica might be expected to be a rather poor group of households under the economic, political, and religious domination of the elite. After all, the largest and presumably most powerful elite site was only an hour's walk upstream, and about a dozen secondary centers with their elites were scattered about the valley. One of the primary objectives of our archaeological research is to understand what household and village life was like some 14 centuries ago in Cerén. The Cerén village, in what is now El Salvador, was much like hundreds of other villages while it was functioning, as far as we can tell. What makes it unusual when it is compared with other archaeological sites is its burial and preservation.

As the villagers went about their everyday activities, a hot magma was gradually working its way upward. That magma chamber first made contact with water from the Río Sucio just north of town and generated a small earthquake, almost certainly accompanied by noisy steam emissions. The villagers fled, presumably heading south, leaving their buildings, their crops, and most of their artifacts behind. As Dan Miller reconstructs the volcanology, the first volcanic deposit to affect the site came from a steam explosion, and the moist, warm (100°C), fine-grained volcanic ash covered roofs, packed around plants, and coated the countryside. The eruption shifted to a dry phase, with particles of all sizes raining down, including some very hot lava bombs (over 575 °C) that caught thatched roofs on fire when they punched through. Ultimately, 5 m of volcanic ash accumulated, and the village was sealed and forgotten for almost 1,400 years.

The very depth of Cerén's burial has provided us with a large challenge in our efforts to detect archaeological features such as buildings and patios, as well as the rest of the Classic Period ground surface. Larry Conyers and Hartmut Spetzler have responded to that challenge by using a wide range of geophysical instrumentation to try to "see through" the volcanic ash to detect elements of the village and landscape. They have been most successful with resistivity, and especially with ground-penetrating radar, in more recent years.

The fine, moist volcanic ash that covered the landscape from the first and third units of the eruption had the salutary effect of tightly packing around the plants that were growing in the village. It packed around corn (maize) plants, for instance, and after a plant decomposed, a faithful cast of that plant remained buried, awaiting our excavations. At Cerén we are fortunate to be able to count the number of corn plants per unit area, to study the size of the ears of corn, and to estimate productivity per unit area. Other plants are similarly preserved as hollow casts, which we generally fill with dental plaster to preserve them into the future. Cerén is an unusual archaeological site in which the vegetation is preserved, and David Lentz and Carlos Ramírez-Sosa look closely at the plants and how they related to household and village life.

P.S.

Volcanology, Stratigraphy, and Effects on Structures

C. Dan Miller

Introduction

Geological and volcanological studies at the Cerén site were designed to provide a stratigraphic framework for archaeological and other investigations at the site, to provide information about the character of the eruptions that destroyed and buried structures at the site, and to provide details about the source and distribution of volcanic deposits that mantle the site.

Stratigraphic sections were measured and described in excavations at each of the main structures at Cerén (Fig. 1.1) to reconstruct the sequence of eruptive events and to allow comparison of the sequence of deposits from one structure to the next. Relationships between stratigraphic units and roof thatch and walls were noted to determine the timing of the destruction of structures during the eruption. The character and thickness of deposits preserved inside of structures varied greatly from undisturbed sections outside, and were dependent upon the timing of damage to walls and roofs. At each site, stratigraphic units were sampled and textural and granulometric characteristics were analyzed.

In addition to excavations at the Cerén site, more than forty distal sections of the Cerén sequence were examined to determine the distribution and thickness of deposits and to produce an isopach map.

I gratefully acknowledge assistance in the field by Brian R. McKee and Eduardo Gutiérrez. I thank Marvin Couchman, U.S. Geological Survey, for doing sieve analyses of eruptive units at Cerén. Chemical analyses of Cerén deposits were performed by David Siems, U.S. Geological Survey.

Origin and Character of the Cerén Sequence

GEOLOGIC SETTING

Excavations at Cerén have exposed a uniform series of pyroclastic deposits slightly more than 5 m thick (Fig. 2.1). The sequence sits on up to 50 cm of tierra blanca joven (TBJ) tephra, a distinctive whitish dacite tephra that erupted about A.D. 260 (Hart and Steen-McIntyre 1983) during the catastrophic eruption of Ilopango Volcano, about 40 km to the southeast. Nearly 5 m of the Cerén sequence is derived from eruptive source(s) within about 1.4 km of the Cerén site. Near the top of the Cerén sequence are tephras inferred by Hart (1983) to have come from eruptions of nearby Boquerón and Playón.

The bulk of the Cerén sequence was produced by eruptions that occurred at one or more vents within a distance of about 1.4 km north and east of the Cerén site, as suggested by Hoblitt (1983) and Miller (1993). The vents lie along a fissure that extends in a north-northwest direction from San Salvador Volcano (Zier 1983). Historically, the fissure has been the locus of several eruptions during the past several thousand years, along a line of vents between Laguna Caldera Volcano and the north flank of Boquerón (San Salvador) Volcano (Fig. 2.2). Magmas from the fissure are basaltic andesite with compositions of about 56% silica (Table 2.1). Magmas that erupted from some parts of the fissure had no significant interaction with surface water or ground-

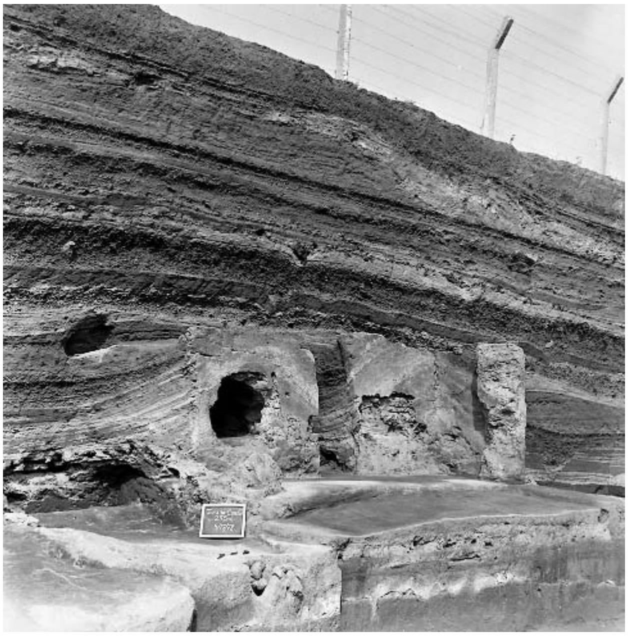


FIGURE 2.1. Loma Caldera eruptive sequence at Cerén site. Partially excavated Structure 1 is in middle of photograph. The Cerén sequence in this picture is approximately 5.2 m thick. Units 1 and 3, near the base of the section, vary in thickness in the vicinity of Structure 1. The walls of Structure 1 were oxidized where they were in contact with Units 1 and 3. *Photograph by Payson D. Sheets.*

TABLE 2.1. Chemical Analyses of Cerén Rocks

Oxide	*Lapilli of Unit 2*	*Lapilli of Unit 4*	*Ballistic Bomb in Unit 2*	*Lava from El Playón*
SIO_2	56.5	55.7	55.4	56.7
AL_2O_3	15.8	16.2	17.0	16.6
$FETO_3$	10.9	11.1	10.5	9.5
MGO	2.43	2.61	2.65	2.47
CAO	6.33	6.82	7.19	7.18
NA_2O	3.66	3.54	3.88	3.98
K_2O	1.88	1.71	1.53	1.78
TIO_2	1.20	1.22	1.12	1.13
P_2O_5	0.39	0.37	0.35	0.25
MNO	0.22	0.22	0.21	0.21
LOI 925C	–0.02	–0.08	–0.15	—
TOTAL	99.25	99.55	99.65	100.42

NOTE: Whole rock XRF analyses of lapilli from Units 2 and 4 and a ballistic block associated with Unit 2 at the Cerén site, and a whole rock emission spectrometry analysis of lava from Playón Volcano (Hart 1983). Analyses of Units 2 and 4 and the Unit 2 ballistic block completed by David Siems, U.S. Geological Survey. FeO and Fe_2O_3 reported as total iron, $FETO_3$. LOI 925C values represent oxidation of sample and loss of volatile components during analysis of sample at 925°C.

water, as, for example, the eruptions at Laguna Ciega, the Playón lava flow and cinder cone that erupted in A.D. 1658, and the eruption of the Boquerón lava flow and summit cinder cone in A.D. 1917 (Williams and Meyer-Abich 1955). Other parts of the fissure, particularly those near the Río Sucio, have brought magma into contact with water and produced explosive hydromagmatic eruptions, such as those from the Loma Caldera vent (Fig. 2.2) and a small, unnamed vent immediately north of Loma Caldera.

SOURCE OF THE CERÉN SEQUENCE

Several lines of evidence suggest that the source of most, if not all, of the deposits that bury the Cerén site is Loma Caldera (Miller 1993), not Laguna Caldera, as was suggested by Hart (1983). First, the Cerén sequence as a whole thickens toward Loma Caldera rather than toward other vents in the area (Fig. 2.3). Furthermore, contours of thickness do not appear to be related in any way to Laguna Caldera. Second, thickness relations in the upper parts of the Cerén sequence (Units 10 and 11, described in Appendix 2A below) indicate that the units are thickest immediately west of the west crater rim of the Loma Caldera vent (62 cm and 180 cm, respectively), and thin to the south toward the Cerén site and to the north toward Laguna Caldera. Finally, Post-TBJ eruptive products from two other possible sources of the Cerén sequence, Laguna Ciega and Boca Tronadora, consist entirely of scoria falls and basaltic spatter from magmatic eruptions rather than of hydromagmatic deposits such as those that constitute a significant proportion of the Cerén sequence. Although the Laguna Ciega and Boca Tronadora vents also erupted along the fissure system described above, both vents erupted after the Cerén sequence, and magma that erupted at these vents apparently did not interact extensively with groundwater and with the Río Sucio as it did at the Loma Caldera vent.

LOMA CALDERA VENT

The Loma Caldera vent is marked by an inconspicuous arcuate ridge or rampart, whose center is about 600 m north of the Cerén site (Fig. 2.2). The vent is defined on the west by a low ridge about 500 m long in a north-south direction and about 30–40 m high. The east half of the once-circular rampart is missing due to erosion of the edifice by the Río Sucio. The morphology of the west half of the vent and its internal composition, exposed in outcrops along the highway to San Juan Opico, indicate that the Loma Caldera edifice is a tuff ring. Tuff rings are broad, low, depositional features formed by accumulation of debris during hydromagmatic and some magmatic eruptions.

ISOPACH MAP OF CERÉN SEQUENCE

More than forty distal field sites were excavated to determine the distribution and thickness of the Cerén sequence (Fig. 2.3). Data are missing for much of the area east of the Loma Caldera vent because young deposits from post-Cerén eruptions at several nearby vents have buried the Cerén sequence, but data are sufficient to indicate that the Cerén sequence is dispersed primarily to the south and west of the vent. The distribution of deposits of the Cerén sequence suggests that the eruptions that buried the site occurred during a period of northerly and easterly winds.

Thickness measurements at the northern edge of the Cerén site (Operation 4), where the sequence is

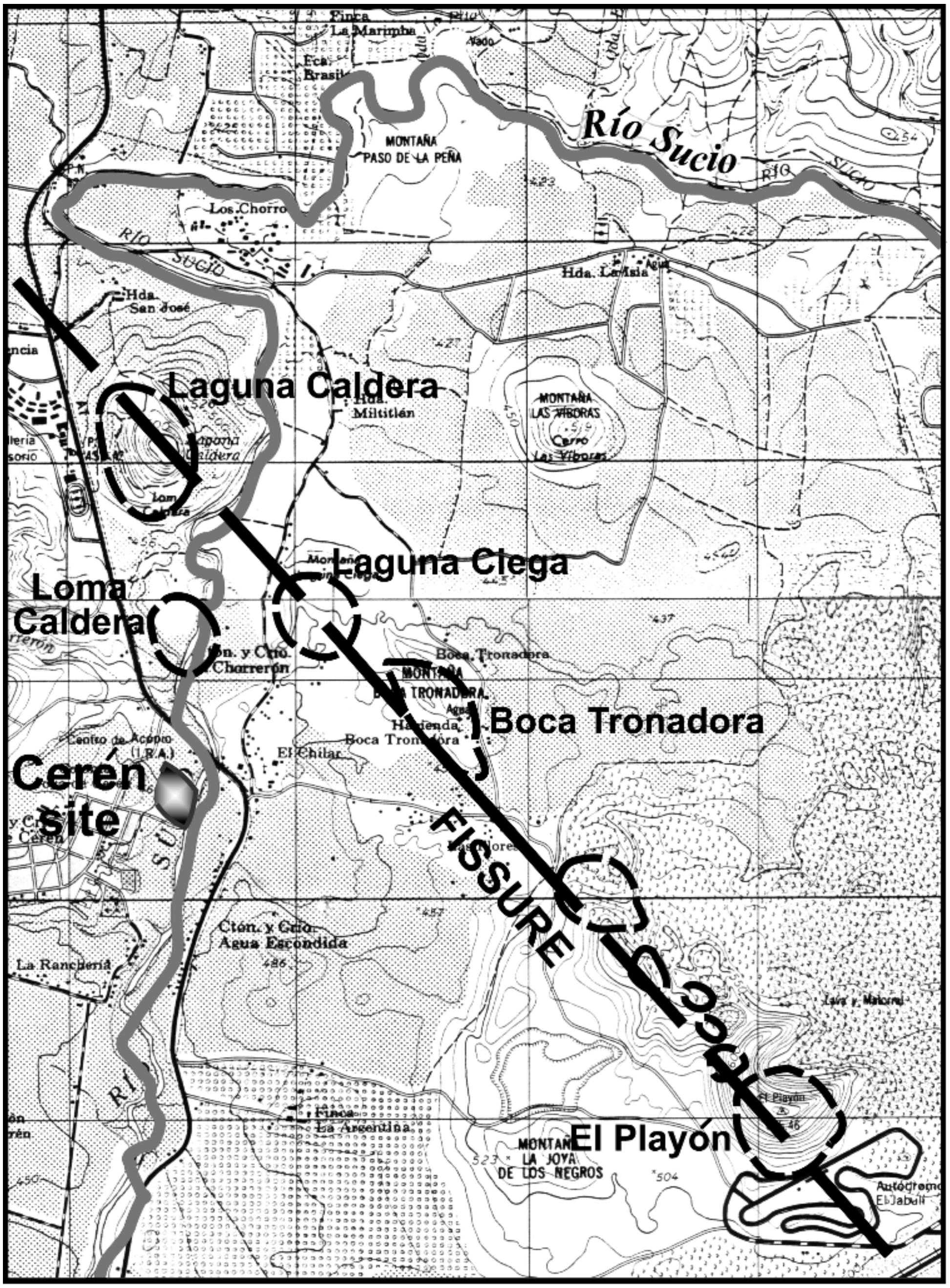


FIGURE 2.2. Location map of Cerén site, nearby volcanic vents, the Río Sucio, and other features. Note alignment of vents along fissure and location of Loma Caldera along Río Sucio. Grid squares in figure are 1 km on a side.

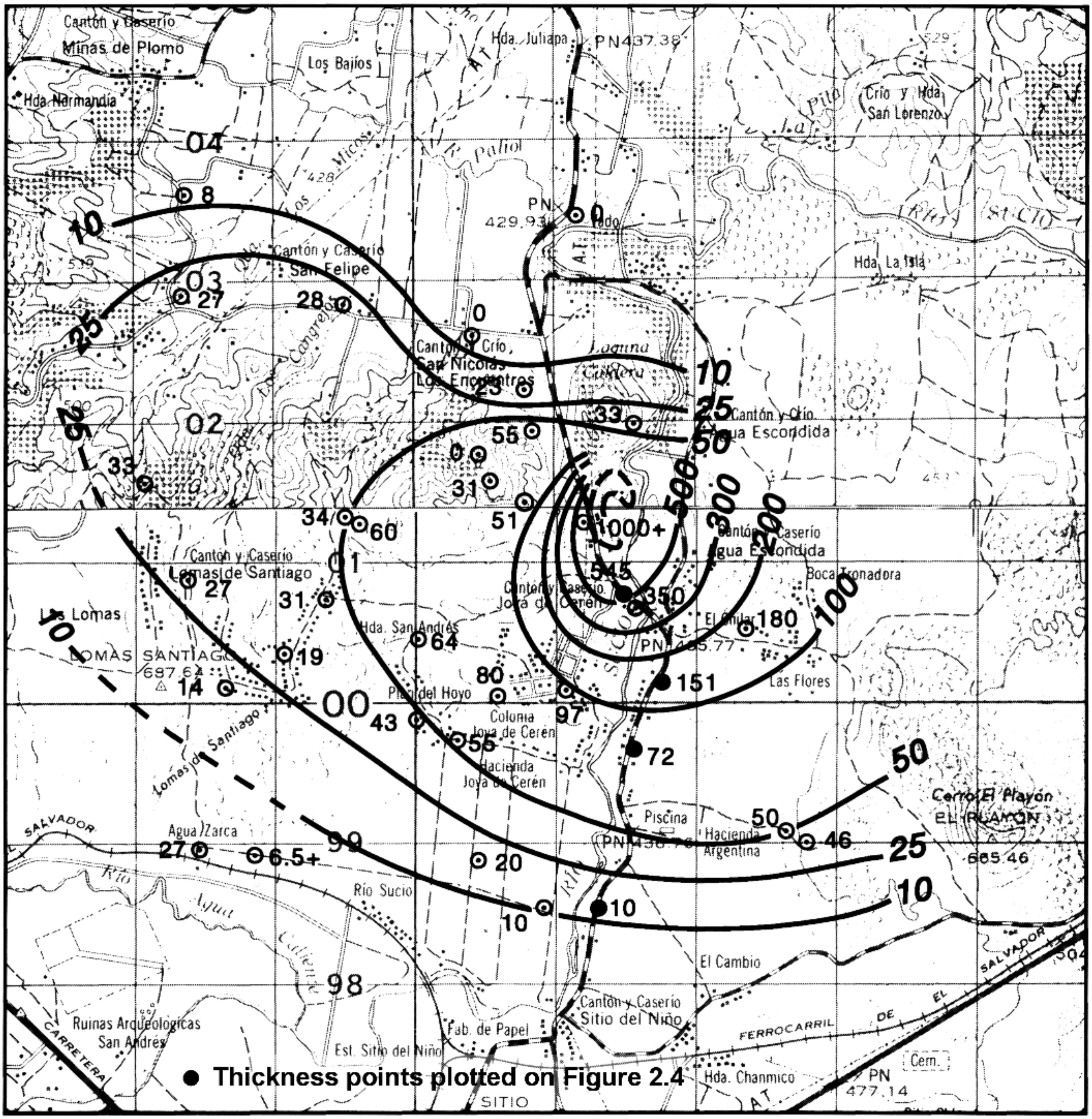


FIGURE 2.3. Isopach map showing distribution and thickness of the Cerén sequence. Thickness contours are in centimeters. Circled points mark locations of stratigraphic sections used to construct the isopach map. Numbers adjacent to circled points represent thickness of deposits. The western half of the Loma Caldera tuff ring is outlined by heavy dashed lines. The Cerén site is located at thickness points labeled 545 and 350.

545 cm thick, and at the southern edge of the site (Operation 12), where it is 350 cm thick, indicate that the site is located on the steep part of a thickness versus distance curve (Fig. 2.4); the Cerén sequence thickens very rapidly north of the site and thins rapidly toward the south to a distance of about 1.3 km, where the thickness curve flattens.

The Cerén sequence as a whole rapidly thins and becomes finer grained with distance, and dies out completely within about 6 km of the Loma Caldera vent. Only Units 4, 7, and 9, lapilli-fall deposits, are likely to extend much beyond this distance. From Figure 2.4 it is clear that if there are other buried structures closer to the source than Cerén, they are likely to be buried deeply and therefore difficult to locate and excavate. In contrast, villages that might have existed at distances greater than about 0.6 km from Loma Caldera (distance of Cerén site) are not likely to have been deeply buried and therefore may not have been as well preserved as Cerén.

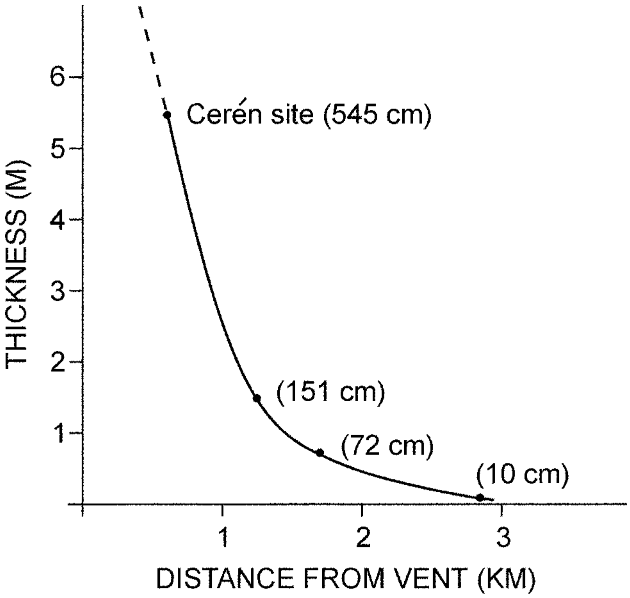


FIGURE 2.4. Thickness (in meters) of Cerén sequence versus distance (in kilometers) in a southerly direction from vent. Locations of stratigraphic sections are plotted as solid points along the highway in Figure 2.3.

STRATIGRAPHY OF THE CERÉN SEQUENCE

Pyroclastic deposits from the Loma Caldera eruption consist of interbedded pyroclastic-fall and pyroclastic-surge beds deposited during a series of discrete explosive eruptions separated by eruptive pauses lasting from minutes to hours (Miller 1992, 1993). Most phases of eruption were hydromagmatic, as suggested by breadcrusted textures of clasts, bedding forms, density variations of clasts, slight rounding of many clasts, and presence of accretionary lapilli. Eruptions at Loma Caldera appear to have resulted from interaction of basaltic-andesite magma with water of the Río Sucio or water at shallow depths in the crust. Fisher and Schmincke (1984) and Houghton and Schmincke (1986) describe hydromagmatic processes and summarize the character of resulting deposits. By comparison with well-documented historical hydromagmatic eruptions, the deposits at Cerén probably accumulated during eruptive activity that lasted for hours (e.g., 1886 Rotomahana-Waimangu eruption, New Zealand; Nairn 1979) to days (e.g., 1977 Ukinrek maars, Alaska; Self et al. 1980).

Individual beds and groups of beds are here described as units, and are numbered and characterized from the bottom of the section to the top. Figure 2.5 illustrates a composite stratigraphic section that is representative of exposures in pit walls at all the structures studied. The units shown in Figure 2.5 are characteristic of the stratigraphy outside of human-made structures. As discussed below, the stratigraphy inside and immediately adjacent to structures is often disturbed and variable; deposits

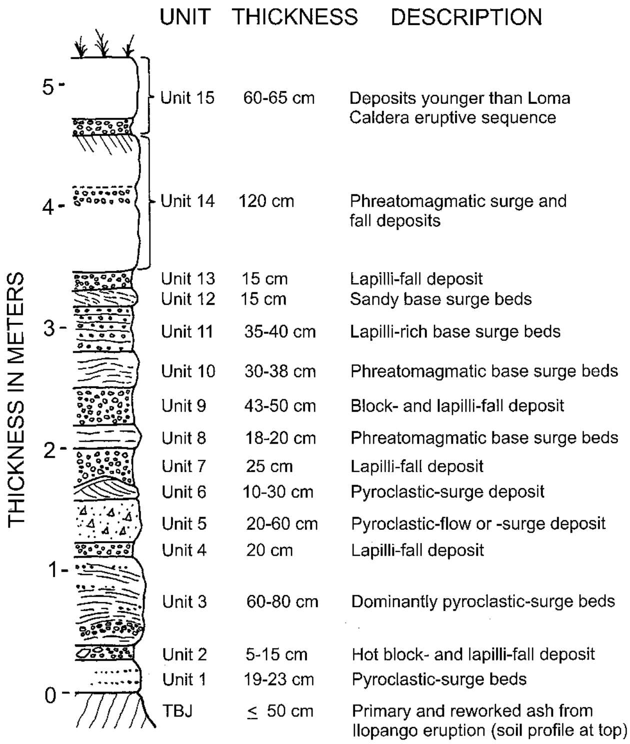


FIGURE 2.5. Composite section of Cerén pyroclastic deposits that were undisturbed by the presence of structures. The Cerén sequence sits on the tierra blanca joven (TBJ) tephra that erupted from Ilopango Volcano. The TBJ tephra has a weak soil profile at the top and was the occupation surface at the Cerén site when the Loma Caldera eruption began.

emplaced by flow mechanisms vary in thickness in proximal versus lee positions relative to structures, and early fall and some surge deposits were kept out of some structures by the presence of thatched roofs and intact walls that survived the earliest phases of the eruption.

On the basis of their thickness, distribution, and textural characteristics, Cerén pyroclastic units are interpreted to have originated as pyroclastic-fall and pyroclastic-surge deposits. Both field and laboratory parameters help to distinguish their different depositional mechanisms. In the field, pyroclastic-fall deposits are massive, friable, clast-supported, and tend to mantle topography at the site with beds of consistent thicknesses. At Cerén, pyroclastic-fall deposits are composed dominantly of juvenile[1] scoria. Scoria clasts are strongly vesicular, suggesting that they were erupted with limited interaction with water. In contrast, pyroclastic-surge deposits are usually bedded, variable in thickness, and indurated and have a smaller proportion of juvenile clasts than fall deposits. Juvenile clasts in surges tend to be less vesicular and display a greater range of densities, suggesting greater interaction with water than fall deposits. Surge deposits at Cerén often contain accretionary lapilli and are found adhering to vertical surfaces, suggesting that they were transported laterally and emplaced wet. Some surge deposits at Cerén display beds that are poorly sorted, mostly matrix-supported, massive, and rich in juvenile clasts. For example, some massive beds in surge Unit 5 resemble pyroclastic flows and were emplaced hot enough to pyrolyze wood to charcoal.

Field evidence allows Units 1–10 to be separated into pyroclastic-fall and -surge deposits. Textural analyses (Fig. 2.6) of Units 1–10 indicate that deposits identified as pyroclastic-fall deposits are texturally different from pyroclastic-surge deposits. Units 2, 4, 7, and 9 plot in the fall and surge fields, while Units 1, 3, 5, 6, 8, and 10 plot within flow and surge fields.

There is no evidence in the sequence of eruptive Units 1–14 to indicate major breaks in time. There are no noticeable soil profiles or other evidence of major episodes of erosion or unconformities within the sequence that were not due to eruptive processes. Minor episodes of erosion due to surface runoff seen in Unit 3 (Appendix 2A, below) suggest a couple of brief hiatuses during deposition of strata early in the eruption. Erosion of deposits indicates that heavy rains accompanied phases of the eruption. Thus, available evidence suggests that Units 1–14 were deposited during a single eruptive episode consisting of numerous discrete explosions that may have occurred over a period of hours to several days and that fluctuated in character and intensity.

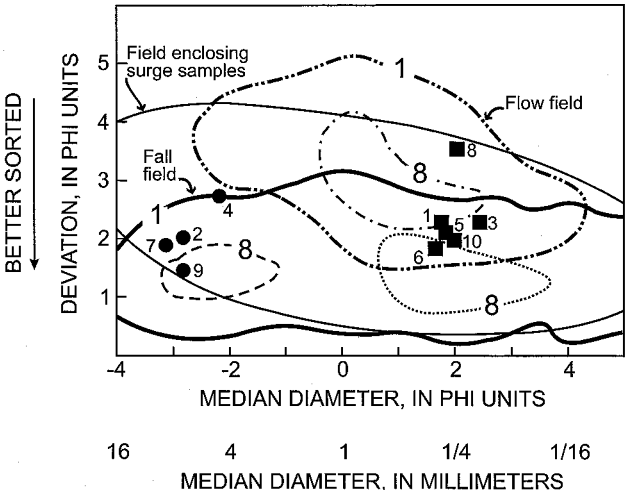


FIGURE 2.6. Inman plot (Inman 1952) showing fall, flow, and surge fields (Walker 1971), as well as Cerén Units 1–10. Samples represent channel samples through Units 1, 2, 3, 4, 6, 7, 9, and 10. Only the upper (pyroclastic flowlike) massive part of Unit 5 was sampled. Only the upper (surgelike) two-thirds of Unit 8 was sampled. Pyroclastic-fall deposits (solid circles) are texturally distinct from pyroclastic-surge and -flow deposits (solid squares). Fields of pyroclastic-flow, pyroclastic-surge, and pyroclastic-fall deposits are enclosed by contours that include 99% (1) and 92% (8) of samples studied by Walker (1971).

Units 1–15 are briefly described in Appendix 2A below, along with their inferred mechanisms of deposition. Thicknesses and other characteristics of Units 1–15 are shown in Figure 2.5.

Relations between Loma Caldera Deposits and Structures

Human-made structures[2] at El Cerén were destroyed during the Loma Caldera eruption by fire, physical impact, and by burial. Events that produced the first 2.5–3 m of the Cerén sequence caused most of the destruction of the site; later deposits buried the remains of the site. Tephra falls like those that produced Units 2, 4, 7, and 9 affected the site primarily by causing fires and burying structures. Historical studies of eruptions (e.g., those of Moore et al. 1966) suggest that the pyroclastic surges, or "ash hurricanes," that produced Units 1, 3, 5, and 6 entered the village of Cerén at 10 to more than a 100 km per hour and damaged or destroyed roofs and walls of many structures on impact. Tephra-fall deposits were emplaced at the site primarily as ash and coarser particles that fell vertically or nearly vertically from eruption columns. Because the site is only about 0.6 km from the inferred vent, fallout deposits also contain ballistic blocks[3] and lapilli that help to account for the poorly sorted nature of many of the lapilli- and ash-fall deposits (Fig. 2.7). Tephra-fall deposits affected the site by igniting flammable materials, by their impact, and through burial. Accumulations of tephra 10 cm or more thick, particularly if wet, also could have caused collapse of thatched roofs; this certainly is true of modern structures (Blong 1984, 212). Because of their large sizes (tens of centimeters in maximum dimension), ballistic fragments were very destructive; they fell through roofs and walls, broke ceramic vessels and other objects both inside and outside of structures, and damaged adobe floors where they fell (Fig. 2.8). In addition, many tephra-fall and ballistic clasts, especially the larger ones, were hot when they fell at Cerén; they caused fires in roofing thatch and the wooden framework that supported roofs and walls.

Pyroclastic-surge deposits were emplaced at the Cerén site by rapidly moving clouds of ash and coarser clasts that resembled "ash hurricanes." These highly mobile flows struck Cerén village at high speeds (observed speeds of pyroclastic flows and surges from less than 70 to more than 600 km/hr are reported in Blong 1984), and caused considerable damage to structures. Pyroclastic surges ripped roofs off structures and blew down walls of weak structures (Fig. 2.9). Holes were punched in walls by rapidly moving dense fragments and debris. Some early surge deposits (Units 1 and 2) accumulated to great thicknesses against walls and on porches of structures facing the Loma Caldera vent (Fig. 2.10). The resulting "ramps" of surge debris allowed some later surges to pass over parts of structures without causing additional damage. Many surge deposits are inferred to have been wet, apparently were emplaced at temperatures at or near 100°C, and thus did not burn organic materials when they came in contact with them.

Effects of the Loma Caldera eruption on structures varied according to their location, orientation, and strength. Distal structures were affected less seriously by surges than those closer to the Loma

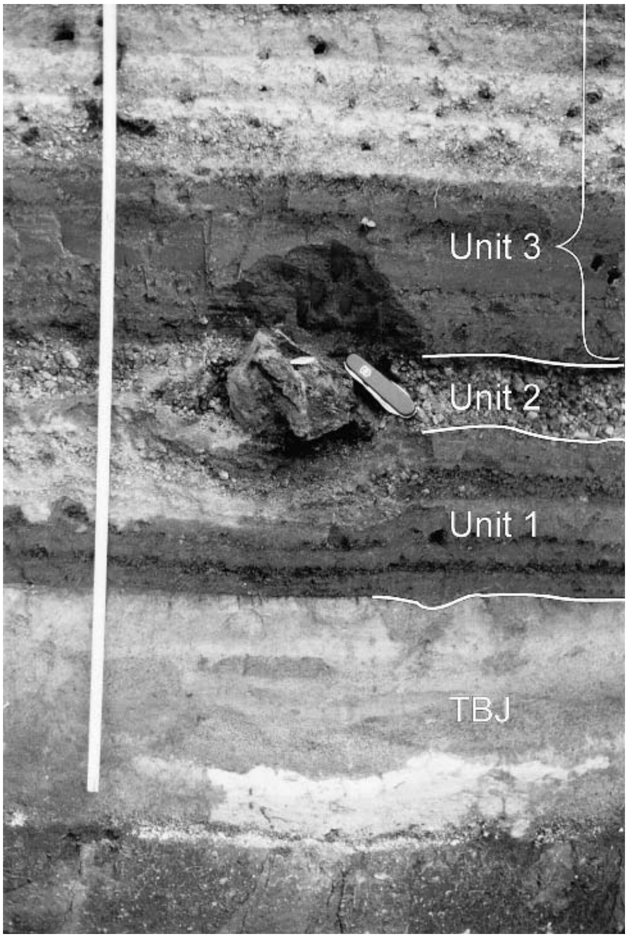


FIGURE 2.7. Poorly sorted pyroclastic-fall deposit (Unit 2) in lower part of Cerén sequence. Note ballistic bomb in the middle of Unit 2 and accompanying deformation (bomb sag) in underlying Unit 1. *Photograph by R. P. Hoblitt, U.S. Geological Survey.*

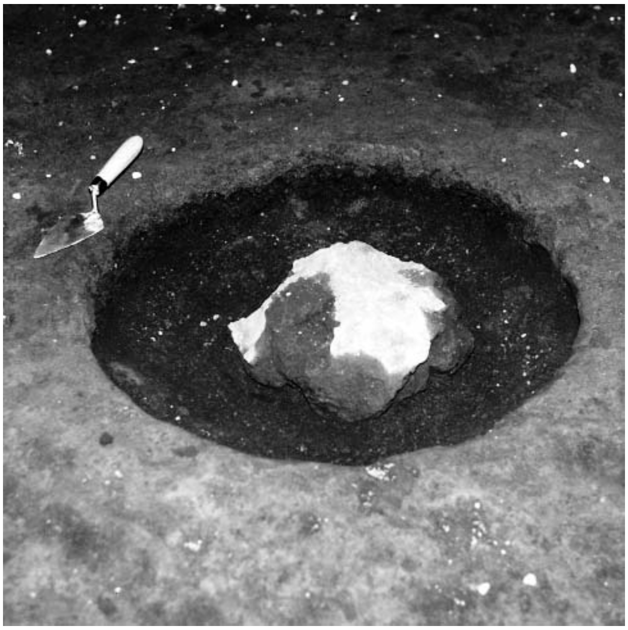


FIGURE 2.8. Ballistic block and impact crater on (excavated) surface of Unit 3. Symmetry of impact crater suggests that this bomb fell nearly vertically. *Photograph by C. Dan Miller.*

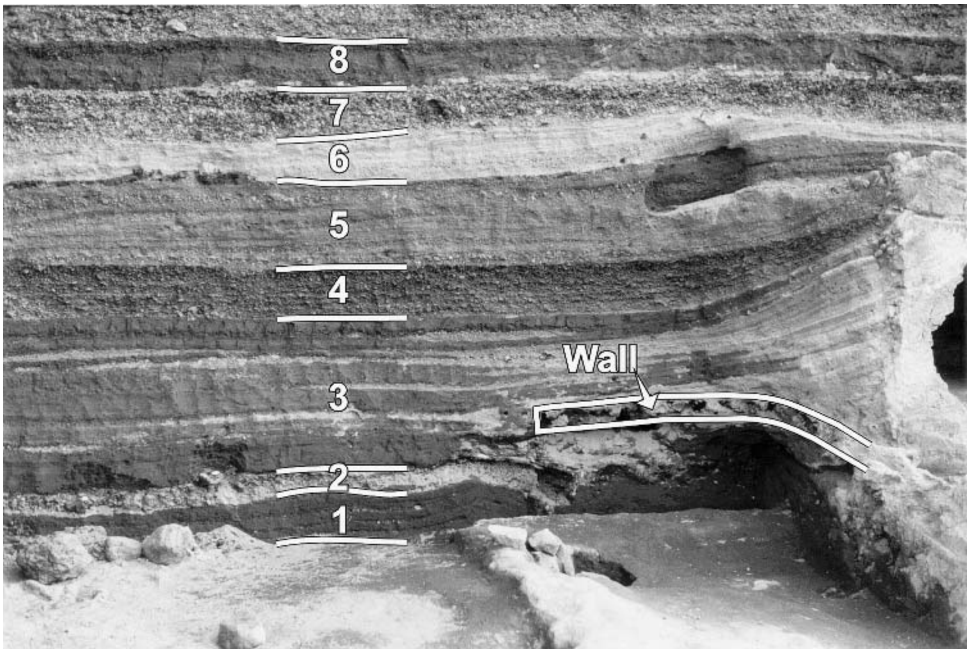


FIGURE 2.9. Damage to a wall of Structure 1 from surges that emplaced Unit 3. Surges moved from right to left. Note the mud-and-stick (bajareque) wall blown over to a horizontal position and embedded in lower third of Unit 3, and the thickening of Unit 3 against the surviving wall of Structure 1. Unit 3 is approximately 75 cm thick where it is labeled on photograph. *Photograph by R. P. Hoblitt, U.S. Geological Survey.*

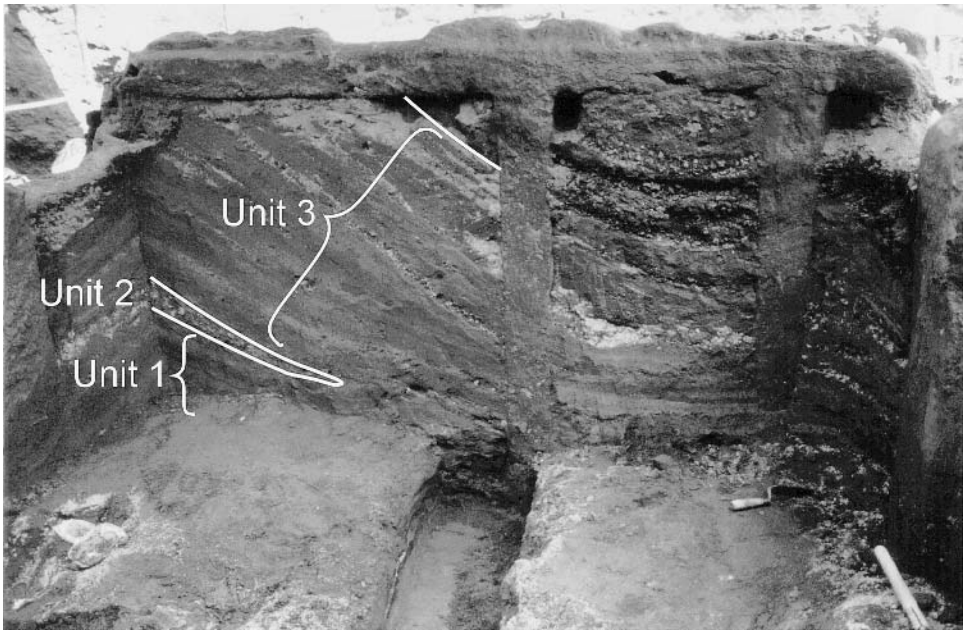


FIGURE 2.10. Thick accumulations of surge Units 1 and 3 exposed in excavation of north porch of Structure 2, facing Loma Caldera vent. Floor of porch is exposed in trench in Unit 1 in middle foreground. *Photograph by C. Dan Miller.*

Caldera vent. Structures with thick adobe walls (e.g., Structure 3) withstood the effects of surges better than those with thin *bajareque* (mud-and-stick) walls. Roofs of all structures at Cerén collapsed or were removed by pyroclastic falls and surges.

SEQUENCE OF EFFECTS ON STRUCTURES

Table 2.2 summarizes stratigraphic relationships and the inferred chronology of destruction and burial at Structures 2, 3, 4, 7, 10, and 12. There are similarities and differences in the sequence of events at these structures, but they represent the range of observed relationships at Cerén.

Structures 2, 4, 7, and 12 were primarily affected by Loma Caldera eruptive Units 1–6; roofs survived until late in deposition of Unit 2 or early in deposition of Unit 3. Walls were knocked down early in Unit 3 or in Unit 5 (Structure 2). Later eruptive deposits buried what was left of Structures 2, 4, and 7. Structures 3 and 10 are anomalous for two reasons: the roofs were removed early in Unit 1, and Units 1–5 accumulated inside these structures. The walls of Structure 3, which were high, composed of thick adobe, and of sturdier construction, remained standing throughout the eruption and were buried by eruptive Units 1–11. Structure 10 suffered damage from surges of Units 1, 3, and 8.

POSSIBLE PRECURSOR: A WARNING TO RESIDENTS OF CERÉN?

A series of linear to arcuate fissures and small, normal faults exposed at the top of the TBJ (the occupation surface at the time of the Loma Caldera eruption) at the eastern part of the Cerén site near Structures 10 and 12 (Fig. 1.1) suggest that faulting/slumping of the west bank of the Río Sucio occurred immediately prior to or during the earliest phases of the Loma Caldera eruption. Fissures range in width from 1 cm to about 20 cm where eroded, and in depth from a few centimeters to more than 20 cm. Most fissures display vertical displacements, down to the east, of 1 to as much as 5 cm. The location of fissures and faults within about 20 m of the top of the bank of the Río Sucio, their alignment roughly parallel to the bank of the river, and their extensional character and consistent down-to-the-east displacements suggest that the fissures resulted from slumping of the west bank of the Río Sucio. Available stratigraphic and morphologic evidence indicates that the fissures formed either shortly before the eruption began

TABLE 2.2. Timing and Effects of Eruption on Structures

Structure 2	*Structure 3*	*Structure 4*	*Structure 7*	*Structure 10*	*Structure 12*
Roof intact through deposition of Units 1 and 2	Roof removed early; Units 1–5 present inside	Roof intact through deposition of Units 1 and 2	Roof intact through deposition of Units 1 and 2	Roof removed early; 1–5 cm of Unit 1 present inside	Unknown if roof intact through deposition of Units 1 and 2
Structure penetrated by Unit 2 ballistic bombs	Charred thatch in upper third of Unit 1	Structure penetrated by Unit 2 ballistic bombs	Unit 1 surge formed dune and reached thickness of 40 cm on N porch	E wall and columns destroyed by Unit 1 surge	Structure penetrated by Unit 2 ballistic bombs
Roof destroyed late in Unit 2–early in Unit 3	Structure penetrated by Unit 2 ballistic bombs	Roof destroyed late in Unit 2–early in Unit 3; thatch charred by Unit 2 bombs	Structure penetrated by Unit 2 ballistic bombs; roofing thatch ignited by hot bombs	Unit 2 bombs and roofing thatch deposited on top of Unit 1	East wall of SE room knocked down early in Unit 3
Part of W wall blown down during deposition of Unit 3	Unit 3 thick, but irregular inside	S wall blown down early during deposition of Unit 3	Unit 2 accumulated only outside of roof line	Roofing thatch and beams charred by large Unit 2 bombs	South wall knocked down midway through deposition of Unit 5
Units 3 and 5 anomalously thick inside and on N porch	Thick accumulations of Units 1 and 3 "armored" outside walls facing vent	Units 1 and 3 thick inside and on N-facing porch	Roof removed early during deposition of Unit 3	Additional roofing thatch deposited at top of Unit 2	Units 3–5 present inside Structure 12
S and E walls blown down late during deposition of Unit 5	Units 4–10 filled structure without damaging walls	Normal thicknesses of Units 3–5 present inside S room	All four walls and columns collapsed early during deposition of Unit 3	Feature B wall, E facade wall, part of S wall knocked down early in Unit 3	Structure buried by Units 6–15
Unit 6 eroded underlying units; structure buried by Units 6–15	Structure buried by Units 11–15	Structure buried by Units 4–15	Structure buried by Units 4–15	E half of S wall tilted during emplacement of Unit 8	

NOTE: Timing and effects of Loma Caldera eruptive phases on structures at Cerén were determined by stratigraphic relations between deposits and structures.

or during the earliest stages of the eruption. It is possible that faulting occurred as a consequence of ground motion associated with seismic activity that is inferred to have preceded and accompanied the eruptive activity. Ground shaking associated with earthquakes is also suggested by the stratigraphic relations outside the walls at Structure 3. Fragments of the decorative wall cornice of Structure 3 broke off and fell to the ground during the earliest stage of the eruption; only a few lapilli of Unit 1 can be found under cornice fragments.

Available evidence suggests that faulting and slumping near the west bank of the Río Sucio near Structures 10 and 12 resulted from ground shaking associated with seismic activity that preceded and accompanied the eruption of Loma Caldera Volcano, located only 600 m to the north. Movement of magma into the vent of a volcano before and during eruptions normally produces earthquakes that are felt by inhabitants in nearby communities. Movements and adjustments of the ground surface, possible structural damage to their houses, and possibly other precursory activities in the vicinity of the awakening volcanic vent may have provided ample warning to residents of Cerén of the cataclysm that was soon to occur and given them the opportunity to escape before the arrival of the lethal pyroclastic surges of Unit 1. The frantic departure of residents of Cerén during precursory earthquakes or during the earliest stages of the eruption would explain both the absence of remains of human occupants in structures excavated to date and the fact that residents abandoned most of their possessions.

Conclusions

The Cerén sequence consists of a series of pyroclastic-fall and pyroclastic-surge beds deposited during fluctuating but essentially continuous eruptive activity. At least the upper part of the Cerén sequence, and probably all of it, erupted from the Loma Caldera vent, an eroded tuff ring about 0.6 km north of the Cerén site. All phases of the eruption were hydromagmatic and appear to have resulted from the interaction of basaltic-andesite magma with water at shallow depths in the crust or from the Río Sucio. Pyroclastic-surge and -fall deposits can be differentiated on the basis of texture, by their content of juvenile clasts, and by bedding characteristics. The Cerén sequence is dispersed primarily to the south and west of the source vent, covers about 35 km^2 within the 10 cm isopach, and dies out within about 6 km of Loma Caldera Volcano.

Structures at Cerén were destroyed by fire, physical impact, and burial. Six scoria falls, each 5–50 cm thick, accumulated during the eruption and affected the site by igniting combustible materials and by burying structures. Tephra beds are interbedded with eight pyroclastic-surge units, each 15–100 cm thick. Surges destroyed or removed thatched roofs of structures and knocked down walls of weaker structures. Effects of the eruption on structures varied according to the location, orientation, and strength of structures; distal structures were affected less seriously by surges than proximal ones. Eruptions at Loma Caldera probably were preceded and accompanied by earthquakes, faulting, and damage to structures that warned residents of Cerén of the impending eruption. Residents apparently abandoned Cerén in haste, leaving their possessions behind.

Appendix 2A

The following provides descriptions of Cerén stratigraphic Units 1–15, along with inferred mechanisms of deposition. Relationships, thicknesses, and other characteristics of the units are shown in Figure 2.5.

UNIT 1

Unit 1 consists primarily of pyroclastic-surge beds, but also contains thin, interbedded pyroclastic-fall beds (Figs. 2.5, 2.7). Unit 1 consists of beds of laminated ash and fine lapilli that vary laterally both in thickness and grain size, especially in the vicinity of occupation structures; surge beds of Unit 1 are interbedded with relatively well-sorted lapilli-fall beds (Hoblitt 1983). Juvenile basaltic-andesite lapilli and occasional ballistic blocks can be found in Unit 1 beginning about 2 cm above the base; large clasts are breadcrusted and have a wide range of densities, suggesting interaction with water while in a molten or semimolten state.

UNIT 2

Unit 2 is a friable, clast-supported, relatively poorly sorted block- and lapilli-fall deposit. Unit 2 is the fourth lapilli-fall bed above the TBJ contact. Unit 2 is variable in thickness but averages 8–10 cm. Unit 2 was described by Hoblitt (1983) as the "coarse air-fall tephra bed." It consists dominantly of vesicular juvenile clasts, the largest of which were deposited at temperatures that exceeded 575°C, (the maximum blocking temperature of the rock; Hoblitt 1983). Unit 2 also contains numerous large ballistic bombs (Fig. 2.7). Some bombs within Unit 2 are flattened "cowflop" bombs, suggesting that clasts were plastic when they landed. The largest bomb found within the Cerén excavations measures about 66 × 40 × 40 cm! According to analyses by Mastin (1991), blocks of this size ejected to distances of 600 m or more had initial ejection velocities at the vent of 95–125 m/s (340–450 km/hr). The floors of most Cerén structures are littered with both juvenile and accidental ballistic blocks, apparently deposited during the violently explosive event that produced Unit 2. Outside Cerén structures, numerous bomb sags were generated within Units 1 and 2 by the impacts of ballistic blocks in wet pyroclastic deposits. The compositions of lapilli and a ballistic bomb from Unit 2 are shown in Table 2.1.

UNIT 3

Unit 3 consists mostly of brownish plane-parallel pyroclastic-surge beds composed primarily of ash. The base of Unit 3 is marked by a distinctive series of brown ash beds that enclose a 2 cm thick gray ash bed (brown/gray/brown beds) (Fig. 2.7). Most beds in Unit 3 are plane parallel; however, some thicken and thin laterally, and some are crossbedded and form dunes. Many beds of Unit 3 are indurated and contain abundant accretionary lapilli, suggesting that they were emplaced wet. About half of the wood and thatch in Unit 3 is pyrolyzed and may have been burned or burning when incorporated. Many clasts in the coarser lenses of Unit 3 are subrounded, suggesting extensive abrasion during transport by turbulent flow. Unit 3 also contains several thin, well-sorted block and lapilli beds that probably were deposited dominantly by fallout mechanisms; large ballistic blocks within these beds were hot enough to pyrolyze adjacent wood and thatch. Unit 3 contains numerous bomb sags and craters resulting from impacts of ballistic blocks (Fig. 2.8).

The presence of scattered, shallow erosional channels at the top of Unit 3 suggests that a rainstorm occurred at the close of or shortly after the eruption of Unit 3. Evidence of a similar period of surface-runoff erosion is preserved about 12 cm below the top of Unit 3. Heavy rains often accompany explosive eruptions, which provide abundant condensation nuclei. The time represented by the formation of shallow erosional rills and channels at two horizons within Unit 3 is thought to have been brief, perhaps a few hours or less in each case.

UNIT 4

Unit 4 is a friable, clast-supported lapilli-fall deposit that forms a widespread, massive layer of fairly uniform thickness (Fig. 2.9). Near the base, Unit 4 is relatively poorly sorted (Fig. 2.6) and consists of a slightly indurated layer of vesicular juvenile lapilli with a sparse coarse ash matrix. The upper half of Unit 4 is composed of friable, clast-supported juvenile scoria lapilli, many of which are slightly rounded and have fluidal outer surfaces. Unit 4 is composed of about 95% juvenile basaltic-andesite clasts; charcoal found within Unit 4 indicates that the clasts were emplaced hot. Overall, Unit 4 has characteristics typical of a near-vent fallout deposit, probably produced during a hydromagmatic eruption. The composition of lapilli in Unit 4 is shown in Table 2.1.

UNIT 5

Unit 5 is a pyroclastic-surge deposit (Fig. 2.9). The upper half of Unit 5 is a poorly sorted, matrix-rich, massive deposit composed of juvenile lapilli in an abundant ash matrix. However, in many localities the lower half of Unit 5 shows planar- and cross-bedding and thickens in depressions and against the proximal sides of structures. Abundant remnants of pyrolyzed thatch and roofing poles within Unit 5 indicate that it was erosive and caused damage to structures and was hot when emplaced. Units 4 and 5 may have been related; a reasonable interpretation is that the vertical eruption column that produced the Unit 4 tephra-fall deposit collapsed, producing the pyroclastic surges of Unit 5.

UNIT 6

Unit 6 is a crossbedded pyroclastic-surge deposit that forms prominent dunes and varies in thickness over short distances (Fig. 2.9). It is light brown, has fewer juvenile clasts than Units 4 and 5, and is composed of scattered lenses of lapilli interbedded with relatively well sorted ash. Some ash beds in Unit 6 are indurated and have abundant accretionary lapilli, suggesting that they were emplaced wet; most lapilli in Unit 6 are subrounded due to abrasion during transport in a turbulent flow.

UNIT 7

Unit 7 is a friable, clast-supported lapilli-fall deposit composed of about 90–95% juvenile scoria (Fig. 2.9). Unit 7 forms a fairly uniform deposit over the Cerén area. Similar to Unit 4 but better sorted (Fig. 2.6), Unit 7 is massive and consists primarily of lapilli; its lower half contains some coarse ash matrix, while its upper half has virtually no matrix and clasts are in contact with each other. Large scoria clasts in this layer are breadcrusted and display a wide range of densities, suggesting interaction of magma with water during the eruption.

UNIT 8

Unit 8 consists of several brownish, poorly sorted, strongly indurated and laminated hydromagmatic ash beds separated by thin beds of small, subrounded lapilli (Fig. 2.9). Unit 8 has fewer juvenile clasts than Unit 7, and fine-grained layers contain accretionary lapilli. These characteristics and undulatory bedding suggest that Unit 8 was deposited by pyroclastic-surge mechanisms. Because it is indurated and difficult to dig through, Unit 8 may have been wet when deposited. Unit 8 has been given the informal title "capa dura" (hard layer) by excavators at the Cerén site.

At one location (Operation 2), where the top of underlying Unit 7 is sloping gently toward the southwest, Unit 8 thickens to about 85 cm in a depression. The texture and induration of the upper 70 cm of Unit 8 at this location resemble a debris flow or lahar, and large scoria clasts are reversely graded. These characteristics suggest that Unit 8 was water-saturated, allowing large scoria clasts to "float" toward the top of the unit, and that the deposit flowed a few meters under the influence of gravity, thickening toward the southwest.

UNIT 9

Unit 9 is a massive juvenile block- and lapilli-fall deposit that blankets the area with a layer of fairly constant thickness. Like Units 4 and 7, the lower half of Unit 9 contains some coarse ash, in addition to blocks and lapilli, and is therefore slightly indurated. The upper half of Unit 9 is clast-supported, friable, and better sorted than the lower half. Approximately 95% of Unit 9 is composed of juvenile clasts, many of which are breadcrusted. Characteristics of Unit 9 suggest that fallout and the accumulation of ballistic debris were the dominant depositional mechanisms.

UNIT 10

Unit 10 consists of a series of hydromagmatic base-surge beds. Brown in color, it is composed of poorly sorted "muddy" ash and lapilli beds that vary slightly in thickness in the vicinity of structures at Cerén. Unit 10 has fewer juvenile clasts than Unit 9, but has a concentration of juvenile breadcrusted bombs (5–10 cm diameter) about one-third of the way up from the base. A concentrated zone of large and prominent accretionary lapilli occurs at the top of the unit.

UNIT 11

Unit 11 is a series of block- and lapilli-surge and -fall beds, consisting of faintly laminated, friable layers composed of subrounded lapilli with occasional ballistic blocks as large as 15 cm in maximum dimension. The unit "pinches and swells" slightly in thickness, shows faint reverse grading, and has lapilli that are dominantly of juvenile origin. From a distance, subhorizontal "lines" of similar-sized clasts can be seen, particularly in the lower fifth of the unit. Although Unit 11 has some beds with characteristics of fallout deposition, its overall bedded character and variations in thickness suggest a hydromagmatic surge mechanism of deposition.

UNIT 12

Unit 12 consists of a series of ash-rich base-surge beds. The unit is composed of planar to faintly crossbedded, poorly sorted but friable ash and lapilli beds. The beds are alternately brown and gray in color and contain fewer juvenile clasts than Unit 11.

UNIT 13

Unit 13 consists of two lapilli-fall beds; the lower bed has a 2 cm thick brown top. Unit 13 is uniform in thickness throughout the Cerén site. Each bed consists of poorly sorted, friable, clast-supported lapilli that are dominantly juvenile. Unit 13 is similar to Units 4, 7, and 9 in its overall characteristics.

UNIT 14

Unit 14 is a composite of numerous hydromagmatic fall and surge deposits. Part of Unit 14 forms prominent primary dune structures and thus varies in thickness over the Cerén site. The lower 25 to 30 cm of Unit 14 form a series of poorly sorted, juvenile-rich lapilli and ash beds. The beds show planar- and crossbedding. The next 25 to 35 cm of Unit 14 consists of thin, laminated, planar and crossbedded sand-sized ash beds that form surge dunes. Above the dune-forming layers is a series of lapilli-fall beds, which are oxidized to a bright reddish-brown color, presumably due to soil-forming processes or to postdepositional interaction with groundwater, or to both. The upper 45 cm of Unit 14 is reddish brown colluvium (reworked, either by people or by surface processes), and has an organic-rich soil at the top. Unit 14 is thought to represent deposits of the final phase of the Loma Caldera eruption, and the presence of colluvium and an organic soil indicates that some time passed before the deposition of overlying deposits, which evidently came from other source vents.

UNIT 15

Unit 15 is a composite unit of all deposits that overlie the Loma Caldera eruptive sequence. Immediately above the soil on the Loma Caldera sequence is a scoriaceous lapilli-fall deposit 10 to 12 cm thick. This may be tephra from the seventeenth-century eruption of Playón Volcano described by Hart (1983), or it could have come from some other nearby vent. Above the lapilli-fall deposit is organic-rich colluvium about 50 cm thick, which forms the present ground surface. Neither the thin tephra layer from the eruption of Boquerón described by Hart (1983) nor young tephra units from other sources were recognized at Cerén.

Notes

1. "Juvenile" refers to magmatic (molten) material involved in an eruption. During eruptions, nonjuvenile material from walls of vents may be mixed with juvenile clasts.

2. As used here, "structures" refers to buildings of adobe and wattle and daub constructed on fired solid adobe platforms.

3. Ballistic blocks are fragments that are ejected during explosions and follow ballistic trajectories until they impact the ground. Ballistic blocks at Cerén include blocks of magma (juvenile fragments) and pre-eruption rocks (accidental fragments) eroded from the vent.

Geophysical Exploration at Cerén

Lawrence B. Conyers and Hartmut Spetzler

Introduction

Since 1979 a wide variety of geophysical instruments have been employed at the Cerén site in El Salvador in order to search for and map the Classic Period landscape and the architectural features built on it. This ancient landscape is presently buried by as much as 6 m of volcanic ejecta. The instruments utilized in this effort were ground-penetrating radar (GPR), electrical resistivity, electromagnetic induction, and seismic refraction. Magnetometers were also tried at a nearby site. The variable results obtained in these geophysical surveys are instructive for further work at Cerén and as a guide for future work at similarly buried sites around the world.

Results of these geophysical surveys determined that some methods were more effective in the rainy season when the ground was saturated and others after a prolonged dry season when the ground was quite dry. Some of the techniques attempted proved to be ineffective in any conditions. Ground-penetrating radar has emerged as the most successful method at Cerén due to its three-dimensional imaging capabilities and excellent resolution of features buried up to 5 m. Electrical resistivity was successful in finding large buried structures as anomalies quickly and efficiently, but this method lacked the depth resolution of GPR.

Both the GPR and resistivity techniques rely on electrical and magnetic contrasts that exist in the subsurface between the matrix (the volcanic overburden) and the stratigraphic horizons or archaeological features of interest. These contrasts are caused primarily by changes in water content, which is a function of their permeability (the ease of water penetration) and porosity (the amount of water they can hold). Other differences, such as clay content and mineralogical differences that exist between features of interest and the surrounding material, may also play a role.

The GPR method measures the reflection of radar waves from buried interfaces of interest. The greater the water saturation of a unit, the more energy is reflected and the higher the amplitude of the resulting reflected waves. It was found that the highest amplitude reflections at Cerén occurred between the tierra blanca joven (TBJ; the Classic Period living surface) and the overlying tephra. Other high-amplitude reflections occurred from the floors and walls of buried house platforms, which were made of clay. The GPR method was most successful toward the end of the dry season when the ground was dry, allowing maximum radar energy penetration. Reflection of radar energy occurred from interfaces that retained some residual moisture. In contrast, electrical resistivity was most successful during the rainy season when the ground was wet and therefore most conductive. In these conditions, the induced electrical field was most effectively transmitted to the depth necessary to detect archaeological features. Contrasts in electrical resistivity, measured at the surface, proved to be an indication that buried structures might have been located below the surface.

Geophysical Research: Methods, Instruments, and Results

The wide range of geophysical instruments employed at and near the Cerén site during the past two decades provides an instructive case study for effectiveness at deeply buried sites in tropical volcanic terrains. Methods varied greatly in their ease of use, interpretation, and overall effectiveness. The various techniques used are presented below, in order from least to most effective, with greater detail presented for the more effective methods.

MAGNETOMETERS

Magnetometers have not been employed at Cerén, largely because of the poor results obtained in a preliminary study in 1972 at Chalchuapa, El Salvador, an earthen architectural site in a geological setting similar to Cerén. In the Chalchuapa study, Froelich Rainey used both cesium and proton magnetometers that were so affected by the strong magnetic fields produced from underlying lava flows that the less distinct magnetic signatures of overlying cultural features were overwhelmed (personal communication to P. Sheets 1972). It is possible that a paired set of more sensitive magnetometers moved in tandem over the ground surface might yield results that are more sensitive to the archaeological features built above these lava flows. This acquisition technique has not been tried at Cerén, as other geophysical methods have proved more successful.

SEISMIC REFRACTION

Supported by the National Geographic Society, the first geophysical explorations at the Cerén site were conducted in 1979 (Loker 1983; Sheets et al. 1985). Three techniques were employed (GPR, electrical resistivity, and seismic refraction) in a 1-hectare grid southwest of a newly discovered structure in Operation 1 (Fig. 3.1). The seismic instrument employed was an Electro-Technical Labs Recording Interval Timer (Model ER-75A-12). Geophones were spaced 5 m apart along transects, with 20 m from the "shot point" to the closest geophone. Energy was produced by sledgehammer percussion on a metal plate placed on the ground. Refracted wave arrivals were recorded at the geophones, printed on Polaroid film, and visually interpreted. Anomalies were barely discernible as subtle changes in the arrival times between geophones. The resulting data were at best barely able to detect buried structures that were already known to exist.

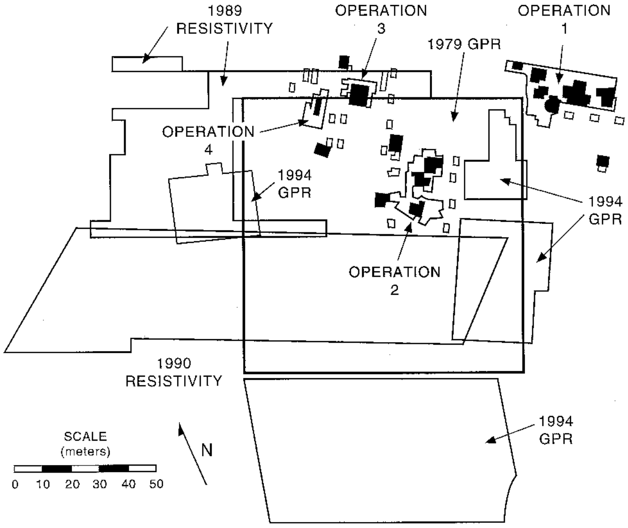


FIGURE 3.1. Base map of geophysical surveys conducted from 1979 to 1994 at the Cerén site. Known structures that are visible on GPR data and have been confirmed by excavations are shown in dark black. Test excavations are indicated within the mapped area.

Because of the equivocal results using linear transects, three other geophone arrays were utilized: broadside, fan, and circular (Loker 1983). These arrays were experimented with over an anomaly (now known as Structure 2 in Operation 2) that had been detected using GPR and resistivity methods. These geophone orientations yielded only a slight indication that some kind of anomaly might be present. It is possible that more sophisticated digital seismic instrumentation, calibrated to site conditions, with more advanced computer processing techniques, might yield better results. The seismic method has not been employed since 1979.

ELECTROMAGNETIC INDUCTION

James Doolittle and Frank Miller (1992) conducted electromagnetic induction studies at Cerén using a Geonics EM34-3 during the summer of 1992. This method induces a primary electromagnetic field into the ground. Depending on the electrical properties of the ground, a secondary field is produced within the sphere of influence of the primary field. The greater the conductivity of the underlying soil and sediment, the more the secondary field is dissipated. Changes in the secondary field are then measured and mapped spatially. Unfortunately, the electromagnetic induction device used by Doolittle and Miller conducted the majority of the energy to depths of 7–15 m, below the cultural horizons of interest. Two of the anomalies discovered were located on the slope and summit of a small hill south of the site. Neither was associated with cultural remains. As a result, the anomalies detected probably had little to do with Classic Period features and were more likely detecting deep geological variations. A better choice of instrumentation would have been the EM31, which induces an electromagnetic field to depths of 3–5 m, where the zones of interest are located.

ELECTRICAL RESISTIVITY

Electrical resistivity measurements were taken at the Cerén site in 1979, 1980, 1989, and 1990 (Fig. 3.1), using an ABEM Terrameter SAS 300 in the Wenner electrode configuration. The surveys were conducted with a 5 m spacing between electrodes and 5 m between data points (Loker 1983) throughout presurveyed grids. In total, about 3.2 hectares have been surveyed using this instrument and technique. The most successful surveys were conducted during the rainy season or soon thereafter, when maximum ground moisture allowed for greatest electrical energy penetration. The first resistivity survey, conducted early in June 1979 when the summer rainy season had just begun, yielded poor but marginally usable results. This was probably because insufficient interstitial moisture was present for transmission of the electrical current into the ground. Had this first resistivity survey been conducted a week or two earlier, before any rain had fallen, no useful data would have been gathered and it is possible the method would not have been used further. Fortunately, that was not the case.

The advantages of resistivity over other geophysical methods are its ease of transport, simplicity of the instruments, immediate availability of quantitative data, and the ease of data processing and interpretation. Most importantly, this method successfully detected buried Classic Period buildings under some 5 m of volcanic ash.

Buried structures were detected as M-shaped anomalies in the data, when horizontal distance along a ground surface transect was plotted against the measured resistivity (Fig. 3.2). Many of these anomalies were later confirmed by excavations. The M shape may have been caused by the upward bowing of volcanic ash layers along the edges of buried buildings and the contrast in moisture retention between those ash layers and underlying clay buildings.

In the 1980 resistivity survey, a 1-hectare grid was laid out to the southwest of Operation 1 (Fig. 3.1),

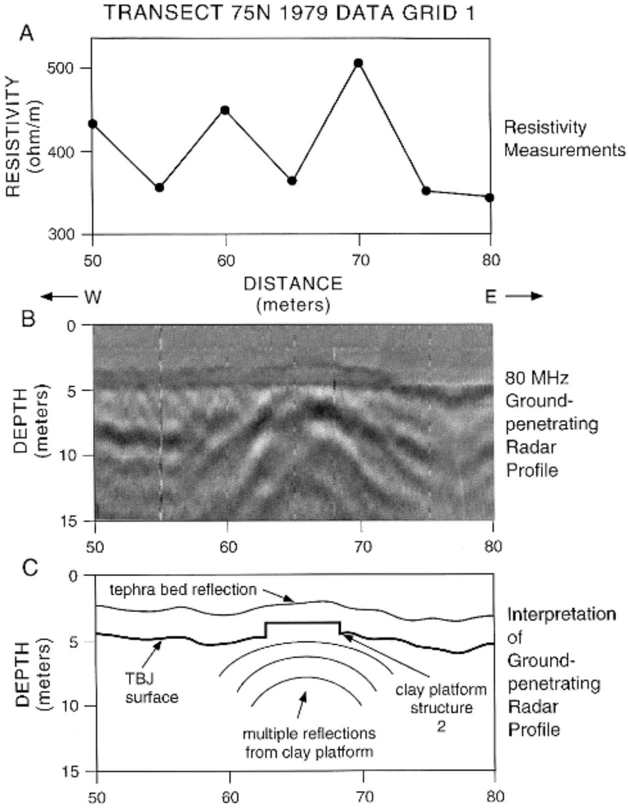


FIGURE 3.2. Resistivity and ground-penetrating radar data over Structure 2. (A) Raw resistivity data (measured in ohm/m) over the structure (data modified from Loker 1983). A distinctive M-shaped anomaly is visible over the buried structure platform. (B) A reprocessed 80 MHz GPR profile. Data were originally collected in 1979 and digitized in 1994. Range gain and background removal filters were applied after digitization. Vertical white lines are the surface positioning marks. The multiple reflections recorded below the platform were caused by multiple reflections between the ground surface/air interface and the buried clay platform. (C) Interpretation of the subsurface from the GPR reflection data in (B).

and a total of 364 measurements were taken every 5 m along transect lines spaced 5 m apart (Spetzler and Tucker 1989). Within that grid, three strong M-shaped anomalies were detected; two were core-drilled. The cores penetrated clay floors, indicating that the anomalies were clearly cultural. They were later excavated and are now known as Structures 2 and 3, a household and a public building, respectively. That survey was done in January, soon after the end of the rainy season when the ground still retained considerable moisture, allowing good electrical current penetration.

In 1989 approximately 1.8 hectares were surveyed (Fig. 3.1) with the same instrumentation and configuration within two grids (Spetzler and Tucker 1989). The 1989 work was done in July, well into the rainy season, and the increased soil moisture aided in energy transmission. One area surveyed was to the west of the excavations (Fig. 3.1) and the other approximately 150 meters farther west in an area not shown in Figure 3.1. Three anomalies were detected in the grid closest to the site, with two confirmed as buried clay structures by coring. Another anomaly was also tested, but its origin remains unclear. In addition, a very distinct anomaly was discovered in the grid farthest to the west in Lot 185, atop a hill. It has a distinctive M shape that has all the characteristics of the anomalies produced over Structures 2 and 3, and it was likely produced by a large Classic Period structure. This possible structure has not yet been confirmed by subsurface testing and is far removed from the remainder of the site.

The 1990 resistivity survey was conducted in a 55 × 90 m rhomboid grid (Fig. 3.1) south of the site (Spetzler and McKee 1990). The work was done in November, at the end of the rainy season when soil moisture was at a maximum. A linear anomalous zone of high-resistivity values was mapped that corresponds to a natural topographic rise, with a zone of low-resistivity values to the southwest. No distinctive M shapes were discovered. Two test pits were excavated in the high-resistivity area, but neither encountered cultural materials. It is likely that the resistivity anomalies in this area were produced by geological phenomena that were not visible in the test excavations.

In summary, resistivity has many advantages over other geophysical methods, including its ease of transport and operation, reasonable speed in covering large areas, ability to immediately interpret the raw data, and, most of all, success in detecting buried structures as anomalies. This method would still be in use at the site had it not been for the success of ground-penetrating radar surveys.

Ground-Penetrating Radar

Ground-penetrating radar has been used to explore for deeply buried archaeological features with increasing success during the last decade. It is the only widely used near-surface geophysical method that is capable of both detecting buried cultural materials and mapping them in three dimensions. Its subsurface resolution can be excellent when the proper equipment is calibrated to known field conditions.

GROUND-PENETRATING RADAR METHODOLOGY

The GPR method involves the transmission of high-frequency electromagnetic radio pulses into the earth and then measures the time elapsed between their transmission, reflection off a subsurface discontinuity, and reception back at a surface antenna (Conyers and Goodman 1997). As the sending and receiving antennas, which are usually attached to each other, are moved along the ground surface in a line, a continuous two-dimensional profile of subsurface reflections is recorded.

The propagation velocity of the radar waves through the earth depends on a number of factors, the most important one being the electrical and magnetic properties of the material through which they pass (Olhoeft 1981). If the velocity of the waves is known, the travel times of recorded reflections can be converted to distance and the two-dimensional profiles can be displayed with an accurate depth scale. Profiles within a grid are then computer-processed, important reflections are correlated, and maps of buried archaeological features and related stratigraphy are constructed.

Ground-penetrating radar waves radiate energy into the ground in a conical shape, with the apex of the cone being at the center of the transmitting surface antenna (Annan and Cosway 1992). The subsurface radiation pattern is therefore always "looking" not only directly below the antenna but in all directions from the apex of the cone.

When the velocity of radar waves traveling in the ground changes abruptly, usually at a subsurface interface, a portion of the energy is reflected back to the surface and recorded at the receiving antenna. Reflections from these interfaces are recorded in time that is measured in nanoseconds, or billionths of a second. Reflection interfaces can occur along natural bedding planes, or the contacts between archaeological structures and the surrounding material. Reflected signals that are received at the surface antenna are then amplified and recorded digitally on a computer hard drive or tape. Their demodulated amplitudes can subsequently be displayed on paper by a graphic recorder, stored on magnetic tape in the audio frequency range, or digitally recorded.

GROUND-PENETRATING RADAR AT CERÉN

Ground-penetrating radar is most successful when high-conductivity targets are embedded within a low-conductivity matrix. The volcanic tephra that covered the sixth-century AD village has a very low conductivity because it is low in clay and very dry during the late winter and early spring, after many months of no rain. Largely because of a differing ability to retain what moisture is present, the contact of the ancient Classic Period living surface (the TBJ horizon or the clay underlying it) with the overlying tephra produces a distinct velocity contrast, making it an excellent reflection surface that produces high-amplitude reflected radar waves. The same is true for the clay structures built on top of this surface.

The earliest use of GPR at Cerén was in 1979, when a SIR-7 subsurface interface radar system with a single 80 MHz frequency antenna was used (Loker 1983; Sheets et al. 1985). The antenna was mounted on the rear of an oxcart, which provided a very consistent speed of movement. The oxcart mounting also provided a consistent 10 cm spacing between the antenna and the ground surface. In the cart were a gas-powered electrical generator, DC converter, graphic recorder, FM tape recorder, and the geophysicist. The work was done in early June in a year with a delayed rainy season, after about 7 months of little or no rain, which facilitated good radar energy penetration because of the low moisture. The data were collected within a 1-hectare grid to the south of Structure 1 along traverses each 100 m long, with each transect spaced 5 m apart (Fig. 3.1). A total of 3,800 m of reflection data were recorded. One anomaly was noted on the paper records that were printed on a graphic recorder during acquisition. It was tested and determined to be ancient architecture, now known as Structure 2 (Fig. 3.2). It was also visible in processed electrical resistivity data. The reflection data from this first GPR survey were stored in analog form on magnetic tape by the U.S. Geological Survey and put in storage until they were digitized in 1993 (Conyers 1995a).

The GPR surveys conducted in 1979 had many disadvantages absent from the other methods that were employed during the early geophysical trials at Cerén. The most obvious was the bulk and weight of the equipment, which had to be shipped to the field in advance by air freight within seven crates. There were also problems with U.S. Customs, which did not want to allow the instrumentation out of the country for fear that the sophisticated electronics would fall into unfriendly hands. Ultimately the project had to engage the U.S. Congress in order to obtain a special waiver of the shipping ban. The fact that the 1979 GPR survey discovered only one anomaly with GPR that proved to be cultural in nature, as well as the relatively greater success of resistivity measurements, almost biased the project against GPR. Only lately, with new digital acquisition and computer processing methods, has GPR produced results superior to the other instruments attempted at Cerén.

In 1979 GPR reflections were printed on paper as they were collected in the field, while simultaneously being recorded as small voltage changes on FM magnetic tape (Loker 1983). The one anomaly that was discovered on the paper copies at the time appeared to represent an arching of tephra, perhaps over a buried structure. This anomaly was tested by core drilling, which led to the discovery of Structure 2. It is now believed that this convex upward reflection was actually a series of reflection multiples generated off the floor of the buried structure (Conyers 1995b). Reflection multiples were created as the radar energy was reflected between the buried clay floor and the ground-air interface a number of times, creating a "ringing" effect in the profile. The clay platform itself is not visible in the 80 MHz frequency reflection data because of the long wavelength of the radar waves and a corresponding lack of resolution.

In August 1992 additional GPR data were acquired to the south of the site (Doolittle and Miller 1992). Due to the high ground moisture when the survey was made (mid-rainy season), radar energy was highly attenuated near the ground surface, and no anomalies or reflections of significance were identified.

The 1979 GPR data, which had been saved on magnetic tape, were digitized and reinterpreted in 1993 (Conyers 1995a). An additional 3,800 m of digital GPR data were also acquired in March 1994 using 300 MHz and 500 MHz antennas and a SIR-10 radar instrument. The total digital GPR database at the site now consists of more than 7,800 m of GPR data in five grids, covering approximately 2 hectares of surface area (Fig. 3.1).

All two-dimensional reflection profiles within the five grids were computer-processed to filter out much of the horizontal banding inherent in GPR data. Range gain control and band-pass filters were routinely employed during the 1994 data acquisition, which further enhanced these data. All of the grids collected in 1994 were surveyed, and topographic corrections were made to the data. The 80 MHz grid acquired in 1979 was not surveyed for surface elevations, and therefore no topographic corrections were possible. Fortunately, in 1979 the ground surface was essentially flat, with only a small rise in the southwest corner of the grid (Loker

1983), and therefore topographic corrections were not essential prior to data interpretation.

TIME-DEPTH ANALYSES

Many methods were employed to determine radar wave velocity, so that two-way GPR travel time could be converted to depth. The most accurate and straightforward method acquired radar data over known objects at known depths (Conyers and Lucius 1996). These tests were conducted just to the east of Operation 2. One test involved detecting a 2.5 cm (diameter) iron bar pounded into the side of a pit exactly 1.1 m below the ground surface. The 500 MHz antennas were then placed at the ground surface and slowly pulled over the metal bar while radar waves were projected into the subsurface. A reflection hyperbola, measured in radar travel time, was visible on the resulting profile, denoting the location of the iron bar. A similar test was performed in a nearby excavation where the southwest corner of Structure 13 had been partially exposed in Operation 2). A 2 m long portion of the structure's wall was measured 2.51 meters below the ground surface, and it was also visible on 300 MHz profiles collected over its buried extension (Conyers and Lucius 1996). In both of these tests, distance and time were directly measured, and therefore velocity could be calculated. The average radar wave velocity from the ground surface to the shallow iron bar was calculated at about 0.17 m/ns and to the deeper wall about 0.13 m/ns.

These analyses arrived at an average velocity for the overburden material while also demonstrating that radar wave velocity decreased with depth, probably due to a small increase in interstitial moisture. Overall, the estimated velocities through the tephra layers were quite high, comparable to that of dry sand, which has an average velocity of about 0.15 m/ns (Davis and Annan 1989).

Less direct velocity measurements were also made at the site in order to verify those made on the bar and the wall. These included transillumination and common midpoint tests, where radar waves are sent from one antenna to another, separated at known distances by the material to be measured (Conyers and Lucius 1996). Their results confirmed the direct velocity measurements obtained in bar and wall tests. An average velocity for the Cerén Sequence tephra was then used to convert all radar travel time to depth during profile processing.

To correlate radar reflections visible in GPR profiles to the known volcanic stratigraphy, two GPR profiles were acquired that ended at the edges of test pits (Conyers 1995). Both 300 and 500 MHz profiles were acquired between these excavations. In this way the stratigraphy in the test pits could be directly correlated to the radar reflections visible in profiles. Using the average velocity determined from the time-depth tests, it was determined that the highest amplitude and most continuous reflector was generated at the contact between the buried sixth-century AD living surface (the TBJ horizon) and the overlying tephra. At this contact there was a noticeable change in moisture content as well as lithology, which likely generated this distinguishable reflection.

The TBJ reflection was correlated from profile to profile within the GPR grids and its depth was mapped. A paleotopographic map of the sixth-century AD living surface was constructed from more than 3,130 subsurface measurements (Fig. 3.3).

MAPPING BURIED STRUCTURES, THE ANCIENT LANDSCAPE, AND OTHER ANTHROPOGENIC FEATURES

Once the topography of the ancient TBJ living surface had been mapped, the location of the structures built on it and other cultural features were delineated. Identifying nonhorizontal or nonplanar features, such as standing walls or columns, in GPR data can be difficult due to the complex ray paths that transmitted and reflected radar energy can take in the subsurface. This is due in part to the conical-shaped transmission beam that creates multiple reflections from the same buried features as the surface antenna is moved across the ground. For this reason, a buried structure does not look like one would imagine in two-dimensional reflection profiles but appears more like a "distorted pseudosection" (Olhoeft 1994).

Synthetic radargram modeling was developed in an attempt to model what buried objects and complex reflection surfaces "should" look like in a two-dimensional profile (Goodman 1994). Computer-simulated models trace the paths of radar waves during transmission and reflection through various modeled media that have defined dimensions and electrical properties. The computer models take into account the reflectivity that is likely to occur at various interfaces, signal attenuation with depth, and other electrical properties of units. Large numbers of potential radar wave paths are simulated on the computer, and reflections that would likely occur in the real world are recorded just as they would be in the field. The amplitudes of the predicted reflections are also predicted by the com-

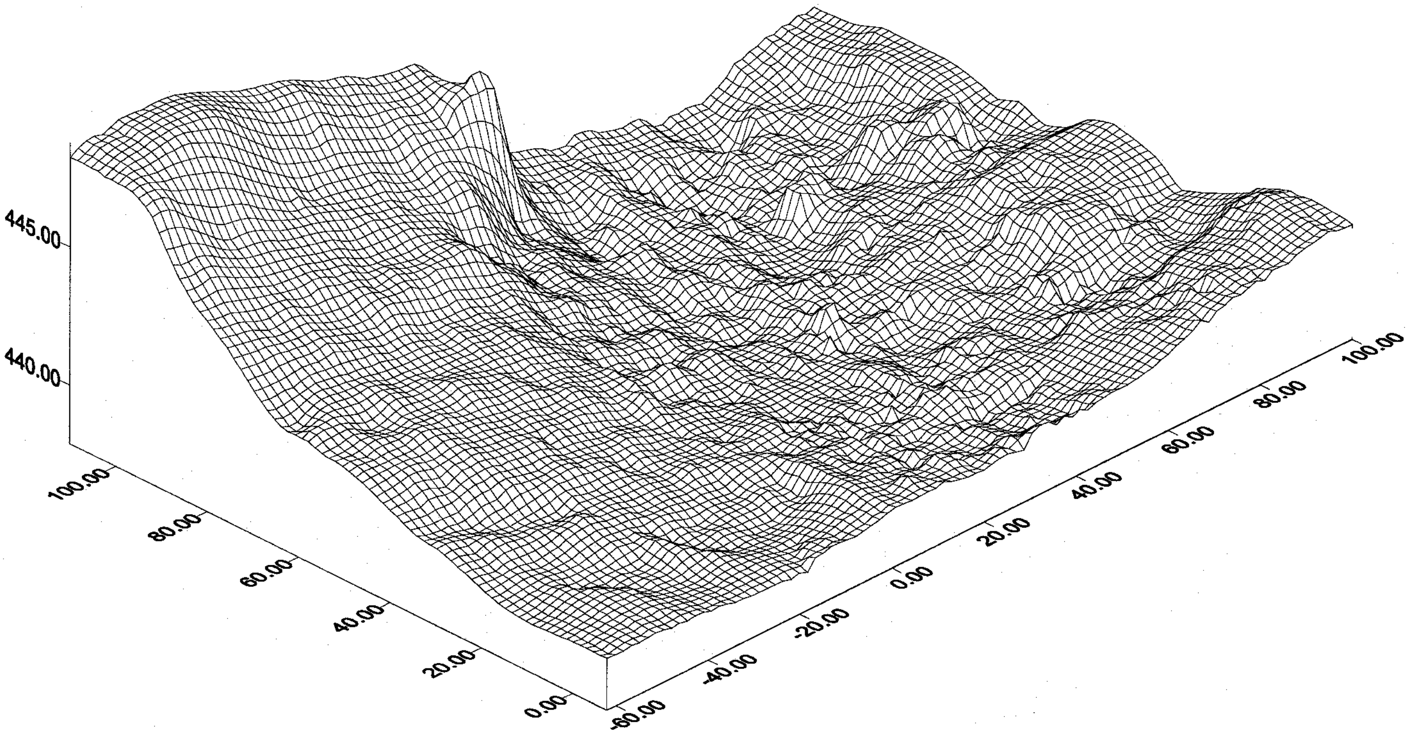


FIGURE 3.3. Three-dimensional map of the buried Classic Period living surface. The view is to the northwest at 35° from the horizon. The buried topography is exaggerated three times. Small bumps along the north edge of the central valley are buried structures.

puter. The resulting two-dimensional models are extremely valuable because they can be compared to actual field data in order to provide a model for what to look for and also as support for the resulting interpretations.

A number of synthetic computer models were created in order to model an area around representative buried structures (Conyers 1995b). In these models, velocities and electrical properties of the various overburden units that were obtained in the field were employed. One of the models replicated a buried structure with a raised platform and standing walls and columns. The structure was a representation of Structure 2, which is visible on three of the 80 MHz GPR profiles in Grid 1. When 300 MHz radar energy was simulated, a strong reflection was generated at the contact between the TBJ living surface and the overlying tephra. A high-amplitude point-source reflection hyperbola was also generated from the floor of the structure. The resulting hyperbolic floor reflection obscures the reflection derived from the TBJ living surface near the edge of the structure. Additional hyperbolic reflections were generated from the tops and sides of the walls and columns. A remarkable similarity was seen to exist between what the models predicted and what was visible in many GPR sections, adding confidence to the interpretations below.

Hyperbolic reflections visible in GPR profiles, which the synthetic models indicated may denote buried structures, were recorded during profile interpretation. As demonstrated in the synthetic models, reflections of this sort can be derived from the tops and sides of structural platforms, as well as from the tops of walls and columns. Reflections generated from house platforms (especially multiple reflections, as in Fig. 3.2) are very distinct on 80 MHz profiles, while those from the top of standing walls or columns are so subtle they are almost invisible, due to the lack of resolution in these low-frequency data. The 300 MHz profiles, with their good subsurface resolution, recorded many subtle changes in topography at the TBJ horizon not visible in 80 MHz data. These profiles displayed some buried structure platforms that are raised as little as 20 cm above the TBJ living surface. Standing walls and other large features are also visible.

The correlation between the location of hyperbolic point-source reflections and multiple reflections and the buried structures known from excavation is excellent. Of the nine excavated or partially excavated structures located within the GPR grids, eight can be readily identified by point-source reflections and a visible rise in the buried living surface near their foundations. In addition, eighteen probable structures were identifiable in GPR profiles that have not yet been confirmed by drilling or excavation (Conyers 1995a).

The most striking feature of the buried TBJ surface is the variation in topography across the site and the intricacy of the buried Classic Period drainage pattern (Fig. 3.3). The landscape prior to the eruption consisted of a small, elongated valley, located in the west-central portion of the GPR grids, surrounded by low bluffs to the north and east. A gradual southern slope rose out of the valley to the southwest, ultimately forming a large hill. Buried structures are located primarily on the northern and southern flanks of the central valley. Within the central valley were located a complex series of drainage channels, geographically restricted topographic rises, and small closed depressions. Drainage channels within the valley had a maximum depth of about 1.5 m and gently sloping banks. Numerous small closed depressions and mounds within some of these channels may have been created by clay-quarrying operations.

The GPR-produced map of the site illustrates the preference of the Cerén inhabitants for building their structures on the north flank of the valley. This area was the location of numerous other use areas, including gardens, orchards, and small maize fields that have been exposed in excavations (Sheets 1992a).

A wide flat plaza, located on the crest of the bluff along the north edge of the valley, was quite distinctive in GPR profiles as a continuous high-amplitude reflection. It is surrounded on the east, south, and west by structures that evidently had a civic function (Sheets 1992a). The northern edge of the plaza is not known, because it was destroyed during the 1976 bulldozing operations.

Three household clusters and numerous scattered houses are visible on GPR profiles within the northern portion of the radar grids. The structure density in this relatively small area indicates that the population density at Cerén may have been quite high at the time of the eruption. The presence of the plaza and its associated communal buildings, as well as the religious structures, just to the east of the GPR grids (Sheets 1992a), is evidence for the presence of many more people than conceivably could have lived in the households so far identified in excavations and the GPR surveys.

Other buildings that were likely part of the village but have yet to be discovered are probably located to the northwest and west of the known extent of the site. Additional GPR surveys were conducted in March 1997 in these areas, but the data have not yet been completely interpreted. Preliminary interpretation has discovered at least two buried structures to the northwest of the site.

Conclusions

Electrical resistivity and ground-penetrating radar proved to be the most effective geophysical techniques for exploration at Cerén. Electrical resistivity measurements were the fastest way to locate large buried clay structures. The data were immediately available for processing and their interpretation was fairly straightforward. The equipment can be transported more easily and contour maps and resistivity profiles can be easily produced manually or on simple computer programs. More sophisticated processing can also be undertaken after returning from the field, although this was not done with the Cerén data.

One of the limitations of resistivity is its inability to determine the exact depth of anomalies. Only the most prominent buried structures were located by this method. Medium and small structures and details about the buried Classic Period living surface were undetectable. The method was also usable only during or immediately after the rainy season, when ground moisture was at a maximum.

In contrast, GPR was most successful toward the end of the dry season, after the volcanic tephra had dried out. Ground-penetrating radar equipment was more difficult to transport to and from the field than that needed for resistivity surveys. The resulting data also needed more sophisticated data processing and interpretation techniques. Even the modern digital systems, which are much smaller than the system taken to Cerén in 1979, must be packed in a number of shipping containers. Fairly powerful computers and sophisticated software are also needed to process the data. As a result, little data were available for interpretation in the field, a detriment when immediate results are a necessity. These problems are being quickly overcome with powerful portable computers and the miniaturization of GPR equipment.

The benefits of GPR far outweighed the difficulties encountered. Ground-penetrating radar detected both large and subtle buried features and measured their depth below the surface. Sophisticated digital data-processing techniques were able to filter out much of the "noise" that was collected along with the useful reflection data, making hard-to-see features visible. Velocity tests allowed reflection times to be converted to approximate depth, creating a three-dimensional picture of the site. Computer modeling of known archaeological features also greatly aided interpretation. This "visualization" method allowed previously unrecognizable anomalies to be recognized in two-dimensional profiles.

The three-dimensional interpretation techniques for GPR data allowed the ancient living surface reflector to be identified and its depth measured. The paleotopographic maps produced from these elevations illustrate the complex nature of the buried Classic Period living surface. The abundance of channels and ridges that existed on this surface between household clusters was startling to many of us who had expected subtle topographic variations. Only after GPR mapping could the archaeological richness derived from excavations be integrated into its ancient landscape.

Geophysical research demonstrates that the ancient village of Cerén was constructed around a small valley located between bluffs. Buildings were constructed on the highest topographic areas, and the valley bottom was likely the location of agricultural activity and clay quarrying. No excavations have yet been conducted in this valley or to the south, and therefore specific activities that might have been conducted in these areas must remain speculative.

The southern boundary of the village was discovered by GPR, along the southern margin of the 1979 GPR grid (Fig. 3.1). Land devoted to agriculture was likely located south of this area, although this has not yet been confirmed by excavation and cannot be discerned in GPR profiles. An additional eighteen structures are suggested from geophysical mapping within an area of a little less than a hectare. The buildings located by archaeological excavation and GPR are probably only a small percentage of the total that still remain undetected to the northwest and west of the present site.

Cerén Plant Resources: Abundance and Diversity

David L. Lentz and Carlos R. Ramírez-Sosa

Because of the rapid deposition of tephra on the site surface, conditions for the preservation of plant remains are excellent at Cerén, and exceptional amounts of paleoethnobotanical data have been retrieved that shed new light on ancient plant use practices. Cerén provides a model, not only for the investigation of subsistence activities at a Central American site, but also as a laboratory for the testing of assumptions concerning the interpretation of scant remains at sites with a less-informative corpus of plant use data. The ultimate goal of paleoethnobotanical research at Cerén is to use modern plant remains retrieval techniques—i.e., soil flotation, macrobotanical collection, and microfossil analysis—to learn more about ancient Mesoamerican subsistence activities and to test the validity of paleoethnobotanical methodology. This work is in progress and far from complete, yet much has been learned thus far from studies at Cerén, and a current inventory of the plants that have been identified and cataloged will be discussed.

Methodology

Plant remains were collected in many ways at the Cerén site: as macroremains, or those large, charred, in situ items found on activity surfaces; as plaster casts of former plants that were encased by the steamy tephra, then preserved for posterity as impressions in the ash matrix; and as samples from soil collections that were subjected to water flotation. The soil or ash contents of occupational fill, intact vessels, and middens were carefully removed, measured, bagged, and stored for subsequent water separation and analysis. These soil and ash samples were processed by water flotation using a manual technique (Pearsall 1989) that resulted in both a light fraction (the items that floated, e.g., charcoal and carbonized seeds) and a heavy fraction. A fine mesh screen (150 μm sieve opening) was employed to collect the light fraction. Rough sorting was accomplished using a stereomicroscope with magnifications adjustable from 7 to 70×. Most of the plant remains preserved at Cerén were carbonized, but others that were clearly in situ were merely desiccated by the heat of the warm tephra blanket. Plant parts preserved in both ways were recovered by flotation procedures. Wood charcoal identification was initiated using a GUESS wood analysis program (Wheeler et al. 1986), with final reference to a Central American wood collection before taxon assignment. For more difficult cases, as with some charcoal and tiny seeds, a scanning electron microscope (JEOL LV5410) located at the New York Botanical Garden's Plant Science Laboratory was employed to generate images of adequate depth of field and resolution for accurate identifications.

As excavators approached ancient activity surface levels, unusual cavities, or hollow areas, in the ash were discovered. These hollow areas were actually tephra impressions of plants and other objects. Using techniques similar to those employed at Pompeii (Jashemski 1973), excavators filled in hollow areas with dental plaster and the results were often fascinating. In a number of cases, the outlines of cornstalks from ancient gardens were revealed. In Structure 4, a plaster cast of maize cobs in a crib showed how whole cobs were kept for

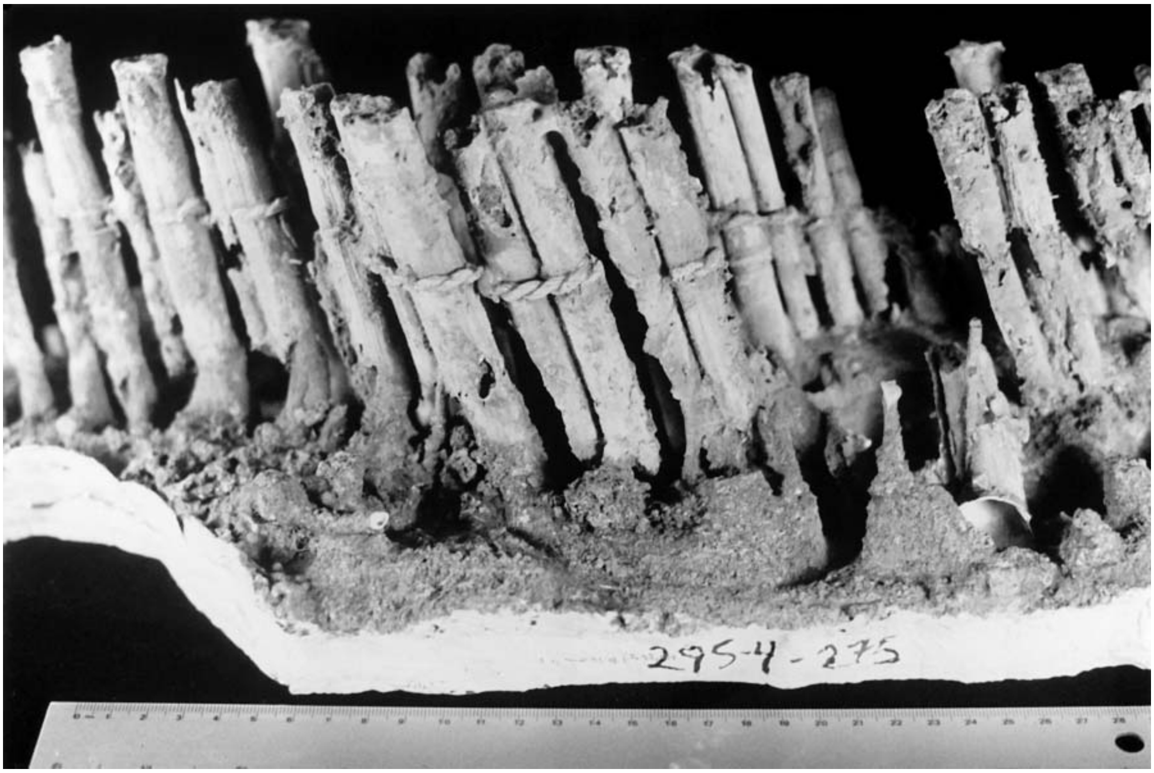


FIGURE 4.1. Plaster cast of a fence associated with Structure 4, made from *Tithonia rotundifolia* (a native Salvadoran plant in the sunflower family) stems. Several of these fences and pole walls, some of which were rolled up and portable, were found at Cerén.

long-term storage. Another of the lifelike plaster casts revealed a fence made from stems of *Tithonia rotundifolia* (a member of the Asteraceae, or sunflower, family), tied with agave twine (Fig. 4.1). Using the plaster molding technique, an entire garden of *Agave* cf. *americana* was discovered beside a house complex. Evidence for various root crops was revealed through this technique, as well. Gardens at Cerén, discovered by the plaster replacement process during excavation, present a view of the species being planted, and also something of the techniques of cultivation.

Cerén Subsistence

Undoubtedly the most ubiquitous plant remains at Cerén were of maize. As seen in the numerous cob impressions, the Cerén maize shares morphological characteristics with the Nal Tel race of maize described by Wellhausen and associates (1957) and Benz (1986). Like the Nal Tel race, the Cerén cobs are short, cylindrical to slightly tapered, 8–16 rows of kernels per cob (average = 13), and have smooth, rounded kernels with few signs of denting. Nal Tel grows well in warm regions at low elevations and would have been ideally suited to the climate and elevation of what is now north-central El Salvador. This race of maize has a wide range of adaptations, is plastic in terms of soil requirements, and matures quickly (Wellhausen et al. 1957). Modern descriptions of Nal Tel come largely from existing landraces, but similar examples have been identified from designs or impressions on ceramic vessels in Late Classic Monte Albán in Oaxaca, Mexico, and at the Augustín site in Guatemala (Wellhausen et al. 1952). Classic Period inhabitants of Copán (Lentz 1991) and Salitrón Viejo (Lentz 1989) in Honduras, just north of Cerén, appeared to use maize of similar morphology. Thus it seems that Nal Tel maize or a variety closely related was widely propagated throughout ancient Mesoamerica from early times and was grown as a regional mainstay.

Large handfuls of beans, both common beans (*Phaseolus vulgaris* L.) and sieva or Lima beans (*P. lunatus* L.) plus some wild relatives, were found at Cerén in ceramic vessels and other storage units. Because different kinds of beans were mixed together, it appears that the Cerén farmers were not very careful about separating varieties of the cultigen (Lawrence Kaplan, personal communication

1996). Presumably these mixed collections would be cooked or sown together, as well. The Cerén bean collection is perhaps the largest from Mesoamerica and will provide insight into the morphological and genetic variability of this valuable domesticate as research continues.

The synergistic effects of a diet of corn and beans have been well publicized. When consumed together, they provide all of the eight essential amino acids for human nutrition. Where maize is deficient in amino acids—for example, tryptophan—beans provide an adequate supplement (L. Kaplan 1973). Additionally, beans, with the help of their nitrogen-fixing *Rhizobium* spp. symbionts, can produce high-quality proteins even when grown in nitrogen-deficient soils. This is a real asset in many of the less fertile areas of Mesoamerica and it undoubtedly helped the Cerén farmers, even though soils in the area were relatively fertile with a neutral pH (6.9–7.4) and a high potassium, phosphorous, and nitrogen content (Payson Sheets, personal communication 1994).

Most of the squash remains retrieved from Cerén were fruit rinds (Table 4.1), a tissue layer that generally cannot be identified to the species level. Peduncles, the stem attachments to the fruit, and seeds are diagnostic parts that are the most likely to be recovered. Several seeds of *Cucurbita moschata* (Duch.) Duch. ex Poir., the most common species cultivated prehistorically in southern Mesoamerica, were identified. Also, seeds of *C. pepo* L. were recovered from Operations 4 and 8 at Cerén, but some of these may have been modern intrusions via rodent introduction. What appears to be a fluted and twisted peduncle of *C. pepo* fruit was found in Operation 7. Evidence of *C. pepo* elsewhere in Precolumbian Mesoamerica was recorded at Edzná (Turner and Miksicek 1984).

Until recently, cultivated chile peppers (*Capsicum annuum* L.) have been almost absent from the paleoethnobotanical record. The data from the Cerén site, however, present quite a different picture. Carbonized chile pepper seeds, peduncles, and rinds were found in great abundance, especially in storage rooms and a kitchen (Structure 11, Operation 1), where they were hung from the rafters in large clusters (Lentz et al. 1996). Several ceramic vessels contained seeds that possibly were in storage for subsequent planting or consumption. Chiles, with their substantial vitamin content, were clearly an important component of the diet at Cerén. Probably these were grown as house garden plants, as is the practice among the modern Kekchi Maya of Guatemala. Operation 7 has a plaster cast that resembles a pepper plant, indicating that peppers were carefully tended dooryard cultigens. Perhaps the earliest example of chile peppers in Mesoamerica came from Phase II (Formative Period) deposits at Cuello (Miksicek 1991), in the form of a tiny seed from a wild variety, *C. annuum* var. *aviculare* (Dierb.) D'Arcy & Eshbaugh. Another chile seed was found at Late Formative Cerros (Cliff and Crane 1989), and carbonized peduncles were identified at Late Classic Dos Pilas (Lentz 1994). But to date, Cerén has the largest assortment of chile remains yet discovered in Mesoamerica.

Notwithstanding the predominance of maize as a staple, root crops clearly were important too. Manioc (*Manihot esculenta* Crantz) has been hypothesized as a major crop for the ancient Mesoamericans (Bronson 1966), but little documentation for this practice has been discovered. The limited evidence for manioc cultivation is at least in part due to the double problem of poor preservation of root crops in seasonally wet areas and the difficulty in identifying the fleshy parts, especially after they have been crushed or carbonized. Also, manioc is usually propagated vegetatively without the use of seeds, so there are few opportunities for seeds to become preserved by the usual means. Fortunately, the plaster replacement method has provided evidence for what may have been an important cultigen. Manioc root and stem casts were uncovered at Cerén in a house garden in Operation 7 and stems were found in Operations 1, 2 and 4. Plaster casts of manioc stems can be recognized by their distinctively wide leaf scars. Judging strictly from the number of examples of each cultigen, however, maize was a more dominant part of the diet than manioc.

Casts of malanga (*Xanthosoma violaceum* Schott) stems were abundant in Operations 1 and 7. This represents the first time the cultigen has been described from a Mesoamerican archaeological site and underscores the importance of research at Cerén. This was apparently a popular crop for the Cerén farmers, because there was evidence of several dense stands, now preserved as plaster casts (Fig. 4.2). Ethnographic accounts of malanga tell us it has been grown in many parts of Mesoamerica (Alcorn 1984; Standley and Steyermark 1958). The plant produces a thick, starchy root that is rendered edible by cooking. Malanga, when considered with manioc, would have added substantially to the caloric base, if not the nutritional base, of the Cerén diet.

Cotton (*Gossypium hirsutum* L.), an indigenous crop in the Maya area, seems to have been a vital

TABLE 4.1. Cerén Plant Remains

		Number of Contexts							
Taxon/Part	*Common Name(s)*	*Op. 1*	*Op. 2*	*Op. 3*	*Op. 4*	*Op. 5*	*Op. 6*	*Op. 7*	*Op. 8*
Gymnosperms									
Pinaceae									
Pinus sp. charcoal	pine, ocote				1				
Dicots									
Dicot leaf			1						
Dicot rind					1				
Dicot root			2		2				
Dicot stem		2	3	2				9	
Dicot charcoal		3			7				
Apocynaceae									
Aspidosperma sp. charcoal	malady, cojotón		1		3				
Asteraceae									
Tithonia rotundifolia stem	mirasol		1		11				
Bignoniaceae									
Crescentia alata fruit	calabash, morro	1		1	5				1
C. alata stem			1		3			1	
Cucurbitaceae									
Cucurbita moschata seeds	squash, ayote	1						7	
C. pepo seeds	pumpkin, ayote				1				1
C. pepo peduncle dried								1	
Cucurbita sp. rind	squash, ayote				2				
Cucurbita sp. seeds	squash, ayote	3	1						
Cucurbita sp. seed impressions	squash, ayote	1							
Lagenaria sp. rind	gourd, tecomate	1							
Euphorbiaceae									
Manihot esculenta root	manioc, yuca							1	
M. esculenta stem			1	1		2			6
Fabaceae									
Phaseolus lunatus seeds	Lima bean, frijol de media luna	1							
P. vulgaris seeds	common bean, frijol	3	1		11				
Phaseolus sp. cotyledons	bean, frijol	1			3				
Phaseolus sp. seed									
Flacourtiaceae									
Casearia sp. charcoal	canjuro, iximche				2				
Lauraceae									
Nectandra sp. charcoal	aguacatillo				1				
Persea americana leaf impression	avocado, aguacate	1							
P. americana cotyledon	avocado, aguacate		2		2			1	
Malpigiaceae									
Byrsonima crassifolia fruit	nance						8		
Malvaceae									
Gossypium hirsutum embryos	cotton, algodón	1							
G. hirsutum fibers	cotton, algodón	1							
G. hirsutum seeds	cotton, algodón	1	1		2				
Meliaceae									
Cedrela sp. charcoal	Spanish cedar, cedro	1							
Moraceae									
Ficus sp. charcoal	fig, amate	2							
Myrtaceae									
Psidium guajava fruit casts	guava, guayaba				78		2	1	
P. guajava stem cast	guava, guayaba				6				
P. guajava leaf	guava, guayaba	1			1				1
Rosaceae								1	
Prunus cf. *brachybotrya* charcoal	escobo								
Rubiaceae									
stem					4				
Sapindaceae									
Cupania dentata charcoal	grande Betty, pava				1				

TABLE 4.1. Continued

Taxon/Part	Common Name(s)	*Number of Contexts*							
		Op. 1	*Op. 2*	*Op. 3*	*Op. 4*	*Op. 5*	*Op. 6*	*Op. 7*	*Op. 8*
Solanaceae anthers	nightshade family				1				
Capsicum annuum seeds	pepper, chile	5	1		7			1	
C. annuum peduncles	pepper, chile				1		1		
C. annuum stems	pepper, chile							1	
Sterculiaceae									
Theobroma cacao fruit	chocolate, cacao				2				
T. cacao seeds	chocolate, cacao		4		8				
Tiliaceae									
Muntingia calabura seeds	capulín	1							
Ulmaceae									
Celtis sp. pits	hackberry, cagalero	1							
Monocots									
Monocot fibers								1	
Monocot leaf								1	
Monocot stem		2	1		1			4	
Amaryllidaceae									
Agave sp. fibers	agave, maguey	3			4			1	
Agave sp. leaf	agave, maguey	1			1			10	
Agave sp. plant	agave, maguey	1			4				
Agave sp. stem	agave, maguey				9				
Araceae									
Xanthosoma violaceum stem	malanga	1						3	
X. violaceum tuber								1	
Arecaceae fibers	palm, palmas				1				
Acrocomia aculeata endocarps	coyol		1					1	
Bromeliaceae									
inflorescence cast	bromeliad							2	
leaf	bromeliad							1	
stem	bromeliad							1	
Cyperaceae rhizome	sedge, coyolillo				1				
Poaceae stem	grass, zacate				5				
leaves	grass, zacate				1				
Trachypogon plumosus stems	maize, maíz	6			4				
Zea mays cob	maize, maíz		2		25	1		2	1
Z. mays kernel	maize, maíz	2			7			1	
Z. mays stem		28	11		2		3	84	
Z. mays ear		3	2					13	
Z. mays prop roots			1		1				

crop at Cerén. It was used as a source of fiber for clothing and other purposes, and the seeds apparently were used as a source of oil. Confirmation of this was found in the trough of a metate in Structure 4, a storehouse filled with food items, where 74 cotton seeds were being ground, ostensibly for oil extraction (Lentz et al. 1996). The oil may have been used as a base for paints, as a liniment, or for other purposes, but the archaeological context suggests the product extracted with the grinding stone, i.e., cottonseed oil, was used for cooking purposes. If this was so, it would have added fats to a diet that is in other respects deficient. One drawback is that unrefined cottonseed oil contains about 0.36% gossypol (Smallwood 1978), a polyphenolic binapthalene-dialdehyde that is toxic at high concentrations. One study revealed the lethal dose in 50% of the cases tested (LD50) with gossypol in rats is 2,870 mg/kg (Telek and Martin 1981). Another experiment revealed that a 15% diet of cotton meal with 1.1% gossypol caused growth suppression in baby chickens (Krishnamurthi 1954). If these results can be converted to human terms, a child with a regular diet of 45% cottonseed oil would have stunted growth, while a 50 kg adult who ingested 40 liters of cottonseed oil in one sitting would receive a lethal dose of gossypol. These possibilities are, at best, highly unlikely. More realistically, individuals would have consumed far less and the oil would probably not have been a major portion of the diet.

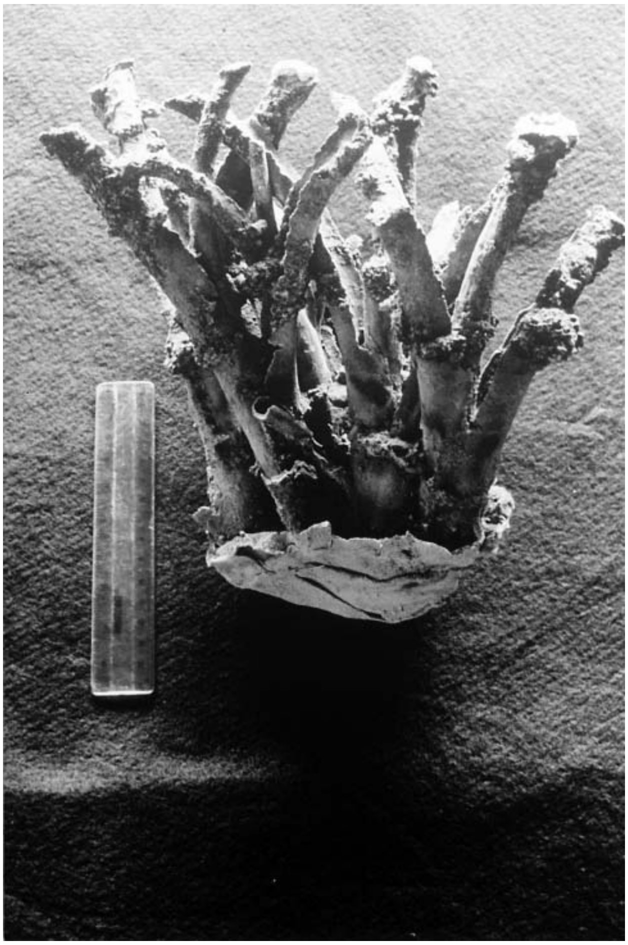


FIGURE 4.2. Plaster casts of malanga (*Xanthosoma violaceum*) stems, a root crop native to Central America, from Operation 7.

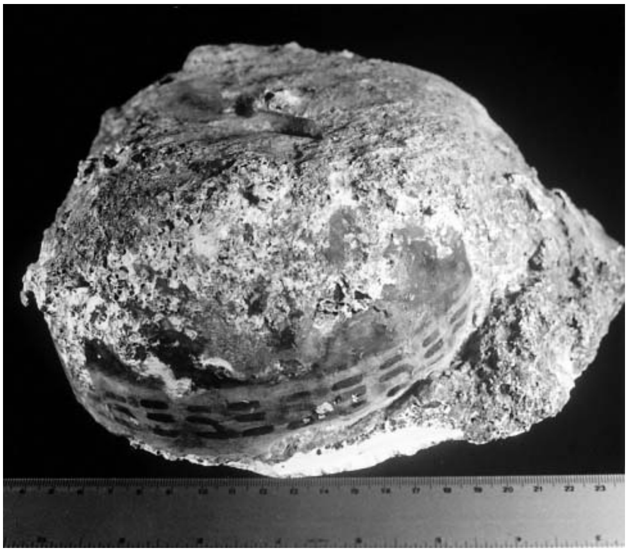


FIGURE 4.3. A painted calabash (*Crescentia alata*).

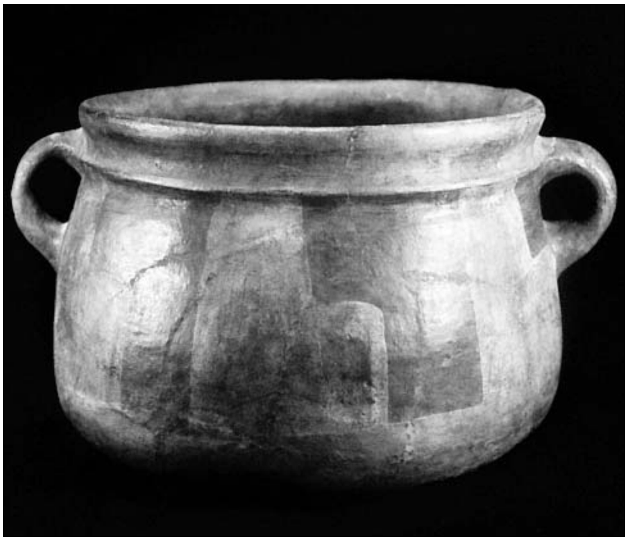
Accordingly, the use of unrefined cottonseed oil in small quantities for cooking purposes seems plausible. However, these calculations do not take into account an interesting long-term effect resulting from a steady diet of small doses of gossypol. It lowers sperm counts and has been used as a reliable male contraceptive in China, with negligible side effects reported (Telek and Martin 1981). One can only wonder at the impact this may have had on Precolumbian society. A final comment on cotton is that because its natural habit is to grow as a shrub, it probably was grown as a perennial at Cerén and elsewhere in Mesoamerica.

Another fiber plant, agave (*Agave* spp.), currently used widely throughout Central America, was grown as a prolific home garden plant at Cerén. Casts of many of these plants define the location of an extensive, carefully tended, infield garden next to Household 4. This garden and others like it were the source of raw material for the many examples of agave fiber twine found at the site.

Numerous authors have hypothesized in various ways that the ancient Mesoamericans relied extensively on tree cropping (Caballero 1989; Dahlin 1979; Folan et al. 1979; Gómez-Pompa et al. 1987, 1990; Lange 1971; Lundell 1938; McBryde 1947; McKillop 1994; Miksicek 1990; Netting 1977; Pérez Romero and Cobos 1990; Puleston 1968, 1982; Turner and Miksicek 1984; Wilken 1971; Wiseman 1978), and these assertions are largely corroborated by paleoethnobotanical data from Cerén, where economically important trees were planted in household courtyards. Branches, leaves, and cotyledons of avocado (*Persea americana* Mill.); abundant casts of whole guava (*Psidium guajava* L.) fruits; branches and rinds of calabash (*Crescentia alata* HBK) (Fig. 4.3); and stems and fruits of nance were arrayed across the activity surfaces of several house compounds. The distribution of these remains tells us that arboriculture was being practiced in patches of land in direct association with house structures. Agave, manioc, peppers, malanga, and corn were planted adjacent to the house compounds, as well. Evidently the citizens of Cerén grew much of their sustenance in infield gardens or orchards that could be fertilized with household wastes and night soil.

A cacao (*Theobroma cacao* L.) tree with an inflorescence still attached to the trunk (a characteristic cauliflorous habit) was unearthed near Structure 4. Additionally, there was considerable evidence for the use of cacao; casts of fruit pods and preserved seeds were found in Operations 2 and 4. The presence of the fruit pods reinforces the idea that cacao was grown locally. Cacao fruits do not travel well and will quickly begin to rot after they are removed from the tree. Thus, it seems likely that cacao, if not grown extensively in the immediate vicinity of the house compounds, was cultivated nearby. Structure 4 (Operation 4) contained a painted ceramic vessel bearing numerous cacao seeds and residue (Fig. 4.4). Because of the fine quality of the vessel and the ethnographic literature that describes cacao as a component in rituals, a ceremonial function is implied. Our conclusion is that cacao was produced in the area and the people of Cerén had an ample supply to use in ways that reflect ceremonial prac-

FIGURE 4.4. Cacao (*Theobroma cacao*) residue (a) in a painted vessel (b) from Operation 4.



tices found in evidence among other Mesoamerican communities at the time.

The absence of abundant palm remains at Cerén raises some interesting questions about the role of this important family of plants, not only at Cerén, but throughout the region. In general, the most widely used palms were the indigenous coyol (*Acrocomia aculeata* [Jacq.] Lodd. ex Mart.),[1] huiscoyol (*Bactris* spp.), and cohune (*Attalea cohune* [Mart.] Henderson). Remains of all of these have been recovered from numerous sites throughout the region, often with more than one species being exploited at any one site. Curiously, there appears to have been no extensive use of palms at Cerén as a food source. Few clearly identifiable palm remains have been recovered from Cerén. One example, a carved coyol endocarp that appeared to have been used as a spindle whorl, was found in Structure 7. This was an unusual item that may have been brought to the site as an exotic or imported item. Evidently the Cerén inhabitants had access to coyol germ plasm, yet, unlike their Copán neighbors to the north who seem to have exploited the palm extensively, eschewed it as a useful food source or perhaps used the palm in a different way so that the sturdy plant parts would have been discarded away from the site. It is possible that the Cerén inhabitants had less need for palms as a food source. The ancient Maya may have been interested in palm fruits because of their high oil content (C. Smith 1967; Lentz 1991). Cerén farmers, however, may have had their oil needs met through sources such as squash or cotton seeds, the latter a by-product of fiber production, and had less demand for palm oil.

Another food source of the ancient Maya that has been discussed for decades is ramón (*Brosimum alicastrum* Sw.). The concept that the fruit of this tropical forest tree was a staple for the prehistoric Maya was suggested first by Lundell (1938), later embellished by Puleston (1968, 1982), and recently resurrected by Atran (1993). This argument is based largely on the fact that many Maya archaeological sites are heavily populated with ramón trees, presumably descended from those planted by the ancient Maya. Lambert and Arnason (1982) argue that ramón trees are found today at archaeological sites because of ecological advantages, but their observations have little to do with whether or not the Maya actually used ramón in ancient times. Alternatively, Peters (1983) observed unusual patterns in phenology, productivity, and breeding systems among ramón populations at Tikal, indicating that the Maya may have cultivated the tree in the past. The fruits are edible and nutritious, and many indigenous people of Mesoamerica are known to consume them (Alcorn 1984; Lentz 1993), but more as a famine food than as a major foodstuff. Remains of ramón (one seed) have been recorded from the Cobá site in southern Mexico (Beltrán Frías 1987), but otherwise the paleoethnobotanical record reflects little use of the plant in the past (Lentz 1999). It is possible that the Cerén inhabitants were using ramón in ways that would systematically keep the remains from entering the site, but if it were being utilized in any significant way, substantial evidence would have been uncovered, especially at a well-preserved site like Cerén. Although the ramón hypothesis has been the focus of many stimulating discussions, the paleoethnobotanical record at Cerén does not support the use of ramón as an important food source in the past.

Visitors to the Cerén site often ask about the use of medicinal plants at the site. Perhaps the best evidence for this is the plaster casts of the Rubiaceae shrubs found in Operation 4. These shrubs (Fig. 4.5), with opposite branches and scars of interpetiolar stipules, resemble *Hamelia patens* Jacq., called ix-canan by the Maya. The Maya use the plant to treat skin problems, and its antimicrobial properties have been well documented (Arvigo and Balick 1993). Perhaps the healers of ancient Cerén were aware of the useful attributes of ix-canan, too.

Environmental Indications

While carbonized seeds and fruit rinds can tell us much about the food consumption habits of the prehistoric Maya, the charcoal from ancient hearths and burned buildings of the past help define what wood products the Cerén occupants were extracting from the surrounding landscape. In general, a number of tropical deciduous forest dominants (*Cedrela* sp., *Ficus* spp., and *Aspidosperma* sp.) as well as second growth/understory trees (*Nectandra* sp., *Cupania dentata,* and *Casearia* sp.) were represented among the charcoal fragments identified. Because these fragments were all identified from roof fall, they probably were used for construction purposes. A surprising trend revealed by the Cerén charcoal record is the amount of pine (*Pinus* spp.) found, even though the trees do not grow near the site today. The explanation for these observations would include a long-distance transport hypothesis or one of climatic- or anthropogenic-induced environmental changes, in which pine trees grew closer to the site in prehistoric times. The presence of pine where

FIGURE 4.5. Plaster cast of a medicinal shrub (cf. *Hamelia patens*) found in the dooryard of Structure 4, Operation 4.

it was unexpected also occurred at Cuello (Miksicek 1991) and Dos Pilas (Lentz 1994). Continued research will help to elucidate this phenomenon more fully.

Roof thatch was composed primarily of stems of *Trachypogon plumosus,* a grass that apparently was common in the area in Late Classic times (Lentz et al. 1996). This grass often grows in broad meadows or even savannas, where it becomes the dominant species as still seen today in other parts of the neotropics (San José, Farinas, and Rosales 1991). The fact that this previously abundant native grass has largely been replaced by Old World grasses in the Zapotitán Valley demonstrates the subtle, yet pervasive, environmental changes brought about by humans during the last 5 centuries.

Summary

The data reviewed clearly indicate that the prehistoric Cerén occupants did indeed have a maize-based system of food production, along with squash and several varieties of beans as field crops probably grown in an infield-outfield system. Other valuable food crops were chile peppers, malanga, and manioc. Cotton and agave were fiber sources, while cotton seeds, as useful by-products, provided a rich source of oil.

Orchard farming and the reliance on tree crops were definitely in evidence at Cerén. Important broadleaf trees included avocado, guava, nance, cacao, calabash, capulín, and others. No evidence for ramón, however, has been recovered thus far. Even though several species of palm were exploited by the ancient Maya, only coyol may have been actively cultivated at Cerén.

Forest products used for construction materials, extracted from plant communities surrounding the site, have been described from among the charcoal remains. These indicate that parts of the surrounding environment were covered with tropical deciduous forest, interdigitated with fields, second-growth forest, circum-riverine wetlands, and *Trachypogon* savanna. Results of this analysis have indicated that forest degradation may have accompanied human occupation at Cerén. Pine appears in the archaeological sediments, although it does not grow in the surrounding area now, suggesting long-distance transport of the wood, possibly as pine charcoal. Alternatively, the species may have grown closer to the site in the past as a result of environmental changes caused by human activities or climatic shifts, and therefore could have been harvested by the Cerén farmers more conveniently.

The archaeological record indicates that the human condition during Classic times at the Cerén site was one of diverse options, at least in relation to plant products available from both wild and domesticated sources. Corn, at least two species of beans, possibly two species of squash, rafters laden with chile peppers, gourds, calabashes, agave, manioc, avocados, capulín, and cacao, all were in evidence. These products were most likely produced locally in home gardens and swidden outfields. Cotton was a likely "cash" crop, as evidenced by the numerous cotton seeds, spindle whorls, and even preserved textiles. Seed oil probably was a useful by-product of textile production. Cotton textiles would have been an excellent commodity for trade, owing to their value-added dimension and ease of transport, and may have been bartered for the numerous exotic goods found at the site. In short, the Cerén community occupied a highly productive niche that enabled the inhabitants to feed themselves from a variety of plant sources and produce enough surplus to draw in trade goods from the greater Mesoamerican cultural sphere.

Acknowledgments

This research was supported by the Heinz Family Foundation, H. John Heinz III Fund Grant Program for Latin American Archaeology (Grant #H0787), and the Committee for Research and Exploration of the National Geographic Society (Grant #6291-98). Also, we wish to thank Arq. María Isaura Arauz and other collaborators from CONCULTURA for their invaluable assistance. Marlene Bellengi helped prepare the manuscript and organize Table 4.1.

Note

1. *Acrocomia aculeata* is often listed in botanical and archaeological literature as *Acrocomia mexicana.*

PART TWO

Household Archaeology

The following chapters describe and interpret the architecture, artifacts, and activity areas found in four households of ancient Cerén. Household 1 is the most complete, with four buildings excavated. Household 2 is largely complete, but its kitchen has yet to be found and excavated. Household 3 is represented only by a portion of its kitchen. Household 4 is known for its storehouse, which also included a major and a minor workshop and a food and drink consumption area.

In order to avoid repeating architectural details in each chapter, a general description of the most common building is presented here. The usual household building is atop a fired earthen platform and has wattle-and-daub (bajareque) walls with earthen columns in the corners and a grass-thatched roof. The household buildings that fit this description are Structures 1, 2, 4, 6, and 7.

The construction of each of these bajareque buildings began with the creation of a subplatform mound whose edges closely correlated with the edges of the thatched roof (the drip line), so drainage was away from the platform. The subplatform mound thus created a gently sloping clay surface away from the platform, so that when the rain fell off the roof it would not run toward the building. Water drainage away from earthen architecture was a key to building maintenance in a tropical wet climate. Then the rectangular or square platform, with its vertical edges and right-angle corners, was constructed and finished with fine clay. That was allowed to dry and was fired to create a hardened floor and sides on the platform. Then poles were set into the floor to reinforce the two side walls and the back wall, spaced about 20 cm from each other. The poles were tied together with horizontal members such as vines, spaced about 15–20 cm apart, to further reinforce the walls. The walls were mudded to about 1.5 m above the floor, creating privacy but leaving a gap between the top of the mudded portion and the roof to allow air and light to enter. The poles continued up and were firmly tied in with roof structure. Solid earthen columns were added to each of the corners but were not structurally integrated with the walls. The bajareque poles supported the roof, with only an occasional wooden post placed atop an earthen column to assist in roof support. The last construction stage was placing the grass thatch on the roofing support members.

These household buildings share many characteristics, including an orientation rotated 30° clockwise from our cardinal directions. However, they do vary in the quality of materials, height of the platform, nature of wall details, interior benches (with or without a niche), and other details. These variations probably relate to factors such as wealth, prestige, household composition, and point in a family cycle. Most buildings show evidence of having been refurbished, and some indicate significant changes such as the entrance having been changed from one side to another or a change in principal function. Some of these buildings have a high shelf (tabanco) that runs along the inside or outside of the partition wall, extending beyond the side walls, and that tabanco can be mudded on top inside or outside the side walls. Domiciles have earthen benches inside their inner rooms.

Kitchens, based on a small sample size of only two, are circular in plan with thin thatched roofs and walls. They are barely elevated above the surrounding ground surface and have replaceable floors of tephra from the earlier Ilopango eruption.

P.S.

Ancient Home and Garden: The View from Household 1 at Cerén

Marilyn Beaudry-Corbett, Scott E. Simmons, and David B. Tucker

Introduction

Household 1 is a designation given to four functionally distinct structures that appear to have related to each other on the basis of proximity, complementary functions, contiguous extramural work areas, and interjoined traffic patterns (Fig. 5.1). These factors distinguish Household 1 from other nearby structures and set it apart as a domestic entity within the community. Household 1 is the most completely exposed domestic complex at the site and can serve as a model for the kinds of structures and activities that may also have characterized other households at the site.

During the 1978 Zapotitán Valley project, Structure 1 at Cerén was partially excavated, along with a nearby roofed platform (Structure 5) and several extramural spaces. A northern section of unknown dimensions had been removed by bulldozers for the building of grain silos in 1976, so the incomplete nature of Structure 1 was recognized before the 1978 work. For various reasons, the full excavation of what remained of Structure 1 was not possible in 1978, so the cut bank was straightened and some tunneling was done. Two test pits to the south of Structure 1 revealed cultivated agricultural fields. (See Zier 1983 for a complete description of the 1978 Cerén excavations.) Additional excavation at Structure 1, as well as at Structures 6 and 11, occurred during four field seasons and is described in more detail in those seasons' reports (Beaudry and Tucker 1989; Mobley-Tanaka 1990; Tucker 1990; Simmons and Villalobos 1993).

This chapter reviews the architecture and artifacts of each structure. Following that is a discussion of the extramural areas associated with the domestic complex. Finally, Household 1 is viewed in terms of its probable place within the Cerén community.

Structure 1 (Domicile)

ARCHITECTURE

Building layout, architecture, and construction of Structure 1 followed the template described in the opening of this section. This domicile building consisted of an interior room with a raised bench finished with a cornice, a front roofed and walled room, and in front of that a roofed area without walls (Fig. 5.2).

The form of the structure as it was when excavated represents the culmination of several phases of construction. In 1990 the disturbed northern edge of the structure was cleared. The study of that profile provided some information about the building's construction history. At least three different phases of construction or remodeling were identified.

Phase 1 consisted of constructing the main part of the platform supporting the interior room and the roofed front room within the four columns and the walls. The structure had a large adobe block as a front step; this block is still in place against the original platform edge.

Phase 2 consisted of adding to the front of the structure a low raised area, made of sandy fill and capped with a layer of sandy adobe. The top 10 cm

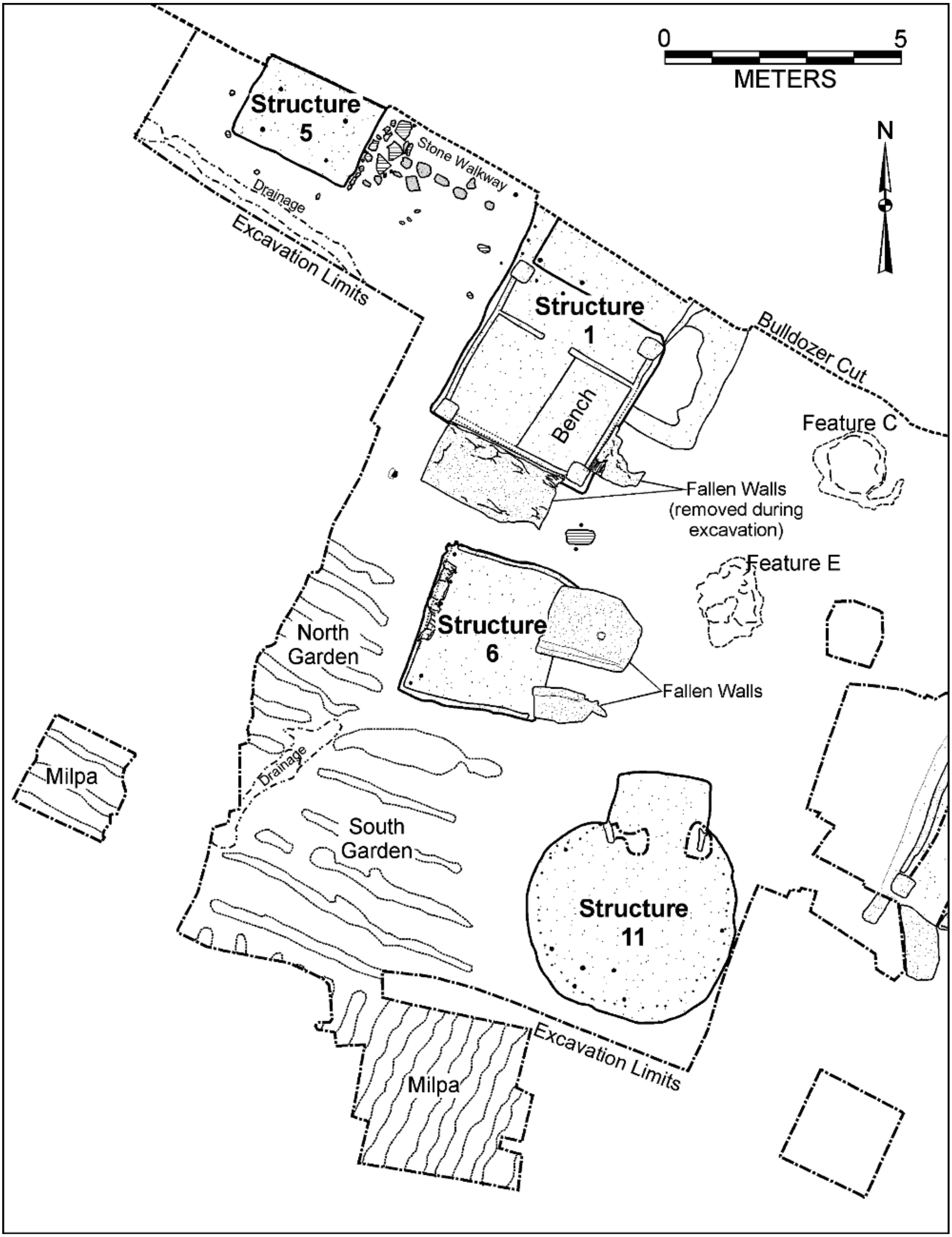


FIGURE 5.1. Map of Household 1 structures.

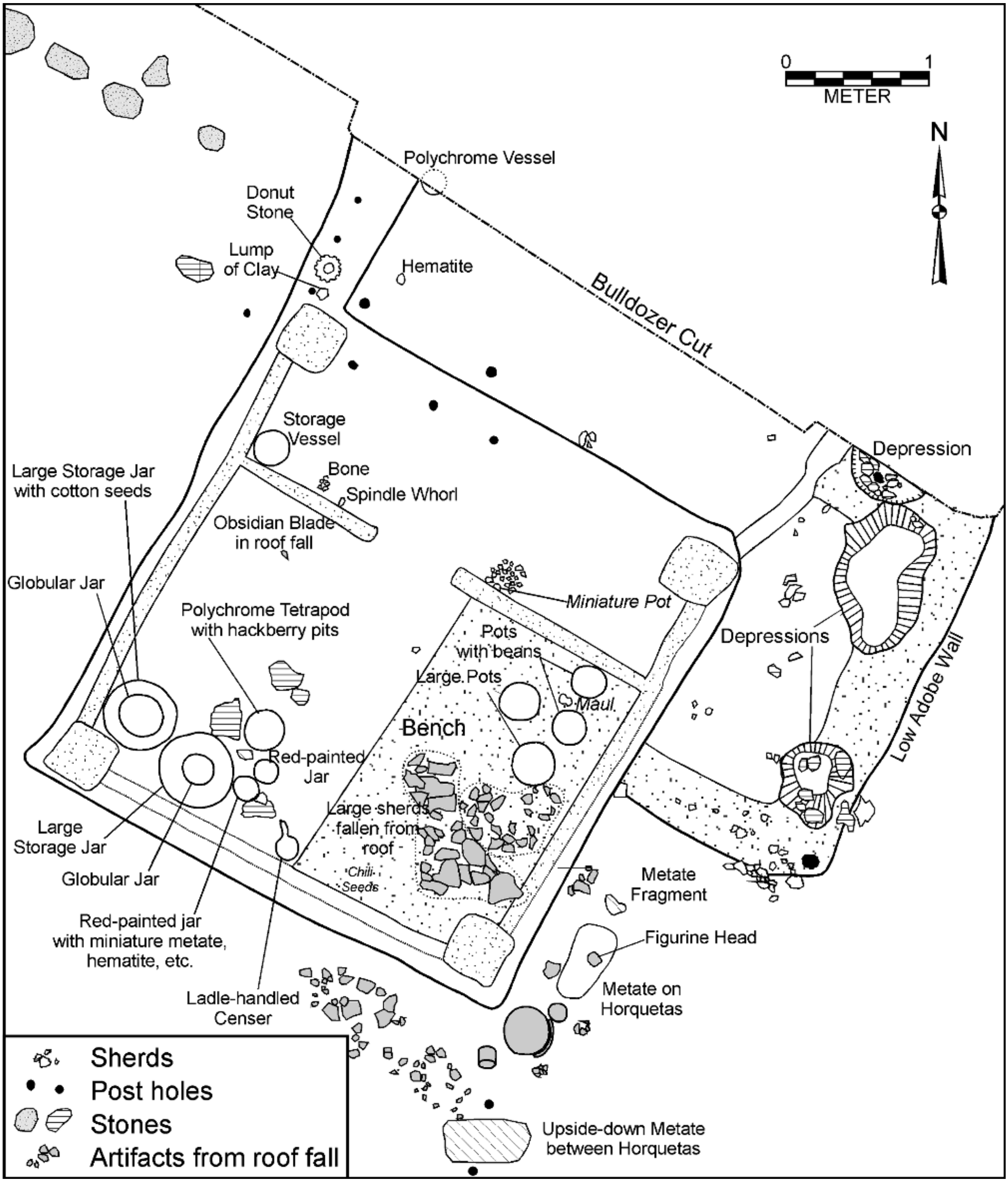


FIGURE 5.2. Map of Structure 1, domicile.

of the partially buried adobe block remained exposed and still functioned as a step onto the platform. This second phase addition may have been a terrace similar to that in front of Structure 3.

Phase 3 consisted of the addition of more fill and an adobe surface on the north side, which probably functioned as a new roofed front area without walls. This final renovation completely buried the adobe step. All levels of platform fill contained trash in the form of sherds and broken obsidian blades. Since fill from the initial phase of construction was not removed, it is not known whether it also contained trash.

A raised adobe mound to the east of the structure may represent a construction phase that predates Phase 1 construction. As excavated, it can be described as a low (5–12 cm) adobe wall in a U-shape that abuts Structure 1 proper. However, it may have been a complete square or rectangle that was later covered by Structure 1. Such a wall may have been the basis for an earlier low platform, if the center had been filled with trash and dirt and the whole area covered with an adobe surfacing or flooring. In fact, several depressions here were found to still contain a jumble of sherds and white tephra from the surrounding original ground surface. Some time later, a new structure was built with a different orientation but making use of part of the original outline and probably reusing the structure fill. At the time of the eruption, the remaining platform outline was being used as an extramural work space.

ARTIFACTS

The front room and the roofed area without walls did not contain very many objects (see Fig. 5.2). The ones present do not seem to relate to a specific subset of domestic activities but do provide insights into occupants' activities wherever they took place. For example, near the base of the northwest column in the unwalled area was a nodule of ground hematite, an unfired lump of clay shaped by hand, and a donut stone. Closer to the roofed front room was a small cluster of sherds, a broken polychrome vessel, and an andesite flake. The front room also was fairly free of household items. A large storage vessel, some bone fragments, and a spindle whorl were along the rear wall, west of the doorway. On the opposite side of the doorway was a collection of about twenty sherds and a miniature ceramic vessel.

The inner room consists of two areas, the western floor and the eastern platform bench. The floor near the doorway was clear of artifacts; an obsidian blade mixed with roof fall probably had been stored on the inner wall. In the back part of the room, a cluster of artifacts was in floor contact. A very large storage jar was sitting upright near the southwest adobe column with a smaller globular jar on top of it. Cotton seeds and fibers were recovered from the interior of the large jar.

An adjacent large storage jar probably also had been covered, since a small fragmented globular jar was found inside it. In addition to these storage-related vessels, three other complete pots were by the rear wall: a polychrome tetrapod serving dish and two small red-painted jars.

Hackberry pits in the serving dish, while not carbonized, are thought to relate to the eruption-period occupation (Lentz et al. 1996: 256). Inside one of the small jars was a variety of small items: three shaped cylinders of compressed hematite and quartz (Beaubien 1990b: 190), a spindle whorl, a miniature metate whose surface showed traces of pigment having been ground on it, and a fragment of mother-of-pearl-like shell. Also in this grouping were two flat stones (exfoliated andesite called lajas) that had been used as grinding stones and were placed close to one of the large storage vessels. Finally, a tumbled river cobble hammerstone and an incomplete vessel lying partially on top of one of the lajas were included in the grouping of objects. A smashed small ladle-handled censer was on the floor by the rear wall, near the edge of the platform bench. Carbonized chile pepper seeds were mixed with the censer sherds.

The platform bench also held a number of objects. Approximately 1.5 m^2 of the platform had been explored in 1978, after having been exposed by a large hole in the interior wall. Zier (1983: 131) noted that "in a tight cluster are four large pots, two of which contain beans, and a grooved maul." Excavation of the rest of this area disclosed a widespread scatter of sherds covering an area of about 1 m^2 north and west of the rear southeast adobe column. None of the pottery was in contact with the bench. Small bits of thatch and tephra particles beneath the lowermost sherds suggest that the vessels had been stored in rafters which fell, smashing pots and whatever contents they held onto the bench. Carbonized chile pepper seeds collected from the upper levels of the scatter, as well as those mixed with the censer fragments, indicate that chiles probably were hung from the roof supports to dry or were kept in large sherds placed in the rafters, as has been observed ethnographically.

Only two partial vessels and one nonmatching sherd were represented in this extensive scatter.

One partial vessel was a polychrome bowl; only the base and one rim sherd were recovered. The other, the lower half of a very large storage vessel, seems too big to have been kept overhead in the roofing. The recovered half may have already been broken, with sections of it being stored in the same area. Most of the sherds were found with the interior facing up, suggesting lateral displacement following a fall from above.

Interestingly, the nonmatching sherd fits a small polychrome bowl, the rest of which was recovered outside the structure. It seems probable that the pot had been broken before the eruption and the parts placed in the roof support storage area. When the roof collapsed, the main part of the pot was projected into the area behind Structure 1 except for one sherd which fell downward, mixing with the other partial vessels inside the structure.

Structure 5 (Ramada)

Structure 5 was a low adobe platform with a thatched roof and no walls, completely described by Zier (1983). An unknown portion of the structure had been removed by the bulldozer in 1976. A human burial under the eastern edge of the platform was also impacted. The few small sherds and a handful of broken and worn obsidian blades found scattered on and around the structure platform suggest that the vicinity of Structure 5 was being used as a convenient location to dispose of potentially dangerous trash. Whereas the structure may have once served an important purpose, as indicated by the human burial, at the time of the eruption the structure may have been in disuse. It was not abandoned, as the thatched roof was maintained.

Structure 6 (Storeroom)

ARCHITECTURE

Structure 6 was a low adobe platform with four walls of various configurations forming a single room (Fig. 5.3). The structure's doorway was in the east wall slightly south of center, facing onto a small patio area between this structure and the kitchen (Structure 11), rather than opening toward the domicile (Structure 1). The sides of the door were decorated with vertical cornices, and a ceramic handle was fixed horizontally into the wall next to the door, 88 cm from the floor.

The north wall, which was closest to the domicile structure, appears to have been extremely low (about 8 cm) and made of poorly consolidated adobe. Eleven holes for the vertical poles typical of bajareque construction were found, along with an impression of the base of the wall. The west and south walls were typical bajareque construction, but the adobe mudding had only been built up to an irregular height of 36 cm. The pole construction of these walls and perhaps the north wall probably continued to form full-height latticework walls awaiting additional mudding.

The low or incomplete walls on three sides of Structure 6 would have provided a great deal of available light and circulating air but seem out of place with the high (1.8 m) east wall, complete with its corniced doorway and embedded ceramic handle. This incongruity has led to an interpretation of Structure 6 as having been in the process of renovation or reconstruction at the time of the eruption, with only the eastern wall having been completed.

The roof appeared to have been supported by the front (east) wall and a row of posts along the back, just inside the west wall. Perhaps this structure had originally been built as an unwalled ramada but was being transformed into a walled storage structure. However, the east wall had stood for a long enough time to require repair; a large patch was noted near its center.

ARTIFACTS

A wide variety of artifacts of different materials was found in Structure 6. The assemblage appears to be the household's accumulation of objects related both to domestic provisioning and to more specialized craft activities. The location of the objects within Structure 6 suggests it was a relatively inactive storage or maintenance area rather than a regularly used work space. Nevertheless, the discovery of a metate in its active position on horquetas (forked props), with numerous vessels crowded around it and with the matching mano a meter away, hints at occasional supplemental maize grinding at this locus.

As the structure was entered from the east, one would have encountered very few objects—a flat worked stone, a fragmentary trough metate overturned above a stone, with the lower part of a jar nearby. Once inside, turning to the right one would see a mixture of objects along the north and west walls. Here there were ten pottery vessels (fragmentary and complete), along with two whole manos, one partial mano, five hammerstones, and a collection of pottery sherds. The extremely intermixed nature of these objects—some on the floor, others

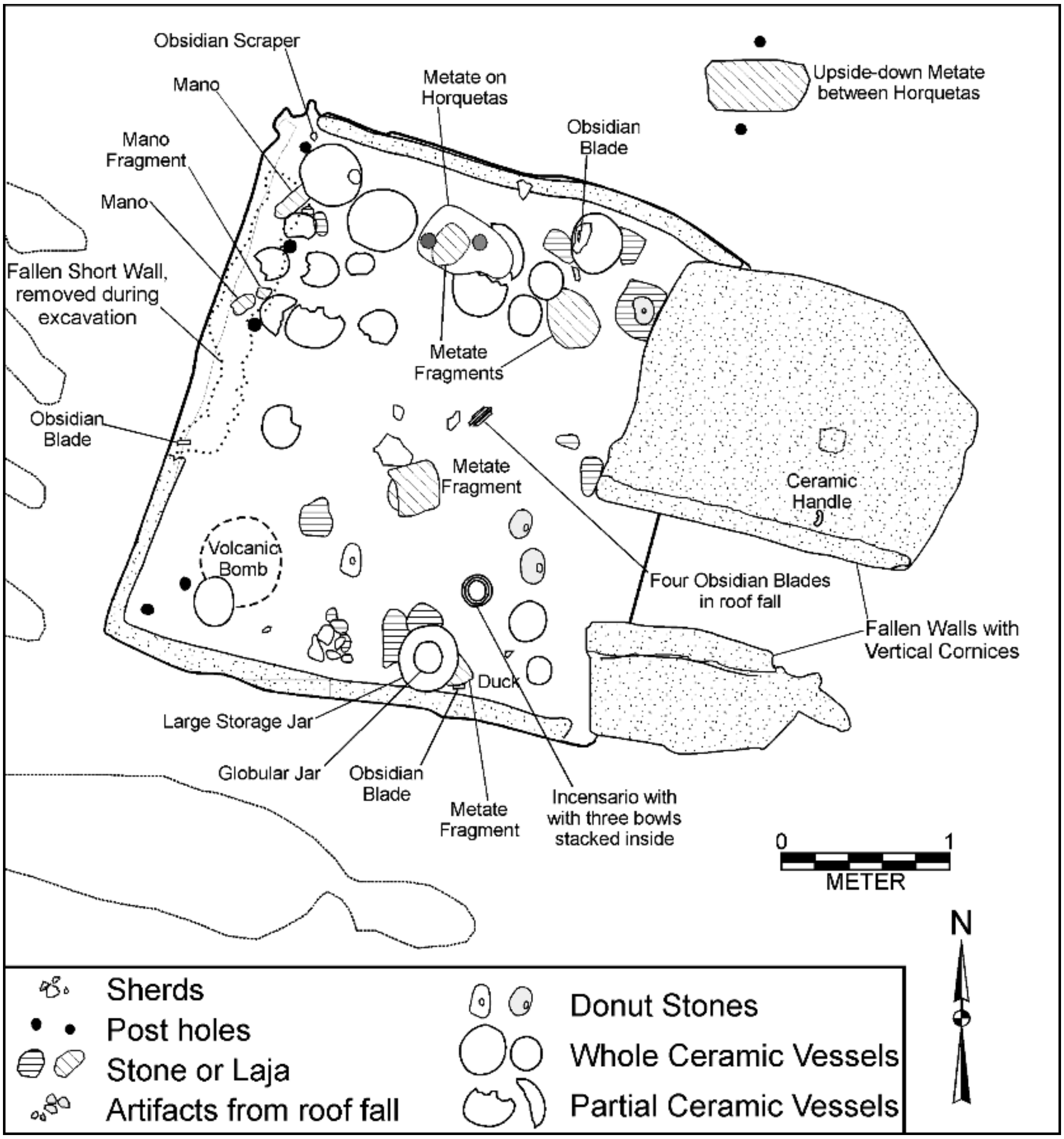


FIGURE 5.3. Map of Structure 6, storeroom.

interleaved with tephra and roof fall—seems to indicate that the objects had been stacked rather than carefully arranged. Bits of gourd rind in one of the open bowls show that organic materials were also kept here. An obsidian scraper, resting at the edge of the posthole in the northwest corner, had probably been tucked out of the way, where it would not accidentally cut a family member.

Various aspects of the pottery in this part of the storeroom (incomplete vessels, sherds mixed with the vessels, sherd disks or blanks, and a thin-walled jar mended with a plug) indicate that broken pieces of pottery were stored for various reasons—to be used as digging implements or containers for various small commodities, or to be refashioned eventually into disks or plugs to repair slightly damaged pots. The presence of six hammerstones, along with the manos (two complete, one fragmentary) and metates (one complete, one fragmentary), suggests that materials for groundstone implement production were stored here.

The amply filled northern part of the structure was the farthest from the door and probably held the least active objects. The southwest part of the structure would also have been out of the traffic pattern, but it held few objects. That area was severely impacted by a volcanic bomb, but only one vessel seems to have been displaced by it. Some string mixed with the bomb debris could have been tying perishable commodities hanging from the roof beams. The southeast section of the structure was not as densely packed as the northern part, but it contained a similar array of objects plus three donut stones, one of the assumed products of this household.

The remains of a domesticated duck, with a string tying it to a pole, were located along the south rear wall of the structure. Spindle whorls, one with hematite adhering to it, attest to spinning as a household activity, either for household consumption or for trade. Botanical analysis identified maize and beans in two of the vessels in the southern area. In general, however, this storeroom seems to have been related more to nonperishable items than to perishable foodstuffs. It is possible, of course, that its use at the time of the eruption was different than usual because of the hypothesized in-progress remodeling.

Structure 11 (Kitchen)

ARCHITECTURE AND PERMANENT FEATURES

Structure 11 is almost unique among the excavated domestic structures at Cerén (see Chapter 7). It is built on a very low irregular earthen platform and the adobe flooring in places is very thin or lacking. The building is circular; in front of the entrance is a square porch area which was roofed but not walled (Fig. 5.4). Two stubs of bajareque (1.31 m full height) served as informal columns at the entrance to the building from the porch. A large pole set in each column forked at the top of the bajareque and presumably served as a support for horizontal beams. The columns were attached to the pole walls of the circular portion of the structure. Those walls were constructed in the usual bajareque wall pattern except that the poles were not covered with daub, although they may have been covered with a thin layer of thatch. Structure 11 was oriented almost directly north, unlike other Cerén structures, which are oriented approximately 30° east of true north.

Inside, along the south side of the structure and placed against the wall, a raised shelf made of horizontally laid poles was supported by posts set into the floor. Although the shelf had partially collapsed, a number of vessels which had been supported on yaguales (fiber rings) were still resting directly on the poles. Ash had accumulated on the floor prior to the collapse of the shelf. The cast cavity of one vertical post (height 24 cm) had a forked top.

On the east side of the entrance is a small three-stone hearth. Within the hearth and in the general area around it was a substantial layer of wood ash and charcoal in direct contact with the floor and separated from roof-fall material by a few centimeters of ash.

A rock embedded in the floor immediately south of this hearth had a mano and a metate resting on it. Near the center of the structure was another metate, set on horquetas.

ARTIFACTS

Artifacts will be described according to their placement within the kitchen setting, starting with the porch and then moving in a clockwise fashion around the interior (see Fig. 5.4).

Area 1: The Porch This rectangular area had few artifacts and seems to have been kept clear for easy access into the structure. Three small items—an obsidian scraper, a long bone of a large mammal, and a fragment of a bone tool—were in the fallen roof thatch on the east side of the porch. A slightly worked handstone and the remains of a painted gourd were the only artifacts on the floor itself and do not seem to represent any specific activity.

Area 2: Near the Hearth and the Floor-Level Metate The eastern part of Structure 11 appears to have been used for cooking and food storage. It is dominated by a three-stone hearth and a tight grouping of other artifacts on the floor. A well-used trough metate, complete with its matching mano, was located near the hearth on the floor. This grinding stone was surrounded by ceramic vessels, several painted gourds, and partial vessels possibly being used as informal containers or scoops. While there was not adequate work space for grinding activity, the trough metate could have become accessible by simply moving a few pots. The designation of one of the two Structure 11 metates as the active one is the consequence of different lines of reasoning. It is conceivable that the metate on the floor, which was almost worn through from use and lacked readily available work space, had been retired from regular use and that the one placed on horquetas was preferred for daily use. Conversely, since other metates left placed on horquetas, like the one in Structure 6, display similar minimal use, we could reason that they were the intermittently used grinding stones. Thus, an exact categorization of the Structure 11 metates as being for active or intermittent use is not possible with the available data. Two charcoal-encrusted vessels, one jar and one basin with handles, are located between the mano-metate set and the hearth. From their loca-

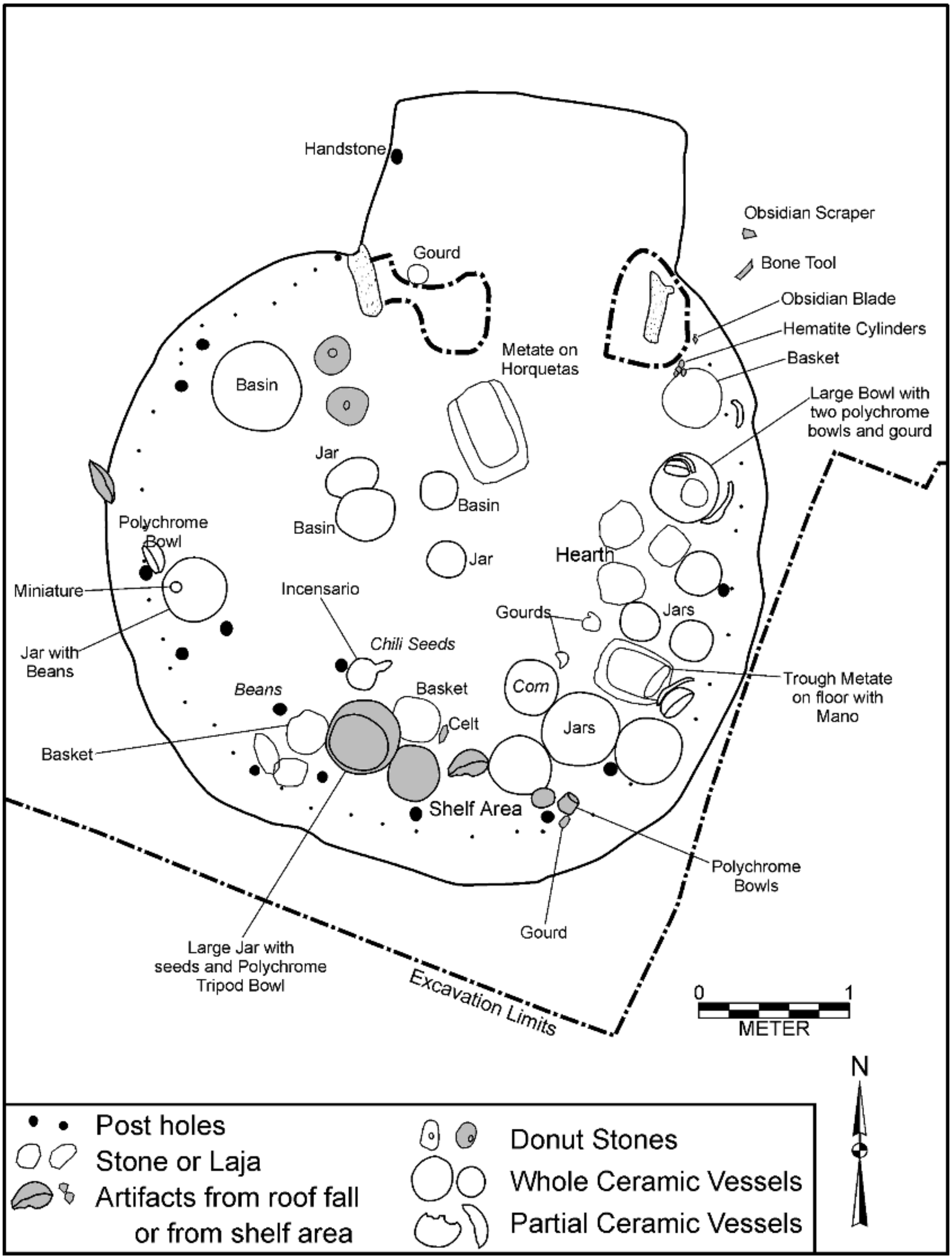


FIGURE 5.4. Map of Structure 11, kitchen.

tion we can definitely attest to the active use of the hearth at the time of the eruption event.

A basket placed on the floor close to the column in the northeast part of the structure probably was used for short-term storage. An obsidian blade and a shaped cylinder of red pigment fell from the roofing in this same area.

Two polychrome open bowls were associated with a large utilitarian bowl and a painted gourd. Since the polychrome bowls are of a size similar to the bowl with finger swipes in the niche in Structure 2, it is possible that the gourd had been used to scoop prepared food from the large bowl for serving in the polychrome bowls. Another open bowl of the same size as the polychrome ones but made of utilitarian ware had been left near the wall next to the mano-metate set, suggesting food service of a less formal nature.

The last three vessels in this area were placed more or less in a line on the floor south of the mano-metate set. One was a cooking jar with charcoal on the exterior; because of its large capacity it could have been for special-occasion meals. One was definitely a storage container, because corn kernels were recovered from the interior. The final one probably was also for storage, since there is no direct evidence of cooking residues.

Area 3: The Rear Part of the Structure, Including the Wooden Shelf This section, farthest from the door, seems to have been used for storage of both containers and commodities. It also is possible that some processing was done in the zone in front of the shelf.

Two small polychrome vessels (one a cylinder, the other a recurved bowl) and a painted gourd were on the eastern end of the shelf. Next to them was a small utilitarian jar with squash seeds inside. The last vessel on the shelf was a large utilitarian jar with unidentified seeds inside. This vessel's very large handles would have been useful if its function was to transport commodities into the kitchen structure. Inside the jar was a tripod serving dish, a variant of the more standard polychrome types. The association of the jar and the serving dish suggests that this could be a set of objects available for occasional nonhousehold events related to Structure 10. A greenstone celt was also found on the shelf. Red pigment mixed with crushed sheet silicate lay immediately on top of a lump of pure red pigment on the eastern portion of the shelf.

A few objects appear to have been suspended from the rafters. A large utilitarian jar was found in roof fall above the shelf. It likely had been hung by a handle with string or netting from the roof beams. It probably was stored empty, since contents would have created excessive weight. A rodent skeleton in the extreme southeast part of the kitchen suggests that the animal had been living in the roof thatch.

The pattern of floor use was interesting. A large utilitarian jar without handles sat on the floor near the eastern end of the shelf. It probably was used for long-term storage of a commodity that could be scooped from the stationary container. Under the shelf were two coarse-weave baskets and a mat with at least three different kinds of beans piled on it.

To the west was a cleared area notable for the scatter of chile pepper seeds on the floor. We hypothesize that chiles were being dried, hung in bundles from the rafters in a pattern similar to that assumed for chiles over the bench in Structure 1. The only artifact was a ladle incensario (censer), which probably had been left on the floor after a recent use, since carbon was adhering to the interior. A rodent skeleton was found underneath this incensario.

The last few objects in the western part of Area 3 were a very large floor-placed jar with beans inside, a miniature bottle-shaped vessel which was found inside the jar but perhaps had been stored in the rafters, a polychrome serving bowl, and a partial utilitarian jar recovered mixed with roof thatch, beans, and squash seeds. The recovery of stored beans in this part of the kitchen leads to the question of whether Household 1 had been drying beans here after harvesting. Ethnographic accounts from the turn of the century (Sapper 2000) reported that the Q'eqchi' in Guatemala left beans on a tabanco (shelf) for 2–3 weeks to dry and then stored them in bags. Baskets found under the tabanco here could have been for that purpose.

Area 4: Around the Metate Placed on an Horqueta and West of It This area was considerably more open and accessible. It is seen as having been a work area with objects for processing, transporting, and cooking. Closest to the metate is an open utilitarian basin with handles. Slightly to the west is a larger open basin with charcoal on the exterior. Two nearby handleless jars, one recovered in a very fragmented condition, are interpreted as having been used for liquid that was poured from them during some type of processing. The ridge on their high necks would have functioned as an aid for gripping while pouring.

Isolated from the other vessels and close to the west wall is a large open cooking basin with the identifying exterior charcoal. It probably represents a utensil that was not in everyday use and so kept out of the way. Also out of the way were two donut stones in the roof rafters.

The roofing material in this area was attractive to household pests. Two rodent skeletons were mixed with the roof fall in an area where seeds were also recovered. Interestingly, another rodent skeleton came from under one of the bowls near the metate. It would appear that household pests were quite prevalent in the kitchen area, undoubtedly attracted by the foodstuffs stored there.

Extramural Space

Household 1 extramural space consists of those areas located immediately outside the walls and/or

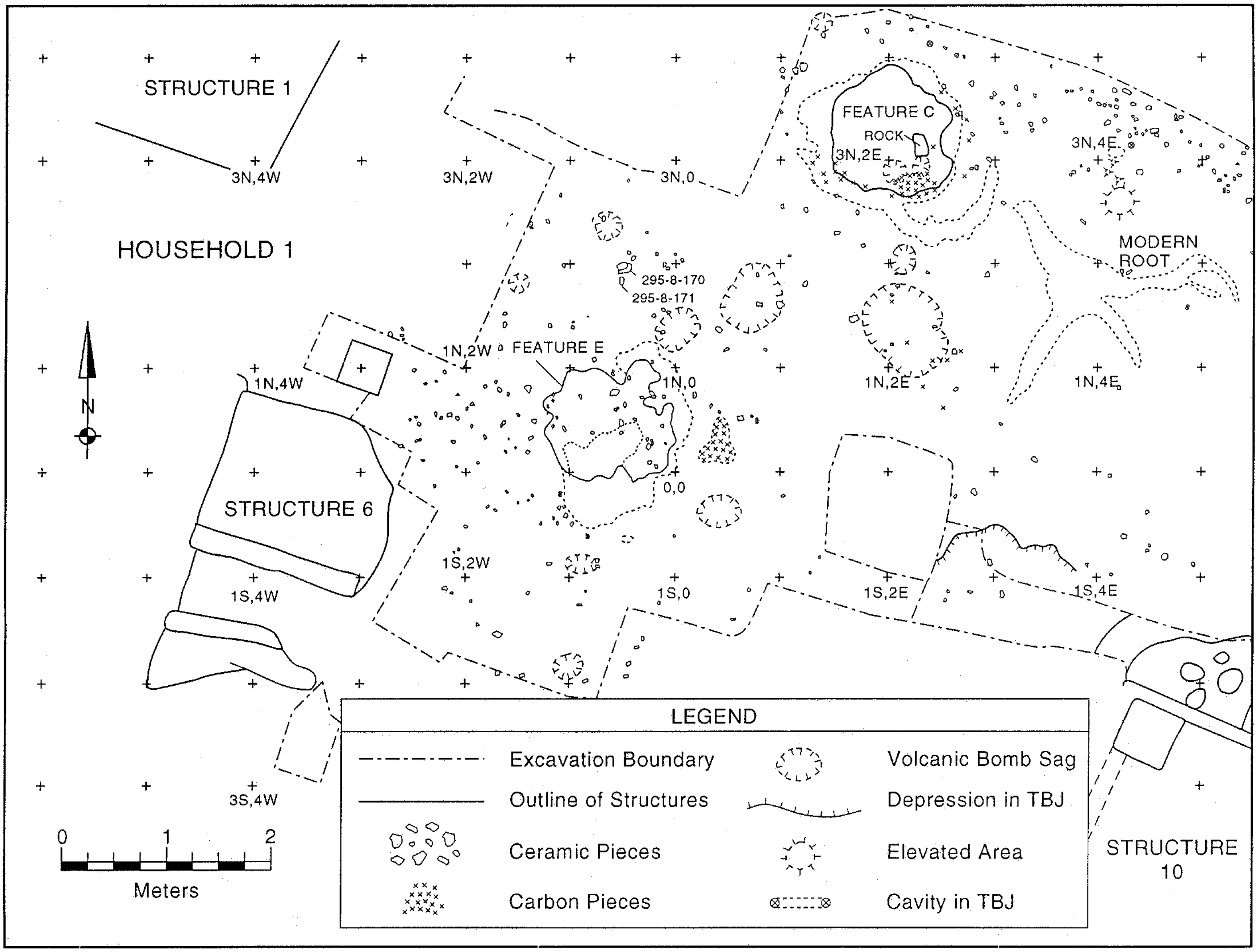


FIGURE 5.5. Map of Household 1 extramural locations.

platforms of each of the four buildings that form the domestic group. These areas are the following:

- The patio immediately east of Structures 1 and 6 and north of Structure 11.
- Extramural areas adjacent to Structure 5.
- Eaves of the buildings, defined as areas underneath the overhanging lower edges of building roofs.
- The north and south gardens, west of Structures 6 and 11, respectively (see Chapter 20).
- The milpa, abutting the southern edge of the south garden and situated immediately southwest of Structure 11 (see Chapter 20).

Figure 5.5 shows extramural space immediately east of Household 1 buildings.

Landscape archaeology conducted at Household 1 entailed the examination, description, and mapping of microtopographic features of the original land surface including the relative degree of surface compactness, soil color and texture, cavities in the surface, and surface contours. Artifacts lying on or embedded in the ground surface and individual archaeological features were also considered (see Fig. 5.5).

MICROTOPOGRAPHIC CHARACTERISTICS

The surface under the eaves and immediately surrounding Household 1 buildings is quite uniform in several respects. It is fairly level, smooth, moderately to densely compact, and uniform with regard to its light tan color and fine texture. In addition, voids indicative of ancient plant growth are absent, suggesting that plants were not growing in Household 1 extramural areas. A few exceptions to this consistent pattern of smooth, hard ground surfaces free of plant growth include certain areas around Structures 1, 5, and 11, where either raised surfaces (south of Structure 1) or irregular surfaces (around the southern and western edges of Structures 5 and 11) were noted (Beaudry and Tucker 1989; Tucker 1990; Mobley-Tanaka 1990; Zier 1983). Drainage patterns are readily discernible and drip lines mark the extent of structure eaves.

In general, these characteristics suggest that the surface surrounding the domestic structures witnessed considerable regular foot traffic. The landscape around the buildings of Household 1 appears to correspond to areas in modern Tuxteco households that have been described by Killion (1992: 127–128) as the "clear area, an extramural area of bare, hard-packed earth surrounding the house lot's dwelling structures."

CULTURAL MATERIAL

Cultural material divides into two subcategories: small artifacts impressed into the ground surface and whole objects resting on the ancient ground surface. Very few whole objects were identified. Those that were present, however, were invariably recovered under the eaves of structures, suggesting that certain household activities probably took place in those extramural areas (Simmons 1996). Active storage of objects used in everyday domestic tasks is indicated by the presence of a weighted digging stick and spindle whorls immediately outside of buildings, as well as by ceramic vessels suspended under the eaves of Structure 1.

The east side of Structure 1 was a focus of such extramural activity, where a metate was found in working position on horquetas. Above this, stored in or hanging from the eaves, were two polychrome vessels, a large globular jar nested in a large sherd, and additional large sherds. One partial polychrome vessel contained a mixture of hematite pigment and mica. This area is related to the raised U-shaped adobe bank. The part of the bank nearest the metate was covered by a mat. South of the active metate was another metate upside down on the ground between two postholes that could have held horquetas. Since this entire area along the side of Structure 1 (Fig. 5.2) was easily accessible from the entrances of the storage and kitchen structures, it is a logical location for numerous outdoor activities, including food preparation. In addition, unlike other food-processing locations within Structures 6 and 11, this area provides a direct view of the patio in front of nearby Structures 10 and 12 and could have been integrated into local social activities.

Discarded or provisionally stored cultural material termed "clutter refuse" (Hayden and Cannon 1983: 131) is commonly found in many communities in southern Mesoamerica in rarely used interior spaces, along outside walls, around compound perimeters, or in various discrete exterior locations such as under trees or at the edges of patios (Deal 1985: 258; Hayden and Cannon 1983; Killion 1992; Lange and Rydberg 1972). The near-absence of clutter refuse in such areas of Household 1 suggests that these well-maintained locations were not used for provisional storage of potentially recyclable objects. However, many partial vessels or large sherds which could be termed provisional discard items have been found in elevated contexts at Household 1, in roofing beams, or on the roof itself. Also, many such vessels were stored in Structure 6 (Tucker 1995: 206).

Hayden and Cannon (1983: 126) use the term "toft" to refer in modern Highland Maya communities to "the area surrounding structures, used for maintenance-storage activities and for the general disposal of household refuse." Artifact densities in Household 1's toft areas varied considerably, averaging 3–10 sherds/m^2 (Tucker 1995). The highest density of sherds (9.1/m^2) was found east of Structure 6, on the western edge of the patio (see Fig. 5.5). Since nearly all these sherds are fragments of utilitarian vessels identical to those found within the nearby domestic buildings, they may have been swept up from areas adjacent to the kitchen and storeroom. The repeated use and transport of ceramic vessels in and around these two buildings probably accounts for vessel breakage and the associated sherd densities in this area of the Household 1 patio. Significantly lesser amounts of lithic debitage (mainly obsidian), as well as some small animal bones that were most likely deposited during the eruption, were also found outside the domestic buildings. However, as noted above, a comparatively large quantity of spent obsidian blade fragments were littered on and around Structure 5. This platform and the surrounding area had once been used commonly enough to warrant a stone pathway connecting it to Structure 1, but by the time of the eruption the path had fallen into disuse, making it suitable for the disposal of relatively more dangerous refuse.

LANDSCAPE FEATURES

Two raised areas on the original ground surface were identified in Household 1 extramural areas (see Fig. 5.5). One of these, Feature E, was composed of a concentration of ash and small pieces of charcoal, with small, mainly undecorated, ceramic sherds scattered throughout. The feature is situated in the central part of the Household 1 patio and measures approximately 1.4 × 1.7 m at its widest points. The heaviest accumulations of ash and carbon are found within an area measuring approximately 1.0 × 1.2 m. At its greatest height, Feature E is roughly 5 cm above the surrounding ground surface.

In addition to the pottery fragments, five pieces of unfired clay were found in Feature E. This feature more than likely served as a temporary dump site for hearth ash and charcoal associated with Household 1, specifically with the kitchen (Simmons and Villalobos 1993: 43). The presence of carbonized residues on the interior surfaces of many of the sherds found within this feature suggests that cooking vessels broken in the hearth during use were discarded along with ash and charcoal that had accumulated in the kitchen hearth.

The second feature identified, Feature C, is located approximately 5 m east of Structure 1; it is a raised clay platform that rises between 10 and 15 cm above the surrounding ground surface (see Fig. 5.5). This roughly circular compacted clay platform is distinctly different in character from the surrounding ground surface and has a uniformly flat and gently sloping surface. Fairly shallow but well-defined linear impressions that intersect in a cross-hatched manner extend over the surface of this feature.

A brownish-yellow or mustard coloring was found throughout much of the surface of the platform. This colored residue seems to represent the remains of some organic material, possibly grasses, sedges, or leaves that carpeted the feature. Given its location relatively close to Structures 1 and 6, it is possible that the feature could have been used as a drying platform for foods or other household materials. Such platforms are still used for drying grains in some traditional Salvadoran households (Víctor Manuel Murcia, personal communication 1993).

SUMMARY: USE OF EXTRAMURAL DOMESTIC SPACE

Several lines of evidence indicate that Household 1 extramural areas were well-maintained, high-foot-traffic zones where relatively few domestic items were kept. The hard-packed level surfaces, lack of plant growth, and near-absence and small size of cultural debris, all suggest that the eave and patio areas were kept clear and swept regularly by household members (Simmons and Villalobos 1993: 38–43). These areas probably functioned as loci for daily tool preparation, craft production, food drying, refuse disposal, children's play, socialization, and other domestic activities that typified village life during Middle Classic times in the Zapotitán Valley.

Household 1 in the Community

The three extant Household 1 structures illustrate the built environment of a well-equipped, well-provisioned agrarian household. In addition to standard domestic sustenance activities involving food procurement, storage, processing, cooking, and consumption, this household appears to have engaged in a variety of craft activities. It also seems to have been connected in some manner with the nondomestic building, Structure 10, the location of a possible religious association.

CRAFT ACTIVITIES

Fiber Spinning Seven of the twelve spindle whorls recovered to date came from Household 1 loci. Ethnographic data (Parsons and Parsons 1990: 314) suggest that a spinner producing thread for use in household-level weaving would not need so many whorls. Thus, it is possible that thread was produced for other households in the community as well as for Household 1. From the typological characteristics of the whorls, it would seem that cotton was the fiber being spun (Beaudry-Corbett and McCafferty 1998).

Maize Processing The presence of five functional metates leads to the assumption that periodically Household 1 women ground more maize than would be needed for simple household consumption. It is possible that the excess ground maize was used in household consumption rituals (M. Smith 1987) or that it was prepared in Household 1 for use in Structure 10 activities.

Ceramic-Related Crafts Southward and Kamilli (1983) postulated that an unfired lump of clay in the north roofed area of Structure 1 related to pottery production, which would have taken place away from the domestic structures. Since a likely potting activity area has not yet been located, that hypothesis cannot be confirmed or negated. However, evidence for reshaping and repairing ceramics is clearly present in the storeroom structure, as described above.

Groundstone Fabrication Hammerstones, most stored in Structure 6, and donut stones, one unfinished as well as numerous finished examples, provide evidence for this craft. It may be significant that the two well-used trough metates (a complete one in the kitchen; a partial one in the storage structure) were both shaped and pecked on the undersides to be utilized on the floor. However, all other metates were only slightly concave because of limited use, were relatively unshaped on the undersides, and had to be mounted on horquetas for use. This variation may indicate a transitional trend, just prior to the eruption, from floor-mounted trough metates to horqueta-mounted basin metates. Such a change would have saved a considerable amount of time in the manufacture of the grinding stones.

RELATIONSHIP WITH STRUCTURE 10

A number of lines of reasoning seem to support a relationship between the occupants of Household 1 and the activities in the nondomestic Structure 10.

1. Simple physical proximity.
2. Evidence of remodeling and renovation of Household 1 structures and of Structure 10. Structure 1 had gone through at least three phases of construction, while Structure 6 seems to have been in the process of renovation at the time of the eruption. This type of architectural change could relate to the length of occupation of the locus by members of Household 1, or it could relate to the household's changing role or status in the community. Structure 10 had had its entrance changed from a northern access to a western access—the direction of Household 1 structures.
3. Pottery, locally produced and imported, restricted to Household 1 and nondomestic Structures 10 and 12. Accessibility to ceramics not distributed to other Cerén households could be related to a geographically wider network of social interactions arising from a religio-political role beyond the community.
4. Household 1 artifact inventory's lack of a tapiscador (corn husker) as found in other domestic components. Since Structure 10 contained two such implements, it is possible that maize processing for both Household 1 and for the nondomestic activities in Structure 10 took place in either setting and that one or both tapiscadores were "on loan" to Structure 10 when the eruption occurred.
5. Household 1's greater need for long-term storage and commodity transfer containers. Structure 6, the storeroom, had more jars without handles and utilitarian bowls with handles than did other storeroom structures. The storage and commodity transfer functions, similar to maize processing, could relate to Structure 10 activities performed by Household 1 members.

Household 2 at Cerén: The Remains of an Agrarian and Craft-Oriented Corporate Group

Brian R. McKee

Introduction

Research at Cerén has provided unprecedented detail on the daily lives of the Classic Period inhabitants of a Mesoamerican village. The village members formed at least three households who inhabited at least six structures. In this chapter, I discuss the archaeological recovery of one of those households.

Houses and households are not synonymous. While houses are architectural units, households are corporate groups (Ashmore and Wilk 1988) whose members cooperate in activities related to production, distribution, transmission, and reproduction (Wilk and Rathje 1982). Hirth (1993) notes that the archaeological study of households is productive because they are the fundamental unit of social organization and often the means through which individuals interact with larger social units. Households also leave material traces for archaeological study, and they are ubiquitous, providing a comparative framework to study adaptation and organization through time and space.

Each structure at Cerén had a primary function, and each household inhabited several specialized structures, including multipurpose sleeping structures (domiciles), storehouses, and kitchens. Cerén households are inferred primarily based on proximity and on having the complement of essential domestic structures. We have excavated two structures used by Household 2 (Fig. 6.1), a domicile (Structure 2) and a storehouse (Structure 7), as well as associated areas. A third structure (Structure 9) was a sweat bath (Chapter 10), probably used by several households. Household 2 presumably used other still-unexcavated structures, including a kitchen.

In this chapter I describe the areas associated with Household 2, beginning with a description of data recovery methods and the architecture and artifacts of Structures 2 and 7. The areas surrounding the structures, including a cornfield and a midden, are then described, and the chapter closes with a discussion of some activities conducted by Household 2 and its role in the Cerén community.

Methods

The excavation methods used in Operation 2, where the Household 2 remains were encountered, have already been described in detail (McKee 1989, 1990a, 1990b, 1992, 1993, 1996) and are only briefly summarized here. We excavated the upper strata with mechanized equipment and hand tools such as picks, shovels, and hoes. At cultural levels we used finer tools. From 1990 onward, we screened the lower strata with one-fourth-inch mesh to enhance artifact recovery, and beginning in 1992 we collected sediment samples for fine screening, flotation, pollen, and chemical analyses. We filled holes representing plants or cultural features with dental plaster (Murphy 1989) in order to make casts of those features. The Classic Period ground surface often consists of volcanic ash from the earlier eruption of Ilopango Volcano, known as the tierra blanca joven (TBJ). The doorways of both Structures 2 and

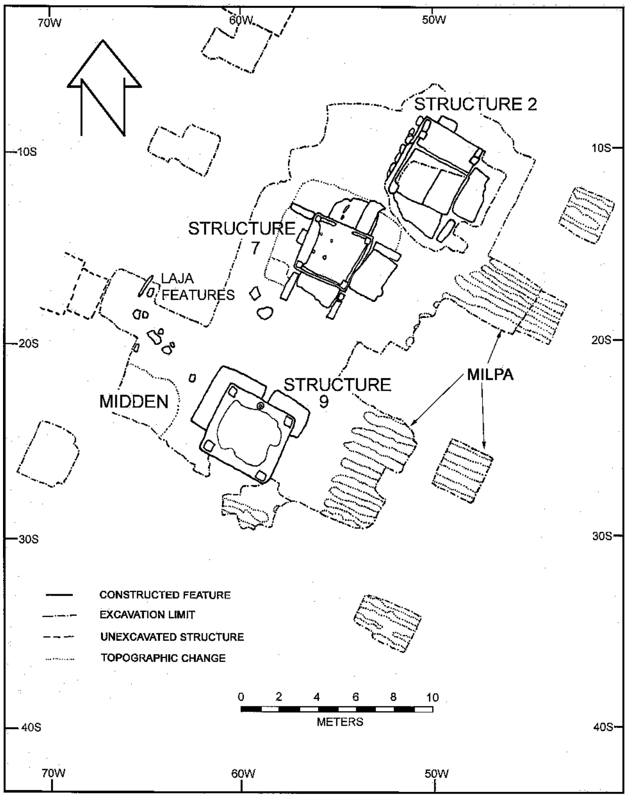


FIGURE 6.1. Plan of Operation 2 showing locations of structures and activity areas.

7 face 30° east of magnetic north. In this chapter, that direction is referred to as north unless otherwise specified.

Structure 2

ARCHITECTURE AND INTERIOR FEATURES

Structure 2 (Fig. 6.2) is a two-room bajareque (wattle-and-daub), thatched-roof domicile similar to Structure 1 (Chapter 5), but it is better preserved. The lowest construction is a thin clay layer on the TBJ surface. A 70–80 cm thick adobe platform measuring 4.33 × 3.42 m rests on that layer (Fig. 6.3). The upper platform surface is nearly flat, and like Structure 7, it was oxidized by prehistoric firing (Wolfman 1990) and by the volcanic tephra layers. The methods used to fire the structure platforms are not known.

The structure has four adobe columns that each measure 42 × 36 cm. The southern columns are at the platform corners, and the northern ones are set back 75 cm from the edge. The columns are 1.25 m to 1.40 m high, shorter than the wall tops and too short to support the roof. Perishable poles could have extended up from the columns to support the roof, but we have no evidence of that. Bajareque walls that were originally 1.75 m high close the southern, western, and eastern sides. The walls were constructed by placing 2–5 cm (diameter) vertical poles in the platform at 8–15 cm spacing. The vertical poles were sandwiched between smaller horizontal poles, and were covered with clay on both sides to form walls 8–15 cm thick. Two puddled adobe walls measuring 60 cm long, 30 cm thick, and 110 cm high extend from the northern columns to the platform edge. Three 2 cm (diameter) holes in the top of each wall may indicate roof support poles.

A bajareque wall with a doorway between the rooms crosses the structure interior. The doorway is 55 cm wide and 153 cm high and is framed with pilasters and a cornice. A door built of poles probably closed the doorway. The walls apparently stood independently of one another, as there is no evidence of poles extending between walls and columns. Instead, they were structurally joined through the roof. The joins between walls were covered with mud plaster, leaving a smooth exterior surface.

The northern room was walled with bajareque on three sides, but the north side was apparently closed by an organic wall similar to that of Structure 4 (Chapter 8); thirty-one 1–1.5 cm (diameter) holes were found near the northern edge and were cast with dental plaster. The holes were the remains of a series of vertical poles lashed with agave fiber string that served as a divider, a door, or a wall. Entry was through the northern room, which measures 3.10 m east-west by 1.60 m north-south, with a floor area of about 5 m^2. Walls enclose the interior room, and a 55 cm high bench covers the eastern 1.4 m of the room and contains a large niche. The southern room covers 7 m^2, and the total interior floor area of Structure 2 is about 12 m^2.

A raised shelf or ceiling (tabanco) covered much of the interior and extended out under the eaves. Impressions on wall tops indicate that closely spaced poles rested on the eastern and western walls, forming a nearly continuous surface. Under the eaves, the shelf was covered with thatch that in turn was plastered with mud, but the poles were not covered inside the structure.

The handles of several broken storage jars were incorporated into the bajareque walls. The Cerén inhabitants recycled handles by attaching them to walls to hang items (McKee 1999). In bajareque structures, the handles may have been lashed to

FIGURE 6.2. Photograph of Structure 2 from above and north. *Photograph by Brian R. McKee.*

the wattles and partially plastered over. Handles present at the four corners of the doorways of Structures 3 and 7 were probably used to hang doors. We have not yet uncovered the inside of the Structure 2 doorway, but there are handles elsewhere, including two on the eastern wall, one on the southern wall, and one on the western wall. They probably were used for hanging various items.

Structure 2 was roofed with a wooden framework covered with grass thatch (Fig. 6.4). Five postholes adjacent to the northern platform edge indicate support on that side. There are no postholes on the other sides, where the roof was probably supported by poles extending up from the walls or columns. Carbonized timbers up to 10 cm thick were found around the house, as were smaller pieces of carbonized wood and burned grass thatch. Two perpendicular layers of 2–3 cm (diameter) poles spaced at 5–10 cm intervals were found near the western wall. Elsewhere, split wood pieces were lying on top of the poles. Based on that evidence and on comparison with recent Maya houses (Wauchope 1938), it appears the roof was supported by a hierarchical structure of poles. Ten cm (diameter) poles formed the main roofing members, at least two layers of smaller poles rested on those supports, and the thatch was then attached to the smaller poles. Forked sticks and agave fiber twine held the roof together, as is the case in recent Maya houses (Wauchope 1938). The roof attached to wattles extending upward from the walls, lending considerable strength to the structure. The roof appears to have been a hip roof, defined by Wauchope (1938: 40) as a roof that is "pitched back from all four sides." Wauchope noted this as the most common roof type in his sample.

Based on the thatch distribution and on drip lines reconstructed for other Cerén structures, the roof-

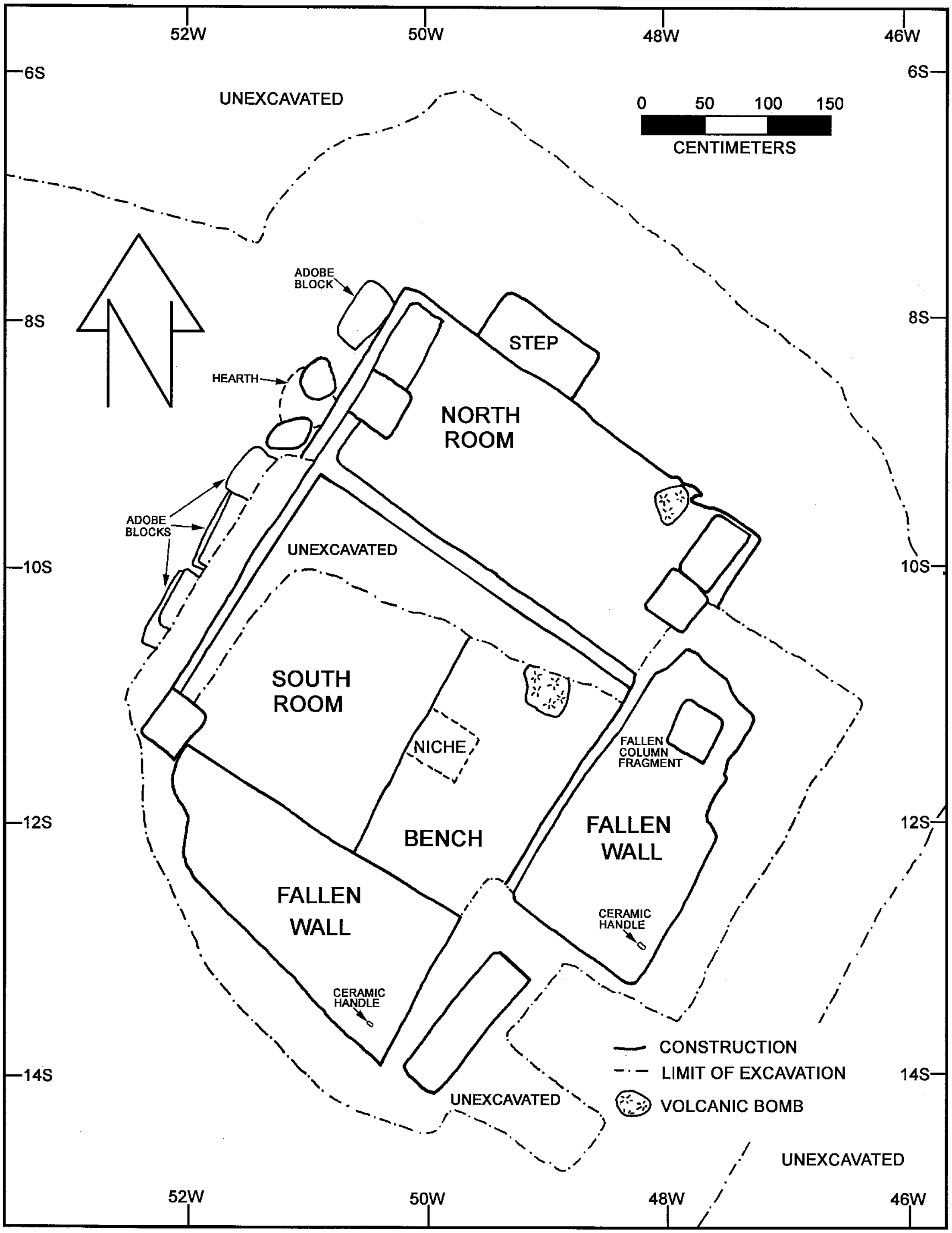


FIGURE 6.3. Plan of Structure 2 showing architectural details.

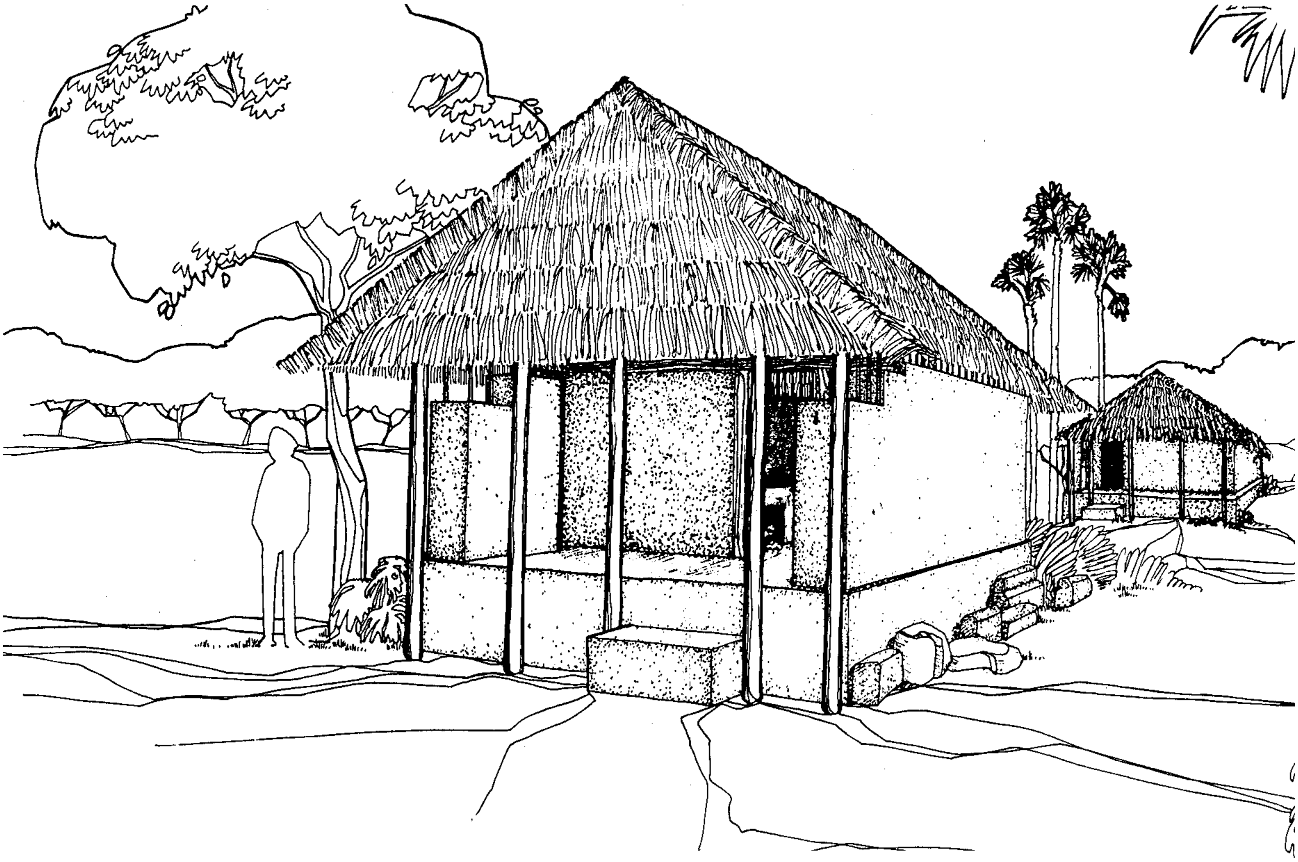


FIGURE 6.4. Artist's reconstruction of Structure 2. *Drawn by Karen Kievit.*

ing extended about 1.5 m beyond the walls on all sides for a roof measuring roughly 7.3 m north-south by 6.4 m east-west, a 47 m^2 area. The platform covered about 15 m^2, and the area under the eaves 30 m^2. This fits a trend at Cerén of the outside roofed area being roughly double the area inside.

ARTIFACTS

Succeeding chapters present detailed artifact analyses, and the following description relates the artifacts to the structures and to one another, rather than providing detailed descriptions. Thorough provenience information is provided in the Operation 2 Field Specimen (FS) list on the CD-ROM *An Interactive Guide to Ancient Cerén: Before the Volcano Erupted.*

The most striking set of artifacts was recovered from the niche and consists of three ceramic vessels, a marine bivalve shell fragment, and a painted object (Fig. 6.5). The pots are polychrome serving vessels, including a Gualpopa bowl, a Copador tripod bowl, and a Copador bowl that was placed upside down over the tripod bowl. Food residue was preserved in this bowl as the marks where someone's fingers passed while removing food. The marine bivalve shell fragment was identified as *Spondylus calcifer* (Chapter 16), and researchers initially thought the paint fragments that covered a 10 × 15 cm area could be the remnants of a codex. The fragments were analyzed at the Smithsonian Institution and interpreted as being from a painted gourd. The artifact was produced by coating the gourd with kaolinite clay which was painted with mineral pigments (Beaubien 1993). A similar but better-preserved gourd from Structure 11 (Chapter 5) confirmed this identification.

Other artifacts recovered from Structure 2 include two large sherds from storage jars. The jars broke prior to the eruption and the sherds were kept in the rafters. They may have been recycled and in use as containers, storing some organic item that has decomposed since the time of the eruption. Alternatively, they may have been in positions of provisional discard (Deal 1983), from which they could have been retrieved if needed for some unspecified future use. Almost two-thirds of the artifacts from Cerén were stored in elevated contexts (Sheets 1998). A small tripod incensario (censer) rested on the bench, and the vertical section of a storage jar was found in the north room, where it fell during the eruption.

We also found a spatulate bone tool on the bench and a small basalt hammerstone. An enigmatic feature consisting of a mixture of TBJ tephra, grass, and water was found in the south room. This 180 × 80 cm deposit, known as the "buff unit" (Miller 1989), rested on Unit 1 tephra from the Loma Caldera eruption, indicating its emplacement during that eruption. A similar deposit was found south of Structure 9 (Chapter 10).

Two obsidian prismatic blades came from the northern room. We also recovered a large-stemmed percussion macroblade and a small, roughly made side scraper. The scraper was resting on the northwest column, but the blades were all stored in the roofing thatch. Nearly all prismatic blades in good condition at Cerén were tucked into thatch. Two possible and not mutually exclusive reasons for this are to protect the blades and to protect people, particularly children, from the sharp edges.

Under the Eaves and around Structure 2

The traditional distinction between inside and outside is blurred at Cerén because so much activity occurred beneath the eaves, a characteristic of modern rural Mesoamerica. There are several features beneath the eaves of Structure 2, and artifacts stored in elevated contexts that fell during the eruption were found here, as were artifacts associated with outside activities.

A 25 cm high clay step on the northern platform edge provides access to the structure. Nine large

FIGURE 6.5. Photograph of niche showing ceramic vessels, painted gourd, and marine shell. *Photograph by Payson Sheets.*

adobe bricks were found under the eaves west of Structure 2, where they were protected from the elements. They presumably were stored for use in a future unknown project. The only use of adobes known at Cerén is for steps or benches, which hardly justifies the fabrication of large numbers. Adobes were used to construct the Campana mound at the primary regional center of San Andrés (Begley 1997), but the transport of bricks between these sites is unlikely. Future excavations may indicate other adobe uses at Cerén.

The only hearth found in Operation 2 is adjacent to the western wall of Structure 2. Two 30–35 cm (diameter) stones were placed 15 cm apart about 10 cm from the wall. A fire had been built between the stones, and pots evidently rested on the stones and leaned against the wall, based on diffuse charcoal staining around the rocks. The wall was only slightly oxidized, with no smoke staining, indicating minimal use.

ARTIFACTS

Artifacts surrounding Structure 2 fit into three contexts: (1) artifacts that were stored in elevated positions in the roofing, on the wall tops, or on the shelf and fell during the eruption, (2) artifacts that were used outside and were left in TBJ contact, and (3) artifacts discarded before the eruption that were lying on the ground surface.

Three biconically perforated donut stones found southwest of Structure 2 fell from elevated positions. One is small with little use-wear, and the second broke during the eruption. The third stone is larger. A void passed through the stone, into the underlying tephra layers. Organic remains adhered to the sides of the void, which marks the location of a wooden stick that has decomposed since the eruption. In addition to organic residues, some wear was present, and Sheets (1989b) interprets this artifact as a perforated mortar with a wooden pestle. Other fallen stone artifacts include an obsidian prismatic blade fragment and a whetstone. A carnivore tooth, elevated prior to the eruption, fell southwest of Structure 2, while two large mammal bone fragments and a minimally worked bone splinter fell south of Structure 2.

The only floor-contact item from a use context recovered near Structure 2 was a ceramic jar with modeled and appliqued human features that was found under the eaves north of the structure. The lack of in-use items around the structure is due to regular maintenance activities (McKee 1990c). The areas under and around the eaves were used for a variety of activities, including as walkways. Several items found around Structure 2 could have been in provisional discard, among them a large jar fragment and four unmodified or minimally modified lajas. Many artifacts were discarded before the eruption around Structure 2, including numerous ceramic sherds, an edible jute (snail) shell (*Pachychilus* sp.), several seeds, one identified as avocado (*Persea americana*), a ground sherd spindle whorl, and an obsidian macroblade fragment.

Structure 7

Structure 7, excavated in 1989 and 1990 (McKee 1989, 1990b), is a one-room thatched-roof bajareque structure located 1.3 m south of Structure 2. Based on architecture and artifacts, we have identified it as the Household 2 storehouse (Fig. 6.6). The structure was previously known as Structure 2b (McKee 1989), but since 1990 it has been referred to as Structure 7.

ARCHITECTURE AND FEATURES

Structure 7 rests on a thin, unfinished clay layer covering the TBJ-derived soil. The platform is nearly square, measuring 3.1 m across, with a surface 64–93 cm above the surrounding terrain (Fig. 6.7). The platform surface is 5 cm lower at the center than at the edges. That could be due to subsidence caused by a pit below the platform for a burial or dedicatory cache. Such pits are often found under Classic Maya structures (Haviland 1988), but we have no direct evidence supporting that interpretation for Structure 7. A 1.45 m wide porch extends 1.65 m north from the main platform. Its surface is 13–14 cm below the main platform. The porch was added in four stages and then was plastered with clay. We do not know if it was built in separate remodeling phases or if the elements represent events in a single construction episode.

The Structure 7 superstructure includes four bajareque walls, with adobe columns at the corners. The porch is unwalled, and the structure was roofed with grass thatch. The columns are roughly square and less regular than those of Structure 2, measuring 30–40 cm across and 1.48–1.56 m high. The columns may have supported the roof, but no voids were found.

The main platform had bajareque walls on all four sides, and a 90 cm wide doorway provided access to the north. Holes indicate the poles from the walls extended 3 cm into the platform. The wall framework consisted of 4–5 cm (diameter) verti-

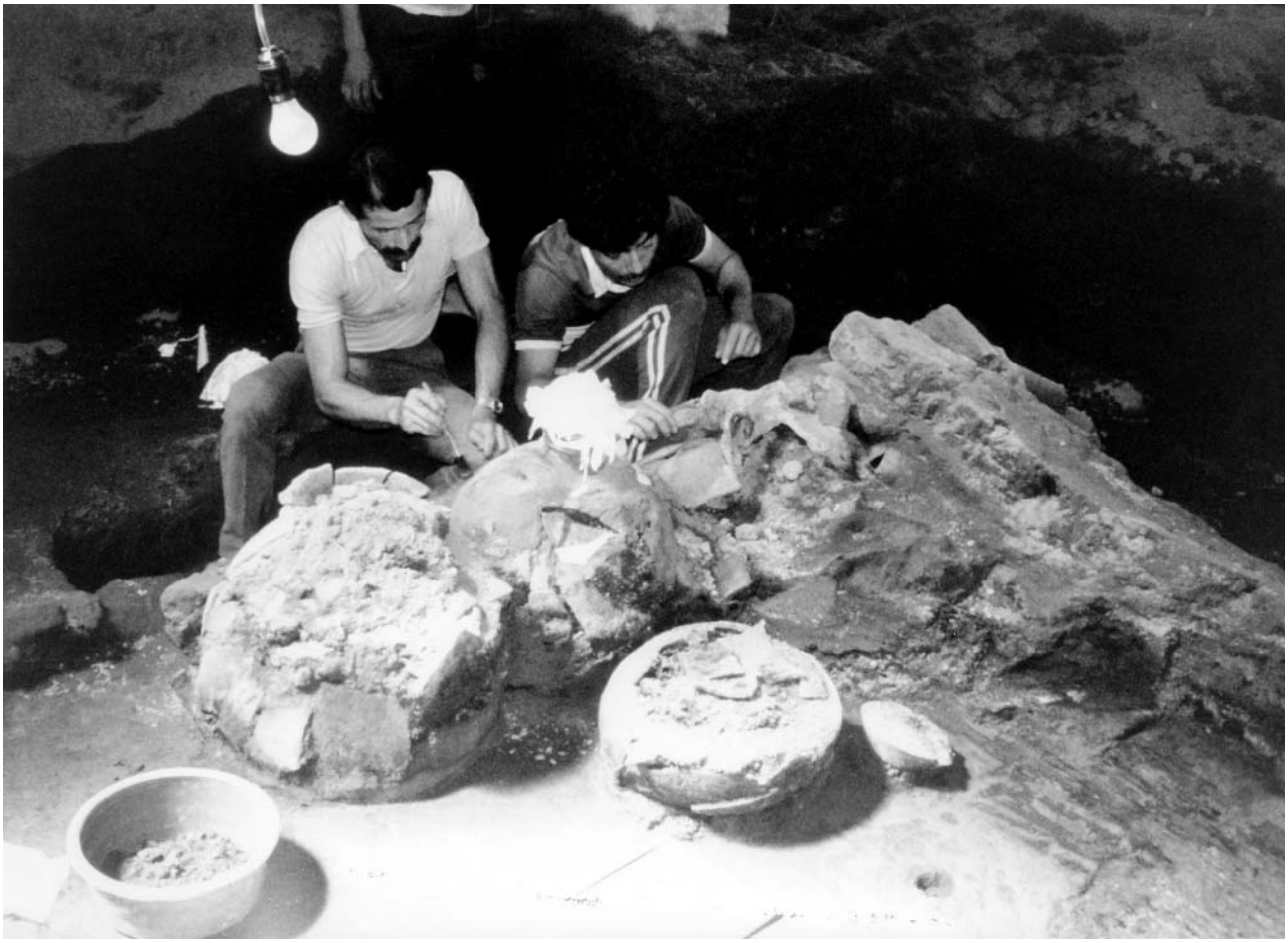


FIGURE 6.6. Structure 7 during excavation. Antonio Rivera Espinosa and Jaime Arturo Morán Rodríguez are excavating large storage vessels adjacent to the southern wall.

cal poles set between 2–3 cm (diameter) horizontal poles. That framework was then plastered with mud. The walls were 14–16 cm thick and 1.55–1.67 m tall. The doorway was closed by a door made from eighteen 1.5–2 cm (diameter) poles lashed together that were preserved as holes in the volcanic tephra. Two small holes at the juncture of the porch and the main platform were used to secure the door, as were four ceramic handles attached to the walls on either side of the doorway.

Carbonized beams and rope indicate the roof construction. No clear patterning of poles was present, but two postholes to the north (Fig. 6.7) suggest means of support. A ceramic handle embedded in the platform southwest of Structure 7 may have been a tie-down to secure the roof against high winds. Based on the drip line and the thatch distribution, the roofed area of Structure 7 was about 37 m^2. The walled area was about 10 m^2, and the porch covered about 3.5 m^2. As with most structures at Cerén, there was about twice as much exterior roofed area as interior.

A raised wooden shelf in the west-central portion of the main platform is indicated by four 8–10 cm (diameter) postholes in the floor and several parallel carbonized wood slats lying on Unit 1 deposits. The feature covered at least 1 m^2, and a large storage jar on the floor beneath the shelf indicates it was at least 26 cm high. The northern portion of the shelf was covered by a woven mat that may have originally covered the entire feature.

Structure 7 evolved and expanded over time. The first evidence of remodeling involves the porch, which increased the floor area by roughly 35% and could have been built in multiple stages. An adobe step on the west side of Structure 7 may also indicate remodeling. The west side of Structure 7 was closed at the time of the eruption, and the step may

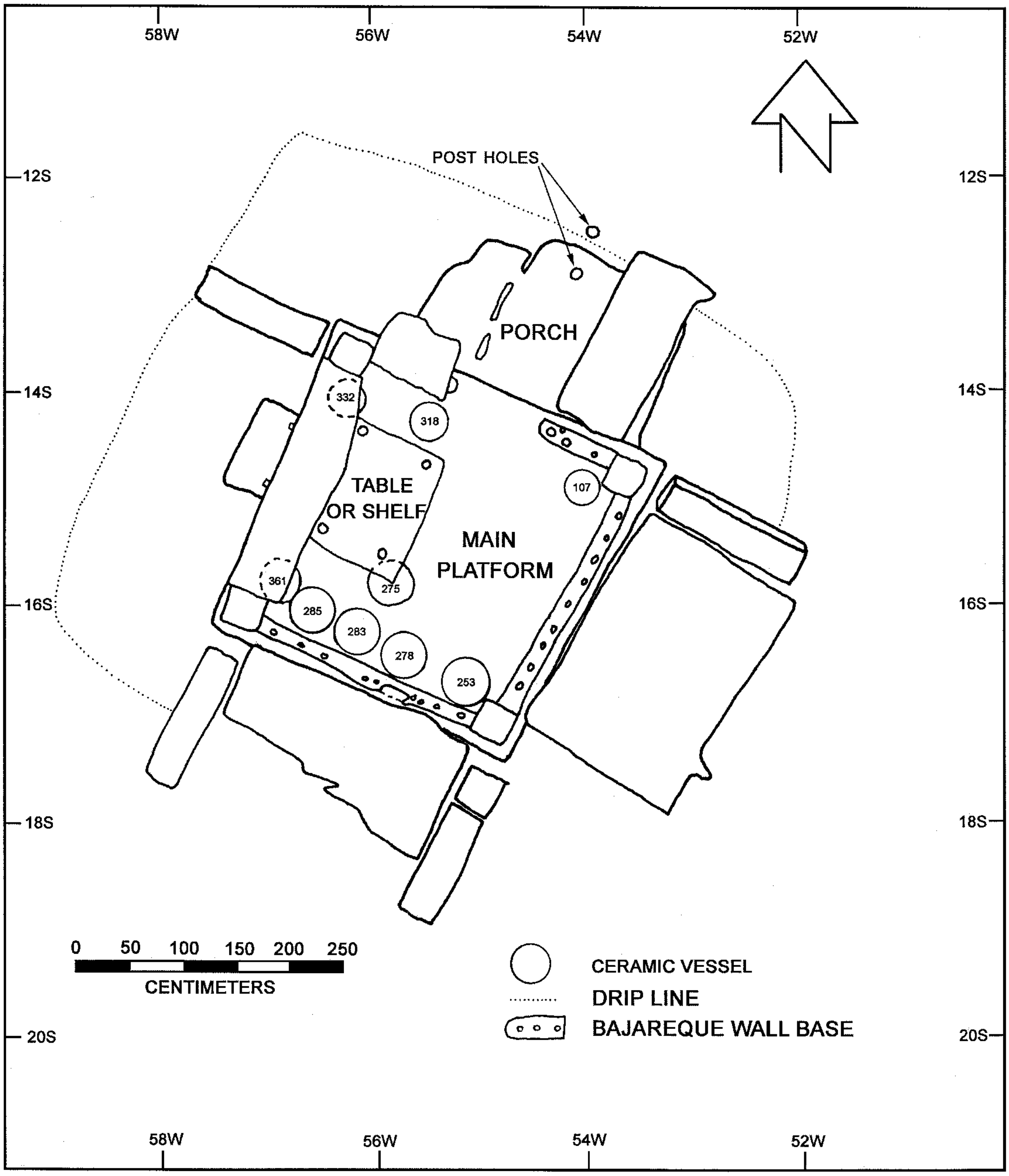


FIGURE 6.7. Plan of Structure 7, showing architecture and the locations of floor contact items.

represent a change in doorway orientation and the rebuilding of walls.

The roof was integral in holding the structure together. The vertical bajareque poles did not penetrate far into the platform, and the horizontal poles did not penetrate the columns. The main strength came from above, as the vertical bajareque poles were lashed to the horizontal poles of the roof. The collapse of the structure illustrates the role of the roof in structural integration. All structural elements remained intact through the eruption of Unit 1. The hot air-fall deposits of Unit 2 ignited the roof, which fell early in the Unit 3 eruption, and the walls and columns came down soon after.

ARTIFACTS

Structure 7 contained many artifacts in both floor-contact and elevated contexts. The floor assemblage was dominated by five large storage jars just inside the southern wall (Fig. 6.6). Three other storage jars and a large basin were found elsewhere.

The vessels contained carbonized seeds, including beans; positive identification is pending. One vessel contained a lump of specular hematite wrapped in organic material, as well as an unidentified cylindrical fibrous object. Other items from the floor include fragments of red paint on a white ground layer, which were scattered about the porch and were the remains of a painted organic item whose organic component decayed.

Many artifacts were stored in elevated positions in Structure 7 and fell during the eruption, including a group of artifacts stored in an organic container. The artifacts which clustered together in a deposit measuring about 20 cm on a side included five cinnabar-filled miniature ceramic vessels (Beaubien 1990b). Seven jadeite beads were also recovered from the deposit, as were another bead made from dark gray stone, a disk-shaped shell bead with an incised five-pointed star, two incised shell pendant fragments, a small mammal bone, a cowrie shell, and three shell fragments. The final items in the deposit were fragments of iron oxide minerals, including limonite and hematite, and some prepared hematite pigment.

Other ceramic artifacts from Structure 7 include a large polychrome dish that probably fell from the rafters and a small jar with a ground sherd lid that fell from the elevated shelf, as did a smaller polychrome dish that had mat impressions in the volcanic ash on both sides. Other fallen ceramic artifacts include a medium-sized scraped-slip jar, a Copador bowl with monkey decoration, a Campana Fine-Line tripod plate, and several large sherds used for storage or in provisional discard.

Five obsidian prismatic blades were recovered from fallen contexts inside Structure 7. All were tucked into roofing thatch, and two fell into a storage jar. A greenstone celt fell into the same jar, as did an anthropomorphic figurine carved from a large mammal longbone and some specular hematite. A fine spindle, with a carved coyol palm endocarp whorl (Beaudry-Corbett and McCafferty 1998) and a wooden shaft, fell into another jar, and a wood ash hemisphere fell onto the floor. The spindle was apparently used to make fine thread. Several rodent skeletons were found in contexts that indicated the rodents fell from the roofing. They presumably lived by taking advantage of stored foodstuffs.

Although the porch contained no floor-contact artifacts, numerous fallen artifacts were found there, including two polychrome vessels and a large sherd. A prismatic blade fragment and a macroblade were stored in the thatch. Several red-painted fragments of organic items were also recovered, as were the lower limb bones of a peccary (*Tayassu* sp.) and two wood ash deposits.

Under the Eaves and around Structure 7

Artifacts in contact with the pre-eruption ground surface and others that fell during the eruption were recovered from around Structure 7. All ground-contact items had been discarded before the eruption, including ceramic sherds, obsidian prismatic blade fragments, a bone needle fragment, and several organic items that subsequently decayed, leaving voids in the tephra. The voids were filled with dental plaster during the recovery process; they were caused by seeds and corncobs trampled into the surface. The blade segments were short but retained sharp edges (Sheets 1990a).

We recovered more items that fell from elevated contexts. Several sherd lots were excavated; some fit together to form whole vessels or match sherd lots recovered inside the structure, but others were from large sherds broken before the eruption. A recurved bowl was found below the roofing thatch northwest of the structure. Three bowls were found west of Structure 7, where they fell shortly before the roof.

Two prismatic blades were found in roofing thatch northwest of Structure 7, and a macroblade fragment was found in the thatch west of the structure. The only grinding implements around Structure 7 were two manos that fell from the rafters west of the structure. Numerous paint fragments consisting of red pigment on a white ground layer were found at various localities. These fragments came from painted organic items whose organic component decayed, probably polychrome painted gourds. A small hematite cylinder was recovered west of Structure 7. Similar cylinders were recovered from various locations at Cerén. Hematite was used to decorate polychrome ceramic vessels, and a portion of the Structure 12 wall was painted red (Chapter 12).

Several deposits of wood ash were recovered from fallen contexts inside the structure, on the porch, and in surrounding areas. These hemispherical deposits ranged from 10 to 20 cm in diameter, and were apparently stored in organic containers that decomposed. Wood ash is largely calcium carbonate, and ethnographic accounts document its use in a variety of tasks, including soaking maize grains to increase niacin availability and improve the amino acid balance of the digestible protein (Johns 1990). Wood ash is also used for culinary seasoning (Dirección del Patrimonio Cultural 1991: 44; Kavena

1990: xvii, 83; Niethammer 1974: 138, 141), in hide preparation (Catlin [1844] 1973: 45), in soap preparation (Wigginton 1972: 151–158), and to prepare plant fibers for textile work (Stevenson 1915: 78).

Other Areas around and between the Structures

Structures 2 and 7 are very close together, with their platforms only separated by about 1 m (Fig. 6.1); their roofs probably overlapped, allowing covered access between the structures, a benefit during storms. The TBJ ground surface is compacted there, as it is under the eaves of both structures, indicating considerable foot traffic. The area west and southwest of Structure 7 was covered by a flat prepared clay surface that extends 1.5 m west of the structure, supporting the hypothesis that access was once from that direction. The structure roofs were separated from the agricultural field by a few centimeters to 2 m. This area contained little trash, and the surface was highly compacted, probably reflecting regular maintenance activities (Hayden and Cannon 1983) and foot traffic.

Structures 7 and 9 are more widely separated. There are several interesting features in this area, including a pit of unknown function about 1.5 m south of Structure 7. There were voids where several corncobs were discarded in this area, as well as two marks that appear to have been human footprints. The TBJ surface between Structures 7 and 9 was kept clean and was quite clear of artifacts, containing less than 1 sherd/m^2. The surface was highly compacted, indicating foot traffic and possibly other activities, but traces of those activities were removed by sweeping and other maintenance processes.

Agricultural Fields

The eastern and southern portions of the Household 2 area were used to grow corn. This field is discussed in more detail in Chapter 20, but a brief summary is necessary to relate it to Household 2 activities. The field was first observed as holes in the Unit 3 tephra east of Structure 9 (McKee 1990a), which were filled with dental plaster; subsequent excavation revealed plaster casts of corn plants. The western edge of the field is 1–3.5 m from the Household 2 roofs, and the field continues to the south beginning a few cm from the Structure 9 roof. The main portion of the field measures at least 26 m north-south by 7 m east-west, an area of 180 m^2, but it is probably considerably larger.

FIGURE 6.8. Plaster cast of corncob from the field east of Structure 9.

The highly organized field was used solely to cultivate corn, and considerable effort went into its preparation. The corn was planted on 10–20 cm high ridges spaced about 80 cm apart with the same orientation as the structures. Two to five corn plants were planted at each ridge-top location, and the planting locations were spaced 60–80 cm apart. The plants were mature and had 15–20 cm long cobs (Fig. 6.8). Most plants were doubled over, possibly due to the eruption but more likely from efforts by the Cerén residents. Modern Maya communities often store cobs on doubled-over corn stalks (Smyth 1991). An enigmatic feature was found at the western edge of a corn row east of Structure 2, where at least five corn plants were tied together using two-ply twine (McKee 1996). The plants may have been removed from their growing locations and then lashed together at the edge of the field for storage (D. Lentz, personal communication 1999).

The agricultural fields at Cerén were not sufficient to meet the community's nutritional needs, even if the entire area surrounding the structures was cultivated. It seems likely that the Cerén inhabitants utilized an infield-outfield cultivation system as proposed by Netting (1977) for the Classic Maya. The kitchen gardens and infields were intensively cultivated, receiving a far greater energy input per unit area than the outfields, which probably utilized shifting cultivation. This energy input resulted in higher productivity. Household rubbish may have been used to fertilize the infields, as evidenced by refuse encountered throughout the cultivated area (McKee 1990a, 1996).

Discard Processes and the Operation 2 Midden

The exceptional preservation at Cerén provides a great opportunity for the archaeologists working there. At most sites, the artifacts recovered were discarded before abandonment. In contrast, Cerén was abandoned so suddenly that the inhabitants left most of their possessions behind, allowing a detailed reconstruction of village life. The Cerén inhabitants generated and discarded trash throughout the occupation, however. Trash is ubiquitous to human existence, and the analysis of discarded materials can provide much information otherwise unavailable even for living cultures (Rathje and Murphy 1992).

Most analyses at Cerén have concentrated on materials that were in use or in storage at the time of the eruption, but researchers are beginning to analyze materials discarded before the eruption. Discarded materials were recovered from four depositional contexts at Cerén. The first context consists of items in provisional discard that were placed where they could be retrieved in case of future need (Deal 1983; Hayden and Cannon 1983, 1984). The second context consists of materials incorporated into the earthen structures; several ceramic sherds were found in the clay of the bulldozer-damaged northern edge of Structure 1 (Mobley-Tanaka 1990). It is not known whether their inclusion was intentional or inadvertent. The third discard context at Cerén consists of a low-density trash scatter across the site. The trash results from several processes, including loss and inadvertent breakage (primary deposition [Schiffer 1987]), and intentional dumping and sweeping that moves artifacts from the primary deposit (secondary deposition [Schiffer 1987]). A fourth discard context at Cerén consists of materials dumped at formal discard locations. Some dumping probably occurred over the bank of the Río Sucio, and the Cerén inhabitants dumped materials in a midden (McKee 1990a, 1992, 1993).

The midden is located in a large depression southwest of Structure 9. The depression may have resulted from natural processes or it could be a borrow pit used to excavate clay to build structures. Conyers (Chapter 3), based on ground-penetrating radar data, interprets it as the upper end of a drainage, but excavation data have not yet confirmed that interpretation. The depression measures at least 4 m in each direction and is minimally 1.5 m deep, but it is probably considerably larger.

Four 1 × 1 m test pits were excavated in the midden (McKee 1990a, 1992, 1993). We reached sterile deposits in only one pit due to time constraints and safety concerns. In the completed unit, sterile deposits were reached 135 cm beneath the pre-eruption ground surface, but the artifact density diminished markedly below 60 cm beneath the surface. Excavations were stopped in the other units at depths of less than 1 m, but they still had high artifact densities when terminated.

The midden stratigraphy is complicated, consisting of strata composed of various mixtures of discarded organic and inorganic items, TBJ tephra, and sediments from the pre-Ilopango soil. Several strata contained wood ash, which was probably from cleaning the Structure 9 firebox (see Chapter 10). Although cultural materials continued to 135 cm below the pre-eruption ground surface, a change in the profile about 70 cm below the surface corresponds with the decline in cultural materials. Below that contact, sediments are a massive, dark reddish brown sandy clay similar to the pre-Ilopango soil. Sediments above the contact vary greatly in color and texture. Bioturbation could account for artifacts found below the contact.

Diverse artifacts representing most of the range of material culture at Cerén were recovered from the midden, including ceramics, obsidian prismatic blade fragments, groundstone, painted fragments of ground layers covering organic items, fragments of bajareque construction, and organic items. The organic items and casts recovered include bone fragments, carbonized seeds, plaster casts of corncobs and tree branches, wood charcoal, and wood ash. A perforated dog tooth probably was worn as jewelry.

Much of the midden material has yet to be analyzed, and space concerns permit only a brief summary of important findings. Sheets (1992b) noted that most blade fragments from the midden were quite short and still had sharp edges, leading him to conclude that they were discarded because they were too short to use after breaking, rather than because they had dulled.

Ceramics from the midden include sherds from utilitarian vessels, serving vessels, and sherd disks (Beaudry-Corbett 1992). Comparing sherds from two pits, one located near the upslope edge of the depression and the other further down the slope, indicated that more sherds were recovered per volume downslope, that the sherds downslope were larger, and that sherds in the lower pit were concentrated 5–30 cm below the pre–Loma Caldera surface while those in the upslope pit were more evenly distributed (Beaudry-Corbett 1992). Refitting attempts found few matches, suggesting that the midden contained few complete broken vessels. Instead, the materials were probably collected elsewhere and transported to the midden (Beaudry-Corbett 1992).

Detailed analysis of the discarded material from Cerén, which has only begun, could link Cerén with sites that have more typical preservation conditions. By comparing the Cerén materials in use and storage contexts with the discarded materials, we can begin to develop quantitative models to interpret the discarded materials found at other sites and better understand the formation processes that intervene between past activities and their archaeological recovery.

Household 2: Its Activities and Role in the Cerén Community

Structures 2 and 7 were clearly occupied by the same household of the Cerén community. Based on both the architecture and the artifact distribution, we can infer with some confidence that Structure 2 was a domicile and Structure 7 was a storehouse.

We can also infer some activities conducted by Household 2. The occupants were involved in agricultural production, as indicated by the proximity of the maize field. Household members may also have produced polychrome painted gourds; the numerous paint fragments and the cinnabar, hematite, and possibly other mineral pigments point to this interpretation. The coyol spindle and small sherd disk spindle whorl probably show the fabrication of thread for textile production (Beaudry-Corbett and McCafferty 1998).

Another role that Household 2 could have played in the Cerén community relates to Structure 9 (Chapter 10). The sweat bath is considerably larger than necessary for one household, and may have been utilized by several households. Because of its proximity to the structures utilized by Household 2, it is likely that this household controlled its construction and maintenance.

There is little direct evidence of distribution at Household 2. Most obsidian blades from the Zapotitán Valley came from the Ixtepeque source in Guatemala (Sheets 1983b). The obsidian likely came through Chalchuapa to San Andrés and reached Cerén from there (Sheets, personal communication 1989). Other artifacts, such as ceramics and groundstone, probably also were manufactured elsewhere and reached Household 2 via exchange for the goods and services produced there. Pooling is defined as resource distribution within the household (Wilk and Rathje 1982), and evidence for pooling is provided by storage, cooking, and serving facilities.

The evidence for transmission between generations and reproduction at Cerén is indirect. The remodeling of Structure 7 may be related to changes in the developmental cycle of the household; as household composition changes, modifications can be made to existing structures to accommodate new members (Goody 1958). The nature of agriculture and construction also provide indirect evidence of transmission between generations. The structures are substantial, involving major labor input, and evidence of remodeling indicates that they were probably in use for many years. The agriculture also involved considerable labor input, in the form of preparation of raised ridges and drainage. The proximity of the cornfield to structures indicates that land, at least within the village, was in short supply.

Land was valuable at Cerén. There is insufficient land in the area immediately surrounding the structures to meet subsistence needs, and it appears that an infield-outfield system was used. All indications show that the land immediately surrounding the structures was controlled by households and that this control passed between generations. These indications include improved fields, relatively permanent crops, and substantial architecture. The tenure of the outfields is not known. It is likely that they were under communal tenure with divisible use rights, but that interpretation is highly speculative. Future excavations in outfields may encounter boundary markers showing areas cultivated by specific households.

Excavations in Operation 2 revealed three structures and surrounding activity areas. Two of the structures, a domicile and a storehouse, clearly belonged to the same household and form part of the basic household repertoire of structures. The third structure, a sweat bath, was certainly used by Household 2 but was probably also used by other households and possibly by the community as a whole. Household 2 members produced corn and likely craft products, and may have provided a community service by maintaining the sweat bath. Unfortunately, we have not yet uncovered the full suite of buildings utilized by Household 2; no kitchen has yet been excavated, and the role of two other nearby structures (Structures 13 and 18) will not be known until they too are excavated. Even a partial view of the remains of this household provides considerable insight into the lives of the Classic Period inhabitants of Cerén.

Acknowledgments

The research at Operation 2 at Cerén benefited from the aid of individuals and institutions too numerous to list here. More detailed acknowledgments are provided in the preliminary reports. The Salvadoran field workers, ably directed by Víctor Manuel Murcia, were highly skilled and a pleasure to work with. The Patrimonio Cultural of El Salvador, in the Department of Education, provided great support and facilitated research under the direction of Arq. María Isaura Arauz. The Patronato Pro-Patrimonio Cultural, an nongovernmental organization involved in the promotion and preservation of Salvadoran culture, provided both personal and financial support for research and conservation. Numerous friends in El Salvador have also made it a joy to live and work there. I would also like to thank all the members of the Cerén research team, many of whom have written chapters in this volume. Payson Sheets, as project director, has fostered a congenial project spirit and the generous sharing of data. Janet Griffitts provided helpful suggestions and references regarding possible uses of wood ash. This chapter benefited from the critical eyes of Payson Sheets, Paul Healy, and Art MacWilliams, who read and commented on an earlier draft. Their criticism has greatly improved the content and style, but I take responsibility for any shortcomings.

Structure 16: The Kitchen of Household 3

Inga Calvin

To date only a portion of the kitchen of Household 3 has been excavated. However, based on the example established by Household 1, future investigations should reveal additional domestic structures that will confirm Household 3 as a distinct residential complex.

Andrea Gerstle and a team of students from Western Michigan University discovered the kitchen of Household 3 in 1991–1992 while excavating test pits to install footings for the site's large protective roofs. Special funds for their work were provided by the Patrimonio Cultural, by the Patronato Pro-Patrimonio Cultural, and by a Fulbright Research Fellowship. While digging a 2 × 2 m test pit identified as Unit P-2 of Operation 7, excavators unexpectedly encountered the remains of Structure 16. Similarities in the construction technique of this building and Structure 11 from Household 1 indicate that Structure 16 served as the kitchen for Household 3.

Architecture and Artifacts

Lying approximately 9 m north-northwest of Structure 4 (Fig. 1.1), Structure 16 exhibits pole-and-thatch wall construction and a slightly elevated, circular ground plan. The floor of Structure 16 rises between 4 and 10 cm above the tierra blanca joven (TBJ) ground surface. A row of poles, 1.0–1.5 cm in diameter and lashed together with two-ply string, forms the curved exterior wall of the building. Based on extrapolations from the excavated arc, the building is approximately 4.0 m in diameter.

In the northeast quadrant of the excavation unit lies a trough-shaped metate resting on a support composed of split river cobbles and unshaped stones. This stack of rocks elevates the metate to a maximum height of about 45 cm above the floor and differs significantly from the forked-stick horquetas used to support the metates inside Structures 11 and 4. Set into the floor is an unworked rock that may have served as a right-foot brace for the person using this metate. Additionally, a depressed area next to the metate indicates where this individual repeatedly stood while grinding. Although neither a mano nor any visible residue was found on the metate, some impressions of possible corn husks encountered to the west of the metate suggest that the trough-shaped metate was used to grind corn.

A large storage vessel containing an unidentified red liquid apparently fell from the rafters of Structure 16 and broke early during the eruption. A red powdery pigment adhered to the interior of one sherd and flowed onto the floor beneath the broken jar.

The presence of abundant charcoal and a large river cobble embedded in the floor near the southeast corner of the 2 × 2 m unit suggests that a hearth probably lies in the unexcavated portion of this building. Because no door was found and because the ground outside and to the west of the raised floor of Structure 16 was plant-free but littered with small sherds, Gerstle posits that the entrance to this structure most likely will be located toward the south or east.

Comparison with the Household 1 Kitchen

Although only a small portion of this building has been uncovered, similarities in the architectural style and quotidian artifacts indicate that both Structure 11 (Chapter 5) and Structure 16 served as the cooking facilities for their respective households. Traits that facilitate this identification include a roughly equivalently sized circular floor plan, although Structure 16 (approximately 4.0 m diameter) may be slightly smaller than Structure 11 (4.48 m diameter). Both buildings are constructed of thatched walls with lashed poles rather than impenetrable bajareque, a construction style that facilitates air circulation during cooking and that seems particularly suited to tropical kitchens. Additionally, both structures have nonfired interior floors that were easy to resurface or replace and that could accommodate spills. In terms of identifiable artifacts, the metate recovered from Structure 16, like that discovered inside Structure 11, had been elevated to a grinding position that suggests use by a fairly short, erect-standing person.

Following the model established by the Household 1 residential complex, and if excavation of Structure 16 confirms an entrance toward the south or east, further investigations may reveal a domicile and another storehouse located to the south or east of Structure 4.

Excavations conducted by Paul Cackler during the 1996 field season may have encountered additional features related to Household 3. Unit P-55 (a pit 2 × 1.8 m in size at TBJ surface and located approximately 5 m to the northwest of Structure 4) contained a high diversity of domesticated plants including beans, possible Rubiaceae (now valued for its medicinal properties), two maguey plants, maize, and flora locally identified as jalacate or, in Nahuatl, *xal-acatl* (used for horizontal reinforcements in modern bajareque architecture). Unit P-56 (a pit 2 × 2.3 m in size at TBJ and located approximately 8.5 m to the west of Structure 4) contained maize plants, two mature chile bushes, and at least one small laurel tree. Based on location, these domesticates may have formed part of the Household 3 gardens. Additionally, Cackler's excavation of Unit P-56 revealed preserved roofing thatch along the southern edge of the pit; investigations to the south of this unit may reveal additional thatched-roof buildings that associate with Structure 16 to form Household 3.

Because excavation of Unit P-2 of Operation 7 has exposed only a small portion of the Household 3 kitchen, it is difficult to speculate what additional artifacts will be recovered from this structure. However, the assemblage recovered from Structure 11 in Household 1 suggests that a variety and quantity of quotidian or special function artifacts, or both, will be encountered inside Structure 16. Further investigations should aid in elaborating the nature of household organization at both the residential and larger community levels. Meanwhile, the unanticipated discovery of Structure 16 and its identification as a kitchen aids in confirming the model of multiple, special-function structures that unite to comprise a single residential complex at Cerén.

Structure 4: A Storehouse-Workshop for Household 4

Andrea I. Gerstle and Payson Sheets

Introduction

Structure 4 was first discovered as a geophysical anomaly by resistivity explorations, and excavated in 1990 by a crew under the direction of Andrea Gerstle (see 1990 report at website http://ceren.colorado.edu or on CD-ROM *An Interactive Guide to Ancient Cerén: Before the Volcano Erupted*). Although it probably was constructed and used as a domicile initially, it evidently was converted to a storehouse that also included a major agave (maguey) fiber workshop and a minor painting workshop (Fig. 8.1). The dozens of agave plants growing south of the building apparently were depulped at the northeast corner of the building, using one of the three pairs of sticks found outside the east wall. An activity area was located in the back room. A meal had been served and largely consumed immediately before the eruption struck; this may have occurred in the structure because of its earlier functioning as a domicile. A high degree of biodiversity in cultigens was encountered around the building, with single species in narrow zones alternating with other species.

Architecture

The platform is almost square, averaging some 65 cm in height and about 3.25 m in length and width (Fig. 8.1), and it was fired prior to adding the walls. Four solid adobe columns, one at each corner, anchor the three bajareque side walls. All bajareque walls, including the interior partition, were further reinforced by large beams running along the tops of the mudded portions. The beams were mudded at the column tops to connect them. As the beams were clay-covered along the wall tops, they formed rounded cornices. All the bajareque walls with beam reinforcements withstood the lateral buffeting of the eruption surges. Only the south wall did not have that reinforcement, and it collapsed (Fig. 8.2). As with so many bajareque walls at Cerén, after the roof collapsed the wall lost its strong reinforcement by being tied into the roofing beams and rafters, and thus became vulnerable to collapse.

The vertical poles in the bajareque walls continued upward at least 10 cm above the mudded portion of the wall before meeting roofing beams, leaving a space for air circulation and light. We initially thought this space would allow very little light inside, but computer modeling of the building (e.g., Fig. 8.3) indicates that the interior would have been reasonably illuminated on sunny days (see website or CD-ROM cited above). The front porch was remodeled extensively, to the point of almost burying the front step and creating an extensive flat porch. At the juncture of that porch and the north platform wall, a pole wall had been built, with some of the poles being anchored deep in holes dug into the porch. The poles were tied together in pairs with two-ply agave twine. A swinging portion of the pole wall, slightly offset to the east of the center of the building, served as the front door. Another pole door in the partition wall closed the inner back room from the front room; it tied to the four salvaged olla handles that were embedded in the four corners of the doorway. It was made of two layers of poles tied together. A building with two doors is

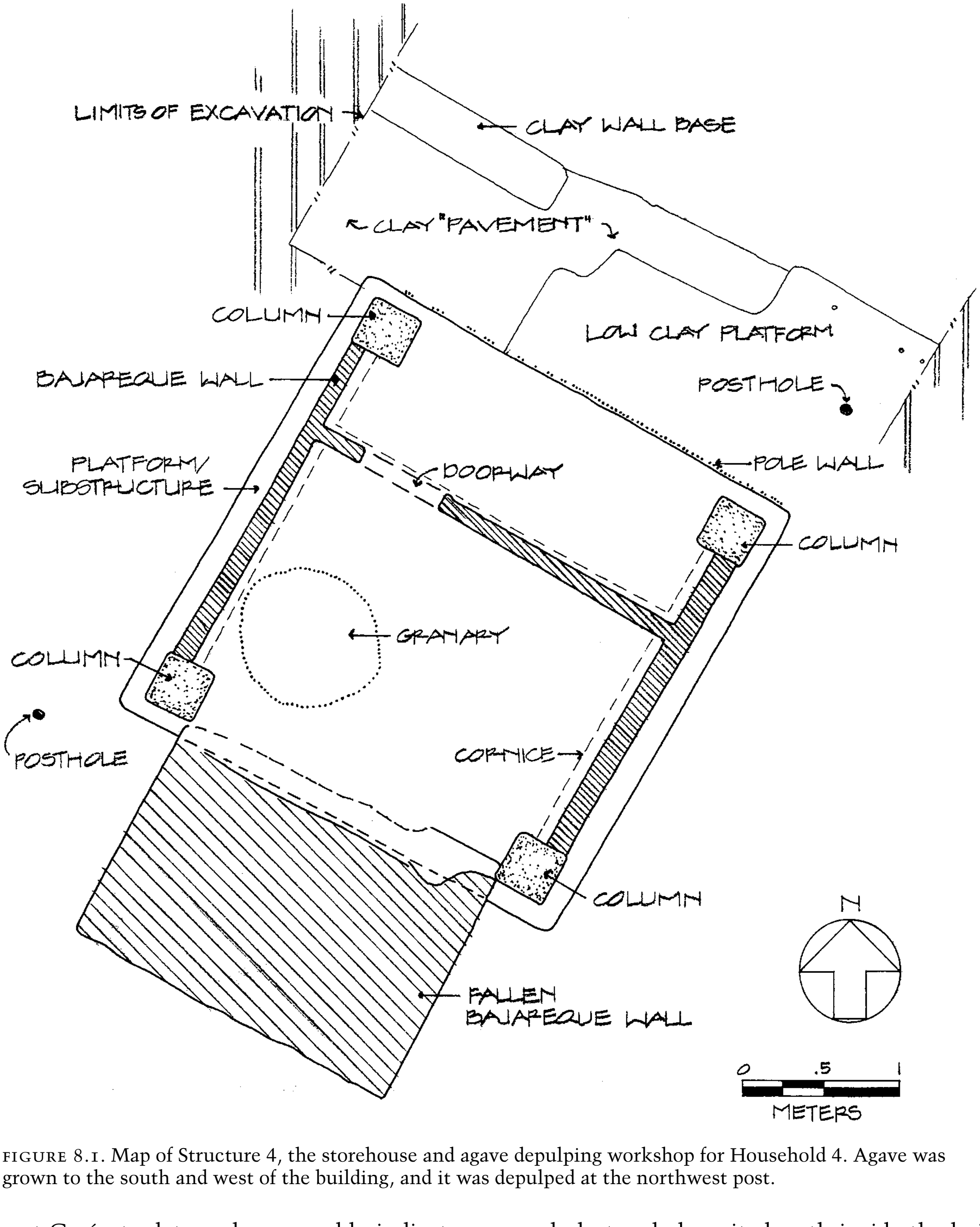


FIGURE 8.1. Map of Structure 4, the storehouse and agave depulping workshop for Household 4. Agave was grown to the south and west of the building, and it was depulped at the northwest post.

unique at Cerén to date and presumably indicates a need to separate the interior activity or storage room from the front storage room. Access to the front room was restricted, and was even more restricted into the back room.

Above the doorway in the interior partition wall, running the full length of the north side of that wall, was a high shelf (tabanco). The shelf was made of long beams supported by the east and west walls, mud-plastered along its length inside the building (in contrast to the Structure 2 tabanco), and probably tied to poles emerging from the partition wall.

A maize crib was built onto the floor of the back room of small-scale wattle and daub. The small vertical poles were reinforced with small horizontal vines, and then this framework was finished on the outside only by a thin layer of clay mud. The structure is 90 cm in diameter, but its height is un-

FIGURE 8.2. Photograph of Structure 4 from the southwest. Note fallen southern wall. The two braces for the inner partition wall were added recently.

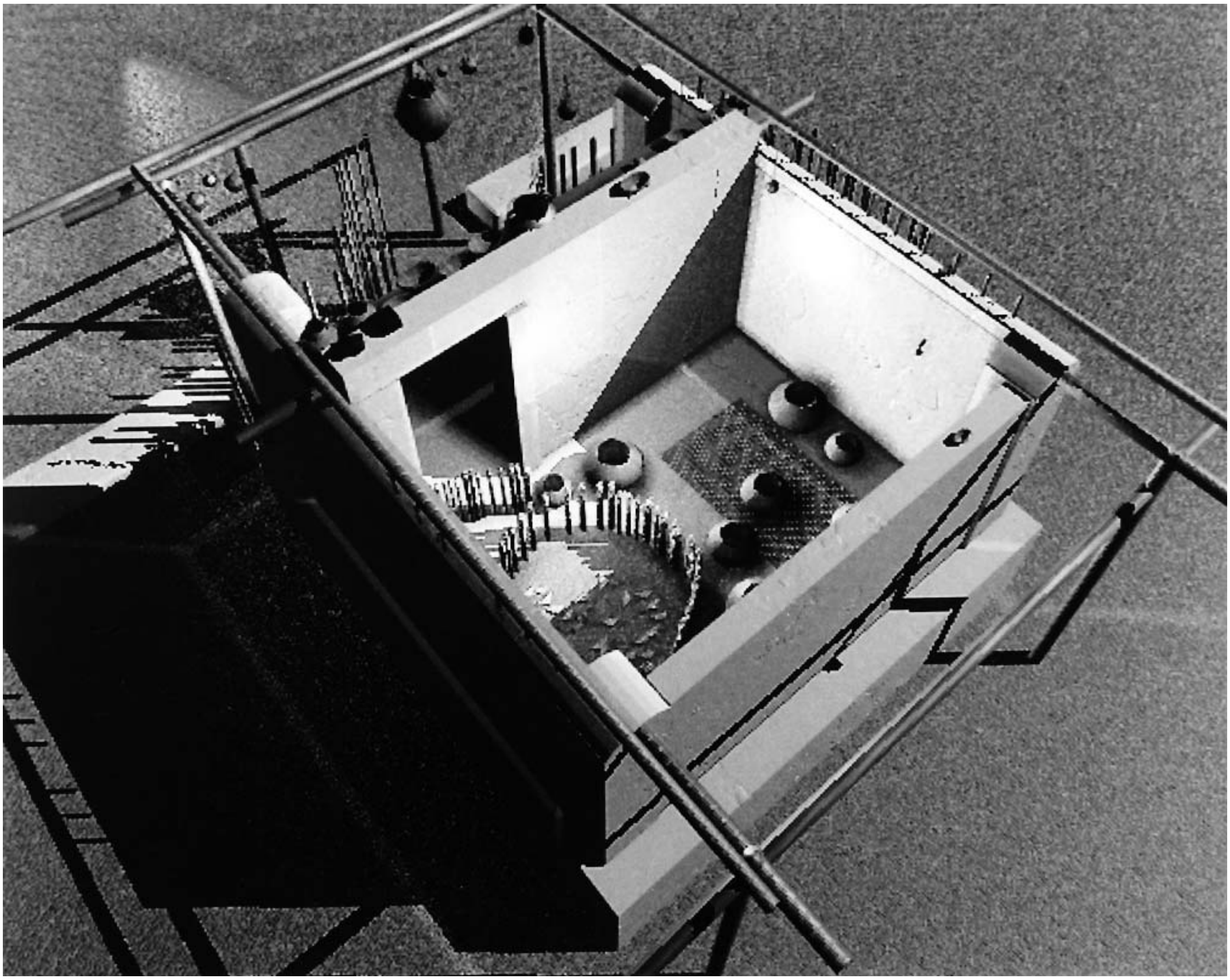


FIGURE 8.3. Computer model of Structure 4, with artifacts. Roof support and thatch have been removed.

known. It contained husked corn on the cob. Layers of leaves laid perpendicular to each other separated the food from the floor, thus serving as a barrier to moisture and dirt. One mouse was found in with the maize. The crib held at least 0.5 m^3 of maize. Another fixed feature was the metate elevated on horquetas (forked sticks) under the roof and just outside the northwest corner of the building. Lentz et al. (1996) found ground cottonseed fragments on its surface, probably ground to obtain oil for cooking. Cotton seeds were also stored in vessels inside the building.

The large roof covered more than 26 m^2, of which one-third was inside the building's walls. Fully two-thirds of the roofed area was outside the walls, providing sheltered activity areas and storage. Two impermanent features were found under that sheltered area on the east side. One is a portable pole fence almost 3 m long that was leaning up against the wall. The other is a portable fence that had been tightly coiled, wrapped in leaves, and tied with two-ply agave fiber twine. Along with them were three pairs of sticks that probably were used for depulping maguey leaves (Simmons 1996), as still is done in traditional Salvadoran villages today.

The architecture of Structure 4 matches that of the domiciles for Households 1 and 2, except it does not have a bench. If it had a bench originally, it was removed completely. Structure 4 served all the functions of the other storehouses, and in addition it was used for storing maize, consuming food, processing agave and cotton seeds, and storing other unique items such as cacao. Other storehouses at Cerén do not have internal partition walls, so we feel Structure 4 probably was converted from a domicile into a storehouse with workshops. The reasons for this modification hopefully will emerge when the domicile, kitchen, and perhaps other buildings associated with it are excavated.

Artifacts

Structure 4 contained the standard set of storehouse artifacts, including Guazapa Scraped Slip ceramic storage vessels, polychrome food-serving vessels (hemispherical and cylinder shapes for solid and liquid, respectively), a metate, a half-dozen obsidian blades in everyday use stored in the thatched roof along with some bone needles, a jade axe, and numerous gourds largely full of wood ash. Because Cerén is in a volcanic area, limestone was not available to be burned into calcium oxide to aid the soaking of maize before grinding, so Cerenians evidently were using the next best material: wood ash in water. Thus the building was serving the usual storehouse functions, but it also had some unusual features and contents, including cotton seeds, cacao, a maize bin, and facilities to depulp agave leafs.

The number of ceramic vessels for the other storehouses at Cerén is between 25 and 30, and Structure 4 is no exception with 27. However, the variety and amount of food stored in them is unusual (Lentz et al. 1996), as one contained cotton seeds, four held cacao, three held maize, two contained squash, three contained beans, and six vessels had chiles (most of which probably were hanging and fell into the vessels when the roof collapsed). One of the cacao-containing vessels had a layer of cotton gauze placed in it with chiles above, perhaps intended to be a Precolumbian mole sauce.

In the paragraphs below, the artifacts of Structure 4 are described and interpreted beginning with the outer north room, followed by the inner south room, and ending with the artifacts outside the walls and under the eaves. On the floor of the north room were three utilitarian storage jars. Between two of them was a lump of red pigment with mica, a "poor person's specular hematite" that could have been used to paint people or organic artifacts. A splotch of hematite paint spilled on the floor on the east side of the room indicates that at least one of the functions of this area was painting. The central and eastern part of the room was kept free of artifacts. Near the pigment lump were a pair of sticks that probably were used in depulping agave leaves.

The high shelf that ran alongside the partition wall was loaded with artifacts. It held ten ceramic vessels, including a ladle incensario (censer) with an animal head decoration that probably was used in Household 4 lineage or animal spirit companion rituals. Two polychrome bowls probably were used to serve corn gruel, and two polychrome tripod plates were likely used to serve tamales. Two scraped slip utility jars were empty, another stored cacao, and another contained chile seeds that likely fell into it as the roof collapsed. Near the jars was a largely complete open-mouthed bowl that also had chile seeds that probably fell into it. A bone needle, an awl or corn husker, and more red pigment were stored on the shelf or in the thatched roofing above it. A few obsidian blades were stored in the thatch in this room. A total of fourteen hemispheres of wood ash were found along the front pole wall; they probably were gourds that were half full of ash from hearth cleaning that were attached to the wall top. The ash probably was stored for use in soaking maize overnight before grinding it into masa. Some lajas were stored on the shelf and wall top and others were used as vessel lids. Also on the shelf were two woven textiles, one of which probably was cotton, and a ball of wax. The wax probably was bee's wax, and if so, they must have also collected the honey to sweeten cacao.

The south room was twice the size of the outer room, and was also loaded with artifacts. The only area kept open was the doorway and a narrow (0.5 m) walkway just inside the partition wall. A large 2 m^2 mat was placed on the floor in the center of the room for what must have been a daytime work or craft area, but its final human activity in the area was the serving and consuming of a meal. After the meal the serving vessels were placed on the floor to the southeast of the mat. Then the area was converted to overnight storage by placing a few vessels on the mat. The eruption intervened between placing the serving vessels on the floor and washing them.

Nine of the twelve pots on the south room floor were Guazapa Scraped Slip storage vessels. Of the nine, three contained food remains: one held cacao seeds, one contained squash remains, and one had cacao seeds covered by cotton gauze cloth with chiles above it. The latter also had a mouse inside that was nibbling the food just before the eruption. The pot with squash also contained an antler maize husker that probably fell into it during the eruption. It presumably was the tool that helped remove the husks from the maize stored on the cob in the large maize bin built onto the floor in the same room.

The other three vessels on the floor were a stack of two upside-down hemispherical polychrome bowls on top of a polychrome cylinder vessel. The latter held a yellow liquid that probably was a mixture of finely ground maize and water (perhaps fermented). One of the bowls was used for serving a gruel and had yet to be washed. That food and drink were consumed in Structure 4 indicates that it was much more than just a storehouse. Although this is speculation, it is possible that the initial use of the building as a domicile, perhaps with ancestors buried beneath it, was connected with a principal household member consuming dinner in its innermost room before retiring for the evening. It apparently was one person, given the single cylinder vessel and one hemispherical vessel with the finger swipes of food; the other hemispherical vessel in the stack probably was used for dry food that left no trace. Given the "instant in time" nature of the Cerén data, we do not know if food was consumed there only on a special occasions or more frequently. The incensario found in the building could be interpreted as further evidence of household rituals and the special importance of the building beyond its immediate function as a storehouse.

A polychrome hemispherical bowl was on the top of the partition wall and sustained a direct hit by a lava bomb that smashed it to small sherds that dispersed all over the south room. The lava bomb, in a ballistic trajectory, then smashed into some of the above-described pots on the floor. Also stored high in the room were a bone needle, red pigment lumps, some lajas, chiles, a large jade axe, a painted gourd, and an unpainted gourd that contained beans.

Important artifacts were also located outside the building's walls but under the roof. A metate was mounted on horquetas at the northwest corner of the building, with the west end higher; thus the user faced east toward the building entrance. It could well have been used for maize grinding, but its last use was to grind cotton seeds, presumably to obtain oil for use in cooking. There were no artifacts placed on the floor north of the platform and under the eaves; the area was apparently kept clean for multi-use activities.

The eastern side of the building was used for storage. Two portable fences also were stored outside of the eastern wall. One was tightly coiled and bundled in leaves that were tied with a two-ply agave fiber twine. The other was extended and was leaning against the wall. It was over 2 m in length. Their use is unknown, but they probably had nothing to do with the agave fiber workshop.

Surprisingly, some valuable items were left outside the building at the northeast corner. A polychrome cylinder vessel was resting on the ground and a finely made large (c. 35 cm diameter) basket containing seeds was resting on lajas. A string bag was hanging above these artifacts and fell when the roof collapsed. It was tightly woven, with only 3 cm gaps between the two-ply agave twines. These items may indicate activities interrupted by the eruption and the hasty departure of Household 4 members.

Workshops

Three pairs of sticks were found in the area outside the east wall but under the roof, toward the north end. The sticks are much like the pair of sticks found in the north room, measuring 20 cm in length and 3–4 cm in diameter. All four pairs probably were used for depulping agave leaves. In each pair, two sticks were tied together at their ends at right angles to a vertical pole. When an agave leaf is put between the sticks and the two sticks are squeezed by one hand while the other hand pulls the leaf through, the leaf is depulped and the fibers liberated. The 1 m radius zone of cracking around the nearby northeast posthole probably indicates where the depulping took place. The extent and degree of cracking of the clay floor are considerable, and because of it and the abundance of agave plants growing south of the structure, we consider this to have been a major fiber workshop.

At least some hematite painting was done inside the north room, based upon the paint spill found on the floor. Also, some hematite pigment lumps were found inside the building. We consider this to have been a minor painting workshop.

Surrounding Cultivated Area

A dense zone of maguey cultivation contained an estimated seventy plants that could have supplied sufficient fiber for a dozen households. The leaves were cut and taken to the northeast corner of Structure 4 for depulping with one of the four pairs of sticks attached to the northeast post supporting the roof. A line of mature chile plants ran to the west of the building, and large numbers of dried chiles were stored in hanging bunches inside. A young cacao tree was growing south of the building, and vessels inside the building stored mature cacao seeds. A guayaba tree was loaded with immature fruit southeast of the building. The two kinds of plants that were used for vertical and horizontal reinforcements in bajareque architecture were growing northwest of the building.

Summary and Conclusions

The architecture of Structure 4 is that of a domicile building, and we feel it likely that it was built and probably used for some time as the principal building of a household. For reasons that must remain speculative until the other buildings of the household are excavated, it was converted into a storehouse and the earthen bench that presumably was in the inner room was removed. There may have been some residual functions from its prior role as the principal structure, as a dinner had been consumed in the innermost room but the dishes had not been washed, a strikingly similar scene to that in the Household 2 domicile less than 50 m away. Perhaps important ancestors were buried beneath the building. That two doors were kept functioning indicates more than storehouse activities were taking place. The incensario may indicate that ancestors were invoked in household rituals in the building.

The extensive cultivation and processing of agave around the building is a major agrarian household specialization, the output of which must have been exchanged for many of the exotic materials found in the household, including hematite, a jade axe, and obsidian. In addition to the storehouse function, Structure 4 had a major fiber workshop. It also had a minor workshop of hematite painting in the north room, evidenced by a paint spill on the floor and pigment lumps in elevated storage.

Virtually all artifacts in and around Structure 4 were in storage locations. The only exceptions are the metate mounted on horquetas that was used for grinding cotton seeds, the food and drink vessels near the mat in the inner room, and the cylinder vase and basket outside the northeast corner.

PART THREE

Special Buildings

In addition to the household buildings, we found a few special buildings that we did not expect to find. They have taught us that there was a far greater richness, complexity, and sophistication to village life than we had imagined and that commoners were not under the total economic, political, and religious control of the nearby elite. Rather, significant manufacturing and exchange went on within the village with no evidence of elite manipulation. And for certain specific purposes, the religious life of the village went on in a small complex of specially built structures. Further, civic and political functions were the focus of at least one building facing the town plaza.

This section begins with a close look at that civic complex by Andrea Gerstle. Cerenians used solid earthen walls for their civic buildings and faced them onto a formal plaza. Structure 3, the largest building excavated so far in the village, was apparently used for the adjudication of disputes, with local authorities (probably village elders) seated on the large benches in the front room listening to both sides before they announced their decision and sealed the deal with liquid dispensed from a large vessel sitting on the southern bench. The construction and maintenance of the civic center presumably was the responsibility of all families living in the village.

A very different building is explored by Brian McKee. Like Structure 3, it was built with solid earthen walls, but the resemblances stop there. It had an earthen shell dome, a large firebox in the center, and an extensive thatched roof to protect the earthen architecture from the elements. It was a large sweat bath that could seat almost a dozen people, and thus was a multihousehold or community facility, apparently maintained by the nearby Household 2. Service relationships within communities are notoriously difficult to document in archaeological sites, but we believe we are making some progress in this domain.

Attention then turns to the two religious buildings, which were constructed at the highest elevation in the village at its easternmost extent and which share an orientation different from the above-mentioned domestic and special buildings. They also are different from the other buildings in that they were extensively painted white with red decorations and each successive floor is at a higher elevation as one progresses inside, presumably indicating leaving the secular world for the sacred. Numerous lines of evidence indicate that they both were maintained by the residents of Household 1, just to the west.

One of these religious structures, a building with massive columns and a large antechamber that we prosaically call Structure 10, was dedicated to feasting and village festivals, as delineated by Linda Brown and Andrea Gerstle. The ceremonialism apparently was focused on deer, probably as symbols of fertility and sustenance, and it appears that ancient Cerén was celebrating the maize harvest in a similar manner. The eruption occurred at the time of the first maize harvest when a festival was taking place. Traditional Maya communities today have ceremonies at the time of the first maize harvest that focus on deer, fertility, and sustenance; perhaps ancient Cerén was celebrating the maize harvest in a similar manner. The eruption apparently interrupted the festival, as only part of the food was consumed.

The other ritual building, just 5 m farther east, is today called Structure 12. As interpreted by Scott Simmons and Payson Sheets, it was used for divination, evidently by a woman. It is the most complex building excavated at the site so far and had no functioning assemblage of artifacts inside it, at least not functioning in utilitarian ways like those found in the other domestic, civic, and religious buildings of the site. If the objects found in a niche under a bench were the diviner's supernatural tool kit, then these artifacts were an assemblage that functioned in the supernatural domain.

P.S.

The Civic Complex

Andrea I. Gerstle

The civic complex at Cerén, only partially investigated to date, has three known major elements: Structure 3, Structure 13, and a plaza area (Fig. 1.1). Two geophysical anomalies on the eastern side of the plaza may turn out to be civic structures, but they might be household buildings. Structures 3 and 13 are located on the west and south sides, respectively, of the known plaza area. The focus here is on Structure 3, which is completely excavated and is the best-known feature of the complex. Structure 13 and the plaza area have been minimally explored, and we are ignorant of other areas and features of the complex. Following a brief description of the known elements, some discussion of the complex and its use is presented. Beaudry-Corbett (Beaudry 1989; Beaudry-Corbett 1990, 1992, 1993) provided the ceramic identifications and discussions of their significance. Similarly, Sheets (1989a,b, 1990a,b, 1992b, 1993a) focused on the chipped and groundstone artifacts.

Structure 3

Structure 3 (Fig. 9.1) is the largest known building in Cerén (Gerstle 1989). It consists of a solid clay platform (approximately 8 × 5 m, up to 1.35 m high), supporting a two-room, solid-walled superstructure with a large thatched roof.

The ground surface on which Structure 3 was erected was raised with a layer of red clay up to 40 cm thick. Probably the clay was laid as a partial foundation for the platform to compensate for the rather steep natural slope of the ground in that area, which is adjacent to a drainage channel (Conyers 1993). The top of the west (back) side of the platform is 2.7 to 2.9 m above the top of the layer of red clay. The building itself is oriented with its long axis about 30° east of north (Fig. 9.2).

Conyers (1995a,b) conducted ground-penetrating radar research with high frequency antennas on the floor of Structure 3 and detected the construction sequence. It began by digging a shallow (10–20 cm) hole almost a meter in diameter in the ground surface right in what would be the center of the building, and constructing a feature that alternated high and low radar reflective materials into a mound shape. That must have been a dedicatory feature. Then basketloads of fill were brought in and tamped down. The fill was of mixed materials; probably the less radar reflective was the Ilopango volcanic ash and the more reflective was the pre-Ilopango clay-laden soil.

Solid clay walls about 2 m high on the platform form two long narrow rooms. These walls, constructed with puddled or rammed adobe, are decorated with projecting squared cornices along their top edges. The cornices on the exterior walls project to the outside; the interior room-divider wall has a cornice projecting into the front room. The exterior walls are considerably thicker (45–55 cm) than the room divider wall (38 cm). The exterior walls also are set about 15 cm in from the platform edge to create a continuous narrow ledge around the building. All wall and platform surfaces were coated with a finishing layer of smoothed clay up to a centimeter thick.

Access to the front room is through a doorway approximately 1.2 m wide centered in the long east

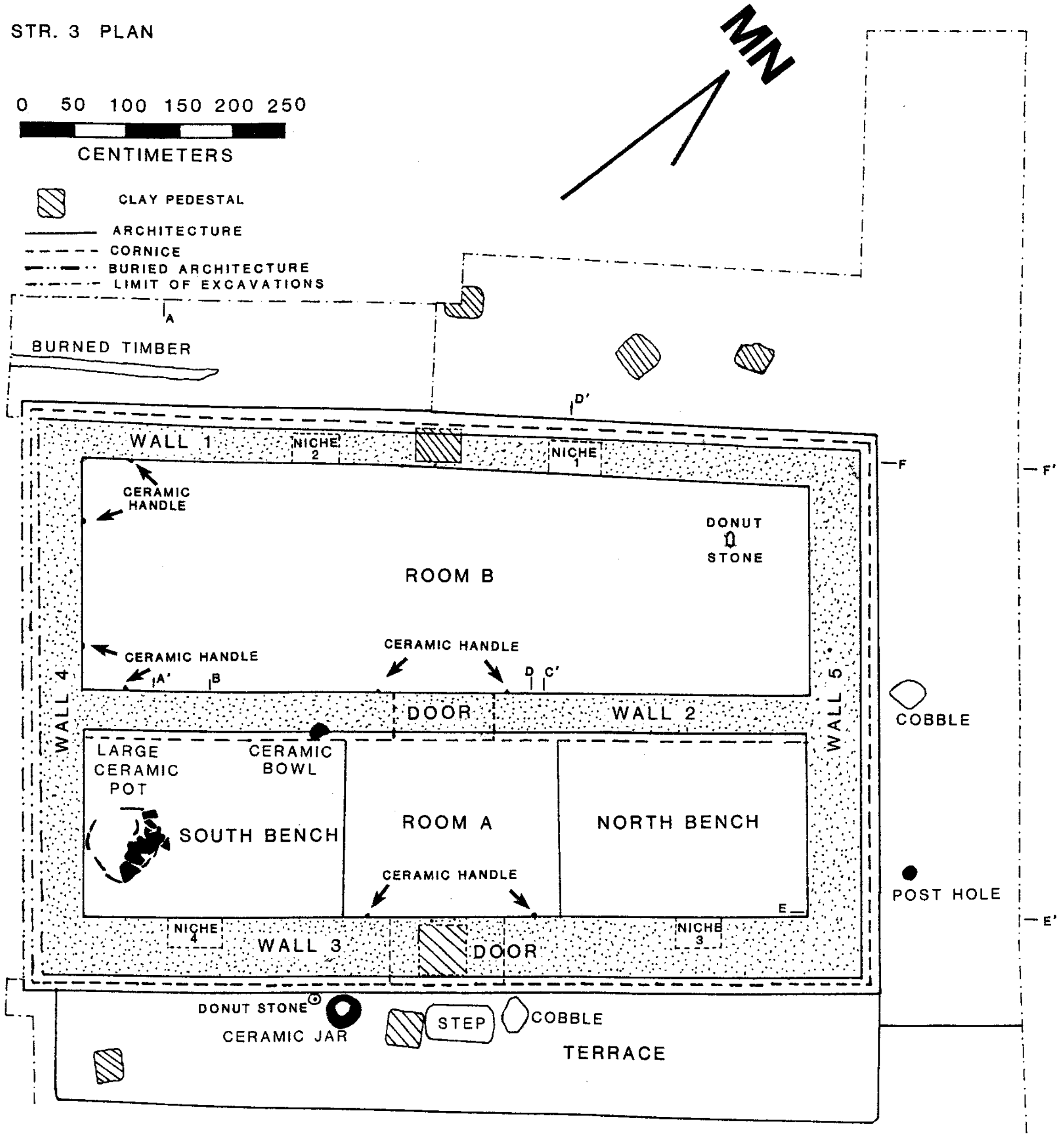


FIGURE 9.1. Plan of Structure 3, with artifacts. The plaza is to the south and east.

wall of the building. The back room is accessible only from the front room, through a doorway centered in the wall separating the two rooms. Both rooms are long and narrow. The front room area is about 12.2 m^2 and the back room is about 14.3 m^2 in area.

Architectural features in the rooms include niches, benches, and embedded ceramic handles. Both the front and the back rooms have two symmetrically placed niches built into the thick exterior walls and opening into the rooms. The niches are about halfway up the walls. They are approximately 40–50 cm wide, 30 cm high, and 30 cm deep, with a roughly rectangular shape. In the front room, the niches are in the long front wall; in the back room, the niches are in the long back wall.

Two large solid-clay benches occupy both ends of the front room (Fig. 9.3). These are each about 4.2 m^2 in area and are 62 cm high. Combined, they occupy almost 70% of the front room's floor area. There are no benches in the back room.

Ceramic loop handles salvaged from broken jars were embedded in the walls in both rooms. These are consistently vertical in orientation. As with so many buildings at Cerén, four handles were placed around the doorways just inside each of the rooms, two larger ones near the top of the door and two smaller ones near the bottom. These were probably used to attach perishable doors. Additional handles were embedded in the walls of the back room near the corners; these were placed high in the walls, 1.5–1.6 m above the room floor. Their function is unknown.

A long and narrow porch (1.0–1.2 m wide and about 20 cm high) was built along the long front side of the platform, ending about 20 cm short of the platform corners. A step made of a single, solid, sun-dried adobe brick was placed on the terrace directly in front of the entrance doorway. (Although adobe bricks were commonly used at the same time in construction at San Andrés, they were only found loose at Structures 3 and 2 at Cerén, never in construction.) The front edge of the terrace is noticeably worn by foot traffic in front of the doorway, as well as near the corners of the platform. Because the ends of the terrace do not meet the corners of the platform, and because of differences in construction quality, it appears that the terrace was a later addition to the building.

The grass-thatched roof of Structure 3 was elevated on a framework of beams and lintels attached to wooden posts occasionally resting on the solid clay walls and on long posts outside the walls up to 1.9 m away from the platform. Although some of these posts were buried directly in the ground, many were placed on square solid-clay pedestals or on large stones. Horizontal beams were placed directly on wall tops or, for beams spanning the rooms, on low solid-clay square pedestals located on the walls. Drip lines in the clay paving around the building indicate that the roof probably extended about 1.5 m beyond the ends and about 1.0 m beyond the back side of the building. On the front, it extended at least 2 m to cover the low terrace or porch. Thus, the large roof covered about 26.5 m^2 of interior space, and about 48 m^2 of area outside

FIGURE 9.2. Photograph of Structure 3, from the south. Note unreinforced solid earthen walls. Larry Conyers (right) and Payson Sheets were conducting a subsurface scan with high frequency ground-penetrating radar antennas on the porch. Volcanic ash was left in front door to support the clay lintel. *Photograph by Payson Sheets.*

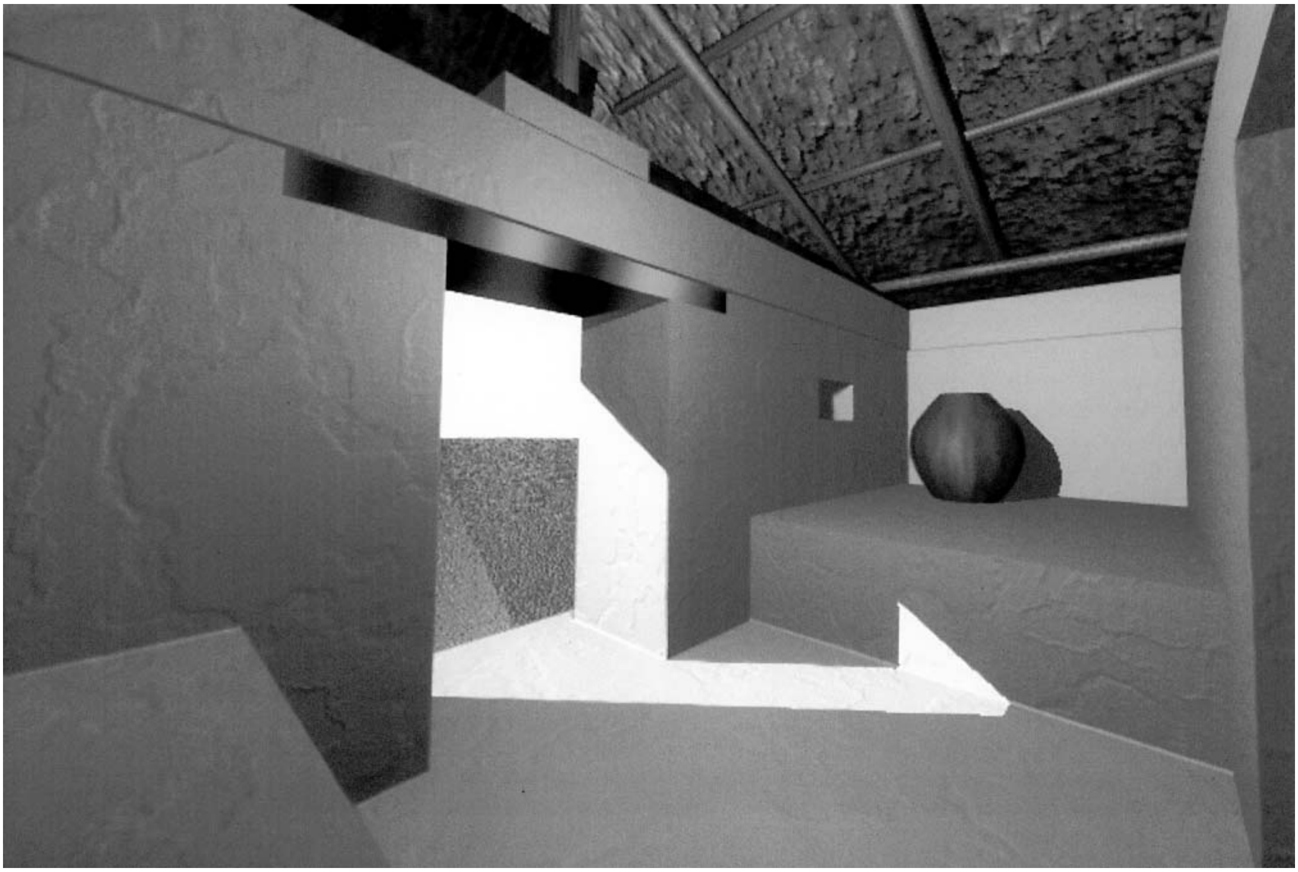


FIGURE 9.3. Front room of Structure 3, with large earthen benches at each end of the room. Note wall niche and large ceramic vessel on southern bench. Computer reconstruction.

the walls. Such a large extramural covered space may have provided protection from sun or rain. Very likely, the roof was enlarged after its original construction to extend over the terrace addition.

The artifact inventory of Structure 3 was strikingly small. Five artifacts were found inside the two rooms and four were found on the terrace. A few items were discarded around the ends and behind the building.

The assemblage in the front room consisted of a massive 60 cm high Guazapa: Miltitlan jar sitting on a bench against the end wall of the room, an unusual melon-stripe Copador bowl on top of the adjacent room-divider wall, and a bone tapiscador (corn-husking tool) in the niche at the opposite end of the room.

The back room contained a donut stone that probably had been mounted on a stick and placed in one corner of the room, as well as a large cobble with pecked rounded corners that had fallen from a nearby wall top. The north end wall in the back room also displayed graffiti consisting of shallow scratches in the wet finishing clay (Fig. 7, Gerstle 1989). The graffiti were made by incising lines and dots in linear arrangements, but no organization or representation is obvious; some people see a stylized angular human form with head, torso, and arms, or head and upper torso with lines of sight indicated.

The artifacts on the terrace included a heavily used Guazapa: Miltitlan jar and a donut stone placed against the platform near the step into the front room. Another jar of the rare Obraje Red-Painted type had been suspended near the outer edge of the roof and had fallen onto the corner of the terrace. A large sherd, possibly being recycled into a new use as a dish, fell into the front room doorway from some high storage location, possibly above the lintel.

Discarded items were found on the clay-paved ground surface around the structure; most were embedded in the ground surface and had probably been trampled. A few small sherds were located in front of the terrace on the plaza surface, but the majority of the discarded items were around the ends and behind the structure. These included a handful of small sherds but also a mano fragment.

Behind the platform, the clay paving is up to 2.7 m wide, with an uneven feathering boundary. Small plants and large and small trees were growing beyond the paving, up to about 6.0 m from the building, but the ground surface is even, compact, and covered with a fine layer of sand. The density of small discarded and trampled sherds is somewhat greater than near the building. A short distance farther west is the maguey garden associated with the Structure 4 residential compound. Clearly, the areas beside and behind Structure 3 were part of the used and maintained area associated with the structure.

Structure 13

Structure 13 has been minimally investigated. It is known only from three test units located around its perimeter (Gerstle 1992a, 1992c; David Tucker, personal communication 1995).

Structure 13 is located south and east of Structure 3 and marks the south side of the plaza. It is oriented perpendicular to Structure 3, with its entrance on the north side facing the plaza. The building has a footprint that is almost square (5.6 m north-south by 5.4 m east-west) and covers 30.6 m^2. No evidence of an interior dividing wall was noted, so it may be a one-room building.

Structure 13 is very similar to Structure 3 in construction and style. The platform is about 1.15 m high. The south and west (and presumably the other) walls are inset about 15 cm from the platform edge, are made of puddled or rammed adobe and are probably very thick, and have cornices along their upper edges. The front north wall is shorter (67 cm high) and does not have a cornice. A doorway is centered in this wall. Loop jar handles are embedded inside the room near the upper and lower corners of the doorway. An adobe step is located in front of the doorway on the clay-paved ground surface. The building was grass-thatch roofed, but the eave extensions are not known.

The partially excavated artifact assemblage from Structure 13 is large and diverse. No artifacts were found associated with the building entrance. In a small area exposed outside the back southwest corner of Structure 13, numerous artifacts were found to have fallen from the building, probably from adjacent wall tops. These include three complete ceramic vessels (including an unusual Guazapa: Martir Incised-Punctate jar [Beaudry-Corbett 1993] and a restricted-mouth bowl), five partial vessels (some of which were extremely large sherds that had been stacked or nested together with small beanlike seeds), a complete turtle carapace, a worked stone ball, red pigment, and a worn obsidian blade. These artifacts probably were in storage on the tops of the structure walls and/or in the roof. A few small sherds and an obsidian blade fragment had been trampled into the clay-paved ground surface adjacent to the back corner of the building. That both Structures 3 and 13 had rounded stone balls suggests they might have been used in public events or games in the plaza, but it is difficult to envision how.

The Plaza

The plaza area was exposed in a few locations near Structures 3 and 13, including a strip up to 1.5 m wide directly in front of Structure 3 (Gerstle 1989), a 2.0 × 6.0 m unit about 2.5 m east of Structure 3 (Gerstle 1992a, 1992c), and in three 2.0 × 2.0 m test pits located about 4.0 m east of Structure 3 (Gerstle 1992a, 1992c). The test pits also extended below the plaza surface, yielding some information on its construction.

The plaza area in front of Structures 3 and 13 is a carefully prepared, virtually level surface encompassing over 480 m^2. Very likely, topographical modification was required, involving cutting on the north side and filling on the south side. The plaza surface was covered with a thin layer of hard-packed red sand. The only artifacts recovered from the plaza were a few small sherds and obsidian fragments embedded in the surface. Clearly, the plaza surface was kept immaculate. Toward the northwest part of the plaza, the density of small trampled fragments increased, and beyond its north edge, footprints indicating north-south travel were preserved in some muddy ground. As the length of people's feet is approximately 15% of their height, estimates of mature males and females were possible, and they ranged from 5 ft to 5 ft 6 in. The north boundary of the plaza may be informal and not defined by a structure, although one witness to the bulldozing stated he saw a building there that was destroyed in 1976.

Discussion

In contrast to the excavated residential compounds to the east, south, and west, the Structure 3–13 compound had no discernible residential functions. The compound is unique at Cerén both in terms of the size and layout of the buildings, the use of puddled or rammed earth as the predominant construction technique, and the size of the plaza area. The complex apparently served civic functions in the community. On all counts, there was a large amount of labor and space invested in the complex.

Although the two buildings have wildly contrasting artifact assemblages, in neither case do they appear to be domestic assemblages. The small assemblage in the Structure 3 main east room indicates that a primary activity was consumption of large amounts of a liquid, probably a corn-based drink such as chicha. The drinkers, possibly village elders and prominent guests, probably sat on the benches while conferring and imbibing. Benches in a front room may have been considered symbols of authority, and village elders could have sat on them while hearing both sides of a dispute, and then used the liquid and likely invoked supernatural sanctions to seal the agreement. The function of the back room is less obvious; perhaps it was used for occasional storage; for gatherings of people for special meetings, consultations, or planning; or for convocations of village elders. The ample porch could have had multiple functions at different times of the day and in different seasons, offering shade and protection from the rain.

Structure 13, still only partially excavated, apparently contains a large and varied artifact assemblage with many unique items such as the turtle carapace and unusual ceramic vessels. This building may have been used for the storage of special community artifacts and preparation for activities that took place in the structures and the plaza. The front side of the building was apparently kept clean and uncluttered.

The large, well-maintained plaza area in front of the two buildings likely was the scene of large-scale public gatherings. The exact nature of those events is unknown, but probably they revolved around village-level social and political affairs that could well have had religious components. They may have included presentations of various kinds, perhaps involving performances as well as public participation.

Structure 9: A Precolumbian Sweat Bath at Cerén

Brian R. McKee

Introduction

Sweat baths are important in health, hygiene, and ritual in traditional Mesoamerica, and historical evidence documents their use since the Conquest. Archaeological, iconographic, and epigraphic data document sweat bath use during the Classic Period, but there are few securely identified archaeological examples. Most known sweat baths are in the central areas of large sites, presumably linked to elite ritual. Structure 9 at Cerén was probably a sweat bath with nearby stone features that likely were related to its use (McKee 1990a, 1993). It is in a rural setting and was not associated with the elite or with sitewide ritual.

Structure 9 (Fig. 10.1) is south and east of previously reported archaeological and ethnographic examples of sweat baths. In this chapter, I describe the structure's excavation and details of its construction and surroundings. I then compare it with archaeological and ethnographic examples of sweat baths to confirm its identification, and examine the modern and historical use of sweat baths to place Structure 9 in cultural context.

Methods

Structure 9 was excavated during the 1990–1991 and 1993 field seasons, utilizing Miller's (1989, 1990) stratigraphy to identify tephra layers. We used shovels and hoes in the upper strata and hand tools closer to cultural remains. In 1990–1991 we carefully excavated by trowel but did not use screens. In 1993 we screened all sediments below the prehistoric roofing, or below Unit 2 in areas without roofing, with one-eighth-inch mesh screens. Conservation concerns precluded excavations that penetrated the structure or the pre-eruption ground surface. Data recorded included three-dimensional maps and stratigraphic positions, associations, and photographs. We addressed conservation issues early, installing supports for some architectural elements before their excavation.

Due to the fragility of the structure and difficulty in supporting the clay roof, we only excavated limited areas inside Structure 9 (Fig. 10.2). The first interior excavation (Probe 1) was where a large volcanic bomb destroyed the southeastern corner of the roof. We excavated narrow trenches from this probe to the southern and eastern walls to determine their thickness (Fig. 10.2). We also excavated the entrance and an exploratory pit through the roof where another volcanic bomb had penetrated the clay dome (Probe 2). The author excavated two upright stone features associated with Structure 9 in 1990, and David Tucker excavated two others in 1994 (see below).

Architecture

Structure 9 is different in many respects from the other structures at Cerén, but there are some similarities, including the predominant orientation of 30° east of magnetic north (see Fig. 6.1), and solid clay walls similar to those of Structures 3 (Chapter 9) and 13. It differs from other structures in its roofing, the exterior bench, and the fire chamber.

FIGURE 10.1. Photograph of Structure 9 from the northeast. Wooden posts were placed as supports following excavation. *Photograph by Brian R. McKee.*

SUBSTRUCTURE

The lowest construction of Structure 9 is a thin clay layer under and west of the structure. A 42–58 cm thick unreinforced solid clay platform sits on this layer. In the southern part of Structure 9, the platform sides are flush with the cornice at the wall tops, but elsewhere the platform extends out beyond the walls, forming a long, broad bench (Fig. 10.2); the same surface serves as the floor inside the structure and as a bench outside.

SUPERSTRUCTURE

The superstructure of Structure 9 includes the walls, four short adobe columns, and the roof. The walls are of solid clay, and a 27 cm tall cornice extends 7 cm past the wall tops on all sides. The wall height from the platform to the cornice top averages 1.05 m. The structure is nearly square, with 3.65–3.83 m long walls that are 35–38 cm thick where the interior surface is visible. All walls are solid except for the entrance on the north side.

The entrance (Fig. 10.3) is 80 cm high and 40–50 cm wide, and is only navigable on hands and knees. Two heavy, shaped wooden beams served as a lintel; the beams have decomposed, but their forms are preserved as clay voids above the doorway, which has no cornice. The entrance interrupts the circumferential bench, and the gap in the bench continues into the structure to the firebox. The base of the entrance passage is approximately even with the ground surface outside the platform, roughly 50 cm below the top of the platform.

A large bench, which is an extension of the platform, surrounds the northern portion of Structure 9. The 77–97 cm wide bench extends from 1 m north of the southwestern corner around the western, northern, and eastern sides, to 90 cm south of the northeastern corner, except where broken

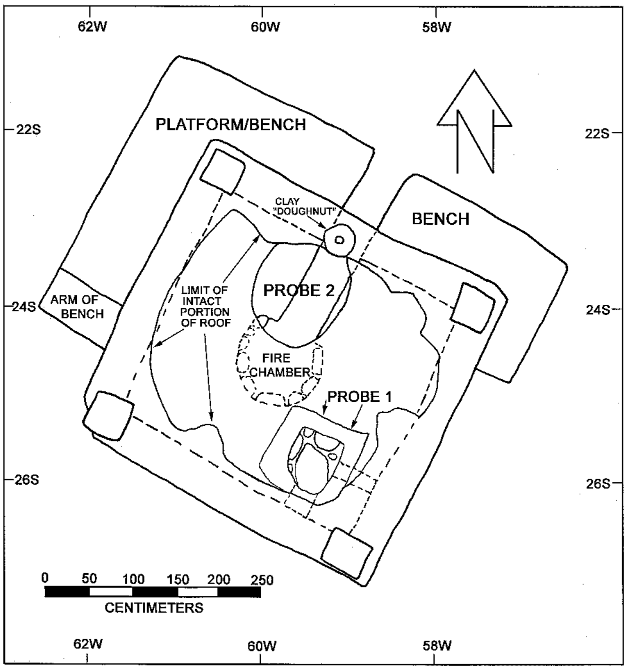


FIGURE 10.2. Plan of Structure 9 showing the locations of exterior features, the clay donut, and Probes 1 and 2. The dashed lines indicate approximated or inferred locations of interior features.

by the entrance (Figs. 10.2, 10.3). The southwestern extremity of the bench forms a roughly triangular 42 cm high "arm," similar to that found on a sofa (Fig. 10.2).

There are four square, 40–46 cm wide, solid clay columns at the corners of the structure (Figs. 10.1, 10.2). They are inset from the edges of the cornices by 8–12 cm, and vary from 26 to 34 cm high.

There is a 35 cm diameter and 6–8 cm thick doughnut-shaped clay feature centered on the dome over the entrance (Figs. 10.2, 10.3). The 10 cm (diameter) "doughnut hole" is filled with a clay lump. It may have functioned as a vent (Payson Sheets, personal communication 1991), or it may have been decorative; without further interior excavations, its function remains uncertain.

The roof was a bajareque (wattle-and-daub) dome covered by grass thatch. It consisted of poles encased in 10–15 cm of clay to form a rounded dome. Four 1.5–2 cm (diameter) holes exposed in Probe 2 indicate pole locations. The dome broke and partially collapsed during the eruption, but adding the heights of the collapsed segments indicates that the peak was at least 73 cm above the cornice top (Fig. 10.4). The 5 cm thick thatched roof was the thinnest encountered at Cerén. The thatch on

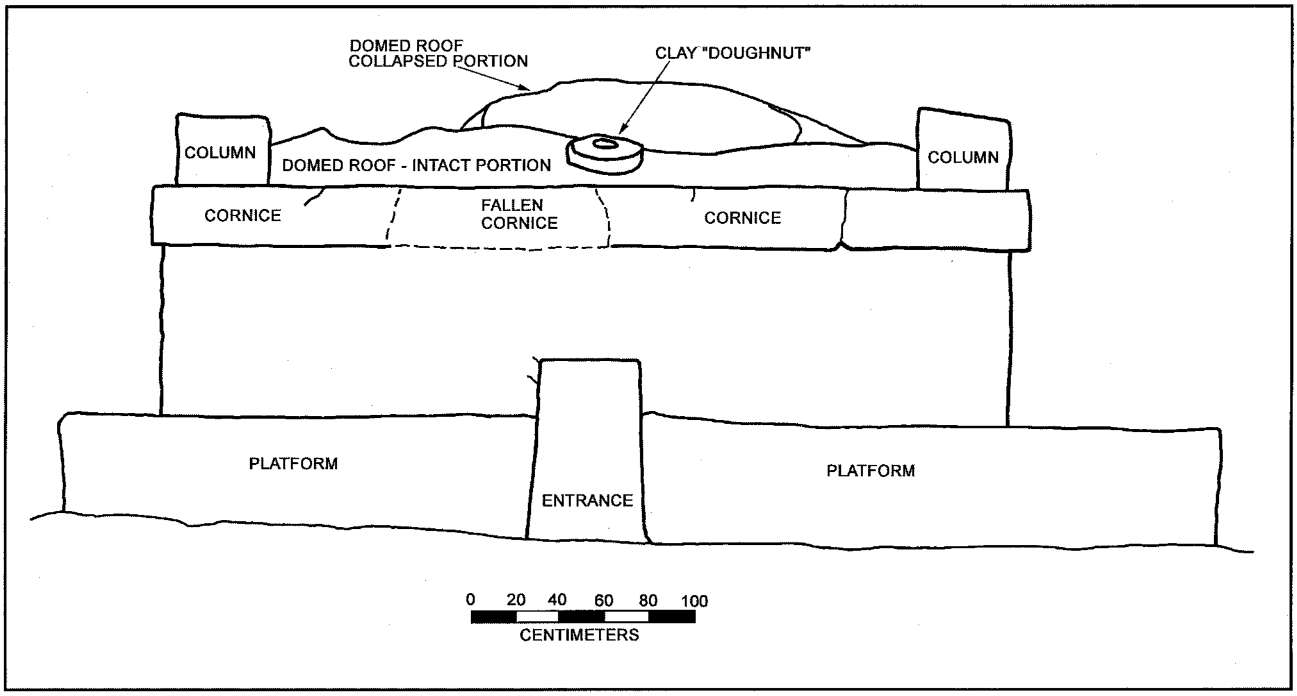


FIGURE 10.3. Elevation of the north wall of Structure 9. Note entrance at center of structure.

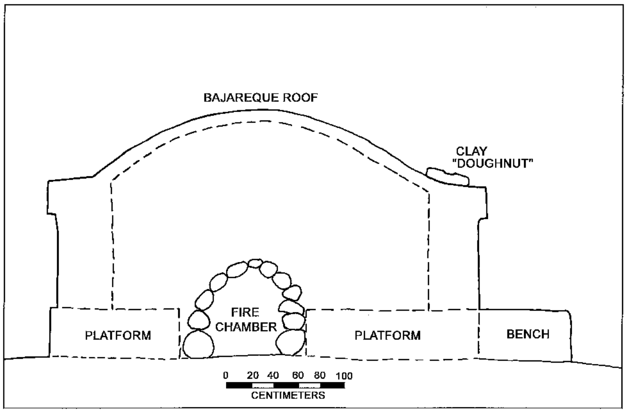


FIGURE 10.4. Reconstructed north-south profile of Structure 9. Dashed lines indicate locations that are approximated or inferred. The location of individual stones of the firebox are also approximated.

the eastern side of Structure 9 fell before that on the western side, but the 6 cm stratigraphic separation represents just a few minutes of the eruption. The drip line was 1–1.5 m beyond the walls.

Beams measuring 8–18 cm in diameter that run the length of each side provide evidence of the support system for the thatched roof. In some areas, the beams were carbonized, while in others only voids were preserved. These beams rested on the column tops at the corners and supported the thatched roof. We encountered an unusual feature just above the roofing thatch south of Structure 9. A substantial deposit of volcanic ash from the earlier Ilopango eruption (tierra blanca joven; TBJ), mixed with seeds, leaves, and clay, was in contact with the roofing thatch in some areas but separated from the thatch by about 1–2 cm of base surge deposits in others. The nature of the emplacement and the function of this feature remain unknown.

THE INTERIOR OF STRUCTURE 9

The interior of Structure 9 (Figs. 10.2, 10.4) is only known from limited excavations in the southeast corner (Probe 1) and the north-central portion (Probe 2). We encountered numerous clay fragments, probably from the roof, in Probe 1. The floor consists of lajas (exfoliated andesite slabs) resting on the platform, which were covered by 1–2 cm of TBJ volcanic ash intentionally placed in this position. The floor is about 10 cm above the level of the exterior platform and 1.25 m below the edge of the domed roof. The fire chamber is visible in the northwestern portion of Probe 1. Excavations in the north-central portion of the structure proceeded from two directions: from the north, through the entrance, and from above, through a hole caused by a volcanic bomb.

Fire Chamber The fire chamber at the center of the structure begins where the benches end, 1.46 m south of the entrance (Figs. 10.2, 10.4). The chamber is hemispherical and 80 cm in diameter, with a base 15–20 cm below the entrance level. It is 75–80 cm high, and is constructed of unshaped vesicular basalt river cobbles set in clay. The lower cobbles average 30 cm in diameter, while the higher rocks range from 10 to 25 cm. The rocks are not coursed, and some exhibit thermal fracturing. Carbon covers much of the interior of the fire chamber, and the interstitial clay is oxidized. There is no chimney. The laja floor is covered with wood ash and charcoal fragments.

Although most of the interior remains unexcavated, we can make some preliminary interpretations. The floor is slightly higher than the bench outside, due to the laja and TBJ floor on the platform. It is probably at this level throughout the interior except in the entrance passage and the fire chamber, where it is 50–60 cm lower. At the edges of the structure, 1.1–1.3 m separate the bottom of the dome from the floor. At the center, the distance is about 1.6–1.9 m. Entry was through the same cramped passage used to feed the fire, which is impassable for large or inflexible people.

The outside dimensions of the structure are nearly 4 × 4 m, but the usable interior space was limited. About 8 m^2 is present between the walls, of which the firebox occupies 2.0–2.5 m^2. The remaining 5.5–6.0 m^2 had a roof height of 1.0–1.8 m (Fig. 10.4). The thatched roof extended 1.0–1.5 m beyond the wall, and the total area under the thatch was between 34 and 49 m^2. The roofed area outside the walls measured between 20 and 35 m^2. These calculations confirm a general trend at Cerén: the roofed areas outside structure walls are greater than those within.

At least four laja features are present west of Structure 9 (Figs. 6.1, 10.5). They consist of a slightly rounded stone lying on the ground surface and a large flat slab set into the ground behind it at an angle of 50–60°. The stones on the ground vary from 35 × 20 cm to 45 × 35 cm in size, and those standing were up to 80 cm wide by 60 cm high. Two of the features face northeast, while two others face roughly east.

Artifacts

No artifacts were found on or in Structure 9, but items in the midden west of Structure 9 (see Chapter 6) may be related to structure use, particularly the wood ash deposits, which could have resulted from firebox cleaning. Several large mammal long bone fragments were found southwest of the stone seats, as was part of a rodent incisor. Linda Brown (personal communication 1997) noted that rodent incisors are still used in bloodletting ceremonies in traditional communities in highland Guatemala. The tooth near the stone seats could be there as the result of natural death, or from human discard related to other practices, but it may have been used for bloodletting.

The Function of Structure 9

Although Structure 9 was probably used as a sweat bath, alternative interpretations should be examined. It was clearly used for heating, based on the fire chamber and the domed clay roof. Possible alternative functions include an oven, a kiln, and a drying structure or smokehouse.

Structure 9 was probably not a kiln. It is larger than most kilns documented ethnographically and archaeologically, and ventilation is inadequate for its size (Healan 1989). The interior was not baked to the expected consistency (Healan 1989), and no wasters are present. It could be an oven used to cook food, but it is extremely large for an oven, and would have demanded large quantities of fuel. Traditional Mesoamerican foods were not prepared in ovens. Structure 9 would also not have worked well for drying. Most smoke or drying houses have high ceilings and permeable walls and ceilings for moisture to escape. The clay walls and roof of Structure 9 preclude this use.

The most probable interpretation is a sweat bath. Ethnographers have recorded sweat baths in highland Mexico and Guatemala, and archaeologists have used these ethnographic analogues to interpret the remains of structures at Mesoamerican

FIGURE 10.5. Photograph of the laja features west of Structure 9. *Photograph by Payson Sheets.*

sites. Archaeologists have identified examples of sweat baths with varying degrees of confidence at Zacualpa (Wauchope 1938), Tikal (W. Coe 1967), Chichén Itzá (Ruppert 1951), Piedras Negras (Cresson 1938, Satterthwaite 1952), El Paraíso (Kidder and Shook 1959), and Los Cimientos-Chustum (Ichon 1977). Further possible examples have been found at Dzibilchaltún (Andrews and Andrews 1980), Agua Tibia (Alcina et al. 1982), Uaxactún (A. Smith 1950), Palenque (Ruz 1952; Robertson 1985), and Abaj Takalik (Aldana, personal communication to Beaudry-Corbett 1992). Houston (1996) argues that sanctuaries in the Cross Group at Palenque may be the symbolic natal sweat baths of gods of Palenque.

Satterthwaite's (1952) Piedras Negras monograph is a thorough study of archaeological and ethnographic sweat baths. By comparing performance characteristics of ethnographically observed sweat baths, Satterthwaite (1952) established criteria to identify archaeological sweat baths and identified eight at Piedras Negras. These criteria fit into four broad categories: those associated with drainage, those associated with heat and steam production, those associated with heat and steam retention, and miscellaneous traits loosely associated with those listed above. All modern structures examined by Satterthwaite had features clearly associated with heat and steam production and retention, and most also had drainage features. Three Piedras Negras sweat baths had evidence for heat production and retention as well as drainage, while the others showed evidence for heat production and retention.

Several features of Structure 9 fit Satterthwaite's criteria. The entrance is low and sunk below the level of the structure interior. The entrance passage allows the passage of both people and water. We recorded elevations near the entrance to the nearest millimeter, indicating a gentle slope downward from the interior to the outside. The clearest evidence for drainage is that the bench north of the entrance was undercut by a 5–8 cm wide erosional channel, probably caused by water flowing out of the structure. After exiting the structure, the water flowed to the west.

The fire chamber provides evidence for heat production. The clay mortar is highly oxidized, and there is wood ash on the floor. The sunken chamber would help keep the structure clean and keep ashes off bathers (Satterthwaite 1952). The doughnut-shaped feature in the clay dome may also relate to heat production (Figs. 10.2, 10.3). If it is a ventilator, it would have allowed the passage of clean air or smoke. We did not find a steam screen. These consist of stones or sherds in contact with the fire chamber. Water is splashed on the screen to produce steam (Cresson 1938). The cobbles forming the fire chamber may have served as a steam screen, as indicated by some cracking (Sheets, personal communication 1997), but this could also have been caused by repeated heating and cooling.

Several features are relevant to heat retention in Structure 9. The first is its size. Satterthwaite (1952: 14) noted that all modern sweat baths he examined were small and low. The Piedras Negras structures are larger than the modern examples, and Structure 9 falls somewhere in between. The modern examples had 2.9–4.9 m^2 of interior space, while the Piedras Negras examples varied from 7.3 to 15.6 m^2. Structure 9 had about 8 m^2 of interior space, of which 5.5 to 6 m^2 were usable. The Cerén structure was 1.0–1.8 m high inside, similar to the ethnographic examples reported by Satterthwaite (1952: 15). The only Piedras Negras sweat bath whose height could be measured had a corbeled ceiling about 2.7 m high. The thick clay walls of Structure 9 would also have aided in heat retention, as would the clay-domed roof and the small entrance. The doorway is extremely low and narrow, as are the doorways in Satterthwaite's ethnographic examples, and is somewhat smaller than the doorways of the Piedras Negras structures. The sunken doorway would also have limited heat loss.

Several other features of Structure 9 are relevant to the sweat bath interpretation, including the thatched roof. Satterthwaite (1952) noted thatch protecting earthen roofs on several modern sweat baths. The rains would otherwise quickly dissolve the roofs. Satterthwaite also mentioned benches in the enclosing structures of sweat baths. Although Structure 9 has no enclosing structure, there is a bench around its periphery. The laja features west of the structure (Fig. 10.5) could also have provided seating. Reichel-Dolmatoff (1990, Plate 21) illustrated similar features used by the Colombian Kogi as seats where priests divine, prepare offerings, or observe astronomical phenomena. Cresson (1938) mentioned that bathers often rest on benches following baths. Paul Amaroli (personal communication 1993) provided an alternative explanation; he noted that upright slabs mark grave locations at Madre Selva near San Salvador.

Ethnographic Examples of Sweat Baths and Their Use

Recent and historical uses of sweat baths are relevant to understanding Structure 9. Ethnographers have reported the use of sweat baths by Maya and

Mexican groups in highland Mexico and Guatemala. Peck et al. (1966) described the use of sweat baths by the Mam. The 3 ft high sweat bath may be integrated into a house wall or stand apart. Wagley (1941) described sweat bath use among the Mam in Santiago Chimaltenango. Most houses had their own sweat bath. Each 5 ft square, shoulder-high sweat bath was "formed like a miniature house." Rosales (1949) described Santiago Chimaltenango sweat baths as constructed of rocks, sticks, and mud, with plank benches inside. One sweat bath owner told Rosales that the locals bathed only in the sweat baths and avoided the cold water of nearby streams. Rosales noted that the bathers threw water on the hot stones, and that the sweat bath was very comfortable on cold days.

Several ethnographers have described Tzeltal use of sweat baths. Blom and La Farge (1925) described sweat baths as 1.5 m wattle cubes thickly plastered with mud, some of which had thatched roofs. Redfield (1930) noted that one in four households at Tepoztlán had a sweat bath constructed of stone and mud. The sweat baths had low entrances that were difficult to enter on the knees. Nash (1970) noted that sweat baths were semi-subterranean, and were made by excavating an area of about 5 m^2 and then raising a mud-plastered stone oval. Nash mentioned that only about half of the households of Tzo'untahal had sweat baths and use was declining. Wauchope (1938) described sweat baths at Santiago Atitlán as constructed of wattle-and-daub and rubble. Firewood was stacked outside the single entrance, and sometimes the structure was covered by a thatched roof.

Cresson (1938), while interpreting the use of enigmatic structures at Piedras Negras, examined modern sweat baths in Mexican villages, paying particular attention to features that might be archaeologically visible, and provided the basis for later work by Satterthwaite (1952). Cresson (1938) noted several features present in all the sweat baths he studied. All had both fireboxes and steam chambers. The steam chamber is the location where bathers cleaned themselves and sat. The firebox was built onto the steam chamber in all cases with a passage between the two rooms. All had drainage passages where water from bathing could exit the structure. Cresson also noted that all structures had a single low entrance to the steam room, and that some structures had ventilator holes while others did not.

At present, sweat baths are restricted to the highlands. Blake and Blake (1988) found that the sweat bath distribution in Maya communities correlated strongly with the environment. They found no sweat baths below an elevation of 1,000 m. They were relatively common between 1,000 and 2,000 m, and most households above 2,000 m had sweat baths. There are two possible reasons for this correlation. Higher communities are cooler with greater rainfall, and sweat baths would be therapeutic in both a practical and spiritual sense, providing warmth on cold or wet days. The second possible reason is that higher communities tend to be more isolated and hence more traditional. Blake and Blake (1988) favor the environmental interpretation, but the wider distribution of sweat baths indicated by the archaeological record supports the latter interpretation. Cerén, at 450 m, is where the environmental model would not predict sweat baths, as are other archaeological examples. Cresson (1938: 101–102) noted that the Maya dictionary of Motul includes the word *zumpulche,* meaning "bath made thus, in which enter the recently delivered women and other sick persons in order to cast out the cold which they have in their bodies," (trans. Cresson) also indicating a wider Precolumbian distribution of sweat baths.

Sweat baths are used for general cleanliness, as well as medicine and ritual (Redfield 1930). The inhabitants of Santiago Chimaltenango bathed four or five times per week (Wagley 1941). Sweat baths are used like saunas, but regular bathing with soap and water also occurs. Wagley (1949) provided a detailed account of the use of sweat baths following birth. After birth, both mother and infant entered the sweat bath, where they were cleaned and the mother massaged. The mother went to the sweat bath twice a day for the first 15 days after birth. The afterbirth of the infant was buried in the floor of the sweat bath. Adults should return to their family sweat bath periodically to pray, and Wagley (1949) noted that individuals moving away from their village sometimes perform rituals to break ties with their natal sweat bath. Redfield (1930) also noted birthing rituals associated with sweat baths. The mother needed to bathe once a week for a month after birth, and the baby sometimes also bathed.

Summary and Conclusions

Excavations in and around Structure 9 uncovered an architecturally unique structure and associated features. The structure has solid clay walls with cornices at their tops resting on a solid clay platform. The structure had a domed bajareque roof protected by a thin roof of grass thatch. The interior consists of a raised laja floor covered with TBJ ash in most areas, except for a domed river cobble firebox in the center. The only entrance leads directly to this firebox. We recovered no artifacts from the structure.

Structure 9 was probably used as a sweat bath, and many aspects of its construction and setting support this interpretation. Features were present related to heat production and retention, the drainage of water, and to seating. Large quantities of wood ash in the nearby midden (see Chapter 6) also provide support for this interpretation.

The ethnographic record indicates the importance that sweat baths play in traditional communities. Highland peoples use them for daily hygienic baths and in a variety of rituals, particularly those associated with childbirth. The size and elaborateness of Structure 9 probably indicate its use by more than one household, and the maintenance of the sweat bath by the residents of Structures 2 and 7 may have been a valued community service exchanged for goods from other households. Structure 9 likely played an important role in both ritual and quotidian aspects of the lives of the inhabitants of Cerén, and may have served an integrative role in the community.

Acknowledgments

The research reported in this chapter benefited from the help of many individuals and institutions. The fieldwork was supported by the 1990–1991 NSF grant awarded to Dr. Sheets, and was conducted under the auspices of CONCULTURA. Many thanks go out to my Salvadoran workers, friends, and colleagues, as well as to my colleagues on the Cerén Project. This chapter benefited from critical readings by Dr. Payson Sheets, Dr. T. Patrick Culbert, Dr. Michael Schiffer, and Dr. George Cowgill. My fellow graduate students at the University of Arizona, particularly John Chamblee, Janet Griffitts, Art MacWilliams, and René Muñoz also provided helpful suggestions that have improved the clarity and readability of this manuscript. Thanks to all!

Structure 10: Feasting and Village Festivals

Linda A. Brown and Andrea I. Gerstle

Structure 10 is located only 5 m west of Household 1 and 5 m east of Structure 12 (Fig. 1.1). Architectural components and the artifact assemblage suggest that Structure 10 was a special-use building which served a nonresidential function. Specifically, Structure 10 was utilized for production of community festivals and the storage of festival paraphernalia.

In the following section, a general description of the Structure 10 architecture is presented, followed by more detailed descriptions of its four main areas and associated features and artifacts. The descriptive data, except where otherwise noted, are based on preliminary excavation reports (Gerstle 1992a, 1993), ceramic analyses by Beaudry-Corbett (1992, 1993), and lithic analyses by Sheets (1992b, 1993a).

Architecture

Structure 10 is a thatched-roof, wattle-and-daub (bajareque) building constructed on a square platform and oriented approximately 23° east of magnetic north (Fig. 11.1). The superstructure has two rooms: an east (front) room and a west (back) room. A wall, constructed outside of this superstructure, encloses the east and north sides of the building, forming two corridors. The only entrance into the structure is at the west end of the north walled corridor.

The superstructure was constructed on a square 3.7 m clay platform. Four solid clay columns, noticeably larger than those used in the construction of domestic buildings, and bajareque walls were built directly on this platform. The eastern side of the superstructure was primarily left open, with only a 95 cm long wall at its southern end.

A low clay floor and walls were constructed along the north and east sides of the superstructure, thereby enclosing the building on two sides. All full-height sections of the exterior side of the corridor walls—the horizontal pole internal support system for the bajareque—were left exposed, while the interior wall surfaces were finished with clay. We do not know whether this exposed bajareque was used as a special building technique or whether residents were in the process of resurfacing the exterior corridor walls and were interrupted by the eruption. Interestingly, the wall section situated between the middle and north columns was quite low, with a height of only 69–70 cm (Fig. 11.2).

The only access to Structure 10 was through a pole door located at the western end of the north corridor. Those entering, once inside the building, had to wind their way around to the east, then to the south, to enter the front room of the superstructure. From there, the west back room was accessed by passing through the doorway in an interior dividing wall.

The west room floor is not level and is higher (30 cm) than the east room floor. A low bench (30 cm high) is located along the north wall. The unusually low height of this bench, as well as the overall higher elevation of the west room floor level, suggests that at some point prior to the eruption the west room floor was raised, burying most of the bench.

All walled areas of Structure 10 were roofed using grass thatch. Intermittent linear depressions, apparently a drip line, suggest the total roofed area was 53 m^2.

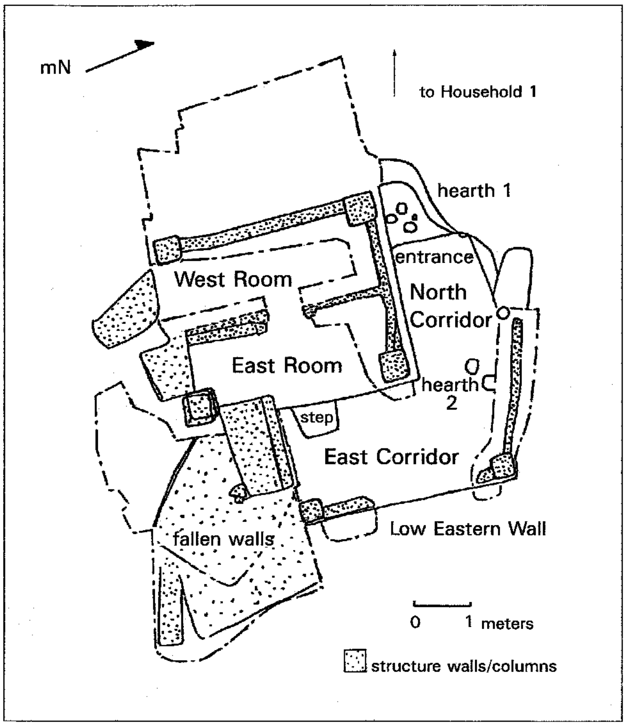


FIGURE 11.1. Structure 10 ground plan.

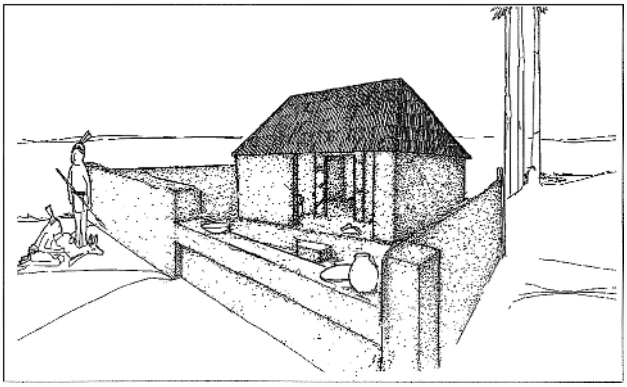


FIGURE 11.2. Artist's reconstruction of Structure 10, looking southwest. *Illustration by Karen Kievet.*

THE NORTH CORRIDOR

The north corridor is long and quite narrow, measuring 4.55 × 1.75 m. Artifacts and features indicate that this area was used for food preparation. Two hearths, three large utilitarian Guazapa open bowls, an unusually large Guazapa jar, a mano fragment, a metate, and a worked stone were found in use or storage contexts in the north corridor. Additionally, several discarded items, including an obsidian macroblade and several sherds, were partially embedded in the floor in this area.

Hearth 1 was immediately outside the doorway on the lower paved area, while Hearth 2 was inside the corridor. Both hearths were made from four large, unmodified river cobbles. A large jar was found in situ directly on top of Hearth 1, and several shelled corncobs had been discarded nearby. Hearth 2 was along the north wall near a metate mounted on forked wooden supports. The east end of the metate was 16 cm higher than the west end; hence we infer that the user faced west toward Household 1 while grinding, standing in a very limited space (30 cm) between the mounted metate and the easternmost wall. One of the large open bowls was placed on the floor under the lower end of the metate, presumably to catch food during grinding. The other two large open bowls were resting on the floor between Hearth 2 and the metate.

A wooden shelf, constructed from small parallel poles tied together with twine, straddled the top of the east superstructure wall extending over both the east room and north corridor. We infer that most of the fallen artifacts in the north corridor were dislodged from this high shelf. Items stored on the shelf probably included an antler and a long bone tool, both presumably used to husk corn, an obsidian prismatic blade, and six ceramic vessels—a Cashal Cream jar, an unusual shoe-shaped jar, a Copador tripod plate, a recurved bowl, a Guazapa open basin, and an open basin.

THE EAST CORRIDOR

At the end of the north corridor, people who entered would turn right to enter the east corridor. The east corridor measures 7.8 × 2.3 m, with a maximum floor height of 22 cm. The south half of the corridor has not been excavated, as it remains buried under three fallen walls; however, the excavated northern portion primarily was used for ceramic vessel storage. A minimum of fourteen medium to large-sized ceramic vessels, two ceramic lids, and a bichrome painted gourd were found in situ on the east corridor floor. Eleven vessels, three of which were nested in one another, were stored flush against the easternmost wall. Three more vessels and a gourd were stored immediately to the west. Most of the vessels were common utilitarian wares. Additionally, a digging stick, consisting of a perforated donut stone with a long stick through the center, was found leaning against the east wall of the superstructure.

Two distinct clusters of fallen artifacts were noted in the eastern corridor. Cluster 1, located just outside of the northeast corner of the superstructure, consisted of carbonized ears of corn, a painted organic cylindrical object, two obsidian blades, a greenstone celt, four donut stones, two worked and three unworked cobbles, five bone artifacts, a spindle whorl, and three sherds. The lighter artifacts in Cluster 1 probably fell from the high shelf in the east room. Cluster 2 was located in the northern end of the corridor area along the eastern exterior wall. This cluster included two obsidian blade fragments, two sherds, and many cobbles that probably were dislodged from the nearby column top.

THE EAST (FRONT) ROOM

From the east corridor, one would use a trapezoid-shaped adobe step to step up into the east room of the superstructure. The east room measures 3.3 × 1.25 m, with a total floor area of 4.55 m^2. This is the only painted room in the structure with the eastern face of the dividing wall, cornices, and door pilasters painted red. The red paint on the lower section of the pilasters was covered with a layer of white paint made from Ilopango tephra and an unknown organic binder.

The east room was used for the storage of special-use items. A deer skull headdress, resting directly on top of pole impressions, apparently fell from storage when the high shelf collapsed during the eruption (Fig. 11.3). The headdress consisted of the complete cranium (minus the mandible) and antlers of an adult white-tailed deer (*Odocoileus virginianus*). The skull had been painted red, noted by traces of red adhering to the outer skull surface, and a small area of blue (possible pigment or paint) was noted on the right antler. The deer skull was found with several segments of a single-ply twine tied around the base of the two antlers; the twine was probably used to tie the headdress to a wearer during ceremonial activities. In addition to the deer skull headdress, two jars and an obsidian blade fell from an elevated context in the east room, probably from the shelf. One of the vessels, a Guazapa wide-mouthed jar, was unusual for having a basket-like handle ornamented with two small anthropomorphic faces.

Four pottery objects (three large jars and a recycled ceramic ring base) and a painted gourd were found in situ on the east room floor. One of the vessels, a caiman effigy jar found resting on top of a fiber ring support, was full of achiote (*Bixa orellana*) seeds. Another of the vessels, a Guazapa dimple-based jar, contained squash (*Cucurbita* sp.) seeds. An inverted ceramic ring base, fashioned from a recycled polychrome vessel base, was stored inside the gourd.

Other small artifacts, including components of a possible ritual costume, found clustered in the east corridor were likely in storage on the high shelf prior to being blown southeastward by the force of the eruption. These include two large tubular bone beads, a tear-drop-shaped flat bone ornament, a notched scapula from a juvenile white-tailed deer, an unidentified painted organic object with a flared rim, a long bone tool, two prismatic blades, and a greenstone celt. Additionally, ears of corn scattered in the east corridor may have been dislodged from this shelf. The corn was stored shucked, as no remnants of husks remained.

THE WEST (BACK) ROOM

The back room measures 3.3 × 1.48 m. In contrast to the special-use artifacts stored in the east room, the

FIGURE 11.3. Deer skull headdress from the east room of Structure 10.

west room primarily was used for storage of utilitarian items. Artifacts stored in elevated contexts included a bone tool fashioned from a white-tailed deer scapula and a complete Sacazil Bichrome two-handled recurved bowl. Two large utilitarian jars, one of which contained impressions of seeds similar in appearance to beans, were stored on the floor.

Discussion

Structure 10 was a permanent village ceremonial facility utilized for the production of community festivals and storage of festival paraphernalia. The archaeological evidence suggests that different spaces within and around the building were used for various activities related to community festivals, including (1) food preparation, (2) food dispensing, (3) the storage of festival goods such as ceramic vessels, foods, and ceremonial paraphernalia, and (4) sweeping and maintenance of the exterior grounds. These activities took place in discrete activity areas.

FOOD PREPARATION

The north corridor was used for food preparation, including grinding and cooking, as indicated by the presence of a metate and two hearths. The presence of empty shelled corn husks discarded around Hearth 1, and the three corn huskers that fell from an elevated context, indicate that corn was husked and shelled in this area.

Festival foods at Cerén evidently included corn, beans, and squash, as all three of these items were in storage in Structure 10 at the time of the eruption. Additionally, the distribution of white-tailed deer and dog (*Canis familiaris*) faunal remains, in conjunction with Artiodactyla (deer or peccary) and Canidae (dog, fox, coyote, wolf) protein on obsidian blades at Household 1, suggest that deer and dogs were butchered in this area (Newman 1993). Dogs and deer likely were consumed during Cerén festivals (see Chapter 16).

FOOD DISPENSING

In addition to storage, the east corridor probably was utilized for food distribution. Generally, the presence of a high number of food-serving vessels is a good indication of the distribution of food during feasts (e.g., M. Smith 1987). However only five serving vessels were recovered from Structure 10, suggesting that festival participants either brought their own serving vessels to feasts or that food prepared at Structure 10 was served at a different location. Special architectural elements of Structure 10, such as the low exterior corridor wall, support the former interpretation, as this low wall may have functioned as a pass-through for dispensing food to ceremonial participants on the exterior of the building during festivals. Excavations focusing on the utilization of the original ground surface around Structure 10 further support the interpretation that food was dispensed at Structure 10, as the ground by Hearth 1 and to the north and east of Structure 10 was hard-packed and smoothed, suggesting areas of heavy foot traffic (see Chapter 5).

STORAGE

Structure 10 was primarily utilized for storage. Almost half of all ceramic vessels in Structure 10 were stored in the east corridor. The north corridor was used for the storage of serving vessels and tools used in food preparation. Also, there was a qualitative and quantitative difference between the types of materials stored in the east and west rooms of the superstructure. Many of the items in the east room were rare or unique in form or decoration, while the west room contained common utilitarian items. This pattern seems paralleled by vessel contents as well. For example, beans were stored in the west room, while the east room contained a large quantity of achiote seeds.

The ethnographic literature notes that contemporary Maya use achiote (annatto) for a number of purposes. Typically, achiote is used as food coloring in cooking, often added to stews to give them a reddish-brown color (S. Coe 1994). But in addition to everyday use, achiote is used in ceremonial contexts. Both achiote and squash are mixed with chile, honey, and maize to make special ceremonial breads (S. Coe 1994). Achiote is added to chocolate, a favorite Maya festival drink, as a symbol of human blood (S. Coe 1994). And contemporary Lacandon Maya use achiote to make red paint, symbolic of human blood and sacrifice, which is applied to beams in ceremonial structures, ritual clothing, incensarios (censers), and the bodies of ritual participants (McGee 1990; Tozzer 1907) as a means to activate and animate objects with a life force (McGee 1998).

Cerén residents probably added achiote to special festival foods, as is done by contemporary populations. However, the large quantities of achiote seeds stored in Structure 10 would suggest its use in making ceremonial paint, in addition to its likely use as a food color for special festival foods.

In addition to the rare and unique items, several obsidian blades were stored in the area of the east room. Interestingly, one of these blades tested positive to human antiserum in crossover immunoelectrophoresis (Newman 1993: 183). Obsidian blades from various site contexts were tested; however, this was the only blade thus far to test positive to human antiserum. While this blood may be the result of an inadvertent cut during original manufacture or subsequent use, the context of the blade in a ceremonial building raises the possibility that it may have been used for deliberate bloodletting (Sheets 1993b: 194).

SWEEPING, MAINTENANCE, AND TRASH REMOVAL

Excavations focusing on the use of exterior space around Structure 10 revealed that the areas to the north and northeast of the building were relatively free of artifacts and vegetation, suggesting an area that was well-swept and maintained (Simmons and Villalobos 1993). This was particularly notable when compared with areas to the southeast of Structure 10, which were littered with artifacts, had an undulating ground surface with loose soil, and were scattered with plants and bushes. Presumably the cleared, hard-packed ground to the north and east of Structure 10 was the area where participants gathered for ceremonial celebrations.

An interesting parallel to the use and maintenance of space around a ceremonial building is seen in the ethnographic literature. During the 1940s, Wisdom (1940) recorded a number of ceremonial structures used by the Chorti Maya of Guatemala. Specifically, he noted that the "land around any ceremonial house . . . is considered a sacred spot and is not to be used for any secular purpose. The ceremonial house has a large space around it, kept clear of vegetation by communal *aldea* [rural settlement] labor, where the Indians congregate during ceremonies" (Wisdom 1940: 426).

Structure 10: Within-Site Relationships

Both artifact assemblages and architecture suggest that Household 1, located only 5 m from Structure 10, may have been involved in the production of festivals (see Chapter 5). If our interpretation that Household 1 members sponsored community festivals is correct, then inferences based on architecture would suggest that this ritual responsibility was a permanent position (rather than rotating, as in the contemporary Maya fiesta system) and perhaps was multigenerational.

Both the proximity and permanence of these buildings, in addition to time depth implied by successive building modifications, suggest a long-term involvement between Household 1 members and activities at Structure 10. The specific types of remodeling done to both Household 1 and Structure 10 are revealing. One of the renovations made to Structure 10 consisted of changing the location of the only entranceway into the building. At some point prior to the eruption, an entranceway that faced north was closed off and a new doorway was built facing west, directly toward Household 1. Interestingly, the entranceway to the Household 1 storeroom faces east, toward Structure 10. This is notable, since all other Cerén domestic storerooms have entrances that face north, opening toward the household domicile. This modification would have facilitated the movement of people and goods between Household 1 and Structure 10.

Furthermore, the Household 1 storeroom was undergoing renovation at the time of the eruption. Beaudry-Corbett (Chapter 13) proposes that this renovation may have been a response to Household 1's greater need for both long-term food storage and vessels for transferring food commodities, as inferred from the ceramic assemblage.

Furthermore, Structure 10 also may be linked to Structure 12, the other ceremonial building at Cerén (see Chapter 12). Again, proximity and architecture would support this interpretation. Structure 10 and Structure 12 are located in close proximity to one another. Both the wide superstructure doorway and the low wall of Structure 10 open out east and directly face Structure 12. To date, only these two buildings have painted interiors and only these buildings diverge from the standard Cerén building alignment, which is oriented at 30° east of north. Moreover, two ceramic wares, one locally produced and the other imported, had a restricted distribution within the community and occurred exclusively in Household 1, Structure 10, and Structure 12 (see Chapter 13). As noted by Beaudry-Corbett, this could be indicative of Household 1 members' participation in a broader social network resulting from their religio-political role that extended beyond the immediate community.

The Structure of Festivals at Cerén

The material evidence and rich contextual data preserved at Cerén allows us to make inferences concerning the structure of festivals within the ancient community. Festivals involved the consumption of food and probably drink, as well as the display of white-tailed deer ceremonial paraphernalia. More speculatively, Cerén festivals may have involved applying red paint to ceremonial participants and/or ritual items, sacrifice of deer and/or dogs, and human bloodletting.

Festivals were frequent enough for hosts to construct and continuously maintain a permanent building dedicated solely to the production of community festivals. The limited space inside Structure 10, in addition to the well-trodden and well-maintained exterior ground surface, suggest that festivals were public events held in open areas. But while festivals likely were public events, the archaeological evidence also suggests the existence, and maintenance, of clear social boundaries separating festival hosts from festival participants. These boundaries are inferred from the architecture and artifact assemblage of Structure 10 and Household 1.

Physical access to Structure 10 clearly was restricted. The corridors around the north and east sides of the main building successfully blocked off the large entry to the superstructure. The only access to the building was past a pole door that opened toward Household 1. Those entering, once inside the building, had to take a circuitous route, winding through the narrow north and east corridors, to arrive at the entrance to the front east room, where the ritual paraphernalia was stored.

In addition to the restricted access to the building, the actual space inside of Structure 10 was quite limited. This is particularly notable in the food preparation area, where the limited space would not have accommodated more than three or four women preparing food. Instead, the number of metates in use positions at Household 1 suggest that it likely was the locus of the labor-intensive grinding for public feasts held at Structure 10 (see Chapter 5).

Scholars have argued that the production of feasts is a powerful mechanism for maintenance and reproduction of social relations (e.g., Cancian 1965; Dietler 1996; M. Douglas 1984; Goody 1982; Hayden and Gargett 1990; Mauss 1966; Mintz 1985; Weismantel 1988). Feasts themselves are powerful social boundary mechanisms, with group boundaries defined and maintained via the host-recipient relationship as well as by who is included and excluded from the guest list (Cancian 1965, M. Douglas and Isherwood 1996). Moreover, specific ceremonial goods associated with group consumption provide additional marking services in delineating group boundaries (M. Douglas and Isherwood 1996).

Returning to Structure 10, the architectural boundaries separating feasting host from consumer also may have functioned in the reproduction of social relations within the community. Public feasting at Cerén may have served in recruiting feast recipients for and obligating them to any number of social reciprocity networks. As the ceramic data suggest (Chapter 13), Household 1 members participated in a wider social network than did other households in the community. If we are correct in our interpretation that Household 1 members held a ritual-political role in the ancient community, which included the sponsoring of community festivals at Structure 10, then feasting likely was one of the mechanisms for the production and reproduction of social networks and alliances that both included and extended beyond the immediate community.

Deer Ceremonialism and Ritual Symbolism in Structure 10

In addition to feasting, festivals at Cerén involved the display of white-tailed deer artifacts. An examination of the distribution of white-tailed deer artifacts within the site is revealing. All deer ceremonial artifacts, or those for personal adornment, were found exclusively in the two ceremonial buildings, Structures 10 and 12 (see Chapter 16). The restricted distribution of deer artifacts is notable and suggests that community members had differential access to deer ceremonial items.

The white-tailed deer stag appears to have been the symbolic animal fulcrum at Structure 10. Mary Pohl (1981) argued that the white-tailed deer stag was a prominent Precolumbian Maya deity who played a significant role in ritual. Specifically, Pohl argued, the white-tailed deer was associated with the *cuch* ceremony that linked together agricultural fertility, the sun, rain, economic prosperity, and the cyclical nature of time, death, renewal, and rebirth.

While the deer stag was the central ceremonial animal in Structure 10, the architectural plan, artifact storage pattern, and selective use of paint in this building suggest that the direction east was the ceremonial focal point. This is indicated by multiple avenues of evidence. The two doorways of the Structure 10 superstructure open to the east, as does the low eastern exterior corridor wall. Furthermore, the east room was reserved for the storage of ceremonial and special-use artifacts, while all other areas contained a more utilitarian artifact assemblage of items commonly seen in domestic contexts at the site. Moreover, the east room was the only room in the building that was decorated with the east-facing wall and door pilasters painted red with white highlights applied to the lower part of the pilasters.

In addition to the walls, several ceremonial artifacts in the east room were painted red, notably the deer skull headdress. A red unidentified organic cylinder object was stored in an elevated context in this room. And the large caiman effigy jar was full of achiote seeds, which are used for a red color by contemporary Maya (S. Coe 1994; McGee 1990, 1998; Tozzer 1907).

One of the underlying structural principles of Classic Period Maya religion is the quadripartite division of the universe (Miller and Taube 1993). During the Early Classic Period, specific directional glyphs are seen in elite contexts. By the Late Classic Period there is epigraphic evidence linking specific colors with directional glyphs, providing evidence of the linkage of color symbolism with the four directions and the association of east with red (Miller and Taube 1993).

Likewise, among contemporary Maya the east holds special ceremonial significance and is associated with the rising sun, the birthing direction, and the color red (Vogt 1969, 1976). Underlying this ceremonial focus on the direction east is the Maya belief that the sun engages in a daily birth-death-rebirth drama and, each morning at sunrise, is reborn from the dangerous nighttime realm of the underworld. This belief forms the underlying organizational structure for the contemporary cofradía (sodality) system in Santiago Atitlán, where one of the main duties of cofradía members is to perform the necessary rituals to assist the sun across the sky (Carlsen 1997; Carlsen and Prechtel 1994).

There is additional evidence linking the white-tailed deer stag to the direction east and the color red in the context of rain-making rituals. In the Dresden Codex, deer are associated with the red *chac* (rain god) of the east and are used as an animal offering in a ceremony for rain (Bricker 1991: 291). Among contemporary Yucatec Maya, a deer hunt, including the ritual consumption of the deer, is an integral component of a rain-making ritual called the *cha-chaac* (Redfield and Villas Rojas 1934: 140).

Returning to Structure 10, the architectural design, the artifact storage pattern, and the restricted use of red paint within the building likewise suggest a ceremonial focal point placed on the direction east. If this interpretation is correct, then the archaeological evidence from Structure 10 suggests that some of the conceptual frameworks forming the foundation of Classic Period Maya elite religion also formed the underlying structural principles of agriculturists living on the southern periphery of the Maya area. These underlying principles include a quadripartite division of the universe, in which cardinal directions are associated with specific colors and perhaps certain animal species.

The archaeological evidence from Cerén suggests that white-tailed deer ceremonialism was part of a ritual complex that was not the exclusive domain of the elites at major Maya urban centers. While Cerén residents undoubtedly went to the site of San Andrés—the main ceremonial center in the Zapotitán Valley—for certain ritual events, apparently they also were able to intervene with the supernatural on their own behalf.

Conclusion

The archaeological evidence from Cerén indicates active participation, in an agricultural community, in the production and staging of community festivals. Community festivals included feasting and the display of white-tailed deer ceremonial items.

Four activities related to the production of festivals are inferred from the archaeological evidence and include food preparation, food dispensing, the storage of festival paraphernalia, and the regular maintenance and cleaning of the exterior ground around the building. These activities took place in discrete areas inside and outside of the structure.

Community ceremonies occurred frequently enough for the hosts to construct and maintain a permanent building used solely for the production of festivals and the storage of ritual paraphernalia. Household 1 likely sponsored ceremonies at Structure 10. We infer that the sponsorship of festivals was institutionalized as implied by the association of two permanent building types: specialized ritual architecture in close proximity to a residential compound Household 1.

The archaeological evidence from Structure 10 suggests that some of conceptual frameworks of Classic Period Maya elite religion also formed underlying structural principles and world-view of agriculturists living on the Maya periphery. Evidence from Cerén suggests that residents were able to intervene directly with the supernatural through an active and public community-based ritual complex.

Divination at Cerén: The Evidence from Structure 12

Scott E. Simmons and Payson Sheets

Introduction

This chapter summarizes the results of archaeological investigations undertaken at Structure 12 and presents interpretations of how the building and its environs may have been used 14 centuries ago by the inhabitants of Cerén. The data and some of the interpretations that are presented here are drawn largely from chapters in two preliminary reports (see Sheets and Sheets 1990; Sheets and Simmons 1993a) that detail the archaeological investigations conducted at the building. Additional interpretations based on reevaluations of the data as well as ethnographic and archaeological research are presented here for the first time.

Structure 12 has been a challenging building to interpret. Its architectural features, the composition of its artifact assemblage, orientation, and decorative elements, and the techniques and materials used in its construction are all unusual compared to those same elements found at other buildings at the site. Although the sample of excavated buildings at Cerén is small, the differences that exist between Structure 12 and most of the other structures at the site are noteworthy for a variety of reasons. Preliminary interpretations regarding the function of Structure 12 include the role it may have played as part of a larger religious complex that included Structure 10, located immediately west of Structure 12 (see Fig. 1.1).

Specifically, the archaeological evidence points to Structure 12's use as a locus for divination. However, what we lack to support this interpretation is close archaeological, ethnographic, or ethnohistorical analogs. In this chapter we present the archaeological, architectural, and other data available on the building, and then critically examine how this information suggests how Structure 12 functioned in Classic times.

SETTING AND SPATIAL RELATIONSHIPS

Structure 12 was constructed at the highest elevation within the site and at the easternmost end of the site. Two test pits south and southwest of Structure 12 revealed a flat, smooth, and nearly level ground surface. Gerstle (1992c: 69) suggested that this was probably a built feature created by artificial raising and leveling and composed of layers of clay and charcoal-stained TBJ fill material. She noted (ibid.) that in each of the two pits, the smooth surface of the TBJ was covered with a thin layer of hard-packed red sand, similar to the material used in the construction of the village plaza. The near absence of weeds and cultural debris on this surface, along with the presence of sand on this artificially constructed earthen feature, suggests that the area immediately south of Structures 10 and 12 probably was a formal plaza area, similar to that seen east of Structure 3. Only one building, Structure 17, has been identified south of Structure 12. Part of what appeared to have been a substructural mound—perhaps the remains of an associated structure—was left north of the building after the 1976 bulldozing. To the east, the steeply sloping western bank of the Río Sucio is less than 10 m from Structure 12. Structure 10 is most closely associated with Structure 12 in proximity and evidently in function.

EXCAVATIONS

The building and its immediate environs were excavated in two stages, in 1990 and 1993. The first stage of excavation was concentrated on the southern two-thirds of the building and the extramural areas immediately south and west of the structure. During 1993 the excavation of the building was completed. This work centered on the north room and the front entrance, as well as the extramural areas immediately to the north, east, and west of Structure 12.

Architectural Components

While some general similarities with other buildings at the site do exist, many of Structure 12's architectural features, construction methods, and decorative elements are unique. In addition, the building was oriented on a different azimuth than the other buildings at the site. Only Structures 10 and 12 are oriented about 15–20° east of north, in contrast to household and civic structures. Both buildings are the only ones painted white with red decoration. This section of the chapter is divided into separate subsections, each focusing on the different architectural components of the building. The discussion begins with a description of the subplatform and moves from the lowest architectural components of the building to the highest, ending with the roof. Thus the discussion roughly follows the building's construction sequence. The terminology used here follows Loten and Pendergast (1984).

SUBPLATFORM

Structure 12 was constructed on a low earthen mound which helped facilitate drainage away from the building, as its edges closely corresponded to the roof's drip line. The subplatform was constructed of the clay-laden Preclassic soil and extends farthest away from the building immediately in front of the building's entrance, where it forms a low ramp up to the entrance step of the structure (Fig. 12.1).

PLATFORM (MAIN PORTION AND NORTH ROOM)

Like the platforms at most other structures at the site, the main portion of Structure 12's platform is basically square in shape and has square columns at its four corners (Fig. 12.1). In terms of its relative size, the main portion of the platform with columns is comparable to domiciles at the site, as are the four columns at its corners. This portion of the platform was the first of two to be constructed. A lower, rectangular-shaped platform was constructed as part of the north room antechamber. Round columns and walls were then constructed atop this platform on the north, east, and west sides to form the north room or antechamber.

ENTRANCE FEATURES

Beginning at the entrance to the building, the clay subplatform ramp leads to the entrance step, which is abutted by entrance columns on its west and east sides (Fig. 12.2). The adobe at the juncture of the riser and tread of the step had been worn so much by heavy use that the underlying laja (andesitic stone slab) was exposed. Two rows of narrow cavities, spanning the entire width of the step between the entrance columns, were identified during the excavation of Unit 3 tephra in the building entrance. Numbering almost eighty, the cavities are the remains of two rows of thin vertical poles spaced roughly 1 cm apart. The poles were part of a cane (*Tithonia rotundifolia*) pole door that was in place at the time of the eruption. The poles, at least forty in each row, were attached to two horizontal poles, both of which would have been inserted into sockets in the inside faces of the entrance columns.

Both entrance columns originally were circular in section, as are the other columns in the north room of the structure. The entrance columns were later modified by the addition of vertical poles covered with considerable amounts of wet clay, resulting in the creation of squared corners on the insides of each of the two columns (Fig. 12.2). But the sockets that fixed the entrance gate in place did not extend into the original round columns, indicating that the gate and the adobe additions to the entrance columns were later construction features, perhaps meant to emphasize the separation of interior sacred from exterior secular space.

A clay-coated wooden lintel spanned the two entrance columns. This rounded beam was set onto the entrance columns, and it is likely that the cane poles of the entrance gate extended to a point just below the bottom of the lintel. The overall height of the doorway is only 90 cm, requiring someone entering to crawl through it (see Sheets and Simmons 1993a).

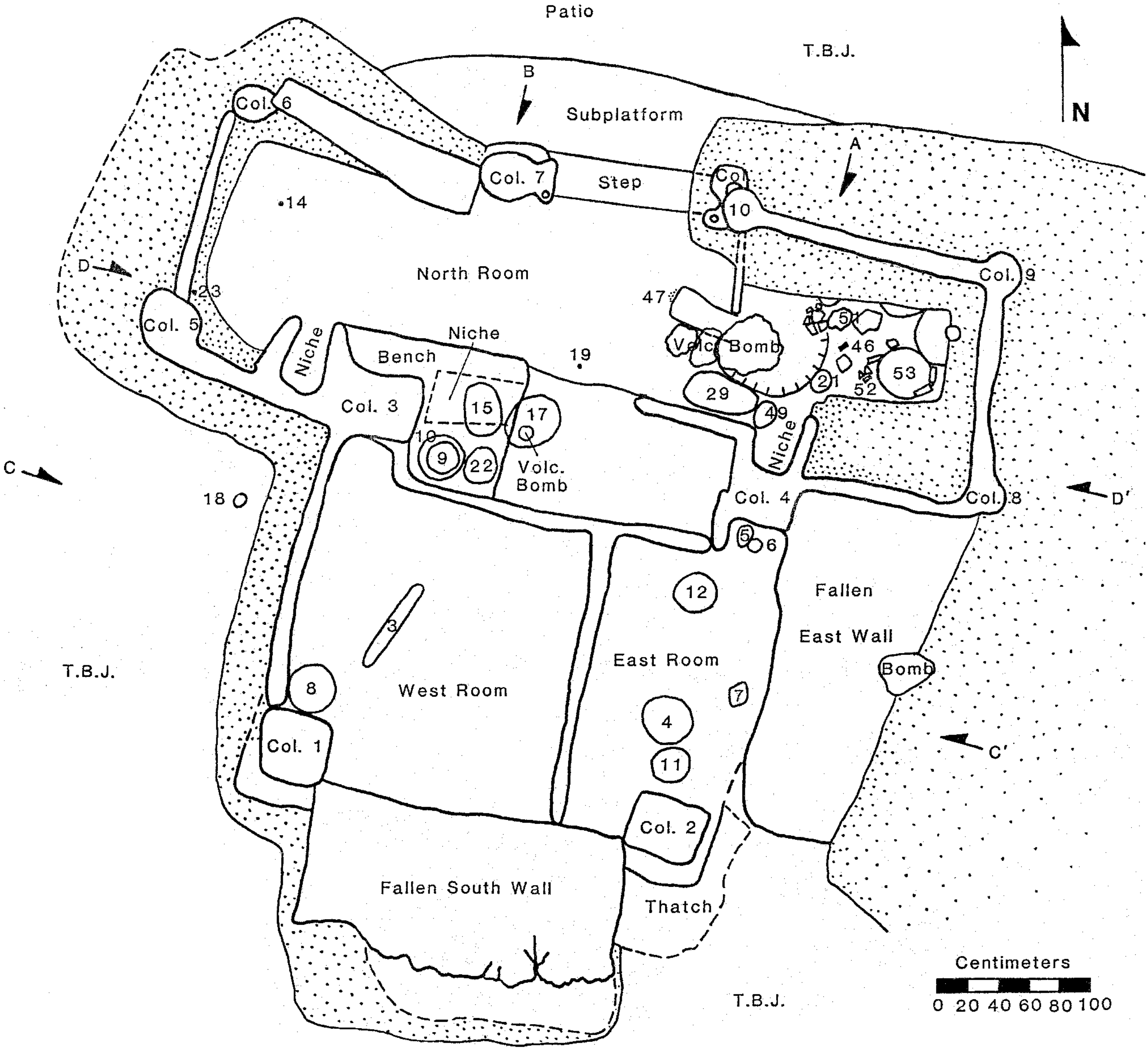


FIGURE 12.1. Ground-plan map of Structure 12, with substantial tephra baulks left against fragile standing walls to help support them. The numbers refer to the artifact FS numbers, and are preceded by 295-5-.

EXTERNAL WALLS AND ROOF

Just west of the entrance is a lattice window of crossed poles coated with clay that is strikingly similar to the one on the west wall of the building. All of the walls of this building were quite thin, and all are of bajareque (clay and pole lattice) construction. But the core sections of the walls were constructed of a sandwich of clay covering a white Ilopango ash core, instead of the solid adobe that was used for constructing the walls of all the other buildings at the site. The use of this Ilopango ash as hearting material for the walls resulted in a substantially weaker wall than those constructed of good quality, clay-laden adobe. In contrast to the ample roofed extramural spaces of domestic and civic buildings for activities and storage, Structure 12 had negligible distances between walls and drip lines. The short distances may have deliberately discouraged inappropriate activities (Fig. 12.3).

INTERNAL WALLS AND OTHER FEATURES

Structure 12 has four main internal walls and six small wing walls (Fig. 12.4). The largest of the internal walls separates the east and west rooms of the building. It was stabilized at its top by an adobe-covered wooden beam that also functioned as the lintel for the doorway linking the east and west rooms. The height of the doorway is significantly lower than the average doorway height at Cerén. A step is probably present between the rooms, but it could not be excavated due to the fragility of the architecture in that area. Another doorway providing access between the north and east rooms is also comparatively low in height, and it too is spanned by an adobe-coated wooden beam.

A horizontal niche was found in the bench in Structure 12 (Fig. 12.1). Slightly trapezoidal in cross-section, its roof was constructed of a large block of laja that was supported by rocks built into the niche margins. Horizontal niches have been found at other buildings at the site, but no other buildings investigated thus far at Cerén have vertical niches. Structure 12 has four, and each was constructed by building horizontally short but vertically tall wing walls on or near the two northern main columns. Two of the vertical niches found on either side of one column were being used to store items at the time of the eruption. The northeastern niche base exhibited organic staining and a smoothed, almost polished surface. This may have been produced by the repeated movement of objects or materials into and out of the niche, including organic solids or spilled liquid substances.

The lattice window located high on the building's west wall was built of slanted, thin wooden poles coated with adobe. Its ten sticks (five slanting in each direction) are encased by a frame of vertical and horizontal adobe-coated sticks set into the wall. The window is almost identical in design and construction to the lattice front wall feature (Fig. 12.2).

DECORATIVE ELEMENTS

One of the most striking decorative features of any building thus far excavated at the site is Structure 12's white and red painted walls. The white paint was made of TBJ tephra and an unknown binder. Horizontal and vertical bands of red paint were ap-

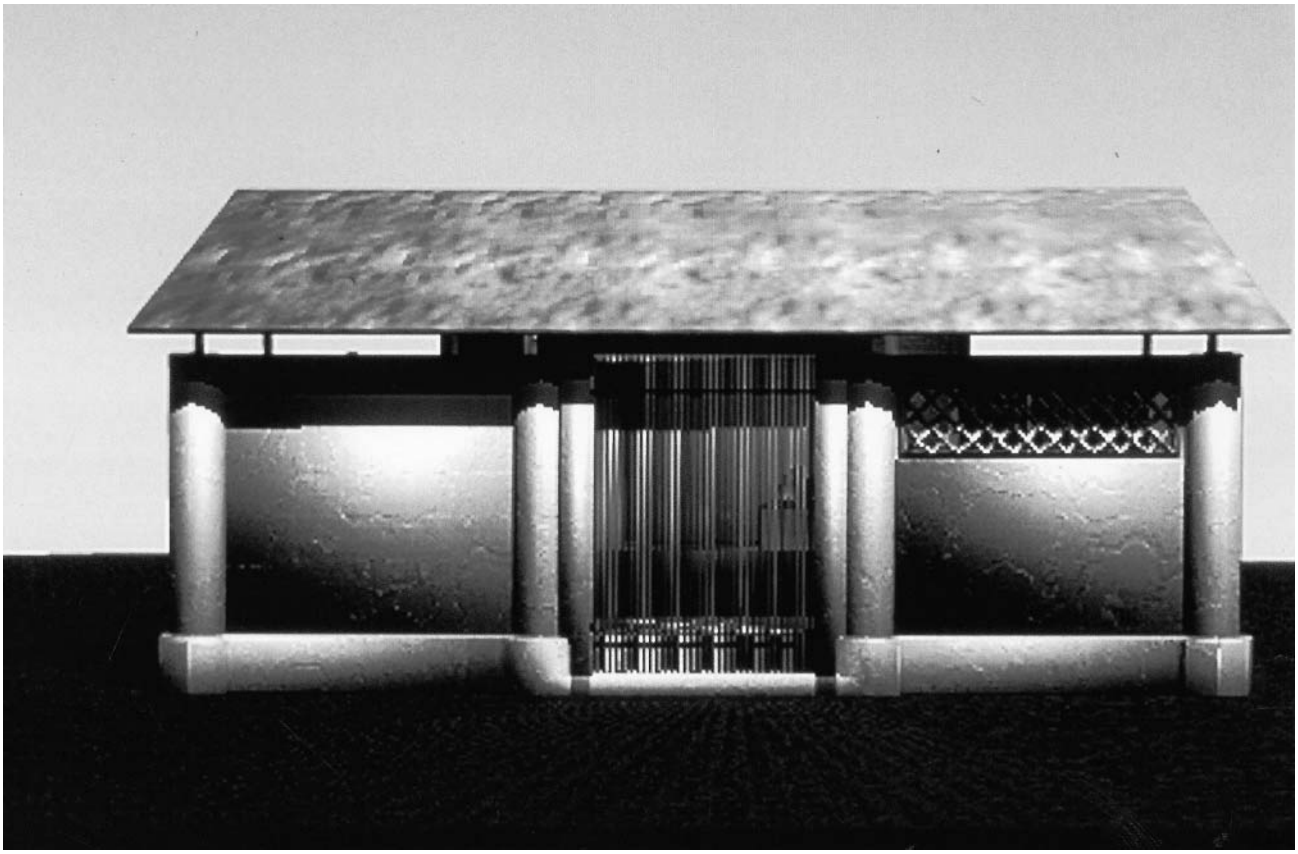


FIGURE 12.2. Computer rendering of the north elevation of Structure 12, with doorway in center and lattice window on right. The rounded doorway columns were squared to make a substantial door jamb, and a double pole-door was in place.

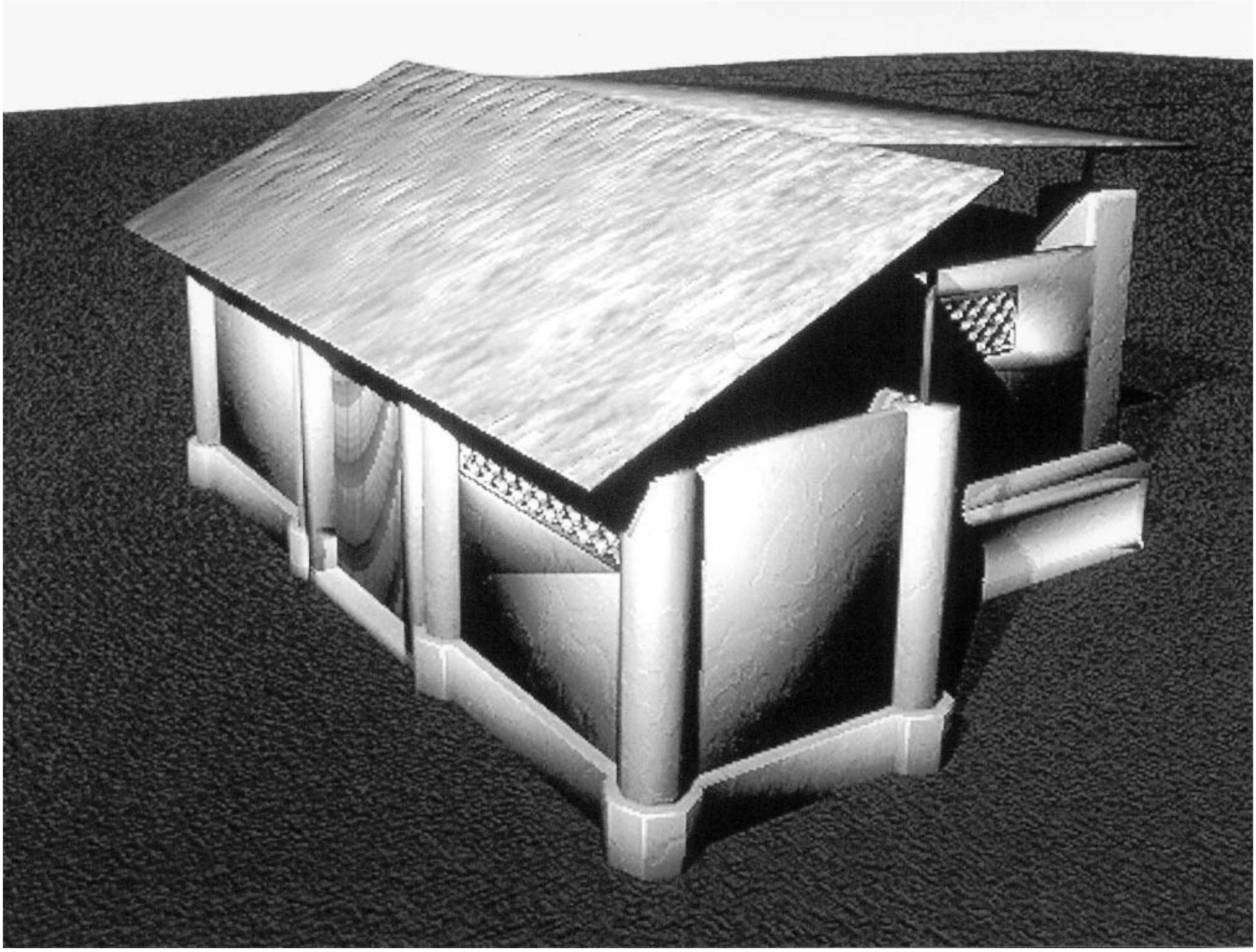


FIGURE 12.3. Computer rendering of Structure 12, from the northwest. After working out the details of the divination, the person asking for the divination apparently would walk around the building to the right to hear the results through the rear lattice window.

plied on top of the adobe and white paint to at least a portion of one of the inner faces of a north room wall, with a red three-lobed floral motif painted on the horizontal band repeated three times. Unlike other buildings at Cerén, Structure 12's platform (main portion) has rounded cornices adorning all horizontal and vertical edges.

The Artifacts

The artifacts found within Structure 12 comprise one of the most unusual collections of cultural material that has been identified at the site thus far (Sheets and Sheets 1990; Sheets and Simmons 1993a; Simmons 1994). Excluding miscellaneous sherds and organic samples, only thirty-three artifacts were recovered from Structure 12. The collection is not only comparatively smaller in size, but its components are unusual in that they do not comprise a functioning assemblage, at least of the utilitarian kind found elsewhere at the site. In addition, no artifacts were stored in roofing thatch, as was common practice in domestic buildings at Cerén (Sheets 1992a; Simmons 1996).

CERAMIC ARTIFACTS

Ceramic objects were the single most abundant artifact type recovered from the building; a total of sixteen vessels (twelve whole and four partial) were recovered. In contrast, individual domestic structures often have twenty to thirty ceramic vessels (see Beaudry-Corbett 1990, 1993, Chapter 13 this volume). In addition to the vessels, two ceramic figurine fragments and a broken ceramic double ring were recovered from the horizontal niche in the north room of Structure 12. Two spindle whorls were on the lintel at the entrance of the building. Eleven of the twelve whole vessels recovered from Structure 12 were classified as utilitarian by Beaudry-Corbett (1993: 142). The remaining whole vessel was a small paint pot that had been resting atop the west wall at the time of the eruption. Three large bowls complete the inventory of utilitarian forms at Structure 12. Four partial vessels (types unidentified), largely destroyed by volcanic bombs, also were found in the building.

Vessels of the Guazapa type Mititlan variety make up the entire assemblage from Structure 12 (Beaudry-Corbett 1990, 1993). Guazapa Mititlan jars with handles, most of which are medium to small in size, along with large Guazapa Mititlan basins with handles are the most common forms found in the building. Guazapa Mititlan vessels are also commonly found in other buildings at Cerén. However, a variety of vessel shapes are present in those buildings, whereas with the exception of the small paint pot only Guazapa Mititlan vessels are found at Structure 12. While several painted sherds were found in Structure 12, no painted vessels and no serving vessels, painted or otherwise, were present there at the time of the eruption.

The Guazapa Mititlan vessels from Structure 12 are not unusual in terms of any kind of unique stylistic, technological, or decorative elements. The exceptions to this are the two constricted neck jars,

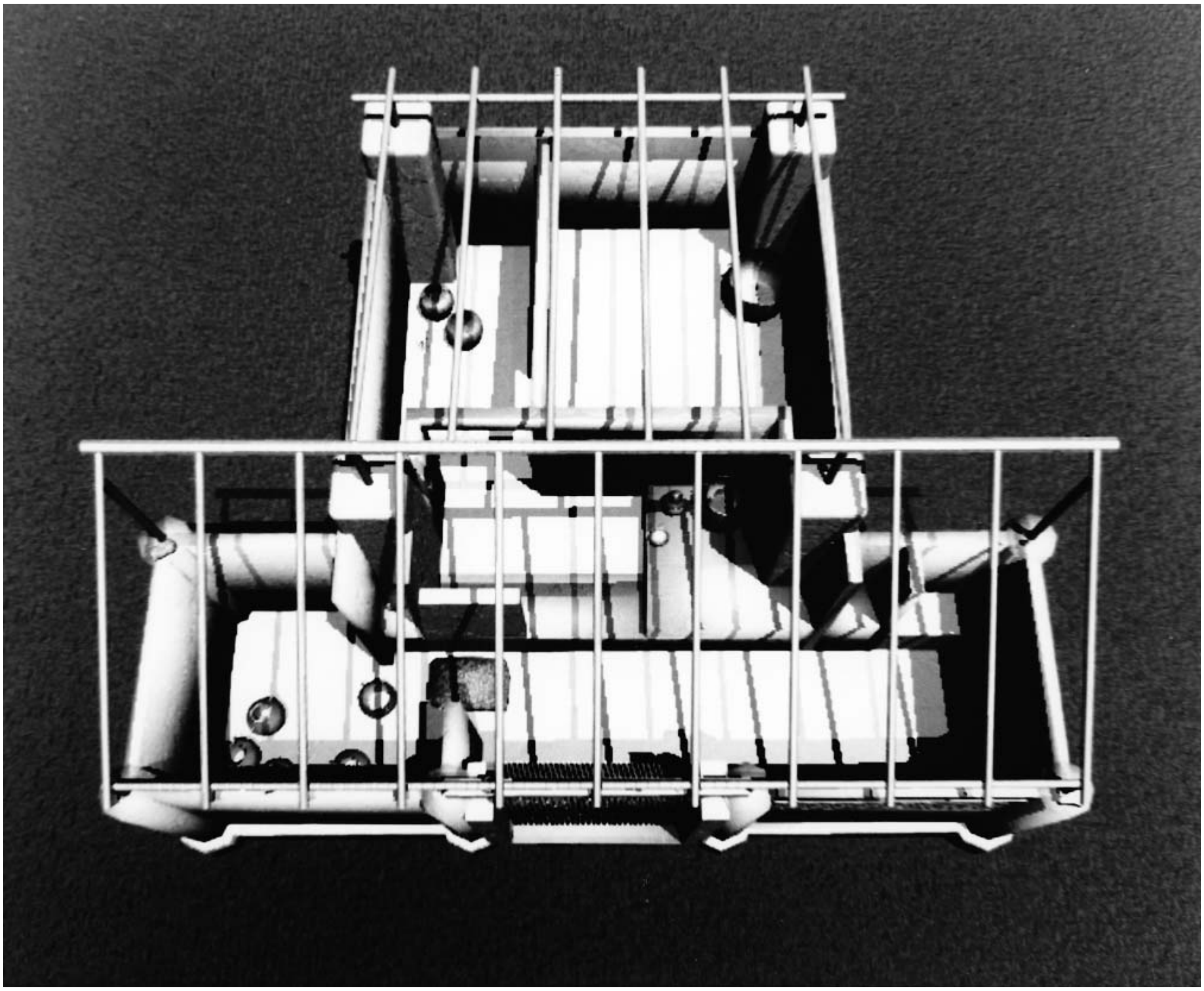


FIGURE 12.4. Computer rendering of Structure 12, as seen from above, with the thatch removed. The north room, or antechamber, is below, with the multiple-height rooms moving upward toward the principal back room in upper right.

similar in style and form to chicha (fermented maize beer) jars that are made in traditional Salvadoran communities today. These jars were found on the floor of the south half of the east room (Sheets and Sheets 1990: 143–144). Each had on its neck an anthropomorphic face modeled from a fillet of clay. One of these had been placed atop four perforated olivella shells, which may have been used as jewelry, perhaps as a necklace. These two jars were too large to have served as drinking vessels. However, they could have been used either as small storage vessels or for transferring liquids to smaller drinking jars or mugs.

LITHIC ARTIFACTS

Relatively few lithic artifacts were found at Structure 12. The groundstone inventory is comprised of two manos, a metate, a worked stone, and a greenstone disk. Only four chipped stone artifacts were recovered: one obsidian macroblade and three obsidian prismatic blade fragments, all of which had been stored in elevated (probably wall top) contexts but not in thatch. In contrast, most of the household buildings at Cerén had at least twice as many obsidian tools, mainly blades, all of which were in good, functioning condition (Sheets 1992a). However, the three blade fragments found in Structure 12 exhibited the heaviest use-wear observed on blades recovered thus far from systemic contexts at the site. In addition, several of the blades were highly patinated, similar to those found discarded in milpas and gardens at the site.

OTHER ARTIFACTS

A few other artifacts were recovered from Structure 12. These include two painted gourds, a deer antler, painted ceramic sherds, and a woven fiber ring with a mat or lattice pattern that was wrapped around the neck of a large ceramic vessel. Other materials recovered from the building include olivella and other marine bivalve shells, wood ash, a small cluster of minerals (plagioclase, biotite, and augite) and two small piles of beans (Sheets and Sheets 1990; Sheets and Simmons 1993a).

Divination at Structure 12: Evidence and Speculations

One of the most striking aspects of Cerén's Structure 12 is how very different it is from the other domestic and civic buildings at the site. The differences that exist in material assemblage, architecture, decoration, features, orientation, and spatial relationships with other structures at the site all provide clues about how the building may have functioned.

OBJECTS AS OFFERINGS AND AS DIVINING IMPLEMENTS

Many individual items were left on the lintel or column tops at the entrance. When the gate was in place, it was necessary to stand on the step in order to leave these objects, and the heavy abrasion that is present on the edge of the step coupled with the minimal abrasion inside the door supports this interpretation (Sheets and Simmons 1993a: 104). The objects left at the building's entrance may have been placed there as offerings or payment for services a ritual practitioner could have rendered, including curing, divination, prediction, and intervention between the residents of the village and deities, spirits, or ancestors.

As Linda Brown (personal communication 1997) is finding in her ethnoarchaeological studies in present-day Santiago Atitlán, diviners often pick up objects that have been discarded in and around the village during the period in which they are being "called" (W. Douglas 1967). These objects, which in Spanish are called "cuentecitos" and are "k'ijbal" in Tz'utjil, act as mediums through which shamanic dream knowledge and curative powers emanate. Cuentecitos are used to access the supernatural powers that the shaman will use during divination and healing ceremonies, and often consist of obsidian blade fragments, figurines, seashells, and numerous other discarded items (ibid.) kept as a supernatural tool kit for divination.

An examination of the objects recovered from Structure 12 reveals that many had been used for a considerable period of time, judging from the heavy wear that was observed (Sheets 1990a: 204). Some had been broken and probably curated, perhaps as heirlooms, by Cerén's residents. These curated objects were evidently kept for some length of time, based on the presence of smoothed surfaces that were seen on earlier breaks. It is possible that a ritual practitioner or practitioners would agree to assist members of the village in exchange for some things that were highly regarded by their owners but did not necessarily have any great intrinsic utilitarian value (Sheets and Simmons 1993a: 118).

It is possible that the objects found within the bench niche (a deer antler, several shell fragments, an animal head ceramic figurine, a ceramic human female figurine, a ceramic ring, and a small pile of beans) comprised the principal tool kit of the ritual practitioner (Linda Brown, personal communication 1997). The animal head figurine was well made, painted white, and had been broken and curated for some time (Sheets and Sheets 1990: 147). The animal head figurine may symbolize the animal spirit companion that accompanies a Maya person through life (Vogt 1969). It might also represent a helping animal spirit, or symbolize the sacred relationship that exists between animals and modern shamans (Eliade 1964).

The other figurine found in Structure 12 is a portion of a larger, handmade female figurine. This figurine had been painted black above its left ear and red on its ears, breasts and base (Sheets and Sheets 1990: 147). The presence of this figurine, along with the manos, metate, and spindle whorls, has led Sweely (1995) to conclude that Structure 12 may have been used by a female shaman. Other objects, including the heavily worn, patinated obsidian blades, the shells, and the broken ceramic ring, do not appear to have had any functional purpose whatsoever, adding strength to the interpretation that objects were placed in the building as offerings and were used as personal divining objects.

The remains of a ceramic vessel hit by a large lava bomb contained a small quantity of corn kernels. In addition, two small piles of beans were found within the building—one in the horizontal niche in the north room and the other along the wall of the east room. These beans were resting directly on the earthen floor, in contrast to beans used for food in the households, which were never stored on the floor. Today, beans are used by some highland Maya shamans during divination and curing ceremonies (Vogt 1969; Wagley 1949). For example, prior to initiating their divination ceremonies, shamans in Chimalteco spread their crystals and beans on a mat for divination ceremonies (Wagley 1949: 71). One shaman in Santiago Atitlán had beans and maize kernels in a set of ritual paraphernalia, while another had red beans and a quartz crystal (W. Douglas 1967: 139).

ARCHITECTURAL FEATURES

One of the most architecturally intriguing aspects of the building is the overall pattern of its external and internal features. These features effectively kept visitors outside the building. The low lintels over doorways, numerous walls, steps, and changing floor elevations made physical movement within Structure 12 more complex than in any other building at the village. Barrie (1996) has noted that architectural features have been used throughout the world as symbolic representations of the cosmos. He wrote that in many instances there appears to be "a direct relationship between specific mythological and religious beliefs and architectural form" (Barrie 1996: 257). Sharer (1995: 524) stated that "the places where the Maya lived, from the smallest house to the largest city, were conceived of as symbolic representations of the universe."

If that is the case, then it is at least possible to interpret the architectural characteristics of Structure 12 in such cognitive terms—as components of a complex cosmological belief system shared by the residents of the village during Classic times. If the building was utilized by a ritual practitioner or practitioners (Sheets and Sheets 1990; Sheets and Simmons 1993a; Simmons 1994; Sweely 1995), it is reasonable to expect the building's architectural design to be congruent with that cosmology. However, because we have not yet found ethnographic or archaeological analogues that would assist us in understanding the ancient rationale behind Structure 12's architectural design and components, the following part of the discussion is speculative in nature.

REPLICATION OF THE SACRED GEOGRAPHY OF THE UNIVERSE

Structures 12 and 10 are the only buildings at the site with three rooms; most have one and some have two (Sheets 1992a). The idea that the universe is generally conceived of as having three levels—the earth, the sky and the underworld—is a central component of Mesoamerican cosmology (Miller and Taube 1993; Carmack et al. 1996; Sharer 1995). In his seminal work on shamanism, Eliade (1964: 259) noted, "The preeminently shamanic technique is the passage from one cosmic region to another—from earth to sky or from earth to the underworld." From a cognitive archaeological perspective (Flannery and Marcus 1993), it is possible to interpret the rooms of the building as symbolic representations of each of the three cosmic planes through which diviners pass. Also, Structure 12 is the only building at Cerén that has three different inner floor levels in the main building, and these levels become increasingly higher as one proceeds through the building to its innermost, west room. Again, from a cognitive perspective, these three different floor levels could be interpreted as a kind of sacred geography of the three-layered universe, in which each floor level represents one of the three levels of the cosmos, with each higher and more inner space being more removed from secular, quotidian space.

The low lintels, numerous doorways, narrow rooms, and changing floor levels at Structure 12 essentially form small, narrow passageways through the building and may be related to another sacred element of the Maya world. Caves are especially spiritual places for Lacandones (McGee 1990: 57–58) and Zinacantecos (Vogt 1969), as they were for the Precolumbian Maya (Sharer 1995) and other ancient Mesoamerican peoples (Miller and Taube 1993). In ancient times, caves probably functioned much as they do today for modern Zinacantecos and Lacandones—as portals to the underworld. Caves are used as a means of communicating with the Earth Lord (Vogt 1969: 387), and shamans have "the power to communicate with the deities and thereby understand the universe" (Sharer 1996: 163). The narrow, twisting passageways within Structure 12 could be symbolic representations of caves and of the trials endured by ritual practitioners in their passage between the levels of the universe. The three doorways with low lintels found in the building could represent the mouths of caves, and thus symbolize portals that the ritual practitioner passed through on the journey between the three layers of the cosmos.

There are four vertical niches at Cerén's Structure 12. Although the manner in which they may have functioned is not clear, it is possible that, like the rooms in the building, the four niches served as symbolic representations of important elements of the universe, perhaps the four principal directions. Sharer (1995: 523) noted: "As a complement to the sacred number three, the number four, representing the cardinal directions, was also especially important to the ancient Maya." Specifically, because the columns help support the roof and the vertical niches are column-associated, niche use may have involved this connectivity between the earth and the celestial world. In addition, it may be that the number of these, like the number of rooms, is more significant than the actual manner in which they functioned.

PERMEABILITY AND SACRED SPACE

Structure 12 is the only building identified thus far at Cerén that has windows. The window located on the west wall of the building allowed for the passage of several things between the innermost west room and the outside; it allowed for sounds, sights, and perhaps smells to pass out of (and into) the structure with relative ease. Sounds emanating from the innermost room of the building and through the window, such as praying and chanting, would have permeated the religious complex from above (because of the floor's and window's elevated heights above the ground surface), and could have been heard outside the building, presumably by those who "commissioned" the diviner.

We are reminded of the talking shrines that were common among the Maya in Late Postclassic and Spanish Colonial times, and wonder if a parallel between these buildings and Structure 12 might exist (Sheets and Simmons 1993a: 121–122). Structure 81 at Santa Rita Corozal, Belize, interpreted as a talking shrine by A. Chase (personal communication to Sheets, 1993), is a Late Postclassic structure with some similarities to Cerén's Structure 12. It has at least four interior doorways, with access to inner portions of the building becoming increasingly restricted (D. Chase 1985: 111–112; Chase and Chase 1988: 17–25). As at Structure 12, functionally unrelated objects were left at Structure 81, probably as offerings.

Finally, Structure 12's double pole-door served as a barrier, both in the physical and symbolic sense, between sacred and secular space. The division between the sacred and the secular is a well-documented element of the cosmological belief systems of various cultures (Eliade 1972), including the ancient and modern Maya (Sharer 1995; Vogt 1976).

Summary and Conclusions

Several lines of evidence suggest that Structure 12 was used by at least one diviner, probably a woman. These lines of evidence include the building's location in an area of the site that has a religious association, the building's unique architectural attributes and decoration, and the artifacts. Unfortunately, there are few analogues to assist our understanding of how this building may have functioned in Middle Classic times.

Structures 10 and 12, along with their patio areas, comprise the religious complex at Cerén (Sheets 1993b). The manner in which Structure 10 functioned may have import for our interpretations of Structure 12. Both the painted deer skull headdress and the large storage vessel decorated with a caiman design, recovered from excavations at Structure 10, have particular bearing on our interpretations of how Structure 12 may have functioned. First, ritual practitioners in various parts of the world use costumes: "the costume transubstantiates the shaman, it transforms him, before all eyes, into a superhuman being" (Eliade 1964: 168). The deer has traditionally played an important role in Mesoamerican economy and religion (Miller and Taube 1993: 74–75). A ritual practitioner at Cerén probably wore the headdress during religious ceremonies focused at the Structure 10/Structure 12 complex. In fact, it appears that a public feast had recently taken place at Structure 10, just prior to the eruption (see Gerstle 1993; Chapter 11, this volume; Sheets 1993b).

The collection of minerals, piles of beans, and curated obsidian blades and blade fragments in nonstorage contexts are perhaps the strongest indicators of divination at Structure 12. Crystals and beans are the most commonly used items today by ritual practitioners throughout various parts of Mesoamerica for divination. The most compelling ethnographic analogue for the curation of used, discarded objects comes from Santiago Atitlán, where ritual practitioners derive power and spiritual meaning from certain objects that they collect and retain for divination and other purposes (Brown 1997, W. Douglas 1967).

The building's architectural features also support the argument that Structure 12 was used as a place of divination. The pattern of three of the same architectural components—three low doors, three rooms, and three floor levels—may represent structural manifestations of the three-layered cosmos. The low doorways and narrow passages in the building might possibly be symbolic of caves, i.e., portals to the underworld. These features, along with the three floor levels, might also symbolize the passage between the three levels of the cosmos. If we are correct that Structure 12 was used by a ritual practitioner during the middle part of the Classic Period, the manner in which divination was practiced in southeastern Mesoamerica has changed considerably in the past 1,400 years, and the archaeological record documenting divination at that time is particularly challenging for us to interpret and understand.

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PART FOUR

Artifacts

Quite a variety of artifacts were found in the village of Cerén, ranging from the inorganic (ceramic, chipped stone, and groundstone objects), through bone and antler, to artifacts made from plant materials such as gourds and twine. Marilyn Beaudry-Corbett examines the ceramics of the village in detail, including fascinating results from chemical compositional analyses of pottery. With the assistance of Ron Bishop, she identified two restricted groups, one imported and one made locally. With her data, she can see how tightly integrated Household 1 was with the religious buildings. Since 13% of the red ware ceramics (19 of 149) were imported, the village apparently was participating in an exchange system that was not only economic but also involved sociopolitical or religious aspects. Overall, a number of people made the pottery for the community, using different sources of materials. Individual pottery makers did not standardize the shapes of their products.

Each household had a relatively standard set of chipped stone artifacts, all of obsidian. Each kept a few prismatic blades stored at predictable locations in the thatched roofs, to be pulled down, used, and then put back up. Each maintained a cache of yet-to-be-used blades higher up in the thatch. And each had a scraper or two and a microblade. All evidently were used as they were, without benefit of hafting or wrapping. Households did not make their chipped stone tools but rather obtained them ready-made from an elite center in the valley; they apparently could choose from quite a few and thus have at least some effect on the exchange ratios. The only lithic manipulation done by Cerenians was basic resharpening of scrapers and perhaps of macroblades.

Similarly, each household had a basic set of groundstone tools, including a metate-mano pair, a few donut stones, and a jade (hard greenstone) axe. Each also had a few lajas (andesite stone slabs) for occasional grinding, as well as some smoothing stones probably used for architectural construction and maintenance. A household that diverges markedly from the above can indicate a part-time occupational specialization. Household 1, for example, had abundant hammerstones for the manufacture of manos, metates, and donut stones, as well as an unusual number of these three objects, apparently more than the household needed for its own use. Household 1 also occasionally produced a great deal more ground cornmeal than it needed internally, presumably for feasting events at nearby Structure 10.

Linda Brown explored the animal bone, tooth, antler, and shell artifacts at Cerén. The most common species, used for food, tool material, and ceremonialism, was the deer. Other species used for food were dog, peccary, bird, rodent, snail, and turtle. Shell and antler artifacts found in Structure 12 received special treatment, likely because of the divinatory activities there. The deer skull headdress, scapulae, antlers, and other bones from Structure 10 are evidence of the centrality of deer ceremonialism at that structure.

More artifacts made from plant materials were found at Cerén than at most Mesoamerican archaeological sites. They include plain and elaborately painted gourds, a palm fruit endocarp fashioned into a spindle whorl, baskets, mats, cloth, net bags, and a variety of wooden items. These artifacts give us some sense of what is generally not preserved in most open sites in moist tropical climates.

The artifact section ends, appropriately, with a chapter on conservation by Harriet Beaubien. She and her objects conservators were on-site during all excavation seasons to ensure that the fragile artifacts were properly lifted and treated, to give them as long a life as possible. She considers both procedures for architectural conservation and general issues of conservation that apply widely.

P.S.

Ceramics and Their Use at Cerén

Marilyn Beaudry-Corbett, with contributions by Ronald L. Bishop

Introduction and Methodology

The overall objective of the Cerén ceramic analysis program has been to use the material record to reconstruct aspects of household life and community-level organization. Because of Cerén's unique recovery circumstances, with structures destroyed during their active use rather than following abandonment, it has been possible to analyze sets of vessels according to their in-use provenience.

As set forth in the Introduction (Chapter 1), three categories of domestic structures have been recognized among the buildings excavated: storehouses, domiciles, and kitchens (see Table 1.1). By virtue of physical proximity, structures are assumed to have been used by the same coresidential group that we are calling a household (see Chapters 5–8). Other structures appear to be special purpose, nonhousehold buildings (see Chapters 9–12). Both household ceramic inventories and those from nondomestic structures are examined in this chapter.

As the first step in the analytical process, each vessel or group of sherds recovered from an in-use provenience was recorded onto a standardized description form for postseason coding and analysis. Figure 13.1 presents the most recently used form, which incorporates refinements from earlier seasons.

Most vessels have been assigned to typological units based on earlier published data for the Zapotitán Valley (Beaudry 1983) or other parts of El Salvador, mainly Chalchuapa (Sharer 1978a). The method used to classify the pottery is the type-variety system. The theory behind this system and its application to Mesoamerican ceramics are well established (Gifford 1960, 1976; Henderson and Beaudry-Corbett 1993; Willey, Culbert, and Adams 1967). It is a hierarchical system in which ceramic types are divided into more precise units (varieties) on the basis of minor variations in decoration or other criteria. Ceramic types, in turn, are combined into ceramic groups which share more general characteristics of paste, surface treatment, and decoration.

Another major part of the analytical process involved chemical compositional analysis of the Cerén material by instrumental neutron activation analysis (INAA), done in collaboration with Ronald L. Bishop, Smithsonian Center for Materials Research and Education (SCMRE). More than two hundred samples are currently in the Cerén paste compositional database, which includes various shapes and sizes of utilitarian pottery, painted serving vessels, special purpose ceramic objects, and some discarded sherds.[1]

These three approaches to the ceramic corpus—typological classification, functional inventory assessment, and chemical compositional analysis—provide information about varied aspects of households and the community, as summarized in Table 13.1.

Ceramic artifacts other than pottery vessels have also been recovered. Those objects, which include spindle whorls, partial figurines, sherd disks, and an incomplete double ring, are summarized briefly in Appendix 13A. Additional analyses, including tabulations of discarded sherds and classification

Pottery Description Form

Catalog No._______ Pot No. _____INAA sample_______ Year:
Provenience Notes:

Amount recovered: All____Incomplete___
Degree of fragmentation:

To be reconstructed? N Y Priority: High___ Medium___ Low____
Reconstruction completed:

Classification: Type designation
Form: Overall

Lip Wall

Rim Base

Neck Handle (#, section, placement)

Other:

Exterior surface treatment and decoration:

Interior surface treatment and decoration:

Paste: Color Inclusions and other details

Metrics

Rim dia.: Vessel height: Orifice dia.:

Neck height: Max. dia.: Support:

Handle dia.: Handle length: Wall thick.:

Photo details:

(Draw profile and motifs on reverse)

FIGURE 13.1. Pottery description form.

of Postclassic materials, have been undertaken but won't be discussed in this chapter. Details of that work can be found in the project's yearly reports.

Findings

CLASSIFICATION

The types and varieties have been grouped into a classificatory unit, the Joya Complex. The ceramic complex represents the complete range of pottery available at a community during a specified time period (Gifford 1976). It is not too likely that new units will be added to the Joya Complex, because only one new variety has been established since the 1989 field season.

Table 13.2 summarizes the Joya Complex components, along with the source for their detailed descriptions. Observations about the more salient typological features of the Cerén pottery follow.

Decoration on utilitarian vessels, including those used for cooking, indicates significant labor investment for the production of pottery not related to special-purpose uses. To decorate so much pottery, a variety of raw materials is needed and more time is required for completing the vessels. The capacity to make that kind of economic investment suggests a prosperous community.

Considerable skill is required for shaping and

TABLE 13.1. Information Sought from Ceramic Analysis Program

Nature of Information	*Analytic Source*
Household	
Composition	
Size	Classification; inventory by household
Stage of life	Inventory by structure, by household
Roles within community (economic; religious)	Classification; inventory; INAA
Where sustenance activities done	Inventory by structure
Participation in non-sustenance activities (communal; craft)	Inventory by household, by structure
Procurement of durable goods (pottery containers including special purpose pieces)	INAA
Community	
Intracommunity organization (household variability in status, specialization, ritual)	Inferences from various analyses
Economic well-being	
Variety of goods available	Classification
Quality of goods available	Classification
Sources supplying goods	INAA
Ethnic and cultural affiliation (directionality of communication)	Classification, INAA
Standing within networks (intraregional and interregional)	
Accessibility to imports	INAA
Participation in extralocal affairs	INAA; inferences from other analyses

TABLE 13.2. Components of the Joya Complex

Typological Units	Established in Type-Variety System[a]	Description in This Volume?
Well Represented at Cerén		
Ceramic Group: Guazapa		
Type: Guazapa Scraped Slip	Sharer 1978: 49	no
Variety: Miltitlan Red-Painted	Beaudry 1989	yes
Type: Cashal Cream	Beaudry 1983: 172	no
Variety: Caldera Red-Painted	Beaudry 1989	yes
Type: Obraje Red-Painted		
Variety: Obraje	Beaudry 1983: 171	no
Type: Martir Incised and Punctate		
Variety: Martir	Beaudry-Corbett 1993	yes
Ceramic Group: Gualpopa		
Type: Gualpopa Polychrome	Sharer 1978: 51–52	no
Variety: unspecified[b]		no
Ceramic Group: Copador		
Type: Copador Polychrome	Sharer 1978: 53–55	no
Variety: unknown		
Rarely Present at Cerén		
Ceramic Group: Aguacate		
Type: Chinchontepec Unslipped		
Variety: Chinchontepec	Sharer 1978: 43	no
Ceramic Group: Chilama		
Type: Sacazil Bichrome		
Variety: Sacazil	Beaudry 1983: 173	no
Ceramic Group: Chuquezate		
Type: Mocal Modeled Appliqué	Sharer 1978: 61	no
Variety: Pedestal Base	Beaudry 1989	yes
Variety: Painted and Slipped	Beaudry 1989	yes
Ceramic Group: Huascaha		
Type: Huascaha Unslipped		
Variety: Huascaha	Beaudry 1983: 168	no
Ceramic Group: La Presa		
Type: La Presa Red		
Variety: La Presa	Beaudry 1983: 173	no
Ceramic Group: Tapalhuaca		
Type: Suquiapa Red-on-Orange	Sharer 1978: 50–55	no
Variety: unspecified[c]		
Ceramic Group: Tazula		
Type: Tazula Black	Beaudry 1983: 167	no
Variety: Undecorated	Beaudry 1989	yes
Ceramic Group: unspecified		
Type: Campana Polychrome		
Variety: Soyate	Sharer 1978: 71	no
Ceramic Group: Zuluniche		
Type: Zuluniche Painted		
Variety: Zuluniche	Beaudry 1989	yes

[a]The source providing the most detailed level pertinent to Cerén specimens is given.
[b]Seven of 11 Cerén vessels would be classified as Geometric Variety; 2 are spiral bowls minus the identifying monkey; 2 can't be assigned to Chalchuapa varieties.
[c]Small jug with handles not reported at Chalchuapa.

firing very large vessels. Such vessels must be built over a period of days, so that the wall dries enough to support the upper parts; the size and wall thickness require special handling and careful control of the firing conditions. Imaginative representations of effigies bespeak artisanal skill; the caiman pot and other effigy vessels also attest to the producers' mastery over their materials.

Cream slip is a favored mode of decoration at Cerén, used on the Guazapa Ceramic Group in a variety of ways across a wide range of forms and sizes. While cream slip is found during this time period in the Petén Maya area, it is not widespread in the southeastern Mesoamerican area for utilitarian pottery or for painted serving vessels. Cream-slip painted pottery is prevalent, however, further south in the Greater Nicoya zone, suggesting a directionality of cultural affiliation or communication.

Interesting shape and decorative characteristics were noted among the design-painted vessels. Tripods are more common at Cerén than at Copán and other areas within the cream paste distribution zone. The dish or plate with supports is quite prevalent in the eastern part of El Salvador for the same time period, however. Thus, we may have an example of a frontier blending of influences.

Specific aspects of the Copador decorative repertoire seem to be emphasized at Cerén. There is a dominance of the "melon stripe" bowl format, for instance. The elongated ("swimming") figure motif, usually placed in the lower register of open bowls, was used on two Cerén cylinder pieces, adapted to a vertical spatial layout rather than the horizontal one for which it seems more appropriate. The presentation of the elongated figure in an inappropriate spatial zone could indicate iconic rather than artistic criteria. The execution of the painted designs varies from very well done to quite sloppily rendered. The imprecise execution might reflect production for a market with limited understanding of the details of the icons. If these interpretations are correct, there could be important ramifications about the ethnic identity of the group acquiring the decorated vessels, as opposed to the group originating the decoration.

Certain ceramics are rare or absent. There is very little Campana Fine Line Polychrome, a quite common type at other western El Salvador sites. The few pieces at Cerén verify that the eruption-period occupation coincided with the epoch when Campana was being made. No ready explanation can be given for the Campana scarcity, but it appears that the Cerén community was more closely connected with the cream paste distribution sphere than with that associated with the Campana Group ceramics.

A notable absence in the eruption-period Cerén pottery corpus is the comal (cooking griddle). Investigators have commented on the presence of the comal in the highlands and its absence from the lowlands (Rands and Smith 1965; Kidder, Jennings, and Shook 1946). This contrasting distribution has been attributed to differences in food preparation between the two ecological zones. The use of comales implies the consumption of tortillas; the lack implies the consumption of tamales or other non-griddle-prepared foods. Comales are quite common in the ceramic complexes at Copán and Chalchuapa from the Early Classic Period but are an infrequent component in the various complexes of Quelepa in eastern El Salvador. It is possible that the comal could be associated with ethnic identity, linguistic affiliation, or other cultural characteristics. This is particularly intriguing because comales are present in the limited Cerén Postclassic ceramic collection that has been classified (Beaudry-Corbett 1993: 147).

Inventories

It is hypothesized that all households engaged in the same basic set of sustenance events, that is, transfer, storage, processing, preparation, consumption, and disposal of foodstuffs. It also is thought that similar goods and objects were involved in those events—commodities (foodstuffs), containers (pottery, baskets, gourds, nets), facilities (work spaces or features such as mats, tables, shelves, horquetas [forked props], hearths), and implements or tools (grinding stones, donut stones, chipped stone tools). The amount of time devoted to sustenance activities, as well as the location of these activities, could be more variable, relating to aspects of household composition and the domestic unit's role within the community.

STOREHOUSE INVENTORIES

Storehouses were loci for keeping perishable commodities as well as imperishable household implements and craft supplies. Food processing very likely also took place in these structures. Since we have excavated three storehouse structures, ceramic inventory data from that provenience category can be compared among households.

Pottery in each structure was grouped by size and shape into categories reflecting general functions (Hally 1983). Measurements of vessel rim diameter,

TABLE 13.3. Pottery Inventory, Storehouses

	Structure 4	*Structure 6*	*Structure 7*
Complete vessels[a]			
Utilitarian vessels			
Jars			
Necked jars with handles			
Small (less than 12 cm)	0	1	1
Small–Medium (12–15 cm)	2	2	0
Medium (16–19 cm)	6	3	3
Medium–Large (20–27 cm)	5	2	2
Jars without handles			
Small (max. dia. 20 cm)	0	1	0
Large (max. dia. 31 cm)	1	3	1
Bowls			
Open with handles/incurved with handles			
Small (21 cm or less)	0	2	1
Large (25 cm or more)	0	2	0
Painted serving vessels			
Round-sided bowls	4	0	3
Recurved bowls	0	0	1
Cylinder vases	2	0	0
Dishes (tripod and possible tripod)	1	0	2
Other vessels			
Incensarios/censers	1	1	1
Slipped incurved bowls	0	0	1
Miniatures	0	1	5
Total, complete vessels	22	18	21
Partial vessels			
Utilitarian, horizontal section[b]	3	3	0
Utilitarian, vertical section[c]	1	2	1
Serving, horizontal section	2	1	0
Serving, vertical section	0	3	2
Unclassified, horizontal section	0	0	1
Total, partial vessels	6	9	4
Grand total, all vessels	28	27	25
Painted vessels classified by type (whole and partial)			
Copador	9	3	2
Gualpopa	0	1	3
Campana	0	0	1
Unclassified	0	0	2

[a] Includes "imperfect" vessels that lack part of a rim, a handle, etc.
[b] Use as a container preserved for secondary use (Schiffer 1987: 30).
[c] Continued use as a container not possible; probably being conserved for recycling as sherd disks, plugs for pot-mending, curtain-rod holders, or door ties.

maximum diameter, height, and neck and handle details were made. Associations among these variables were noted to the point where it was possible to assign jars, for instance, to size groupings if two measurements could be made. In addition to the size-shape analysis, volume capacity potential was calculated for the two jar categories (necked with handles, necked without handles), using the formula given in Ericson and Stickel (1973).

Pottery inventory similarities among the storehouses demonstrate community-wide sustenance practices and religious activity. The total number of vessels per storehouse is similar (Table 13.3). When not in use, pottery generally was stored similarly. Jars usually were placed directly on the floor. Painted serving dishes were kept elsewhere—on a shelf, atop another vessel, or in the rafters. One exception was in Structure 4, where three round-sided, painted Copador bowls were nested in a corner removed from general traffic. Each storehouse contained one incensario (censer), an indication of household-level religious activity.

Variability in terms of size and shape (Table 13.3) likely relates to aspects of household composition. The various morphological groups probably were used for different sustenance activities, with some multifunctionality likely. Jars with handles would have been appropriate for transferring commodities as well as for storage, processing, and food preparation. Large jars without handles could have been for more stationary storage, either of commodities that were accessed infrequently or for stuffs transferred in other containers and then poured into the handleless jars. Smaller jars without handles could have been used for short-distance transfer and for processing tasks. Bowls with handles would have been appropriate for processing, preparation, and transfer over short distances where spillage would not have been a problem.

Structure 6 surpasses the other storerooms in terms of jars without handles and utilitarian bowls with handles. It would appear that Household 1 had more need for long-term storage and for transferring stored commodities than did Households 2 and 4.

Structure 4 held twice as many medium and medium-large jars as the other two storerooms. At this point, we do not know what household characteristic is being reflected by this variation. It could be family size, stage in family cycle, something related to the household's role in the community, or another variable. The concentration of these jars could have been as containers for special items such as cotton seeds, cacao, or other restricted access commodities. Both cotton seeds and cacao have been identified as contents of vessels in Structure 4 (Lentz et al. 1996: 250).

The volume capacity calculations for the two jar categories show that Structure 4's jars had the greatest potential capacity (Table 13.4). This knowledge, coupled with Structure 4's concentration of medium and medium-large jars, encourages us to seek further insights into this household's composition.

The presence of partial vessels and sherd disks in Structure 6 hints at craft activity in Household 1 different from that of Household 2, where five miniature paint pots were kept in Structure 7.

These differences between structures of approximately the same size and with similar architectural features raise questions about the causes for the variation. To what extent are we recording idiosyncratic behavior related to individual differences rather than variation tied to sociocultural factors?

TABLE 13.4. Vessel Volume Potential (in cc), Storehouses

	Necked Jars with Handles	*Necked Jars without Handles*	*Total*
Structure 6 (Household 1)	148,022	43,199	191,221
Structure 7 (Household 2)	127,936	13,233	141,169
Structure 4 (Household 4)	311,095	13,233	324,428

NOTE: An estimated volume was used for fragmentary, unreconstructed objects. For each size category, medians for rim diameters, maximum diameters, and heights were used and an estimated volume calculation was done for an object.

Are we seeing differences equivalent to modern housekeeping practices where one householder keeps saucepans shelved next to the stove, while another keeps them in a nearby pantry?

To better evaluate these concerns, we need to review inventories at the household level rather than at a structure-specific level. At this time we can only examine the pottery inventory for the most completely excavated residential unit, Household 1.

HOUSEHOLD 1 INVENTORY

Some vessel categories seem more closely associated with a particular structure type, while others are equally likely to be found in the different structures (Table 13.5). This provides insights into where sustenance activities took place in the household. For instance, the painted serving vessels were either in the kitchen or domicile, probably reflecting movement from where they were filled with food to where the food was consumed. Finger marks on the interior of a polychrome bowl in the niche under the bench in Structure 2 attest to food-serving use in the Household 2 domicile setting.

Jars in the storehouse had a lower volume potential than those in the kitchen and not a much greater potential than the ones in the domicile (Table 13.6). Thus, even though it seems appropriate to classify structures according to the same general household functions, a lot of variability is masked if we think of the building types as being equivalent in terms of expected pottery inventories. These ad hoc classifications are useful heuristic devices as long as we study the specifics in sufficient detail to see the variations as well as the similarities.

Another caveat should also be given. The extent to which the hypothesized in-process renovation of the Household 1 storeroom may have displaced ves-

TABLE 13.5. Pottery Inventory, Household 1 Structures

	Domicile (Str. 1)	*Storehouse (Str. 6)*	*Kitchen (Str. 11)*	*Total*
Complete vessels				
Utilitarian vessels				
Jars				
Necked jars with handles				
Small (less than 12 cm)	0	1	0	1
Small–Medium (12–15 cm)	0	2	0	2
Medium (16–19 cm)	2	3	2	7
Medium–Large (20–27 cm)	0	2	8	10
Large (more than 27 cm)	2	0	0	2
Jars without handles				
Small (max. dia. 20 cm)	1	1	0	2
Large (max. dia. 31 cm)	1	3	2	6
Small bichrome painted jars	2	0	0	2
Bowls				
Open with handles				
Small (21 cm or less)	0	2	2	4
Large (25 cm or more)	0	2	4	6
Painted serving vessels				
Round-sided bowls	1	0	3	4
Recurved bowls	1	0	1	2
Cylinder vases	0	0	1	1
Dishes (tripod and possible tripod)	1	0	1	2
Other vessels				
Incensarios/censers	1	1	1	3
Miniatures	0	1	1	2
Total, complete vessels	12	18	26	56
Partial vessels				
Utilitarian, horizontal section	3	3	2	8
Utilitarian, vertical section	0	2	2	4
Serving, horizontal section	1	1	0	2
Serving, vertical section	0	3	0	3
Total, partial vessels	4	9	4	17
Grand total, all vessels	16	27	30	73
Painted vessels classified by type (whole and partial)				
Copador	1	3	2	6
Gualpopa	2	1	3	6
Campana	1	0	0	1
Suquiapa	2	0	0	2
Gualpopa/Copador variant	0	0	1	1

TABLE 13.6. Vessel Volume Potential (in cc), Household 1 Structures

	Necked Jars with Handles	*Necked Jars without Handles*	*Total*
Structure 1 (Domicile)	151,011	26,466	177,477
Structure 6 (Storehouse)	148,022	43,199	191,221
Structure 11 (Kitchen)	357,204	26,466	383,670
Household 1, total volume potential	656,237	96,131	752,368

sels, causing them to be temporarily located in the domicile or kitchen, will never be known. Our reconstructed inventory represents the vessels' location at the moment of abandonment, which may not have been the normal or preferred location.

DOMESTIC VERSUS NONDOMESTIC STRUCTURES

The inventories of nondomestic Structures 10 and 12 show some interesting variability when compared with those of individual domestic structures (Table 13.7).[2]

Characteristics of Structure 10's pottery inventory suggest that this building's functions related to longer-term or larger-quantity commodity storage and food preparation. Food serving does not seem to have taken place there, as judged by the stored vessels (see Chapter 11).

Even though its inventory is incomplete, Structure 10 has the highest total overall vessel count, with one or more examples of each utilitarian size category (Table 13.8) and the greatest storage volume potential (Table 13.9). The five jars without handles are hypothesized as having had a nonportable storage function; their measured capacity is also higher than that of jars of the same type in any other structure.

Characteristics of Structure 12's inventory suggest that its pottery relates to food offerings or to commodities stored for nondomestic use. Structure 12 has only a moderate number of vessels, no painted serving vessels, and nothing distinctive in terms of the sizes of the utilitarian vessels (see Tables 13.7 and 13.8). The interesting finding is that even though the volume capacity available for jars in Structure 12 is the lowest recorded, almost half is from jars without handles (see Table 13.9). Other lines of evidence have suggested a possible shamanistic function for Structure 12 (see Chapter 12); storage of offerings would be compatible with that function.

Chemical Compositional Analysis
With Ronald L. Bishop

CREAM PASTE SERVING VESSELS

Previous investigations (Beaudry 1984; Bishop and Beaudry 1994) had concluded that many of the Late Classic cream paste serving vessels (classified as Copador and Gualpopa Polychrome and the slightly earlier Chilanga Bichrome) had been made in the Copán Valley under variable or dispersed production conditions. The vessels then were distributed from this centralized production zone to the proveniences where they were used and discarded. A data set of 120 cases has been developed as a Copán Valley–focus cream paste chemical compositional reference unit. This reference group contains cream paste vessels made and used in the Copán Valley, as well as Copán Valley products exported to other areas including El Salvador (Chalchuapa), the Guatemala–El Salvador border area (Asunción Mita), the Middle Motagua Valley, and Pusilha, Belize. That reference group, along with two smaller data sets (ten cases from the lower Motagua in the Quiriguá area; nine cases from Cambio, a site close to Cerén in the Zapotitán Valley of El Salvador), was used in the analysis of 60 Cerén cream paste specimens.

It should be noted that Neff et al. (1999: 295) have recently argued that the source area for Classic Period cream paste polychrome pottery was highland western El Salvador and southeastern Guatemala. This interpretation is based on a perceived link with earlier Usulután decorated cream paste ceramics. Continued expansion of the SARCAR data set will allow us to carefully evaluate their conclusions in the very near future. For this discussion we will continue to use the term "Copán-Focus Cream Paste Group."

Figure 13.2 illustrates the location of clusters, as suggested by the dendrogram, relative to the total variation in the data set. Statistical or archaeologically significant divisions within the Cerén Cream Paste pottery are difficult to obtain. As these data are being examined at a very general level, no rigorous statistical evaluation was attempted. Two general groupings of samples can be found that relate primarily to relative values of iron and the rare earth elements lanthanum and cerium. Overall, however, the samples show relatively little tendency to form tight clusters that could represent well-characterized compositional groups. This pattern is not unlike that observed for the cream ware pottery from the Copán Valley and related groups (Bishop and Beaudry 1994). While no clear separation can be obtained between the Cerén Cream Paste and the Copán Area Cream Paste, the majority of the Cerén Cream Paste samples can be observed to diverge from the other cream paste ware pottery when plotted with reference to the derived principal components 2 and 4 (Fig. 13.2). Compositional overlap of some of the Cerén Cream Paste pottery and that of the Copán Valley is evident.

The Cambio cases are subsumed within the

TABLE 13.7. Ceramic Inventory by Structure

	Nondomestic Structures			Domiciles		Storehouses			Kitchen
	Str. 10[a]	*Str. 12*	*Str. 3*	*Str. 1*	*Str. 2*	*Str. 4*	*Str. 6*	*Str. 7*	*Str. 11*
Utilitarian vessels	**25**	**11**	**4**	**8**	**0**	**14**	**16**	**8**	**18**
Jars	20	8	3	6	0	14	12	7	12
Bowls	5	3	1	0	0	0	4	1	6
Small bichrome painted jars	0	0	0	2	0	0	0	0	0
Painted serving vessels	**5**	**0**	**1**	**3**	**3**	**7**	**0**	**6**	**6**
Other vessels	**0**	**1**	**0**	**1**	**1**	**1**	**2**	**7**	**2**
Incensarios	0	0	0	1	1	1	1	1	1
Miniatures	0	1	0	0	0	0	1	5	1
Slipped, incurved bowl	0	0	0	0	0	0	0	1	0
Total whole vessels	**30**	**12**	**5**	**12**	**4**	**22**	**18**	**21**	**26**
Total partial vessels	**3**	**4**	**0**	**4**	**3**	**6**	**9**	**4**	**4**
Recycled pottery	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Grand total	**36**	**16**	**5**	**16**	**7**	**28**	**27**	**25**	**30**

[a]The Structure 10 inventory is incomplete, since there may be additional ceramic containers under the fallen southeastern wall and in the northern extramural area where some in situ pots have been noted. The known in situ pots have been included in this table.

TABLE 13.8. Utilitarian Vessel Inventory by Size

	Nondomestic Structures			Domiciles		Storehouses			Kitchen
	Str. 10	*Str. 12*	*Str. 3*	*Str. 1*[a]	*Str. 2*	*Str. 4*	*Str. 6*	*Str. 7*	*Str. 11*
Jars									
Necked with handles					none				
Small (less than 12 cm dia.)	1	0	0	0		0	1	1	0
Small–medium (12–15 cm dia.)	3[b]	2	0	0		2	2	0	0
Medium (16–19 cm)	4	1	1	2		6	3	3	2
Medium–large (20–27 cm)	3	0	1	0		5	2	2	8
Large (more than 27 cm)	2	0	1	2		0	0	0	0
Necked without handles									
Small (max. dia. 20 cm)	2	0	0	1		0	1	0	0
Large (max. dia. 31 cm)	3	2	0	1		1	3	1	2
Bowls					none				
Small (rim dia. 20 cm or less)	1	0	0	0		0	2	0	2
Large (rim dia. 21 cm or more)	4	3	1	0		0	2	1	4
Jars in situ, not classified by size	2	3	0	0		0	0	0	0

[a]Two small bichrome painted jugs are not included.
[b]Includes the vessel with over-the-rim handle.

TABLE 13.9. Vessel Volume Potential (in cc) by Structure

	Necked Jars with Handles	*Necked Jars without Handles*	*Total*
Nondomestic Structures			
Structure 10	360,929	66,163	427,094
Structure 12	39,469	54,936	122,513[a]
Domestic Structures			
Structure 1	151,011	26,466	177,477
Structure 4	311,095	13,233	324,428
Structure 6	148,022	43,199	191,221
Structure 7	127,936	13,233	141,169
Structure 11	357,204	26,466	383,670

[a] Includes capacity of 28,108 cc estimated for in situ vessels that cannot be classified by presence or absence of handles.

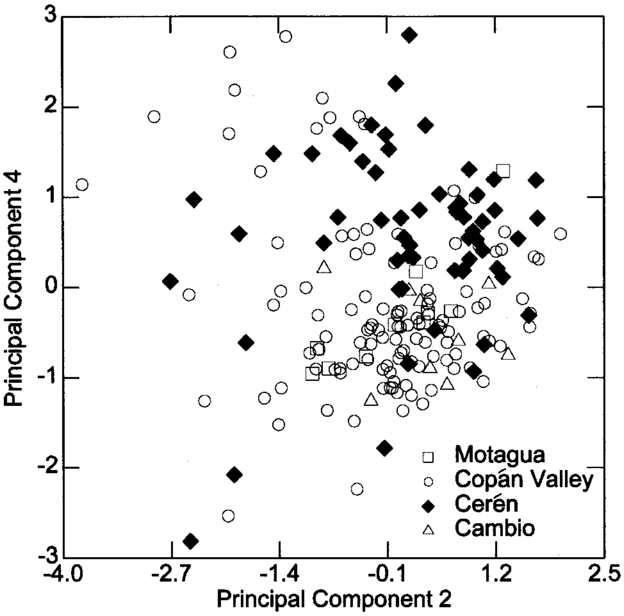


FIGURE 13.2. Principal components plot, cream paste ware serving vessels.

Copán-Focus group, but the small sample size may not adequately approximate the actual variability from that Zapotitán locus.

Summary This picture of the Cerén Cream Paste vessels vis-à-vis the Copán-Focus Cream Paste Group can be interpreted as a further indication of multiple producers within the general source area with distribution from there. Beaudry-Corbett has postulated that Copador especially was used to signal affiliation or identification with the somewhat distant Maya society at Copán. Distribution could have occurred through a different mechanism, of course, and the decorated ceramics could have functioned in a different social context as well. Nevertheless, Cerén relied upon pottery producers outside of the Zapotitán Valley to provide most of their painted serving vessels—no matter how or where they obtained them.

RED PASTE WARES

Data analytical procedures were similar to those used on the cream paste materials. In this instance, 149 cases of Cerén red ware, along with 21 specimens from Cambio and 35 samples from Chalchuapa, were analyzed. Red paste pottery from other sites is included to identify the exploitation of discrete clay sources in different locales, as well as to isolate other causes of variability reflected in the chemical composition of ceramic pastes—random variability in the natural resources, random and patterned variability induced by the measurement techniques, and culturally produced variability. The last-mentioned may relate to various causes, such as preferential mixtures or recipes used by different contemporaneous potters or by potters of different generations. Perceived appropriateness of a certain recipe for specific functional types of pottery could also induce variability in paste composition.

Only 16 of the 205 red paste samples could not be assigned to a paste compositional group. A total of eight chemically based paste groups are identified. Six of these are interpreted as having been produced at Cerén or very nearby; the others are interpreted as having been imported to Cerén (Fig. 13.3).

Thus, it would appear that the data set reflects both the exploitation of discrete clay sources in different locales (imported pottery) and culturally produced variability (pottery made locally from similar source material but prepared slightly differently). The criteria by which the chemical compositional groups were classified as local or imported will be explained, and then the findings will be examined for insights into production organization, the nature of craft specialization, and economic organization of the supply path from producer to consumer.

Cerén Imports *Zapotitán Valley* (N = 12) (Cerén provenience, 6; Cambio provenience, 6). With the exception of two undecorated Huascaha type vessels (Beaudry 1983: 168) from Cambio, all of these are painted decorated serving vessels. Included are Arambala Polychromes from Cambio. This type, absent from Cerén, is assumed to have been produced after the destruction of Cerén. The only examples of Campana Fine Line Polychrome recovered at Cerén cluster here. The few Cerén provenience pieces, along with both Arambala and utilitarian ware from Cambio, lead to the conclusion that the production locus is in the Zapotitán Valley, possibly near San Andrés, which could have provided the mechanism for distribution of the Campana type to Cerén and the later Arambala type to Cambio.

Chalchuapa Area Group (N = 35) (Cerén, 13; Chalchuapa, 20; Cambio, 2). The Chalchuapa pieces are both utilitarian types and painted decorated serving vessels, including a majority of the analyzed Arambala. Chalchuapa probably was the major production zone for Arambala pottery distributed throughout western El Salvador.

The Cerén pieces in this group include both specialized types and the utilitarian type Guazapa: Miltitlan. The Cerén proveniences of the Chalchuapa area group vessels suggest that these imports were restricted to Household 1 and Structures 10 and 12, the nondomestic structures. This pattern of differential intracommunity access to certain pottery is repeated in one of the locally made paste compositional groups to be discussed shortly. It is tempting to see the large jars and basins as having arrived at Cerén with perishable commodities and then having been maintained for periodic use in the shaman-related structures or in the working areas of nearby Household 1.

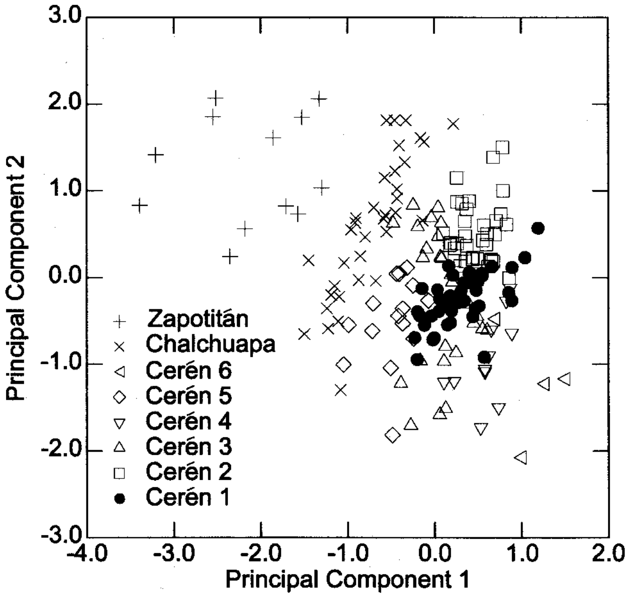


FIGURE 13.3. Principal components plot, red paste ware.

Local Products Generally Available within the Community *Cerén 1* (N = 43) (Cerén, 32; Chalchuapa, 4; Cambio 7). The presence of Cambio domestic types in this cluster suggests that products made from this paste recipe were supplied to both communities. Included in this compositional group are several unusual Cerén pieces—a partial vessel decorated with a modeled face, discarded pieces of a figurine, a reworked sherd being used as a lid for a jar in Structure 10, and a Mocal type incensario.

Cerén 2 (N = 36) (Cerén, 31; Chalchuapa, 2; Cambio, 3). All of the vessels in this group are utilitarian Guazapa Group types; a majority are jars of various sizes. It is assumed that this pottery was produced at or very near Cerén. The few specimens that reached Chalchuapa and Cambio probably functioned as containers for a transported commodity.

Cerén 3 (N = 30) (Cerén, 27; Chalchuapa 1; Cambio 2). Like Cerén 1 and 2, this compositional cluster has a greater than expected number of Cerén-provenience pieces. In contrast with Cerén 2, however, some more specialized vessels were made from this paste recipe—an unslipped miniature, a small jug, a jar decorated with an appliquéd caiman effigy and a jar with an appliquéd face as well as an over-the-orifice handle (the Easter basket jar). Both the caiman jar and the Easter basket jar were in Structure 10. Interestingly, one of the two Cambio provenience specimens in this group is an Arambala Polychrome piece, the post-Cerén destruction type. The sole Chalchuapa specimen is a Pajonal Ceramic Group sherd dated there to the Terminal Preclassic–Early Classic Phase (Sharer 1978a: 44). Thus, it would seem that this clay resource was used for a long time and that during the eruption-period occupation of Cerén it was used both for standard utilitarian pottery and for more unusual pieces.

Local Products, Restricted Access *Cerén 4* (N = 11) (Cerén, 10; Cambio, 1). This small cluster is made up of utilitarian jars, a bowl, and two incensarios. Its restricted provenience may relate to the possible founding family role of Household 1 residents.

Local Products, Older or Inactive Recipe *Cerén 5* (N = 18) (Cerén, 17; Chalchuapa, 1). A majority of the specimens were partial Guazapa Group vessels or sherds, representing broken pottery in secondary use or waiting to be recycled. The one Chalchuapa specimen, a Pajonal Ceramic Group sherd from an earlier time period, reinforces the idea of earlier production.

Other, Probably Local, Products *Cerén 6* (N = 4) (Cerén, 4). Although these specimens cluster together and are linked at a moderate level with Cerén 1 specimens, they do not represent a cohesive chemical group. Rather, they share a tendency to deviate in a similar manner from the other sampled pottery. They are given a group symbol in Figure 13.3 only to call attention to their location along the right side of the principal component plot. Stylistically they are not cohesive either—one is an incensario; the others are all unclassified pieces.

Summary The patterning in the red paste ware chemical compositional groups allows us to draw some conclusions about the functioning of the Cerén community. First of all, the restricted distribution of two of the chemical compositional groups—one imported, one locally made—indicates a difference between Household 1 and the other households, and links that residential group with the nearby nondomestic structures by pottery connections as well as by the other lines of evidence.

The presence of nonlocal red ware pottery at Cerén attests to the community's participation in a supralocal interaction sphere. The small number of vessels that were imported (19 of 149 specimens analyzed) and the generally specialized nature of the vessels imply that economic exchange probably was not the reason behind their presence in the community. More likely, they functioned somehow in the socio-political-religious realm.

Most of Cerén's pottery container needs were filled by goods produced locally. It appears that a number of potters supplied the community. The identification of five chemically distinct compositional groups points either to variability in the natural resources or to variability in the preparation of the clay body by different potters. In either case, the resulting fired paste is not highly standardized. Since the compositional groups are not correlated with specific shapes, sizes, or decorative modes, it would appear that potters were not highly specialized in terms of the products they made.

Conclusions

HOUSEHOLD COMPOSITION

At this time, almost two hundred vessels have been recovered from nine excavated structures but only one household has been fully exposed. Thus, we have had to restrict comparisons to one category of structure (storehouses) across households. This analysis did reveal some community-wide similarities, as well as some differences.

The distribution of pottery containers among the structural components of Household 1 provides a baseline of information that can be used in a comparative analysis as excavation of other households is completed. Meanwhile, we can use the available data to generate some predictions of what we might recover if the incompletely excavated households had pottery container needs similar to those of Household 1.

For example, we would predict that Household 2 and Household 4 will have a similar number of painted serving vessels but that they will not necessarily be kept in the same locations. Another prediction can be made about the expected number of pottery containers that will be found in the kitchen structure of Household 2. An expected total Household 2 inventory can be calculated based on the assumption that the combined domicile and storehouse inventory will represent the same proportion of the total inventory as found at Household 1.

Once the other households' structural components are excavated, the actual data can be compared with the prediction and the model refined or explanations sought for the observed deviations from the expected. These are some of the tantalizing avenues for household analysis that can be explored as the database expands.

COMMUNITY ORGANIZATION

Various subsets of the available pottery data provide more insights into community organization where the incomplete household inventories are not so much a limiting factor. Household 1 is associated with shaman-related structures to the east of the household's locus. Residents performed craft activities related to fabricating sherd disks and to the use of spindle whorls (see Appendix 13A, below). Household 2 also engaged in craft activities, as demonstrated by five miniature paint pots. The concentration in Structure 4 of storage containers could relate to that household's community role in storing cotton seeds or cacao.

All the domestic structures had some type of incensario, demonstrating equivalent household level ritual. Very few figurine fragments were recovered. The most complete example was from the midden west of Structure 9, the sweat bath. It isn't known if that deposit represents secondary dumping episodes or where the refuse came from. It would seem that figurines did not play an active role in household ritual from in-use inventories.

We also have determined that Cerén was economically prosperous, based on the wide variety of well-crafted ceramic products available, including decorated utilitarian and serving types. Most of the community's pottery needs were produced by local or nearby potters, but there was access to regionally distributed types as well, especially the cream paste pottery produced outside the Zapotitán Valley. Variability in resources utilized for the local products suggests a number of different pottery-making units. At this time, it is only speculative as to whether these craftspeople were part-time or full-time practitioners. Seemingly, they were not specialized in terms of size, shape, or other product specifications.

Broader conclusions about the community's status within a socio-political-religious hierarchy and its ethnic identity are not easily teased out of ceramic data. However, it is hoped that the results from the multifaceted ceramic analysis program can be coupled with insights from other analyses to reach this next important level of synthesis.

Notes

1. The Cerén INAA database is curated as part of the Smithsonian Archaeological Research Collection and Records Facility (SARCAR). Appendix 13C contains a summary of the INAA procedures.

2. Structure 3 was not included because of the uniqueness of its assemblage.

Appendix 13A. Nonvessel Ceramic Artifacts

Fired clay artifacts other than vessels have been recovered during the various field operations. These include spindle whorls (malacates), figurine fragments, sherd disks, and part of a double ring. These objects are briefly described, along with provenience information.

SPINDLE WHORLS

Ten specimens from various operations are known (Table 13.10).

FIGURINE FRAGMENTS

Only four objects classified as figurines have been recovered, two from Structure 12 and one each from Structures 1 and the midden near Structure 9. A close examination of the Structure 12 artifacts shows that they were not free-standing objects but originally had been part of ceramic vessels. From their recovery context, however, it would appear that they were being curated in Structure 12 as objects in their own right.

FS 1-131: a head, found on metate outside of Structure 1 on the east side; height 7.0 cm; width above ear 7.0 cm.

FS 2-448, FS 2-451, FS 2-589: 4 fragments from a seated human figurine were recovered from the midden excavations west of Structure 9. Midsection with legs crossed and right foot in place; upper torso with shoulder. Exterior torso and interior blackened but shoulder with arm not blackened. Exterior covered with powdery white material approximately 0.25 mm thick. Since a thick postdepositional coating overlies the white material, that covering would seem to be part of the original object.

FS 5-24: in niche, Structure 12; a hollow figure with a rough base suggesting the object was not originally free-standing. Modeled face with large ear-spools and a necklace of beads; slight indication of a sash; lower part of body not detailed. Unslipped, fairly dense black flecks of inclusions; paste color 7.5YR 5/4.

FS 5-28: animal head, in niche, Structure 12; interpreted as having been a lug protruding from a vessel. Carefully delineated and modeled with deep hollow eyes, 1.0 cm deep ending in a point like a pencil tip. Nose broken off. Unslipped with traces of blue-green and red (a stain?) on edge broken from the pot. Heavily tempered brown paste.

SHERD DISKS

A number of whole or partial sherd disks have been recovered (Tables 13.11–13.14). The general dimensions and weights of the shaped whole disks and the roughed-out complete blanks suggest several weight-size categories: large size and heavy weight (weight over 70 g); medium size and weight (weight range 20.7–32.7 g); and small size and light weight (weight under 16 g). This variability probably relates to the different uses to which the disks were put.

FRAGMENTED DOUBLE RING

This object, FS 5-26, was found in a niche in Structure 12. One-half of the double ring is complete; it is broken where the second ring would begin. The outside diameter is 3.5 cm; the inside diameter, 1.5 cm.

TABLE 13.10. Spindle Whorls

FS No.	Dia. (cm)	Height (cm)	Hole dia. (cm)	Weight (g)	Provenience and Notes
1-42	2.5	1.5	1.0	10.3	Structure 1, Area 3, inside small Suquiapa jar with other artifacts; polished, orange-slipped, vertical grooves
1-85	2.5	1.9	0.6	11.1	Structure 6, Area A, on top of Pot 20,undecorated
1-124	3.0	1.5	0.7	18.3	Structure 6, Area D, grooved; traces of hematite
1-277 partial	2.6	2.0	0.7	15.2 (est.)	Structure 11, outside back wall; incised design
1-278	2.6	1.5	0.7	15.7	Structure 11, outside back wall, incised design
5-33	2.6	2.4	0.7	13.0	Structure 12, in doorway; smoothed, polished with punctations, red-brown
5-39	2.2	1.9	0.5	8.6	Structure 12, near 5-33; undecorated, black-brown
7-293	2.7	1.7	0.7	9.8	Pit 18, 0–10 cm on TBJ; undecorated, polished dark brown
7-305 partial	2.5 (est.)	1.5	0.7	13.5 (est.)	Pit 20, 0–10 cm on TBJ; incised design, polished
8-71	2.8	1.2	0.7	12.9	Structure 10, north side of step in Unit 1; top blackened, side and bottom orange-brown paste, grooved pattern
Mean	2.6	1.7	0.7	12.8	
Range	2.2–3.0	1.2–2.0	0.5–1.0	8.6–18.3	

TABLE 13.11. Completely Shaped and Drilled Sherd Disk

FS No.	Thickness (cm)	Surface Area (cm)	Weight (g)	Provenience and Notes
2-140	0.7	dia. 4.0	15.2	Guazapa Scraped Slip; biconically drilled hole

TABLE 13.12. Whole Blank, Roughly Shaped and Partially Drilled

FS No.	Thickness (cm)	Surface Area (cm)	Weight (g)	Provenience and Notes
1-203	0.6	4.5 × 4.5	20.7	Structure 1, eroding from platform fill; partially drilled (biconically)

TABLE 13.13. Complete Blanks, Roughly Shaped

FS No.	Thickness (cm)	Surface Area (cm)	Weight (g)	Provenience and Notes
1-103	0.6	4.9 × 5.6	20.7	Structure 6, northwest area
	0.7	4.3 × 6.5	22.0	
	0.6	5.0 × 7.8	30.1	
	0.6	5.9 × 7.1	30.2	
	0.5	5.7 × 7.2	31.5	
	0.7	5.8 × 6.1	32.7	
	0.6	7.6 × 10.1	71.3	

TABLE 13.14. Partial Blanks, Roughly Shaped

FS No.	Thickness (cm)	Surface Area (cm)	Weight (g)	Provenience and Notes
1-205	0.8	3.7 × 4.6	23.6	Structure 1 eroding from platform fill; approx. one-fourth present
	0.8	3.8 × 3.7	17.0	
2-142	NA	NA	NA	East of Structure 2 (Area 8); approx. one-fourth present; from Gualpopa open bowl
7-261	0.9	3.4 × 4.1	13.0	Pit 11 (Structure 13) 20–30 cm below surface
	1.0	3.0 × 4.1	14.6	
	0.8	4.8 × 6.2	25.8	
	0.8	4.8 × 5.2	34.5	
	0.9	3.8 × 7.0	36.1	
	1.0	5.8 × 5.4	42.6	
	1.0	6.5 × 5.7	53.2	
	0.9	9.0 × 8.7	77.1	

Paste is smoothed and unslipped with fairly dense inclusions; paste color 5YR 5.6.

Appendix 13B. Description Of Classification Units

CERAMIC GROUP: Guazapa.
WARE:[1] Boquerón Red.
TYPE: Guazapa Scraped Slip.
VARIETY: Miltitlan Red-Painted.
ILLUSTRATIONS: Figure 13.4A–G; Figure 13.5A–C.
BASIS FOR DESCRIPTION: Whole and partial vessels from Structures 1, 3, and 6; sherds from all excavation areas during 1989 season.
IDENTIFYING ATTRIBUTES: Same as Majagual Variety (Beaudry 1983: 171; Sharer 1978a: 49), except that red paint has been added to the vessel, usually at the lip or on the neck, on handles, and on the lower exterior wall and base surfaces. Open shapes have bright red painted interiors (10R 4/8).
FORMS:

JARS: (1) Short outflaring rim with medial ridge, rounded lip; may or may not have handles (Figs. 13.4A, 13.5A); handles, when present, are placed on the shoulder. (2) Medium-high, slightly outslanting neck with medial ridge, globular body with sharply angled shoulder (no handles evident) (Fig. 13.4B). (3) High vertical neck (9, 10 cm), exterior bolstered rim with flattened lip, two round section handles whose upper edge is 3–5 cm from the neck and body join (Fig. 13.4C). (4) Short outcurved neck, flattened or flattened and grooved lip, two handles placed just below the neck and body join (Figs. 13.4D, 13.5B). (5) Very short neck with interior rim thickened below the lip, giving a slightly cupped effect, small

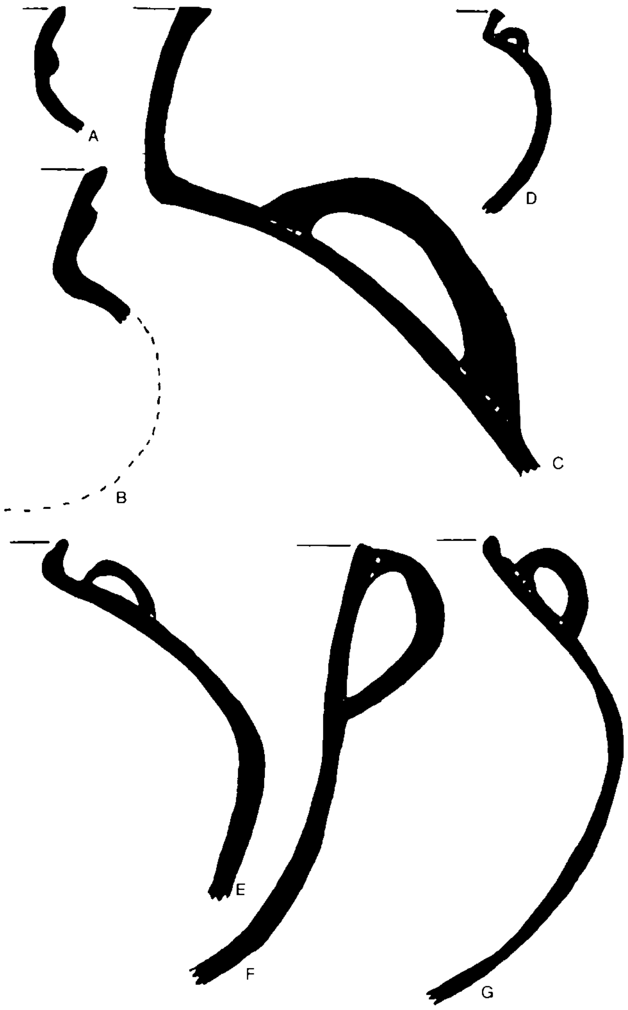
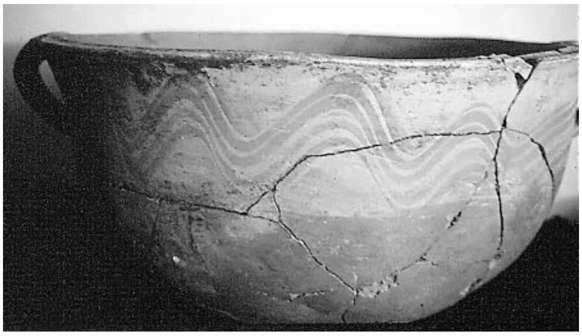


FIGURE 13.4. (A–G) Profiles of Guazapa Scraped Slip: Miltitlan Red-Painted Variety. Not to scale.

A

B



C

FIGURE 13.5. Guazapa Scraped Slip: Miltitlan Red-Painted Variety. (A) Vertically oriented design. (B) Alternating straight vertical and horizontal lines. (C) Horizontally oriented design.

handles on the upper shoulder (Fig. 13.4E). (6) Neckless small jar with a groove below a slightly thickened lip, sharply angled shoulder, two small handles placed just under the groove (Fig. 13.4G).

BOWL: Large, open bowl (basin) with rim thickened to the exterior, flattened and grooved lip, two handles from lip to vessel wall (Figs. 13.4F, 13.5C).

STORAGE VESSEL: Massive, with incurved upper area, exterior bolstered rim with slanted flattened lip, large round section handles with upper attachment 4 cm below rim.

DECORATION: All vessels have scraped slip on the upper wall and a solid red painted lower exterior wall. Jars have cream slip on the interior of the neck from the lip to the wall join. Bowls have red-slipped interiors. The scraped slip pattern is formed by covering the exterior upper-wall area with thick cream slip and then removing some of it to leave a generally curvilinear design. Swirls frequently are oriented horizontally on open vessels, vertically on jars (see Fig. 13.5A, C). The pattern is made in sets of four to six lines; the lower part of vertically oriented swirls may be hidden by the solid red area. Occasionally vertical linear patterns or alternating straight vertical and horizontal lines are seen (see Fig. 13.5B). The area under a handle may have a horizontal pattern, while the rest of the pot has a vertically oriented curvilinear design. Treatment of the lip, neck, or rim varies. Red paint may be applied from a ridge on the neck over the neck-body join; the lip may be red-painted and the neck cream-slipped with three or four encircling scraped lines below the neck-body join; the lip may be red-painted and the neck cream-slipped with two encircling lines above the scraped slip register. Red paint may be used from the lip to the upper handle attachment. Red paint may be missing on the exterior of open shapes with the interior red-slipped.

COMMENTS: This mode (upper part of the vessel decorated with scraped slip and the lower part red-painted) was not reported at Chalchuapa, nor was it recognized during the 1978 Zapotitán Valley project. Following the 1989 season, some of the 1978 Cerén materials were reexamined, and a number of cases were noted where there is faint evidence of the zoned use of red paint. Greater familiarity with the entire decorative pattern on whole vessels enabled me to detect evidence that would lead to the classification of some 1978 pieces as Guazapa: Miltitlan rather than Guazapa: Majagual (without any red paint component). This reexamination also indicated that some of the Cerén Chorros Red-over-Cream: Chorros and Thin Wall Varieties (Beaudry 1983: 172) are better classified at the Guazapa Group level or moved to Guazapa: Miltitlan.

TYPE: Cashal Cream-Slipped.
VARIETY: Caldera Red-Painted.
ILLUSTRATIONS: Figure 13.6A–F; Figure 13.7A–C.
BASIS FOR DESCRIPTION: Whole vessels, Structures 2 and 6 (1989 season); subsequent seasons yielded more examples that resulted in this expanded description.
IDENTIFYING ATTRIBUTES: Cream slip as in Cashal Variety, with the addition of red paint in simple designs, thin to medium-thick wall vessels.
FORMS:

JARS: (1) Globular with rounded base (Figs. 13.6A, 13.7A). (2) Small size, short vertical neck with medial ridge, two small round-section handles placed a few centimeters below the neck-body join, rounded base (Fig. 13.6B). (3) Globular, medium height, outflaring neck, medial ridge on neck, rounded base (no handles) (Figs. 13.6C, 13.7B). (4) Prominent ridge on upper shoulder (no handle recovered; rim and neck height unknown) (Fig. 13.6D).

BOWLS: (1) Open with direct rim, groove below the rim, small oval section handles placed from top of groove to where wall curve begins, very slightly flattened base (Fig. 13.6E). (2) Deep with outcurved rim, prominent sublabial ridge and handles (probably placed from top of ridge; upper part of handles missing), lower shape unknown (Fig. 13.6F).

DECORATION: Lip red-painted; exterior cream-slipped with broad, simple designs in red paint. The designs include T shapes (see Fig. 13.7A), inverted L shapes, incomplete circles similar to commas (see Fig. 13.7B, C), circles, and various step-fret forms.
COMMENTS: After the 1989 season, a single example of a thin-walled partial vessel from Structure 6 was classified as a new type and variety, Huatales Bichrome: Huatales, within the same ware but in a different ceramic group (Guarumal), based on earlier Zapotitán Valley work (Beaudry 1983: 173). As the Cerén sample expanded, it became apparent that all the Cerén specimens could legitimately be classified within the Guazapa Group Cashal Cream type. This reclassification is advantageous to preclude an unnecessary proliferation of typological units and to represent as closely as possible the amount of variability in the assemblage.

TYPE: Martir Incised Punctate.
VARIETY: Martir.
BASIS FOR DESCRIPTION: 2 whole vessels (FS 7-123, FS 8-479).
IDENTIFYING ATTRIBUTES: (1) Pattern of alternat-

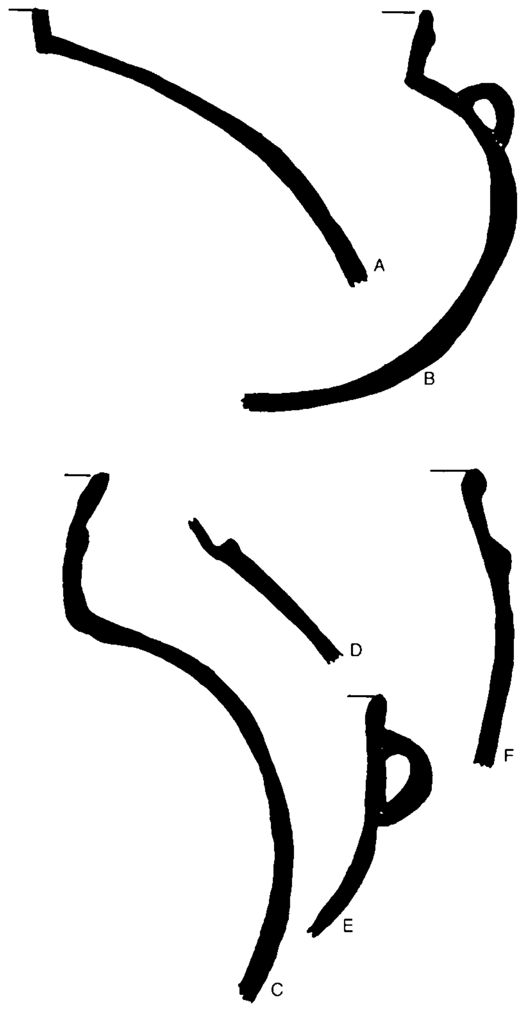


FIGURE 13.6. (A–F) Profiles of Cashal Cream-Slipped: Caldera Red-Painted Variety. Not to scale.

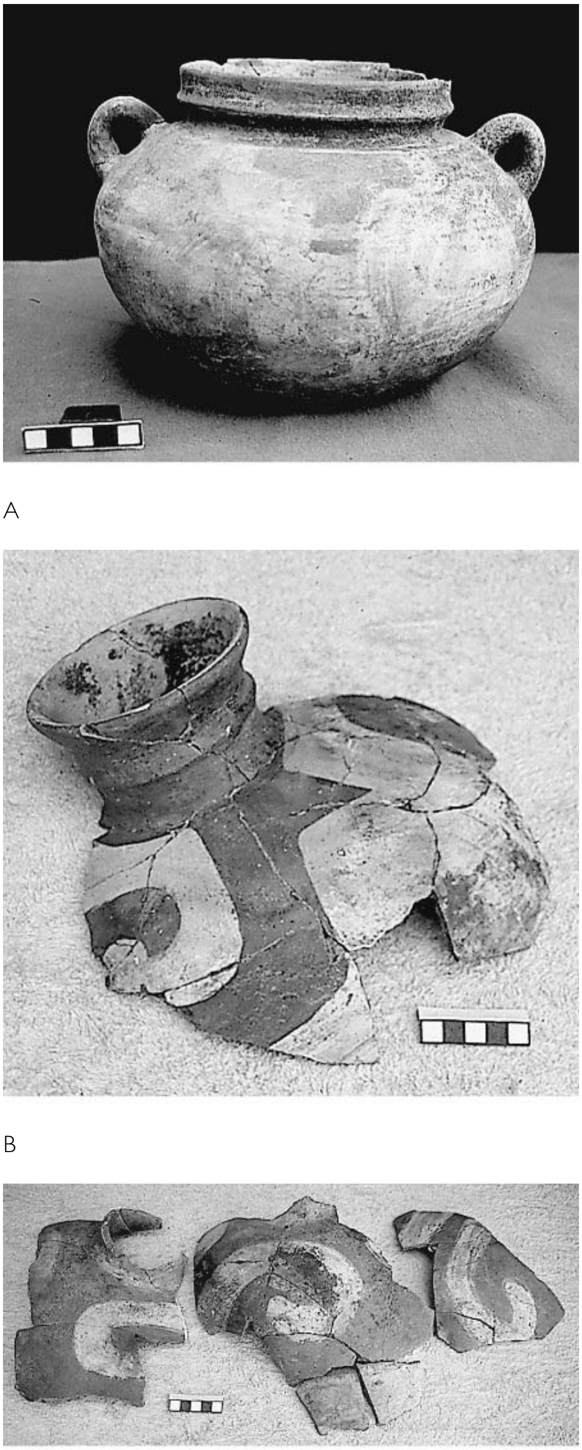


FIGURE 13.7. Cashal Cream-Slipped: Caldera Red-Painted Variety. (A) T-shape design. (B, C) Incomplete circles similar to commas.

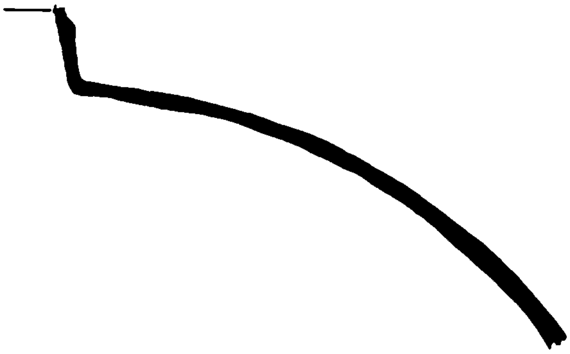


FIGURE 13.8. Profile of Zuluniche Painted: Zuluniche Variety. Not to scale.

ing linear incision and zoned punctation placed on neck and upper body above the maximum diameter. (2) Jar form with handles. (3) Probable red paint on lip and below incised and punctated area. (4) Possible cream slip in incised area.

FORM: Jar with outflared neck, rounded or flattened lip, fairly globular walls, slightly flattened base. Two oval section handles placed below lip onto the shoulder of jar.

DIMENSIONS: Rim diameter—13, 13.5 cm; maximum diameter—21.5, 22.6 cm; height—17, 23.5 cm.

DECORATION: Incision alternating with punctation; paint and slip uncertain because both vessels are badly fire-altered.

CERAMIC GROUP: Tazula.
WARE: Playón Red.
TYPE: Tazula Black.
VARIETY: Undecorated.
BASIS FOR DESCRIPTION: 1 partial vessel, Structure 2, during 1989 season; 2 additional vessels recovered in subsequent seasons.
IDENTIFYING ATTRIBUTES: As for Tazula variety (Beaudry 1983: 167), except for lack of incision or excision.
FORMS: (1) Direct rim bowl with convex walls and flat base. (2) Incurved wall bowl. (3) Outflared wall dish with flat base.
DECORATION: None.

CERAMIC GROUP: Zuluniche.
WARE: Alcantanilla Light Red.
TYPE: Zuluniche Painted.
VARIETY: Zuluniche.
ILLUSTRATION: Figure 13.8.
BASIS FOR DESCRIPTION: 1 partial vessel, Structure 6.

IDENTIFYING ATTRIBUTES: Fine paste, thin wall, globular jar.

FORM: Globular jar with short vertical neck with three appliqued bosses (lip missing); no handles; slightly flattened base.

DECORATION: Difficult to determine because of discoloration from depositional conditions. Neck is totally discolored. At the neck-body join there seems to have been a band of light red paint, perhaps widening into painted zones or fingers of red paint. There is a second painted band high on the shoulder. The exterior may have been burnished rather than slipped, since polishing marks can be seen and the color of the exterior is exactly the same as the unstained interior.

COMMENTS: This vessel had been damaged prior to the site's destruction and had been repaired by using a small pottery plug made from a shaped piece of Gualpopa Polychrome. The hole and plug were ground to achieve a tight fit. As far as is currently known, this is the first time that this method of pottery repair has been reported in Mesoamerica.

Since the paste of this vessel is distinctive from other recovered Cerén vessels, it has been given a new ware designation with the following characteristics:

NAME: Alcantanilla Light Red Ware.

PASTE TEXTURE: Dense but with a few linear voids.

DENSITY OF INCLUSIONS: Light to medium.

SIZE AND SHAPE OF INCLUSIONS: Very small, almost minute, rounded in shape.

INCLUSION MATERIALS: Pumice and specks of mica.

FIRED PASTE COLOR: Probably altered, but existing color is 2.5 YR 6/6.

CORE: Light-gray carbon core.

CERAMIC GROUP: Chuquezate.

WARE: Unspecified.

TYPE: Mocal Modeled Appliqué.

VARIETY: Pedestal Base.

ILLUSTRATIONS: Figure 13.9A, B.

BASIS FOR DESCRIPTION: 1 whole vessel, Structure 6 (1-95).

IDENTIFYING ATTRIBUTES: Specialized form, modeled with appliqué effigy features.

FORM: Slightly recurved bowl with incurved upper wall, single flattened oval handle from lip with effigy face at the top, pedestal base (Fig. 13.9A).

DECORATION: Spiked decoration on bowl body, one set of three vertically placed spikes on each side of the handle. Two other groups of spikes, each about 18 cm, across the rim from the handle. One group consists of one vertical column of five spikes and a second column with four spikes (the center position is plain). The second group consists of one vertical column with four spikes, center position plain. The effigy face on the handle is crudely executed (Fig. 13.9B). It appears to be of an animal, possibly a tapir, with ears placed directly over the eyes and protruding above the rim. The handle is attached at an unusual angle, as if it were slightly twisted.

TYPE: Mocal Modeled Appliqué.

VARIETY: Slipped and Painted.

ILLUSTRATIONS: Figure 13.9C, D.

BASIS FOR DESCRIPTION: Initially based on 1 whole vessel from Structure 1 (1-53). Subsequent sea-

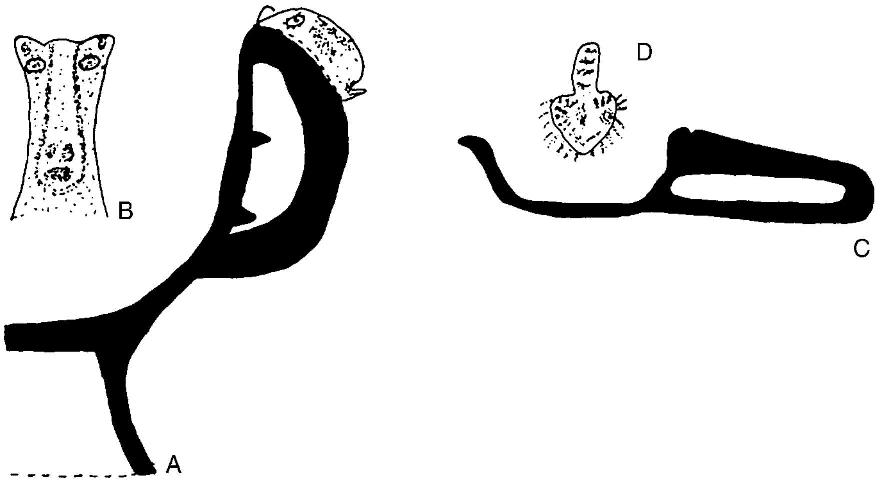


FIGURE 13.9. (A) Profile of Mocal Modeled Appliqué: Pedestal Base Variety. (B) Face on handle, Mocal Modeled Appliqué: Pedestal Base Variety. (C) Profile of Mocal Modeled Appliqué: Slipped and Painted Variety. (D) Face on handle, Mocal Modeled Appliqué: Slipped and Painted Variety. Not to scale.

sons produced similar specimens from Structures 4 and 11 (FS 1-282, FS 4-165).

IDENTIFYING ATTRIBUTES: Black surface color; effigy face on loop handle; thickly applied cream slip, swirled or scraped; red-painted rim, handle, and base.

FORM: Dish with outcurving rim and flattened lip; one oval section handle, slightly flattened in cross-section, in a ladle form with effigy figure on upper surface (Fig. 13.9C).

DECORATION: On the exterior, cream slip is vaguely scraped in a horizontal swirled pattern. On the interior, scraped cream slip has straight lines rather than a swirling pattern. Lip, handle (including effigy), and exterior base are all red-painted. Modeled and appliquéd head of an animal, possibly an owl, is on the upper handle surface (Fig. 13.9D).

COMMENTS: Sharer originally placed the Mocal Modeled Appliquéd type in the Matzin and Ahal (Postclassic) Ceramic Complexes at Chalchuapa, but mentioned that the type may have begun during the Payu Complex (Late Classic) (1978a: 62). Its presence at Cerén confirms the earlier temporal placement. The paste of the Cerén examples is different from that described by Sharer; thus they are not classified as the Mocal variety.

Note

1. In Mesoamerican ceramic classification, ware frequently is defined both in terms of resource-specific attributes (paste, temper,) firing, and surface treatment (Gifford 1976: 14; Willey et al. 1967: 304). Following earlier work in the Zapotitán Valley (Beaudry 1983: 165), ware here is being used in a more restrictive manner. Grouping into wares was done on the basis of paste characteristics (including Munsell color designations), inclusions, and firing results leading to what Rice (1976) called "paste ware." Surface treatment is handled at the type level of classification.

Appendix 13C. Analytical Procedures and Comments on Data Analysis

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ANALYTICAL PROCEDURES

Sample Preparation A tungsten carbide drill bit was used to take 200–400 mg of ceramic paste from the cleaned cross-section of a broken sherd. Samples were weighed, encapsulated, and accompanied during each irradiation by samples of standard reference materials of known elemental content. Standards used at Brookhaven National Laboratory consisted of a set of six U.S. Geological Survey Rock Standards: AGV-1, BCR-1, DTS-1, PCC-1, GSP-1, and G-2. As an "in-house" standard, a commercially available air-floated, Redart, 200-mesh Ohio Red Clay, obtained from Hammill and Gillespie, Inc., of Livingston, New Jersey, fired to vitrification (approximately 1,000°C), was included with each run to monitor analytical precision. For a more extensive discussion of use of reference standards for the analysis of archaeological ceramics at Brookhaven, see Harbottle 1982.

At SCMRE's INAA facility, maintained at the National Institute of Standards and Technology, two samples of the single reference material of SRM 1633, coal fly ash, are included with each irradiation (Blackman 1986). Again, a sample of Ohio Red Clay is included with the other samples for an irradiation and processed as an unknown. Data from Brookhaven National Laboratory were normalized to the reference base of SRM 1633 by use of a set of experimentally determined conversion factors.

Neutron Bombardment and Gamma Ray Spectroscopy The specific procedures for the characterization of archaeological pottery by neutron activation analysis vary among laboratories. Reasons for this variation include the sample size, intensity of irradiation, length of cooling before gamma counting, and equipment for gamma ray spectroscopy. Also taken into consideration is the level of analytical precision that is acceptable—that is, how well the measurements can be replicated—and the throughput of samples. All of these considerations influence the number of times a sample will be prepared, the number of irradiations and counts, and which elements will be quantified from the short, intermediate, and long-lived radioisotopes that are produced.

At Brookhaven National Laboratory, samples and standards routinely underwent two separate irradiations in the High-Flux Beam Reactor. A 1-minute short irradiation at a neutron flux of 1 × 1014 neutrons/cm^2/sec served to create the short-lived isotopes. Samples were counted for 400 seconds following a 2–5 hour decay and counted again for 2,000 seconds after cooling overnight. This led to the determination of elemental concentrations for Na, K, and Mn. Occasionally, the first irradiation and counting period was omitted, relying instead

TABLE 13.15. Gamma Counting Parameters for Routinely Quantified Elements

Element[1]	Nuclide Analyzed	Gamma Ray Energy (keV)	Count Time		Precision[2]	
			BNL	SI	BNL[3]	SI[4]
Na	Na-24	1369	1	1	3.8	2.0
K	K-42	1525	1	1	5.1	5.0
Ca	Sc-47	1297	2	1		
Sc*	Sc-46	889	2	2	4.2	1.6
Cr*	Cr-51	320	2	2	5.3	3.0
Fe*	Fe-58	1099 and 1292	2	2	3.3	1.6
Co	Co-60	1173 and 1333	2	2	3.9	2.4
Mn	Mn-56	847	1	na	nc	
Zn	Zn-65	1115	2	2	6.7	4.9
As	As-76	559	na	1		4.7
Br	Br-82	554	na	1		nc
Rb*	Rb-86	1077	2	2	9.4	6.2
Sr	Sr-85	514	na	2		nc
Zr	Zr-95	757	na	2		nc
Sb	Sb-122	564	na	1		7.9
Sb—124	1691	2	na	10	nc	
Cs*	Cs-134	796	2	2	7.1	2.8
Ba	Ba-131	496	2	1	7.3	8.0
La*	La-140	1596	2	1	3.8	1.9
Ce*	Ce-141	145	2	2	3.7	2.1
Nd	Nd-147	91	na	1		16.1
Sm*	Sm-153	103	2	1	5.6	2.8
Eu*	Eu-152	1408	2	2	5.4	2.7
Tb	Tb-160	298	na	2		9.5
Yb*	Yb-175	396	2	1	5.9	5.0
Lu*	Lu-177	208	2	1	11.5	6.3
Hf*	Hf-181	482	2	2	5.4	3.1
Ta	Ta-182	1221	2	2	6.8	5.9
Th*	Pa-233	312	2	2	3.6	2.2
U	Np-239	106	na	1		19.8

na = not analyzed
nc = not calculated

NOTE: Calculation of the day-to-day precision has not involved the elimination extreme values that one might identify through the use of Chauvenet's Criterion. Precision figures represent the estimate of total precision and include those errors that might arise from sampling error (even from a relatively homogeneous clay), analytical error (spectrum processing, counting statistics, counting geometry, etc.), and random error.

[1] Elements whose concentrations were considered in the data analysis of the Cerén and related samples in this study are indicated by asterisks.

[2] Precision figures given at one standard deviation expressed as percent.

[3] Precision values based on approximately 50 analyses of Brookhaven in-house standard Ohio Red Clay.

[4] Precision values based on 181 analyses of in-house standard Ohio Red Clay. Samples drawn from a different 60-pound bag of clay than analyzed at Brookhaven National Laboratory.

upon the elemental concentrations obtained from calculations following the long irradiation and gamma count.

A second or long irradiation of 3.5 hours used a neutron flux of 5×10 neutrons/cm^2/sec or its equivalent. Irradiation was followed by a 7-day decay and 4,000-second count that was used to quantify the concentrations for the longer lived isotopes. Table 13.15 lists the counting scheme for each element determined.

Brookhaven gamma ray equipment was either a 7 or 14% Ge-Li detector capable of resolutions of 1.82 keV and 1.79 keV respectively, measured at the 1332 keV gamma ray. Amplified pulses were fed to a Nuclear Data 2400 4096 channel pulse height analyzer and recorded to hard media pending computer processing by the BRUTAL gamma spectrometry program (see Harbottle 1976). Data processing and reduction of the gamma peak data to elemental concentrations included corrections for pulse pile-up and gamma peak interferences.

Analyses of pottery after 1983 at the National Institute of Standards and Technology (NIST) involves a single, long irradiation. The samples and

TABLE 13.16. Principal Component Loadings for Cream Paste Ware Ceramics

	PC1	*PC2*	*PC3*	*PC4*
Sc	0.433	–0.480	0.367	–0.205
Cr	0.311	–0.147	0.689	–0.485
Fe	0.168	–0.674	0.294	0.616
La	0.906	0.099	0.167	0.078
Ce	0.907	0.170	0.150	0.031
Eu	0.902	0.283	0.084	0.107
Lu	0.889	0.092	–0.234	0.074
Sm	0.946	0.251	0.016	0.053
Yb	0.916	0.101	–0.179	0.064
Hf	0.474	–0.714	–0.322	0.003
Th	0.523	–0.407	–0.529	–0.437
% of total variance explained	52.6	14.4	11.1	8.0

TABLE 13.17. Principal Component Loadings for Red Paste Ware Ceramics

	PC1	*PC2*	*PC3*
Sc	–0.366	0.704	0.478
Fe	–0.245	0.643	0.649
Rb	0.739	–0.142	0.007
Cs	0.854	–0.351	0.177
La	0.852	0.163	–0.183
Ce	0.773	–0.008	0.252
Eu	0.233	0.701	–0.414
Yb	0.713	0.491	–0.069
Lu	0.633	0.509	–0.075
Sm	0.533	0.531	–0.243
Hf	0.707	–0.191	0.338
Th	0.812	–0.366	0.275
% of total variance explained	43.3	21.0	10.1

accompanying standard material (SRM 1633, coal fly ash) are irradiated for four hours at a neutron flux of 4 × 1014 neutrons/cm^2/sec. Following a six-day decay, each sample is counted for one hour using an intrinsic germanium detector (FWHM at 1333 60Co of 1.71 keV); data are collected on an 8192-channel Nuclear Data ND6600 multichannel analyzer. As at Brookhaven, corrections are made for pulse pile-up and gamma peak interferences. The samples are allowed to decay for 30 days and then each sample is recounted for two hours using the same system. Table 13.15 presents gamma counting parameters for the two laboratories.

COMMENTS ON DATA ANALYSIS

Different sets of elemental concentrations were used to extract the principal components from the cream paste ware and red paste ware data sets (Tables 13.16, 13.17). Some elements were excluded from consideration, since they were not determined in some of the analyses carried out by the Maya Ceramic Survey Project at Brookhaven National Laboratory (Na, K); others were eliminated due to several missing determinations or poor analytical determination (Ba and Ta in the cream ware data set). Known to be mobile in most environments, the Rb and Cs values were eliminated during the analysis of the cream paste ware data but appear to be useful when seeing variation among the red paste ware samples. After considering the analytical error and correlational pattern, the elemental concentrations for Sc, Fe, La, Ce, Eu, Lu, Sm, Yb, Hf, and Th were used during the analysis of both data sets. Cr values were included for the cream paste ware and Rb and Cs for the red paste ware.

Principal components were extracted from the variance-covariance matrix of logged elemental concentrations. The number of components extracted was based on examination of skee plots, where eigenvalues are plotted against their associated component. In both data sets, eigenvalues greater than 1.0 were extracted (0.9 in the case of the cream paste ware).

The Chipped Stone Artifacts of Cerén

Payson Sheets

Introduction

Because Cerén was merely a village, we would expect it to have been rather far down in the chipped stone manufacturing and distribution system of the Zapotitán Valley. That Classic Period system was revealed by a regional surface survey of the 546 km^2 Zapotitán Valley in central-western El Salvador (Black 1983; Sheets 1983). The research found dense Late Classic Period populations functioning within a multi-tier settlement system ranging from large primary and secondary regional centers to large villages with ritual construction, to smaller villages, to tiny hamlets and isolated residences. The lithic artifacts found in the survey and testing closely reflected that hierarchy, with villages quite consistently receiving most of their chipped stone implements already manufactured and doing only some resharpening. Cerén's lithics are generally consistent with the villages in that research. The recent ground-penetrating radar research concurs, indicating that Cerén probably was a village of 100–200 people (Conyers 1995a).

What the Cerén site provides that the regional survey could not is an unusual opportunity to understand how people in a southern Mesoamerican village used, curated, and disposed of their chipped stone implements during the Classic Period. Two structures had no chipped stone artifacts whatsoever: the public building and the sweat bath. Each household had a relatively standard set of chipped stone implements, and both of the religious buildings had chipped stone tools that differed from the household tools in specific and important ways. Although the obsidian implements in the households and the two religious buildings were a part of core-blade technology, there was a marked difference between household and religious structures in terms of their conditions, storage contexts, and uses.

Cerén Chipped Stone

The overwhelming majority of Cerén chipped stone implements were made of obsidian. The strict conservation ethic that guides research prohibits destructive analyses for sourcing or other purposes, but visual inspection shows a high similarity between the obsidian of these implements and obsidian from the Ixtepeque source 75 km to the northwest, particularly the slightly brownish hue to the gray color and highly lustrous nature mentioned by Aoyama et al. (1999: 241). All obsidian chemically sourced from the nearby Cambio site came from Ixtepeque (Michel, Asaro, and Stross 1983), indicating the likelihood that most, if not all, Cerén obsidian came from Ixtepeque. The paucity of manufacturing wastage in the site indicates that little chipped stone manufacture took place within the Cerén village. That is consonant with the valley survey finding of little chipped stone manufacturing debris in villages, probably because villages were too small to support a specialist with the technical skills required by core-blade technology (Sheets 1983), combined with an apparent low use and discard rate for blades. Evidently itinerant specialists did not visit Cerén and make macroblades and prismatic blades there. If a resident or visiting knapper had done significant manufacture at

Cerén, we would expect to find evidence of it in the form of exhausted cores, core rejuvenation, or perhaps macrocore-shaping debitage, but we do not. Rather, Cerenians probably traveled to larger settlements and exchanged their surplus commodities in order to obtain obsidian implements. The most likely settlement for that exchange probably was San Andrés, only 5 km to the south, but secondary regional centers were not much farther. If Cerenians had choices, they could have had effects on exchanges, and therefore they were not the passive recipients of elite-controlled economies. Cerenians apparently would resharpen their own scrapers and occasionally retouch other implements, as evidenced by the occasional waste flake from these activities that has been found at the site.

To date, a total of sixty-two chipped stone artifacts have been excavated from the Cerén site that were in a systemic context (Table 14.1). Only two items were in their use locations (andesite flake smoother and macroblade fragment mounted in floor). All others were in temporary or long-term storage. Not surprisingly, no obsidian has yet been found in the civic complex or at the sweat bath. All sixty-two implements were found in households and the two religious buildings. Of that total, forty-eight are prismatic blades, eight are macroblades, four are scrapers, one is an andesite flake ceramic smoother, and one is a jasper flake core converted into a hammerstone. In addition to the systemic context chipped stone artifacts, some two hundred discarded obsidian artifacts have been recovered from agricultural fields and the midden in Operation 2. Most of the discarded artifacts are obsidian prismatic blade fragments. A few of the discarded artifacts are obsidian macroblade fragments and andesite flakes.

Although the sample is small, it appears that each household had a relatively standard obsidian tool kit consisting of five to seven prismatic blades in everyday use, an isolated cache high in the roof consisting of four to five pristine blades in longer-term storage (not yet put into use), a macroblade, and two or three scrapers. The prismatic blades in everyday use range from about 4 to over 12 cm in length, and most retain very sharp edges, with little or no detectable use wear at up to 70-power magnification. Some macroblades were modified at the proximal end to create a tang, presumably for holding. All prismatic blades and macroblades apparently were directly handheld during use, as there is no evidence of their being wrapped in hide or other material or being hafted. That is consistent with Karl Taube's observation (1991) that obsidian blades were handheld in Postclassic and Colonial depictions and were not wrapped or hafted.

The curation strategy for prismatic blades in everyday use in households is consistent. Blades were stored individually in the thatched roofing at predictable locations—over doorways or at corners—where a person could reach up and extract the blade for use and then return it to the thatch. Similarly, the bundle of pristine blades not yet put into use was kept high in the thatch in storehouses, where it would have taken considerable effort to access it. In spite of their massiveness, macroblades were also kept in thatch, but scrapers were about evenly divided in their placement on wall tops and in thatched roofing, while one was placed on the edge of a storehouse posthole. It appears that two objectives were met by elevated obsidian storage: childproofing the house and protecting the brittle, acute cutting edges from inadvertent damage.

Obsidian prismatic blades must have been quite effective for cutting softer materials. However, the edge is very acute and obsidian is brittle, limiting their uses on harder materials. Macroblade edges and scraper edges (also quite sharp but less acute than macroblade edges) would have been more useful in cutting resistant materials. Prismatic blades regularly have edge angles between 15 and 25°, while macroblades often have edge angles of 20–35° or higher and scrapers have edge angles from about 60 to even exceeding 90° (in some cases where measured close to the edge). The greater durability of scraper edges is probably the reason they were not curated with the same care that prismatic blades and macroblades received, along with the fact they were resharpened in the household.

Simmons (1996) noted that the wear on obsidian blades found in Household 2 closely matched the wear from cutting gourds described by Lewenstein (1987) in her experimental studies at Cerros. That supports the possibility that gourds were processed and decorated within Household 2, a suspicion that began with the discovery of five miniature ceramic paint pots containing cinnabar pigments. The only known use of cinnabar at the site is in painting gourds.

Of the total of twenty-nine prismatic blade edges examined for organic residues by crossover immunoelectrophoresis (accurate to the family level), two tested positive for deer protein, two for dog protein, and one for human protein (Newman 1993). To avoid contamination of artifacts in the field, only physical cleaning is done on all lithic artifacts, with no liquids. One of the blades testing positive for deer protein was stored in roof thatch in the House-

TABLE 14.1. Chipped Stone Artifacts in Systemic Contexts

FS No.	Artifact Type	Dimensions (cm)	Condition/Wear	Location	Context	Comments
1A2	andesite flake		heavy abrasion	Str. 1	floor	ceramic smoother
1-35	obsidian			Str. 1	roof	
1-43	pr. bl., proximal	7.9 × 1 × 0.3	pos. for deer protein	Str. 1	roof	
1-53	obsidian			Str. 1	roof	
1-71a	pr. bl., whole	c. 8	unused	Str. 6	roof	
1-71b	pr. bl., whole	c. 8	unused	Str. 6	roof	
1-71c	pr. bl., whole	c. 8	unused	Str. 6	roof	
1-71d	pr. bl., whole	c. 8	unused	Str. 6	roof	
1-83	pr. bl.	c. 4	edges nicked	Str. 6	roof	
1-101	scraper?	5.4 × 3.5 × 1.8	heavily used	Str. 6	roof	roughly shaped
1-110	pr. bl., proximal	6 × 1.1 × 0.3	1 edge mod. use	Str. 6	roof	other edge pristine
1-119	scraper		much wear	Str. 6	floor, post	well shaped, often reshaped
1-127	pr. bl., proximal	4.9 × 1.2 × 0.3		Str. 6	roof	
1-140	macroblade, distal	6.8 × 3.6 × 0.8	heavy use	Str. 6		
1-205	pr. bl.	3.5 × 1.1 × 0.3	used, notched	Str. 1	fill	tinkler? disc.?
1-231	scraper	7.0 × 4.2 × 1.3	heavy use	Str. 11	roof	41.3 g; in thatch
1-233	pr. bl., whole	6.4 × 1.6 × 0.3	no use, lt. dmg.	Str. 11	roof	deer protein, edge
2-32	pr. bl., medial	3.1 × 1.6 × 0.3	mod. use	Str. 2	roof?	stratig. elevated
2-53	pr. bl., whole	12 × 1.6 × 0.3	few use nicks	Str. 2	roof	pristine condition
2-54	pr. bl., proximal	5.1 × 1.6 × 0.3	mod. use	Str. 2	roof	step fr. recovery
2-58	macroblade	14.7 × 4.2 × 1	lt. use	Str. 2	roof	stemmed
2-67	side scraper	3.6 × 3.1 × 1.1	no use evident	Str. 2	column	roughly shaped
2-69	pr. bl., distal	small	lt.-mod. use	Str. 2	fallen	poss. on column
2-133	pr. bl., medial	4.7 × 1.1 × 0.3	scraper retouch	Str. 7	roof	ends straight
2-134	pr. bl., distal	4.6 × 1.4 × 0.3	lt. use, few nicks	Str. 7	roof	almost pristine
2-272a	pr. bl., whole	12.3 × 1.6 × 0.3	no use, lt. dmg.	Str. 7	roof	almost pristine
2-272b	pr. bl., medial	6.8 × 1.9 × 0.2	no use, lt. dmg.	Str. 7	roof	almost pristine
2-272c	pr. bl., medial	1.4 × 1.3 × 0.3	no use	Str. 7	roof	edges pristine
2-288	macroblade	8.6 × 5.5 × 1.5	heavy use	Str. 7	roof	proximal, medial
2-300	pr. bl., whole	7.7 × 1.4 × 0.3	lt. use, snapped	Str. 7	roof	broke in fall
2-304	pr. bl., distal	3.1 × 1.7 × 0.2	no use	Str. 7	roof	edges pristine
2-313	pr. bl., medial	4.2 × 1.2 × 0.3	lt. use	Str. 7	roof	2.3 g
2-337	macroblade	5.7 × 5.2 × 1.7	heavy use	Str. 7	roof	proximal, 47.7 g, heat dmg.
2-340	pr. bl., medial	2.2 × 1.4 × 0.2	lt. use	Str. 7	roof	fits -341
2-341	pr. bl., medial	2.3 × 1.4 × 0.2	lt. use	Str. 7	roof	fits -340
4-141	pr. bl., medial	8.5 × 1.5 × 0.3	no use seen	Str. 4	roof	4 g, pristine
4-142	pr. bl., medial	10.1 × 1.4 × 0.2	no use, snapped	Str. 4	roof	5.5 g, was in thatch
4-159	macroblade	5.5 × 2.9 × 1.3	lt. use, 16.9 g	Str. 4	roof	proximal
4-162	pr. bl., proximal	8.8 × 1.4 × 0.2	use none to max.	Str. 4	roof	almost whole, 3.4 g
4-198	macroblade	3.6 × 2.6 × 0.6	lt. use	Str. 4	roof	medial, fits -159
4-286	pr. bl., proximal	11.5 × 1.4 × 0.3	no use seen	Str. 4	roof	5.3 g, almost new
4-287	pr. bl., medial	3.9 × 1.1 × 0.3	lt. use, broken	Str. 4	roof	broke in fall
4-288	pr. bl., medial	1.8 × 1.2 × 0.3; 1.1 g	no use seen	Str. 4	roof	broke in fall
4-289	pr. bl., proximal	1.0 × 0.8 × 0.3	lt. edge flaking	Str. 4	roof	
5-14	pr. bl., whole	6.5 × 1.4 × 0.4	heavy use	Str. 12	fallen	was on N wall top
5-38	pr. bl., medial	3.2 × 2.0 × 0.3	heavy use, dmg.	Str. 12	fallen	column top or beam
5-41	macroblade	20.2 × 6.0 × 2.5	heavy use, ret.	Str. 12	fallen	retouched, complete
5-46	pr. bl., proximal	3.9 × 1.6 × 0.4	mod. use, ret.	Str. 12	fallen	broke in fall
7-126	pr. bl., proximal	5.2 × 0.8 × 0.3	heavy use	Str. 13	roof	
7-346	pr. bl., medial	5.1 × 1.2 × 0.2	slight use	Str. 16	roof	
7-2125	2 pieces obsidian			Str. 13	roof	from Pit-38
8-81	small macroblade	7.8 × 3.5 × 0.8; 14 g	heavy edge dmg.	Str. 10	in floor	built into floor
8-84	jasper core, hs.	6 × 4; 153 g	was flake core	Str. 10	N floor	last use: hs.
8-158	pr. bl., proximal	6.6 × 1.8 × 0.3	lt. use	Str. 10	fallen	4 g, wall top prob.
8-177	pr. bl., medial	6.3 × 1.9 × 0.3	mod. use	Str. 10	fallen	stored with -178
8-178	pr. bl., proximal	5.9 × 1.2 × 0.2	mod. use, dmg.	Str. 10	fallen	dmg. in fall, with -177
8-450	pr. bl., proximal	5.1 × 1.2 × 0.3	no use seen	Str. 10	fallen	on beam or wall top
8-451	pr. bl., distal	7.3 × 1.5 × 0.4	well used, dmg.	Str. 10	wall top	pos. for human Hb
8-498	pr. bl., fragment	c. 8 × 1 × 0.3	lt. use	Str. 10	wall top	edges good cond.
8-499	pr. bl., proximal	9.4 × 1.5 × 0.4	no use seen	Str. 10	fallen	beam or wall top
8-624	pr. bl., proximal	6.0 × 1.5 × 0.4	heavy use	Str. 10	roof/wall	fits -625
8-625	pr. bl., medial	3.1 × 1.5 × 0.4	heavy use	Str. 10	roof/wall	fits -624

ABBREVIATIONS: cond. = condition; disc. = discarded; dmg. = damage(d); fr. = fracture; Hb = hemoglobin; hs. = hammerstone; lt. = light; max. = maximum; mod. = moderate; prob. = probably; pos. = positive; poss. = possibly; pr. bl. = prismatic blade; ret. = retouched; stratig. = stratigraphically.

FIGURE 14.1. Obsidian implements in everyday use in Household 2. Three prismatic blades (proximal portion, distal portion, and complete blade) and one macroblade. FS 295-2-54, FS 134, FS 53, and FS 58. Scale in centimeters. *Photograph by Payson Sheets.*

FIGURE 14.2. Bundle of complete and unused obsidian prismatic blades from Household 1. They were cached high in the thatched roof of the storehouse, Structure 6, for future use. FS 295-1-71a, b, c, and d. Scale in centimeters. *Photograph by Payson Sheets.*

hold 1 kitchen, where the blade presumably was used to cut up deer meat for food. The other blade testing positive for deer was in the same household's domicile, where the blade probably was used in craft activities such as cutting deer hide or gut for sinew. This may be further evidence of the service relationship between Household 1 and the religious buildings; the latter had many deer items evidently used for supernatural purposes. The two blades testing positive for dog protein had been discarded in the Household 1 patio area. They presumably had been used for cutting up dogs for food. The blade testing positive for human protein had been stored on the high shelf or nearby wall top in Structure 10, the religious association, and likely had been used in human bloodletting rituals.

Prismatic blades, the principal cutting implement at Cerén, were consistently stored in roofing thatch in households but never in thatch in nonhousehold buildings. For example, the blades in Structure 10 were stored on the high shelf, on a wall top, and on a roof beam. I believe the reason for the difference is that a household blade would have been used by one or possibly two people, and thus could have been stored in thatch with only a tiny proximal portion of the blade showing, specifically where their users were accustomed to storing them. Elevated storage was still needed for blades in Structure 10. Presumably, many different people could have used blades in that building, and elevated open storage was preferable to storage in thatch. Storage of blades in thatch in this kind of building could have resulted in a lot of rummaging around looking for a blade and people cutting themselves in so doing. However, that brings up the question of why elevated open storage was not used in households, to which all I can suggest is that the risk of someone inadvertently damaging a blade by placing a ceramic pot or donut stone on it was avoided by using thatch for storage.

The placement of blades in Structure 12, where we believe a female shaman practiced, was similar to that in Structure 10. Blades were placed in elevated locations in plain view on wall tops, on column tops, and on top of the lintel over the doorway. However, the nature of the blades in the two structures differs markedly. The three prismatic blades placed on the lintel or nearby were not in usable condition due to previous heavy use, which had resulted in considerable edge damage, and the shortness of the blade segments. One had been discarded and suffered even more edge damage and patination from exposure on the ground surface prior to its being taken to the building. The macroblade was complete, but its edges were quite dulled by heavy use; it was placed on the lintel as well. Because they may have been offerings brought to the shaman or payments for services, the value of the prismatic blades might have been symbolic—they certainly had little intrinsic or practical value. More probably, they may have been cuentecitos (objects picked up by the shaman for their supernatural association) (Linda Brown, personal communication 1997). It is common for a diviner to pick up something from a locality of supernatural power or a particular experience and keep it as part of their divinatory tool kit. The macroblade retained considerable practical value, as it could have been resharpened, but it may also have had symbolic significance in this context.

Only a few nonobsidian chipped stone artifacts have been found at Cerén. A flake core of jasper that later had been used as a hammerstone was found in Structure 10, but no evidence of removing flakes from this core has been found at the site. It is possible that it may have served as a core at some other site. We don't even know if it was converted into a hammerstone at Cerén, only its final deposition. A small andesite flake, found in the front room of Household 1's domicile, has been interpreted as a pottery smoother, as a part of a small-scale ceramic manufacturing area (Sheets 1983).

Obsidian has been found in three kinds of discard locations: as a highly dispersed scatter of artifacts in agricultural fields, on the peripheries of household lots, and in a midden. The obsidian prismatic blade fragments discarded in fields and house lots are morphologically similar to blades found at most Mesoamerican sites. They are short, generally 1.5 to 3 cm in length, and thus are too short to be handheld effectively. And they have thoroughly rounded edges that resulted principally from postdiscard edge damage—from trampling in an active agricultural zone, patio maintenance, or other activities. The postdiscard edge damage is so great in most cases that it is not possible to determine what their specific edge conditions were when they were discarded and thus study use wear. Many became quite patinated after discard, presumably by prolonged surface exposure, deposition of salts from groundwater, and sun-baking. As Tucker (1995) noted, the blades discarded in Cerén house lots and fields average well under one discarded prismatic blade per square meter of exposed Classic Period surface. Thus, compared to ceramics, discarded obsidian blades were rare in high-activity areas within the village. This probably is because people recognized the danger of a sharp segment discarded nearby and therefore discarded them in low-traffic locations.

The other discard context is the midden to the southwest of the sauna in Operation 2. Nine of the thirteen chipped stone artifacts recovered from the midden in 1991 were prismatic blade fragments. They are similar to the prismatic blades discarded into fields in that most are between 1.5 and 3 cm long. However, they differ markedly from those discarded in the fields in that most of them retain very sharp edges. It appears that the predominant reason for discarding these artifacts in the midden is that the blades broke during use, leaving distal segments that were still quite sharp but too short to hold effectively. It is possible that their sharpness was a reason not to discard them into a house lot or a milpa, as that could have inadvertently cut someone. Thus, they may have been deliberately brought to the midden because it was considered a safe disposal area. If true, this suggests that Cerenians may have been making discard choices about prismatic blades based on the condition of their edges, thus assessing risk relative to anticipated human behavior. Unfortunately, the unknown component to this interpretation is the specific wear condition of the blades discarded in house lots and gardens at the time of discard.

Most archaeologists, myself included, would have expected most blades to have been discarded because they had been dulled so much by use that they were no longer serviceable. That expectation may, at least in part, derive from the considerable efforts archaeologists have put into lithic microwear studies during the past three decades, which has generated a heightened sensitivity to the nature, causes, and variations of edge attrition.

In addition to prismatic blades, the other lithic artifacts in the midden included a complete and a fragmentary obsidian percussion blade, an andesite flake probably from shaping a laja (stone slab), and a tiny, unclassified fragment of obsidian.

Summary and Conclusions

Each Cerén household contained a relatively standard set of at least a half-dozen prismatic blades in everyday use and a few unused blades stored for future use. The blades in everyday use were kept in specific locations in roofing thatch, above doorways or in corners, where they could be reached by one or two members of the household. This is a household example of restricted knowledge. The pristine blades were stored in a bundle in roofing thatch in a less accessible location. Blades snapping into small segments too short to handle seems to have led to discard more often than did heavy use wear that inhibited their cutting utility. It is possible that efforts were made to deposit short, sharp blades in safe locations such as the midden, but the relative sharpness of blades when they were discarded around households is unknown. In addition to the prismatic blades, each household had at least one macroblade and scraper. As noted elsewhere in this volume, each household apparently overproduced at least one commodity for use in exchanges, and the obsidian implements coming into households were a result of those exchanges.

In terms of their manufacture, the prismatic blades and macroblade from the religious buildings did not differ significantly from those in household buildings, as one would expect if manufacture were done at a larger settlement. Thus, their morphology does not assist us in understanding their use. However, they differed markedly in their storage, their contexts, and apparently in their uses. No obsidian implement in either of the religious buildings was stored in roofing thatch; rather, they were given high open storage on a shelf, on wall tops, on column tops, and possibly on roof beams. The blades in Structure 10 retained quite sharp edges, and their open elevated storage rendered them accessible to a large number of potential users for cutting purposes while somewhat protecting them from inadvertent damage. One blade was probably used for human bloodletting, as human hemoglobin was discovered along its edge (Newman 1993). The blades in Structure 12 were unlikely to have been used as offerings or payments for divination services, as they were edge-damaged beyond reasonable use. More probably, they were cuentecitos collected by the diviner and used as part of a supernatural tool kit.

Groundstone Artifacts in the Cerén Village

Payson Sheets

Introduction

The term *groundstone* is used here in the broad sense (e.g. Hummer 1983; Sheets 1978, 1992b) to include artifacts made for grinding (e.g., manos, metates, and donut stones), polishing, and smoothing, as well as those for which grinding was used in their manufacture (e.g., celts, beads). Also included here are the hammerstones that were used in their manufacture. Thus a wider range of forms, functions, and materials is considered here than in the chipped stone chapter (Chapter 14). A total of seventy-three groundstone artifacts have been found to date in systemic contexts at Cerén. As with the chipped stone, there seems to be a standard set of groundstone tools in each household, consisting of a jade ax, mano and metate, some donut stones, a few lajas (naturally flat fracturing slabs of dense andesite), and some smoothing or abrading stones. It is striking how differentially distributed groundstone artifacts are within the site; more than half of them were found in Household 1, simply because they were being made there.

The Groundstone Artifacts

Groundstone artifacts are here summarized in two ways, first by looking at the basic set that each household contained (with the caveat of a very small sample), and then by examining how households differed and how those differences are interpreted.

A sufficient number of household buildings have been excavated to at least begin to perceive a standard household set of groundstone implements. Each household had a jade or hard greenstone ax, a mano and metate, a few laja utility grinding or pounding stones, and a few donut stones and miscellaneous abrading/smoothing stones. The donut stones functioned as digging-stick weights and perforated mortars, and may have had other uses that are as yet unknown. Two of the household axes were stored elevated in the south ends of storehouses, probably on roof beams. The other ax was stored elevated at the south end of the kitchen in Household 2, which happened to be renovating its storehouse when the eruption struck. It is possible that its usual storage location was the storehouse when that building was not under renovation. The axes apparently were used unhafted, as no evidence of handles has been discovered and no haft wear has been noted to date. Because of the distance to the source of jade, and particularly because of the large amount of skilled labor in manufacture, an ax must have been the most expensive thing a Cerén household would have had to obtain by exchange; the material presumably derived from the Sierra de las Minas area of the middle Motagua River, 140 km northwest of Cerén. The sandstone whetstone in Household 2 probably was used for celt sharpening within that domestic group, but presumably they would have needed an abrasive such as crushed crystalline quartz. This household may have resharpened axes of other households, as the whetstone is the only one found to date at the site. If this speculation is correct, it identifies a service relationship of Household 2 to nearby households. The remainder of the standard groundstone package for

TABLE 15.1. Groundstone Artifacts in Systemic Contexts

FS No.	*Item*	*Dimensions (cm)*	*Comments*	*Location*	*Context*
1-39	min. metate	5 × 3.3 × 2.6	for grinding hematite	Str. 1	in vessel 7, floor
1-56	hammerstone		heavily used	Str. 1, Area 3	floor bet. 2 lajas
1-78	hammerstone		mod. use, pot rest	Str. 6	in Pot 14
1-80	hammerstone		used, pot rest	Str. 6	floor near Pot 14
1-84	metate	55.2 × 30.5 × 17.4	mod. use	Str. 6	on horquetas
1-86	hammerstone		used	Str. 6	on wood
1-104	mano		matches 1-84	Str. 6	floor
1-105	hammerstone		used	Str. 6	floor
1-106	hammerstone		used	Str. 6	floor
1-107	mano	short	one-handed	Str. 6	floor
1-108	hammerstone		used	Str. 6	floor
1-109	mano frag.		use as pot rest	Str. 6	floor
1-111	hammerstone		was shaped laja	Str. 6	floor; broke, then hs.
1-113	donut stone	16.4 × 14.6 × 7.4	no use-wear, mortar	Str. 6	floor
1-114	pumice		abrader	Str. 6	floor
1-115	metate frag.	30 × 12.5	use as pot rest	Str. 6	floor
1-116	metate frag.	almost whole	use as pot rest	Str. 6	floor
1-122	donut stone		undecorated, mod. use-wear, mortar	Str. 6	floor
1-123	donut stone		undecorated, well used, mortar	Str. 6	floor
1-132	metate		light use	Str. 1	on horquetas
1-134	metate frag.		used as pot rest	Str. 6	floor
1-137	metate frag.		used as pot rest	Str. 6	floor
1-202	polish stone	12 × 10 × 4.9	hard greenstone	Str. 1, Area 5	floor, much used
1-211	metate frag.	29 × 23 × 12	broken	Str. 6	floor, pot rest
1-212	donut stone	16 × 8.5	used, broken	Str. 6	floor; was mortar
1-214	metate	54 × 39.5 × 19.6	upside down	Strs. 1–6	unmounted, used
1-235	donut stone	15.5 × 9.9	grooved, decorated	Str. 11	floor
1-236	donut stone	20.1 × 7.9	unfinished, decorated	Str. 11	floor
1-241	metate	55.5 × 35 × 20	slight use	Str. 11	on horquetas
1-242	mano	12 × 10 × 9	one-handed	Str. 11	floor
1-265	metate	58 × 36 × 16	heavily used, matches -266	Str. 11	floor near hearth
1-266	mano	25.4 × 7.2 × 6.6	used, matches -265	Str. 11	resting on metate
1-284	celt	7.3 × 3.8 × 1.5	well made	Str. 11	on shelf/table
1-300	small mano	11.1 × 8.5 × 4.6	slight use	Str. 11	roof beam
1A13a	maul	12.6 × 7.7 × 5.2	lt. use, grooved	Str. 1	bench
1A13b	donut stone	13 × 10.5 × 4.4	on digging stick	Str. 1	against wall
1A17b	polisher	9.6 × 6.4 × 4.3	quite polished	Str. 1	Area 5, fallen
2-34	donut stone	12.4 × 11.9 × 6	decorated	Str. 2	west wall top
2-39	whetstone		siltstone, used	Str. 2	west wall top
2-57	hammerstone	small	lt. use	Str. 2	on bench
2-74	donut stone	7.1 × 13.6	with wooden pestle	Str. 2	west wall top
2-86	donut stone	medium	lt. use	Str. 3	west wall top
2-216	jade bead	1.6 × 1.4 × 1.2	highly polished	Str. 2	in bag, high back wall
2-217	jade bead	1.4 × 0.9	highly polished	Str. 7	in bag, high back wall
2-218	jade bead	1.5 × 0.9	highly polished	Str. 7	in bag, high back wall
2-223	jade bead	1.4 × 0.9	highly polished	Str. 7	in bag, high back wall
2-224	jade bead	1.8 × 1.7	highly polished	Str. 7	in bag, high back wall
2-225	jade bead	1.5 × 1.7	highly polished	Str. 7	in bag, high back wall
2-227	stone bead	1.6 × 0.4	gray, well polished	Str. 7	in bag, high back wall
2-290	mano	17.5 × 8.5 × 4.6	used, match?	Str. 7	west wall top
2-291	small mano	11 × 9.5 × 5	used, also as hs.	Str. 7	west wall top
2-299	celt	8.4 × 4.0 × 2.2	well-shaped jade	Str. 7	beam
2-358	jade bead	1.5 × 1.1	highly polished	Str. 7	in bag, high back wall
3-21	donut stone	large	with wooden pole	Str. 3	floor, back room
3-35	donut stone	small	mod. use-wear	Str. 3	porch
3-36	large shaped stone		corners rounded	Str. 3	west wall top
4-112	celt	12.2 × 4.8 × 3.2	jade, well shaped	Str. 4	beam or wall top
4-220	metate	63.5 × 39 × 14.4	on horquetas	Str. 4	under NW corner

TABLE 15.1. Continued

FS No.	*Item*	*Dimensions (cm)*	*Comments*	*Location*	*Context*
5-5	small mano	12.2 × 10.2 × 6	also as hammerstone	Str. 12	in vert. niche, E room
5-13	large mano	27.5 × 9.3 × 7	mod. use	Str. 12	east wall top
5-29	metate	49 × 33 × 16	lt. use	Str. 12	leaning-platform
5-40	stone disk	3.3 × 3.0 × 1.0	hard greenstone	Str. 12	on lintel of entry
5-50	mano	23.1 × 9.9 × 8.0	well shaped, lt. use	Str. 12	on Column 8
7-no#	metate		yet unlifted	Str. 16	elevated on rocks
8-47	donut stone	16.7 × 11	lt. use, decorated	Str. 10	prob. NE column
8-49	donut stone	18.8 × 8	irreg. shape, used	Str. 10	prob. NE column
8-51	donut stone	14.5 × 9.9	well shaped, used	Str. 10	prob. NE column
8-83	mano	18 × 8.5 × 5	well shaped, short	Str. 10	north wall top
8-502	celt, jade	6.2 × 2.1 × 1.5	well shaped	Str. 10	prob. roof beam
8-616	pot rest	20.1 × 8.8 × 4.9	was hammerstone	Str. 10	floor, east room

ABBREVIATIONS: bet. = between; frag. = fragment; hs. = hammerstone; irreg. = irregular; lt. = light; min. = miniature; mod. = moderate; prob. = probably.

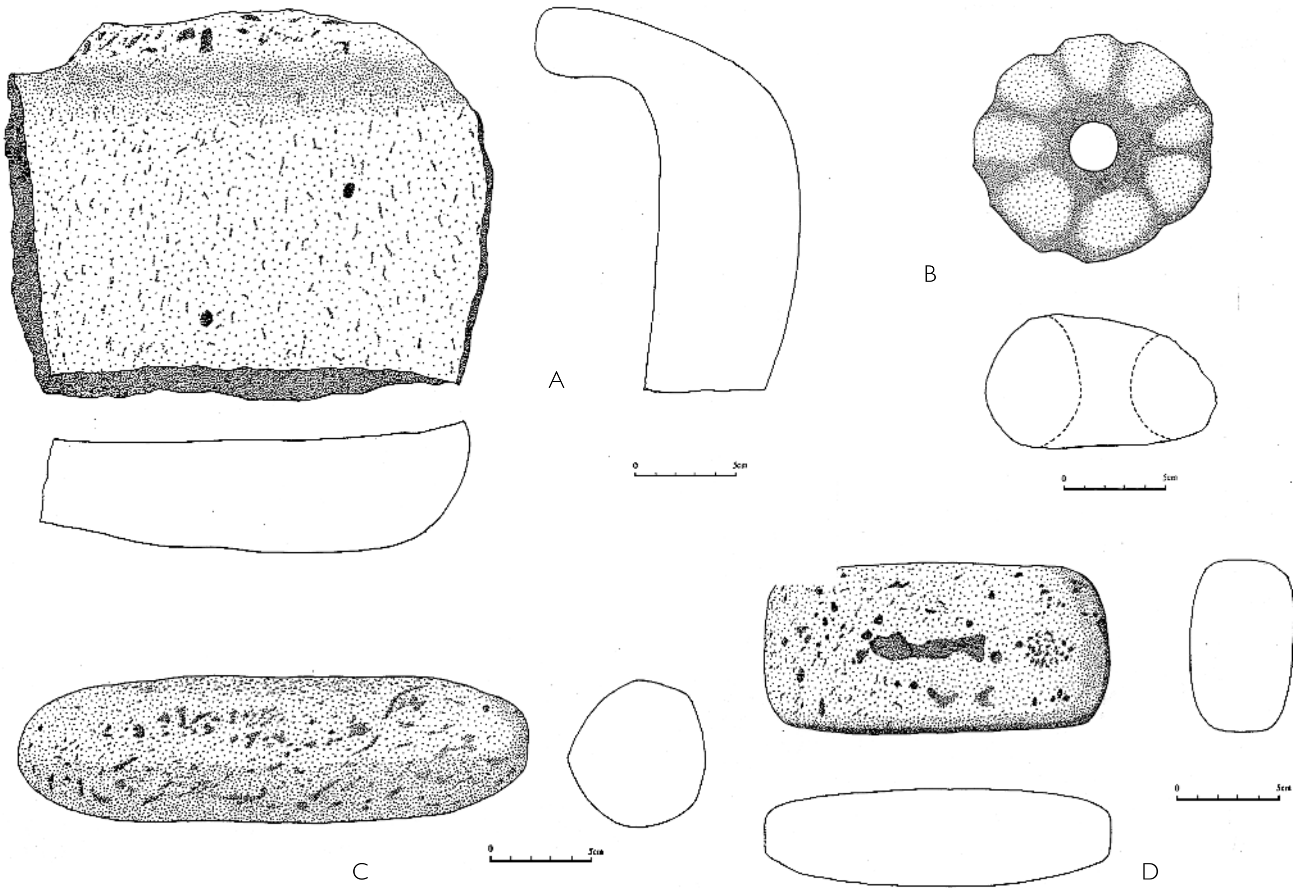


FIGURE 15.1. Groundstone artifacts from the Cerén site. (a) Metate fragment from Structure 6 of Household 1, the storehouse, FS 295-1-137. (b) Grooved donut stone from Structure 1, the domicile for Household 2, FS 295-2-34. (c) Mano found resting on top of well-used metate on floor of kitchen, Structure 11, Household 1, FS 295-1-266. (d) Mano from storehouse of Household 2 (Structure 7), stored on top of west wall, FS 295-2-290.

the household, consisting of donut stones and a mano and metate set, probably was obtained from a nearby household that specialized in their manufacture, likely Household 1. The various smoothing stones, probably for finishing earthen floors and walls, could easily have been obtained from river gravels by individual household members. The final item of the standard household package consists of a few lajas, some with percussion flaking to shape the edge and some with evidence that they were used as portable grinding stones, probably for a variety of materials. Various laja sources were available in the Zapotitán Valley within a 20 km radius of the site, so direct procurement, localized exchanges, and markets were all possible ways to obtain lajas. In Household 4, lajas may have been used to soften agave leaves before depulping.

Household 1 was almost swamped by groundstone artifacts; with forty it had more groundstone artifacts than the rest of the site altogether. Perhaps that is not surprising, if our inference is correct that Household 1 was manufacturing groundstone implements, specifically donut stones and manos and metates. Fully 77% of the hammerstones at the site (10 out of 13) were in this household, and apparently they were used in shaping vesicular andesite, the predominant material for manos, metates, and donut stones. (Table 15.1 lists 7 of 9 hammerstones as being from the storehouse [Structure 6] of this household, but it only mentions the single most extensive use of each artifact, and 10 of 13 is more accurate.) Most hammerstones were stored in the storehouse, and were also functioning as round-bottomed ceramic vessel supports at the moment of the eruption. Groundstone manufacture may have been seasonal, primarily during the dry season, when agriculture demanded less time and effort.

The metate with the most use by far in Household 1 was the one on the floor of the kitchen, adjacent to the hearth and immediately adjacent to the vessel with maize kernels soaking, presumably overnight so they could be ground into masa (dough) the next day. The metates mounted on horquetas (forked sticks) were used much less, as evidenced by the same amount of slight use wear on each; it is likely they were used only episodically, when needed to supply masa to the celebrants at Structure 10.

Household 1's count of eight donut stones is well ahead of any other household's, and the fact that one donut stone had been perforated but that shaping had not been completed is additional evidence that manufacture was done within the household.

FIGURE 15.2. Metate that was elevated on horquetas in the kitchen of Household 1, with matching mano. Metate is FS 295-1-84 and mano is -104, both from inside Structure 11. Scale in centimeters.

One undecorated donut stone clearly was a digging stick weight, as it was mounted on the stick that was stored leaning against the east wall of Structure 1. At least two others evidently were perforated mortars, as evidenced by thick organic residues that could be ground nuts, as well as by asymmetric wear. The function of the large decorated donut stone from the floor of the northern room of Structure 1 is unknown. Thus, donut stones had at least three distinct functions in Cerén, two of which are known. The large decorated donut stones, often found on porches, had functions that are as yet unknown.

A four-legged miniature metate was stored in a ceramic vessel in the inner room of Structure 1, along with two hematite cylinders, a spindle whorl, and a shell. The vessel and its contents probably belonged to a woman. The miniature metate had been used to grind hematite in its final preparation for use as a pigment. The hematite cylinder presumably was rubbed directly onto the tiny metate, and the metate top retains considerable pigment. The small vessel with its contents is one of a number of items that one might expect to have been stored in the storehouse, but in fact an unusual number of small valuable items were found in Household 1's domicile and kitchen. These include the above-mentioned vessel contents, a jade ax, a grooved maul, other hematite cylinders, and other items that probably were moved out of the storehouse until all walls could be mudded again. The eruption thus caught the household at an unusual moment, when things were not in their usual places. That is, although the eruption provided a snapshot aspect to the Cerén inventory, we must recognize that it captured artifacts in unusual as well as usual loci of storage and use.

Other Household 1 groundstone artifacts include six polishing-finishing stones made of stones ranging from andesite to pumice that generally were stored within the structures. They probably were used for smoothing earthen floors and walls and for final smoothing of groundstone implements. Three metate fragments were kept in the storehouse, one of which was employed as a pot rest. A maul perhaps used for leather-working and two lajas used as portable grinding stones complete the Household 1 groundstone inventory.

Household 2 at first glance seems anomalous because it does not have a metate, but when its kitchen is excavated it presumably will have one. It did have a mano in the storehouse, as well as a hammerstone that previously had been a mano. That hammerstone, along with the other hammerstone, likely were used occasionally for roughening the household's grinding stones. The occupants also owned three donut stones, including a large one nicely decorated with grooves. The other two had notable organic incrustations and asymmetric wear, and probably were used as perforated mortars. A jade ax was stored in an elevated context at the back end of the storehouse, on a roof beam or possibly on the wall top. Near the ax was a set of seven jade beads and a bead of a dark gray, unidentified stone, all presumably parts of a necklace. The beads were shaped very well and were highly polished. Two were drilled from both sides with a drill that left almost parallel sides, while the other five were drilled biconically. They had been stored with five miniature ceramic paint pots in some kind of organic bag either suspended from a rafter or resting on top of it. Each of the paint pots contained a different hue of cinnabar. These paint pots and jade beads must have been quite costly to obtain, and the fact that they were left behind indicates the haste with which the site was abandoned when Loma Caldera began to erupt. Finally, the household had six lajas, two with wear on the surface and some with evidence of edge shaping. In summary, then, Household 2 had the standard household set of groundstone tools, along with a set of seven fine jade beads. The artifacts and architecture indicate that Household 2 was more affluent than Household 1.

Structure 4, the storehouse of Household 4, had only two groundstone artifacts. A metate was mounted on horquetas under the eve of the roof, outside the northwest corner of the walls. Although it may have been used for maize grinding at times, an analysis of the organic residue from its grinding surface found cottonseed fragments. Cotton seeds were ground for oil, probably to be used in food processing. Cotton seeds were found stored in a ceramic vessel within the building. The only other groundstone artifact was a large jade ax stored in an elevated context (wall top or on a roof beam) at the south end of the building.

Shifting to a public building, Structure 3 contained three groundstone artifacts. A well-shaped donut stone was resting on the porch by the front entrance. Another donut stone was in the back room, found resting on its side, probably because it was mounted on a stick. In addition, a large rounded stone was kept on top of the back wall of the building. Its function is unknown, and its storage location seems hazardous.

The two religious buildings were relatively well endowed with groundstone artifacts. Structure 10 had seven, of which six were in elevated storage or use locations. A mano was found on the floor, and it likely was used with the nearby metate on horquetas that was just inside the northeast corner of the enclosure wall. They probably were used for maize grinding to feed participants in ceremonial performances. Near them, and in elevated stor-

FIGURE 15.3. Biconically perforated stones, called donut stones, evidently used as perforated mortars. Note organic incrustations. Both from Household 2. FS 295-2-86 and -34. Scale in centimeters.

age, were a moderately used hammerstone and a slightly used greenstone ax. If archaeologists are correct that stone axes were used for woodworking, one wonders why one would be in a religious building. Perhaps it had served some utilitarian function in working wood, or it could have had symbolic value in a ceremony. Finally, three donut stones were stored on roof beams over the food-processing enclosure room. They represent the full range in finishing, from one with fine-groove decoration, one plain, and one roughly made. None appears to have been used as a mortar, so their function is unknown. Because this religious building had the standard household assemblage of groundstones (mano and metate, ax, and donut stones), Paul Cackler (personal communication 1996) suggests it could have possessed agricultural land, which was used to produce some of the food consumed during ceremonies. If true, the institution represented by the building and its contents had a more structured place in village life than had been considered before.

Structure 12 contained a number of groundstone artifacts, probably received as offerings for services. The largest is a metate, early in its use life, that had been removed from its place on a kitchen floor (evidence: organic-laden Ilopango tephra, which has only been found used as kitchen floors, was stuck to its bottom), and brought to the building. It was left leaning against the north wall. Three manos were also found in the building, but not close to the metate. One of the manos was placed on wood ash in a vertical niche, and the other two were on top of east walls. The final groundstone artifact was a small greenstone disk that was placed on top of the lintel over the doorway. It is a well-shaped disk and presumably had a considerable intrinsic value, but its original use is uncertain. It resembles sculptural inserts.

Summary and Conclusions

Each household had a basic groundstone tool kit, minimally consisting of a mano and metate for grinding maize, a hard greenstone ax for woodworking, and a few donut stones for digging-stick weights, mortars, and other uses. They also had a few lajas for various grinding-pounding purposes and an assortment of smoothing stones, largely for architectural purposes. Beyond that, the ways in which households differed in the groundstones they possessed have been instructive, as the differences are often representative of household specializations. Household 1 apparently made donut stones, manos, and metates, shaping them with their extensive array of hammerstones, and it is significant that they had more groundstone artifacts than the rest of the known site combined.

It is also instructive that, with only one exception, all structures have artifacts that clearly are components of functioning assemblages. Only Structure 12 has artifacts that do not work together as a functioning assemblage. The artifacts probably were left individually by different people at different times as offerings or payments for services, and some may have been collected by the diviner as a supernatural tool kit.

Most of the site's groundstone artifacts were made within the village, as exemplified by those of Household 1. Future excavations should determine if it is the only household specializing in groundstone toolmaking in the village. The only artifact owned by each household that came from a considerable distance is a jade ax.

All households had to overproduce some commodity to exchange for the groundstone artifacts that came from a distance, such as the hard greenstone and jade presumably from Guatemala's Sierra de las Minas region. The jade axes presumably would have been very expensive for each household. As a luxury or high status item, one household had a set of fine jade beads. And someone left a shaped, hard greenstone disk at the diviner's building.

Thus, to assemble the standard groundstone package, each household would have had to exchange moderate amounts of surplus agrarian or craft items for the mano, metate, and donut stones manufactured in a household within the village. Households probably obtained their own smoothing stones from river gravels. Lajas could have been obtained by households by directly visiting a valley source a few hours' walk away or by exchange. A household would have had to exchange considerable materials to obtain their ax, probably from a large site such as San Andrés or a secondary regional center. That they had a choice in selecting the source for their axes probably provided some empowerment to peasant families.

Household and Community Animal Use at Cerén

Linda A. Brown

Animals were among the resources exploited by Cerén inhabitants. Their utilization in household and community life was elucidated through a study of all modified and unmodified animal remains recovered from cultural contexts in excavations between 1978 and 1996 (Brown 1996). Not included in this study were animals incidentally caught in the eruption, such as mice in roofing thatch, toads in gardens, and birds asphyxiated by tephra.

Although the Cerén faunal assemblage is small (N = 96), the rich contextual data from this ancient village demonstrate that animal resources played a critical role in the domestic and ceremonial affairs of rural agriculturists. As will be discussed below, in addition to serving as a food source, animals provided a raw material source for tools, were used for personal adornment, and functioned in village ritual contexts.

Taxonomic Identifications

A total of ninety-six bone, antler, turtle-shell, snail, and marine-shell artifacts have been recovered from cultural contexts at the Cerén site to date (Table 16.1).[1] Vertebrate species identified from remains that reflect cultural processes include white-tailed deer (*Odocoileus virginianus*), domesticated dog (*Canis familiaris*), peccary (*Tayassu* sp.), duck (Anatidae), freshwater snail (*Pachychilus* sp.), mud turtle (*Kinosternon* sp.) and rodent (Rodentia). In addition to utilizing nearby animal resources, Cerén residents obtained marine shells, including spondylus (*Spondylus calcifer*), cowry (*Cypraea cervinetta*), and olive shell (*Oliva spicata* and *Oliva* sp.), from trade networks that extended to the Pacific Coast.

Distribution of Identified Species

DEER

The majority of faunal material recovered from Cerén are white-tailed deer. According to maximal and minimal methods[2] for calculating the minimum number of individuals (MNI) (Table 16.2), white-tailed deer constitute 50–55% of the animals identified. Additionally, white-tailed deer account for up to 28% of the total number of individual specimens preserved (NISP) at the site (Tables 16.3, 16.4).

The most common deer element present was antler (N = 3). All antlers showed evidence of modification or use, or both. Two naturally shed antlers, one recovered from Structure 4, a domestic storeroom, and the other recovered from the kitchen area of Structure 10, were highly polished. Preliminary interpretation based on artifact form, the location of use wear, and ethnographic analogy (e.g., Hayden and Cannon 1984; Vogt 1969) suggests that the antler stored in Structure 10 was probably a corn husker (tapiscador), while the pointed tool in Household 4 may have been used as an awl. The third antler, which was stored in a niche in Structure 12 and recovered in a ceremonial context (see Chapter 12), was not naturally shed, as portions of the cranial bone were still attached to the base. This piece consists of the left antler of an adult stag, and it was found associated with other unusual artifacts

TABLE 16.1. Frequency of Animal Remains Associated with Nondomestic Contexts, Households, and the Midden

	Nondomestic Structures				Domestic Structures			Midden
	Str. 10	*Str. 12*	*Str. 3*	*Str. 13*	*Hh. 1*	*Hh. 2*	*Hh. 4*	
Mammals								
White-tailed deer (*Odocoileus virginianus*)	4	1	0	0	1	0	2	0
Domesticated dog (*Canis familiaris*)	0	0	0	0	1	1	0	2
Peccary (*Tayassu* sp.).	0	0	0	0	0	2	0	0
Deer or peccary (Artiodactyla)	0	0	0	0	1	0	0	0
Rodent (unidentified)	0	0	0	0	0	0	0	1
Unidentified mammal	6	0	1	0	13+	6	3	8+
Total mammals	10	1	1	0	16	9	5	11
Reptiles								
Mud turtle (*Kinosternon* sp.)	0	0	0	2	0	0	0	0
Total reptiles	0	0	0	2	0	0	0	0
Birds								
Duck (Anatidae)	0	0	0	0	1	0	0	0
Unidentified bird	0	0	0	0	3	0	1	1+
Total birds	0	0	0	0	4	0	1	1
Mollusks								
Freshwater								
Pachychilus sp.	0	0	0	0	0	1	0	0
Marine								
Spondylus calcifer	0	0	0	0	0	1	0	0
Spondylus sp.	0	4+	0	0	0	0	0	0
Oliva spicata	0	4+	0	0	0	0	0	0
Oliva sp.	0	0	0	0	0	1	0	0
Cypraea cervinetta	0	0	0	0	0	1	0	0
Unidentified	0	0	1	0	2+	6+	0	0
Total mollusks	0	8	1	0	2	10	0	0

+ Includes additional small fragments thought to be either recent breaks or fragments of a counted piece.

TABLE 16.2. Vertebrate Minimum Number of Individuals (MNI) at the Cerén Site

	Maximal Method		*Minimal Method*	
Species	*N*	*%*	*N*	*%*
Anatidae (duck)	1	6	1	6
Canis familiaris (domesticated dog)	3	19	1	9
Kinosternon sp. (mud turtle)	1	6	1	6
Odocoileus virginianus (white-tailed deer)	8	50	6	55
Rodentia (large rodent)	2	13	1	9
Tayassu sp. (peccary)	1	6	1	6
Total vertebrates	16		11	

TABLE 16.3. Total Number of Individual Specimens Preserved (NISP) for Vertebrates at the Cerén Site (Including Unidentified Mammal Remains)

Taxon	*N*	*%*
Anatidae (duck)	1*	1.3
Artiodactyla (deer or peccary)	4+	5.3
Aves (birds)	5+	6.6
Canis familiaris (domesticated dog)	4	5.3
Kinosternon sp. (mud turtle)	2	2.6
Mammal (medium-sized)	9+	12.0
Mammal (large-sized)	27+	36.0
Mammal (unknown size)	11+	15.0
Odocoileus virginianus (white-tailed deer)	8	10.6
Rodentia	2	2.6
Tayassu sp. (peccary)	2	2.6
Total vertebrates	75	

* Complete articulated skeleton.
+ Plus small fragments thought to join with a counted piece.

TABLE 16.4. Total Number of Individual Specimens Preserved (NISP) at the Cerén Site (Unidentified Medium and Large Mammal Remains Removed)

Taxon	*N*	%
Anatidae (duck)	1*	3.6
Artiodactyla (deer or peccary)	4+	14.3
Aves (birds)	5+	17.8
Canis familiaris (domesticated dog)	4	14.3
Kinosternon sp. (mud turtle)	2	7.1
Odocoileus virginianus (white-tailed deer)	8	28.6
Rodentia	2	7.1
Tayassu sp. (peccary)	2	7.1
Total vertebrates	28	

* Complete articulated skeleton.
+ Plus small fragments thought to join with a counted piece.

that together may have formed a tool kit for a ritual practitioner (Brown and Sheets 1998). A linear series of small holes (1 mm diameter), possibly used for decorating the antler with feathers, had been drilled into the antler following the long axis of the main tine.

Another ceremonial deer artifact, a white-tail deer stag headdress, was recovered in Structure 10, where it fell from storage on a high shelf during the eruption (see Chapter 11). The headdress consisted of a complete cranium, minus the mandible, and originally was painted red, as patches of red still adhered to the outer bone surface (Fig. 11.3). Twine, presumably for fastening the headdress to a wearer, was recovered tied around the base of the antlers, while faint traces of blue (possibly paint) were noted on the right antler.

In addition to the headdress, two white-tailed deer scapulae, one from an adult and one from a juvenile, were recovered in Structure 10. The larger scapula displayed heavy use-wear along the edges and may have been used for scraping, while the juvenile scapula was notched, presumably for suspending it from something or someone. An unidentified white substance, perhaps the remains of white paint, adhered to the anterior and posterior sides of the blade.

Other deer remains were found in domestic contexts. Two deer leg elements, an adult left humerus and a left tibia from a subadult, were identified. The humerus was found on the original ground surface in the agave patch outside of Household 4, while the tibia was recovered from an elevated storage context in the kitchen of Household 1 (Structure 11). Carnivore gnaw marks on the tibia suggest that it had been picked up and curated after a carnivore, possibly one of the local dogs, had gnawed off one of the epiphyses and then discarded the bone.

DOGS

Dogs are the species with the second-highest minimum number of individuals (MNI) present at Cerén. One to three adult domesticated dogs (representing 9 to 19% of the MNI) are present. All individuals are represented by loose teeth recovered either from domestic contexts or the midden behind the sweat bath (Structure 9). Only one tooth, a dog canine, showed signs of cultural modification; it was biconically drilled though the root, presumably to be strung and worn as a necklace. Curiously, it was recovered in the midden—probably it had been lost, rather than intentionally discarded, as the tooth is whole and still in excellent condition. A dog carnassial (upper premolar) fell from an elevated context in the Household 2 storehouse (Structure 7), where it may have been being curated to be fashioned into a pendant at a later time.

The remaining two dog teeth were recovered from discard contexts at the site. One carnassial (lower molar) was recovered from the midden behind Structure 9, while a premolar tooth had been discarded on the ground just outside of the Household 1 kitchen.

OTHER MAMMALS

The two remaining mammals identified in the Cerén assemblage were a peccary (*Tayassu* sp.) and an unidentified large rodent (Rodentia). The peccary bones, a left tibia and a fibula, were badly burned by fires ignited during the eruption. Like the dog carnassial tooth, they were curated in an elevated context in the storehouse of Household 2 (Structure 7). The two loose incisor tooth fragments from a large rodent were recovered from discard contexts. One fragment was found behind the stone seats just outside of the sweat bath (Structure 9), while the other fragment was discarded in the midden directly behind Structure 9.

OTHER VERTEBRATES

In addition to the mammals, two other vertebrates were identified at Cerén: a duck (Anatidae) and a mud turtle (*Kinosternon* sp.). At the moment of the eruption, the duck was tethered to an interior wall of the Household 1 storeroom, as indicated by the presence of twine wrapped around one of the duck's legs and anchored to an exposed pole in the bajareque (mud-and-stick) wall. As the articulated skeleton was badly burned, the specimen was block-lifted to preserve its integrity and is enmeshed in an ash matrix, precluding a closer taxonomic assignment. However, it was identified as a domesticated duck by Edy Montalvo from the Universidad Nacional, and this was confirmed by biologist Zulma Ricord de Mendoza (Payson Sheets, personal communication 1995). Future excavation and consolidation of the remains in a controlled laboratory setting should stabilize the fragile remains, thereby allowing for closer taxonomic identification.

In addition to the duck, other bird remains were recovered at the site. Several long-bone fragments that were fashioned into beads fell from an elevated context in the Household 1 kitchen (Structure 11), while a bird long-bone needle was recovered from storage in the Household 4 storeroom (Structure 4). Meanwhile, an unmodified bird long-bone fragment was recovered in a discard context in the midden behind the sweat bath (Structure 9).

A complete carapace and plastron of a mud turtle were found in a test pit that exposed Structure 13, an unexcavated building that appears to be part of a civic complex, as it is situated on the same plaza as Structure 3. The turtle shell had fallen from elevated storage. As no associated skeletal material was recovered, the turtle shell may have been being stored for future use, or may have been used as a drum, as frequently reported in ethnohistoric and ethnographic accounts (e.g., Tozzer 1941, Vogt 1969).

FRESHWATER AND MARINE SHELLS

In addition to vertebrates, Cerén residents exploited freshwater and marine mollusks. The villagers may have harvested and consumed freshwater snails (*Pachychilus* sp.) from the nearby river, as suggested by one broken shell fragment of a jute (freshwater snail), cut at the tip and recovered in a discard context outside Household 2. Additionally, Cerén residents obtained tropical Pacific West Coast marine shells, including spondylus, cowry, and olive shell, probably from markets at the nearby San Andrés site (Table 16.5). The presence of spondylus shell, often considered a prestige item (Miller and Taube 1993), in a rural agricultural community is notable and indicates that acquisition of spondylus was not restricted to the elite on the Southeast Maya Periphery during the Classic Period. At Cerén, spondylus was recovered from both domestic and ceremonial contexts in the village. Thinly cut sections of the pink interior shell border were stored on column tops and above the door lintel of Structure 12, a building used for divination and other ritual activities. These items may have been placed there by the ritual practitioner or left as an offering or payment for services provided by the person who practiced there (Sheets and Sheets 1990; also see Chapter 12, this volume). Additional spondylus shell fragments were curated in the interior niche of Structure 12. As access into Structure 12 was controlled (see Chapter 12), presumably these items were placed there by the ritual practitioner, and they probably held special ceremonial significance as personal sacra.

TABLE 16.5. Identification and Total Number of Mollusks Recovered from the Cerén Site

Taxon	*N*	%
Marine		
Unidentified bivalve	6+	24
Cypraea cervinetta	1	4
Unidentified gastropod	4+	16
Oliva spicata	4+	16
Oliva sp.	1	4
Spondylus calcifer	1	4
Spondylus sp.	7	28
Freshwater		
Pachychilus sp.	1	4

+ Plus small fragments thought to join with a counted piece.

The only domestic context with spondylus shell present was Household 2. A complete *Spondylus calcifer* shell valve, with the center cut out, was stored in a niche in the sleeping bench of the domicile (Structure 2). In addition to spondylus, the Household 2 storeroom contained numerous shell artifacts, including a univalve and a cowry shell bead, a carved rosette, and three incised bivalve fragments. These shells, which fell from elevated storage during the eruption, were recovered in a deposit with jade beads and a carved bone figurine of a man wearing a loincloth and a large hat. Presumably, most of these items were part of a shell and jade necklace.

The Distribution of Animal Remains at Cerén

UNMODIFIED ANIMAL REMAINS

Household 1 contained the highest concentration of unmodified animal remains recovered at the site thus far (Table 16.6), suggesting that this household processed more meat than did other households excavated to date. While interpretations based solely on a numerical count are not reliable, given the limitations of the data set, the processing of deer and dog at Household 1 is supported by both faunal remains and the results of crossover immunoelectrophoresis conducted by Margaret Newman (1993: 183).

A sample of obsidian blades recovered from all site contexts was tested, and thus far only those from Household 1 have tested positive for any type of nonhuman animal protein. Two blades from storage contexts, one from a storeroom (Structure 6) and one from a kitchen (Structure 11), tested positive to Artiodactyla (deer or peccary) antiserum (Newman 1993). The recovery of a white-tailed deer left tibia from an elevated context in the kitchen, along with this blade, suggests that the Artiodactyla protein may be from deer, although peccary cannot be ruled out.

Animal remains were found outside, discarded on the original ground surface around the Household 1 kitchen (Structure 11). A single loose dog premolar tooth was found discarded on the ground in addition to bones which, due to the degree of fragmentation, could only be classified as medium-sized mammal. And two obsidian blades that tested positive for Canidae (dog, coyote, wolf, fox) protein (Newman 1993: 184) were recovered from a discard context in the Household 1 patio area.

Ethnohistoric data report that dog and deer were common sacrificial animals and often were consumed in the context of public feasts (e.g., Tozzer 1941). There is evidence that suggests that Household 1 members had a service relationship with community ceremonialism at Structure 10 (see Chapters 5, 11, 13). One aspect of this relationship may have included processing dog and deer meat for public feasting.

In addition to having dog and deer remains, Household 1 was the only household thus far to have a live animal tethered inside of a structure at the time of the eruption—the duck recovered from the storeroom (see above).

MODIFIED ANIMAL REMAINS

Forty-seven artifacts exhibit signs of cultural modification (Table 16.7). Bone artifact types identified in the Cerén assemblage include probable tapiscadores (corn huskers), awls, needles, tubular beads, curved and notched long-bone tools, an incised bone, bone and tooth pendants, shaped scapulae, a bone figurine, and a deer skull headdress. Modi-

TABLE 16.6. Frequency of Unmodified Animal Remains Associated with Nondomestic Structures, Households, and the Midden

	Nondomestic Structures				*Households*			*Midden*
	Str. 10	*Str. 12*	*Str. 3*	*Str. 13*	*Hh. 1*	*Hh. 2*	*Hh. 4*	
Mammals								
White-tailed deer (*Odocoileus virginianus*)	0	0	0	0	1	0	1	0
Domesticated dog (*Canis familiaris*)	0	0	0	0	1	1	0	1
Peccary (*Tayassu* sp.)	0	0	0	0	0	2	0	0
Rodent (unidentified)	0	0	0	0	0	0	0	1
Unidentified mammal	1	0	0	0	9+	2	0	6+
Total mammals	1	0	0	0	12	3	1	8
Reptiles								
Mud turtle (*Kinosternon* sp.)	0	0	0	2	0	0	0	0
Total reptiles	0	0	0	2	0	0	0	0
Birds								
Duck (Anatidae)	0	0	0	0	1	0	0	0
Unidentified bird	0	0	0	0	0	0	0	1+
Total birds	0	0	0	0	1	0	0	1
Marine shells								
Unidentified	0	0	1	0	2+	1	0	0
Total marine shells	0	0	1	0	2	1	0	0

+ Plus small fragments thought to join with a counted piece.

TABLE 16.7. Frequency of Modified Animal Remains Associated with Nondomestic Structures, Households, and the Midden

	Nondomestic Structures				*Households*			*Midden*
	Str. 10	*Str. 12*	*Str. 3*	*Str. 13*	*Hh. 1*	*Hh. 2*	*Hh. 4*	
Mammals								
White-tailed deer (*Odocoileus virginianus*)	4	1	0	0	0	0	1	0
Domesticated dog (*Canis familiaris*)	0	0	0	0	0	0	0	1
Peccary (*Tayassu* sp.)	0	0	0	0	0	0	0	
Unidentified mammal	5	0	1	0	4+	4	3	2
Total mammals	9	1	1	0	4	4	4	3
Birds								
Unidentified bird	0	0	0	0	3	0	1	0
Total birds	0	0	0	0	3	0	1	0
Mollusks								
Marine								
Spondylus calcifer	0	0	0	0	0	1	0	0
Spondylus sp.	0	6+	0	0	0	0	0	0
Oliva spicata	0	4+	0	0	0	0	0	0
Oliva sp.						1		
Cowry (*Cyraea cervinetta*)	0	0	0	0	0	1	0	0
Freshwater								
Pachychilus sp.						1		
Unidentified	0	0	0	0	0	5+	0	0
Total mollusks	0	10	0	0	0	9	0	0

+ Plus small fragments thought to join with a counted piece.

fied shell artifacts include incised painted bivalve shells, a cut spondylus valve, a carved rosette, univalve shell beads, and one fragment of a cut freshwater snail shell (Fig. 16.1).

When modified artifacts were examined in relationship to site context, some patterns were observed. For example, the Household 2 storeroom (Structure 7) contained the highest number of modified marine shells from any context. As mentioned earlier, a notable concentration of incised bivalve shells, shell beads, a small carved bone figurine, and jade beads were recovered in a deposit and probably were components of a necklace. In contrast to the number of artifacts for personal adornment recovered in the Household 2 storeroom, the Household 4 storeroom exclusively contained utilitarian bone and antler artifacts, including bone needles, a bone spatula and awls, and a pointed antler tool that may have been used as a tapiscador or as an awl, or as both.

Of the five probable tapiscadores identified, four were recovered in ceremonial or public contexts. The three found in Structure 10 may have been there temporarily, as the presence of food debris in open vessels suggests that the villagers had recently finished a ceremony and had yet to clean up (Payson Sheets, personal communication 1996). Perhaps some of the tapiscadores would have been returned to various households—in particular to Household 1, where none were recovered—during the days following the ceremony. The remaining tapiscador, along with a small bivalve fragment, was recovered in a civic context (Structure 3).

Modified animal remains found in the two ceremonial structures were notable. All faunal material recovered in Structure 10 was white-tailed deer or large mammal remains, and all artifacts but one were modified (Table 16.8). In contrast, the Structure 12 assemblage contains only one antler and instead is dominated by marine shells. For example, in addition to the thinly cut sections of spondylus shell, in Structure 12 four olive shell beads were being used as a tetrapod support for a jar similar to modern ones that hold a corn-based drink such as chicha (see Chapter 12).

White-tailed Deer and Community Ceremonialism

The distribution and type of deer artifacts recovered at Cerén suggest a link between white-tailed deer and village ceremonialism. All white-tailed deer artifacts for ceremonial use or personal adornment were recovered in the two specialized ceremonial buildings (Structures 10 and 12), suggesting that deer ceremonialism was restricted in the village. This distribution suggests that the display and use of deer ceremonial paraphernalia were associated with communal, rather than household, ritual contexts. If the white-tailed deer was a supernatural deity associated with the sun, agricultural fertility, and the changing of elite and village leadership positions, as suggested by Mary Pohl (1981), then perhaps the curation and use of deer artifacts may have been restricted to certain specialized contexts and appropriately sanctioned group members.

The presence of deer and dog faunal remains, and of Artiodactyla and Canidae protein on obsidian blades, in Household 1 suggests that animals were butchered in this area. Deer and dogs likely were being consumed in ceremonial feasting occurring at nearby Structure 10, located 5 m to the east of Household 1. It is not clear whether animals were being killed ritually, as an aspect of village ceremonialism, or not. However, the frequent reports of animal sacrifice in ethnohistoric accounts (Tozzer 1941) and modern ethnographic accounts (e.g., Vogt 1969), as well as depictions in Classic Period iconography (e.g., Pohl 1981), make this interpretation plausible.

Conclusions

Cerén residents exploited numerous animals, including white-tailed deer, dogs, peccaries, birds, rodents, mud turtles, freshwater snails, and marine shells, for food, personal adornment, and/or ritual use. Unmodified animal remains, mostly large

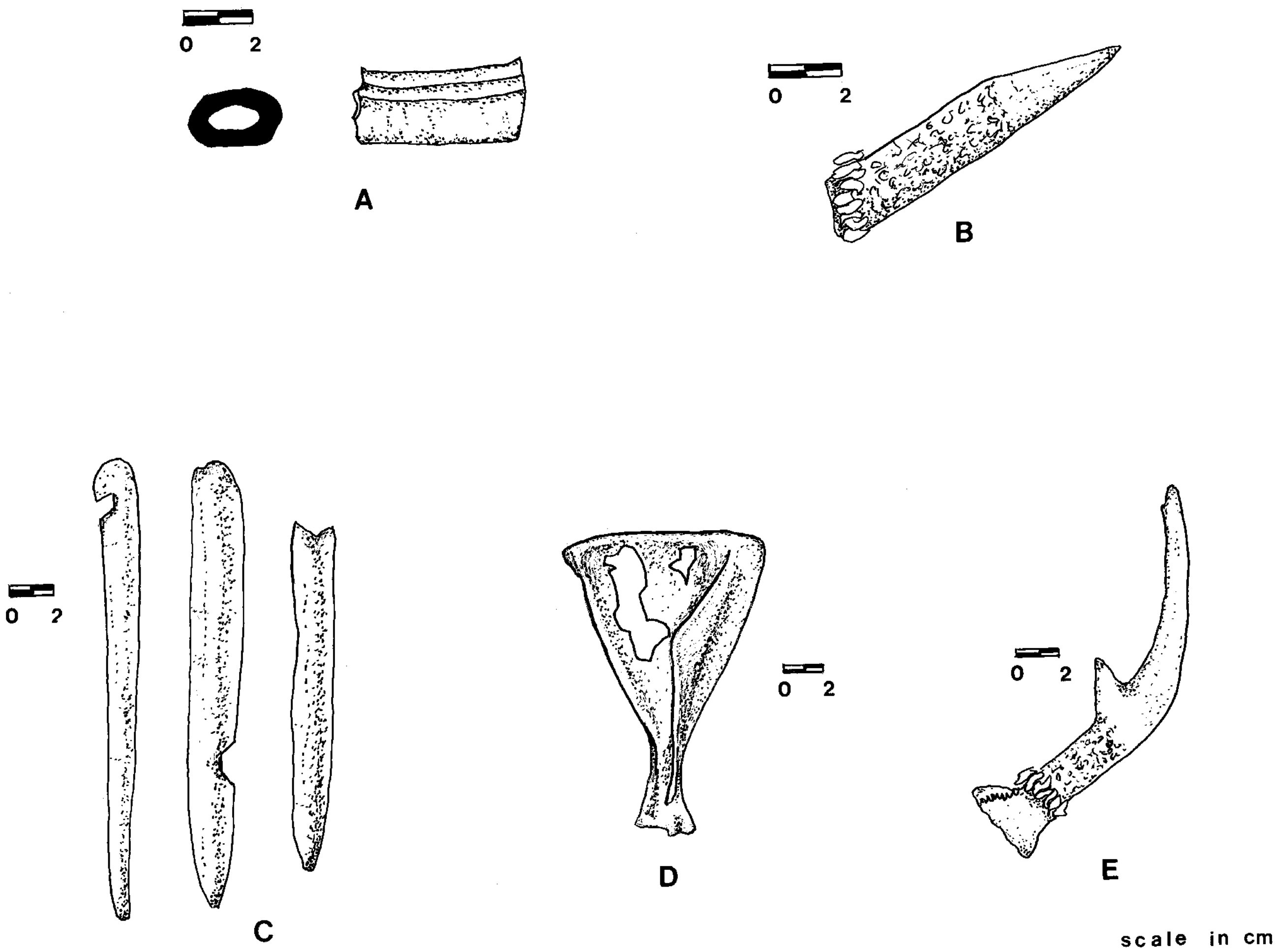


FIGURE 16.1. Some bone artifacts recovered at Cerén. (A) Bone bead recovered from Structure 10. (B) Pointed antler tool (possible awl) from Structure 4. (C) Possible tapiscadores (corn huskers) from Structures 3 and 10. (D) Deer scapula tool from Structure 10. (E) A drilled antler from Structure 12.

TABLE 16.8 List of Antler and Bone Artifacts Recovered in Structure 10

Artifact Type	*Animal Identification*
Deer skull headdress	White-tailed deer
Shaped scapula	White-tailed deer
Shaped scapula	White-tailed deer
Possible tapiscador	White-tailed deer
Possible tapiscador	Large mammal
Possible tapiscador	Large mammal
Ornament	Large mammal
Bead	Large mammal
Bead	Large mammal
Unmodified long bone fragment	Large mammal

mammal, occur in highest frequency in structures and outside areas around Household 1. This along with other evidence suggests that household members may have been processing animals for feasting at Structure 10.

Household 2 had a number of unmodified mammal remains stored in elevated contexts in the storeroom (Structure 7), as well as a notable concentration of small valuable items in the storeroom including shell beads, incised shell, and a carved bone figurine. Additionally, a spondylus valve was found tucked in a niche in the main sleeping bench in the Household 2 domicile (Structure 2). In contrast, the animal remains from the Household 4 storeroom were exclusively utilitarian artifacts, including bone needles and antler tools.

The animal remains from Structure 12, a ceremonial building interpreted as being used for divination and other ritual activities, included the careful placement of cut spondylus shells in elevated contexts, the use of olive shell beads as a jar support, and a modified deer antler stored in an interior niche. The white-tailed deer was used for community ritual at Structure 10, as indicated by the deer skull headdress, and deer may have been consumed during public feasts that were prepared at this location. Other modified animal remains found in Structure 10 were utilitarian bone and antler tools, including some that were likely used for husking corn for feasts.

Notes

1. In contrast to preliminary counts (Brown 1996), in this chapter small fragments thought to join with a counted piece are represented by a plus sign and not tallied as a separate count, to minimize artificially inflated calculations.

2. For minimal number calculations, faunal remains from the entire site were viewed as a single data set, then skeletal elements were separated to calculate the number of individual animals represented. For maximal calculations, each household assemblage was viewed as a single data set. For example, using the minimal number method, a left humerus of a deer recovered in Household 1 and the right humerus of a deer from Household 2 would equal one individual. Under the maximal method, these would be counted as two individuals.

Artifacts Made from Plant Materials

Harriet F. Beaubien and Marilyn Beaudry-Corbett

Introduction

The combination of Cerén's unique archaeological situation and the early recognition of the extent to which perishable material could be recovered with careful removal, processing, and conservation has resulted in an assemblage of materials not usually available from household excavation projects. This category of remains gives us useful data about Cerén inhabitants' use of plant materials. It also provides an opportunity to evaluate the extent to which we can expect parallels between ethnographic information and the prehistoric record.

Materials of plant origin survived as chars, impressions (subsequently cast from voids), and occasionally as directly preserved materials. The inventory of artifacts includes both portable objects and architectural components fabricated from processed plant materials. (In this chapter we will not discuss fixed architectural features such as shelves and roofing.) Objects were made from the woody parts of gourds or calabashes and palm fruit endocarps, from various plant fibers, and from wood stems or cane. Architectural components were made from wood, cane, and string. We should mention that terms like *gourds* and *cane* are applied according to common usage, rather than from the standpoint of scientific botanical attribution. In some cases, such as for gourds, we have made a tentative botanical attribution. In other cases, such as for fibers, we are unable to relate the remains directly to the botanical realm.

In archaeology, it is always necessary to evaluate the nature of the available sample before searching for qualitative or quantitative patterns in the data. In this case, the limitations of the data set are numerous. First of all, even at Cerén, organics tend to be fugitive. Decayed materials may not be recognized or their presence may only be inferred from the context. For example, recovered pigments would have been kept in receptacles, but none exist; they undoubtedly decayed without leaving evidence of their nature. Thus, we know that our data set is very incomplete.

Another limitation is the unequal number of structures in the various functional categories. For example, only one kitchen has been excavated, while three storehouses and two domiciles have been investigated. The ceramics inventories (Chapter 13) caution us against taking a normative view of these structures, expecting them to house similar assemblages based on their functional classification.

A further problem with this data set results from reassembly uncertainties. As an example, it is extremely difficult to evaluate whether fragments of painted layers scattered around a room represent parts of the same gourd object or several different objects. Refitting is more straightforward when dealing with chipped stone or pottery.

These various caveats lead us to use a broad brush in dealing with artifacts made from plant materials. Numbers are presented for completeness, but our review of the findings is based on a qualitative rather than a quantitative approach. Table 17.1 summarizes the finds for each type of plant material according to the recovery location. We caution that the table presents only materials where

TABLE 17.1. Artifacts by Plant Material and Provenience

	Domicile		*Storehouse*		*Kitchen*	*Civic*	*Special Use*	
	Str. 1	*Str. 2*	*Str. 4*	*Str. 7*	*Str. 11*	*Str. 3*	*Str. 10*	*Str. 12*
Gourds		1	2	1+	5		2	2
Palm fruit				1			1?	
Fibers								
Support ring					2		2	
Basketry			2		3			
Matting	1		2	1	1			1*
Cloth			2	1				
String bag			1					
String							1	
Wood/stems								
Utensil	2	1					2	
Forked support	1		1	1	1	1	1	
Fencing		1	3?	1			1	
Wood ash			15	10+				
Total	4	3	28	16+	12	1	9	3

* Woven strip on pot neck.
NOTE: Structure 6 (storehouse) and Structure 9 (special use/sweat bath) produced no artifacts made from plant materials.

the recovery provenience seems related to their systemic context. For example, we itemize string used on the deer skull headdress but not string blown into a pot or caught on an agave plant.

Findings

Relating these materials to the systemic context, it seems that the kitchen and storehouses were more likely to contain them than were domiciles. It is likely that a wider range of household maintenance activities took place in these structures with active space, as opposed to those with passive interior space for sleeping and sitting. The special purpose structures are not homologous in terms of their function (see Chapters 9–12), so it is to be expected that objects of plant origin would vary among them. The types of plant-origin artifacts in Structure 10 are similar to those in Structure 11 (kitchen) and Structures 4 and 7 (both storehouses), more evidence that Structure 10 had a nondomestic purpose that involved both storage and food preparation.

GOURDS OR CALABASHES

The processed fruit rinds of gourds or calabashes likely were in common use as utensils for dipping water or dried materials, as food service containers, and for other purposes. From various features described below and in Beaubien 1993, the gourd artifacts recovered at Cerén seem comparable to *Crescentia alata,* the tree-variety gourd seen in the landscape and in use today.

Their presence in the artifact assemblage lends credence to the ancient use of gourd containers mentioned in the Popol Vuh and described in some detail in Bishop Landa's ethnographic records. As cited by Fowler (1989: 154) gourd working and the use of gourds among the Pipil were mentioned by various Conquest Period observers, and the gourd-working industry of Izalco was described in the mid-twentieth century. Osborne (1975: 134–135) commented on the use of husks or shells of several fruits as containers in Central America during the 1950s. McBryde (1947: 57, 148) also mentioned several varieties of the calabash or gourd tree utilized in the inner Coastal Plain and highlands of Guatemala. Those recovered at Cerén add enormously to our knowledge of this class of artifact, since only an exceptional few had previously been recovered archaeologically as waterlogged fragments from the cenote at Chichén Itzá (Coggins 1992: 360–364). Decorative paint layers possibly applied to gourds were also recovered at Tikal (Beaubien, personal observation, site museum 1991) and at Copán (Beaubien, personal observation, site excavations 1993 ff.; Bell et al. 1999).

It is interesting that Osborne (1975: 323) raised the possibility that trade or migration between 1544 and 1574 was responsible for the introduction into

El Salvador of the Guatemalan skill in gourd decoration. We do not have definitive proof of production at Cerén, but the findings demonstrate that Zapotitán Valley residents had access to this specialized craft product long before the Conquest Period.

Because of organic decomposition, unpainted gourds have not been easy to detect archaeologically, although they probably were present. One impression was recorded in Structure 4 (Feature W), and their presence has been inferred from the shape of preserved contents such as wood ash hemispheres. Those which had a painted surface decoration were detected because of the surviving paint remains and were recovered, although in extremely fragile, often fragmentary, condition.

Based on the nature of the surviving paint layers, we can reconstruct two situations that occurred during the volcanic destruction. Some gourd objects were buried intact by ash; their organic component eventually decomposed, but the paint layers retained much of the object's original form. A variation of this pattern occurred when one painted gourd, protected in a niche, flattened as the organic object decomposed. A total of seven gourd bowls and one lid are identifiable.

Other objects were shattered and the pieces scattered during the eruption activity. Those paint layers survive as flattened or slightly curved segments of larger forms. The scattered find spots of this second category make it difficult to determine the number of objects represented. In fact, three segments found near Structure 7 may belong to the same object; four additional objects are represented by recovered segments. Other disassociated paint fragments, found in four groupings, could not be securely associated with a particular type of object and have not been used in this summary.

General Form The bowls as preserved range in diameter from 11 cm (1-310) to 22 cm (1-247), and in height from 3 cm to 11 cm; the lid (4-273) is 9 × 0.5 cm. They appear to have been made by cutting gourds laterally so that stem nodes are in the center of the resulting form. This feature is preserved most clearly in the lid. The full curvature of the bowls is not well preserved, but a generally hemispherical form is suggested. The largest bowl, however, presents a somewhat elongated profile.

Structural Characteristics of the Paint Layers Each layer of paint, whether recovered as a cohesive layer or as fragments, measures approximately 0.5 mm in thickness and has two well-bonded components: a ground (or preparation) layer overlaid with a pigmented layer. Impressions are preserved on the underside where the fine-textured wet paint came in contact with the gourd shell. Both exterior and interior were painted, verified readily by nine of the objects in which paired layers were found with their ground surfaces touching. These would have originally been separated by the gourd shell but merged as it decomposed. Paint layers applied to the exterior possess a smooth-textured underside; those applied to the interior are fibrous or pebbly; and a recognizable pattern of radiating ribs is preserved on the interior paint layer from the flattened gourd. Even now, the paint is cohesive with a strong binder and shows little sign of abrasion, suggesting that during use, the painted gourd could have been handled without loss of paint. A protective varnish may have been applied, but this has not been confirmed analytically. (Results of paint analysis are included in Table 18.1.)

Decorative Scheme While no two decorated gourds are alike, they may be sorted into several general groups distinguishable both by the color of their ground (or preparation) layer and by the decorative approach.

Group 1 has the following characteristics. The preparation layer is white. The interior is painted a solid color, either green or red; if green, a red rim band is present. The exterior decoration is polychromatic and is organized into registers with repeated motifs. Group 1-A (a variation of Group 1) also has a white ground, but the exterior paint appears to be monochrome rather than polychrome.

Group 2 is distinguished by a pink preparation layer. The interior is solid pinkish red, either from the preparation layer alone or with an additional application of paint. The exterior decoration is polychromatic on a red background, and the decorative motifs are arranged in an asymmetrical fashion rather than in registers.

Group 1. Eight objects share this decorative scheme; they are listed in Table 17.2 and illustrated in Figure 17.1.

A few comments are in order about some of the motifs and the register layout of the gourds. The geometric and human figural motifs as well as the organization into registers call to mind characteristics of Cerén's ceramic serving vessels. The element on 8-160 (Fig. 17.1e) can be interpreted as either an animal head or a stylized seated figure bending forward like those painted on Copador and Arambala recurved bowls (Fig. 17.2a).

The radiating linear pattern on the base of 2-51 (Fig. 17.1g) may represent the gourd's rib pat-

TABLE 17.2. Painted Gourds by Decorative Group and Provenience

	Domicile	*Storehouse*		*Kitchen*	*Special Use*	
	Str. 2	*Str. 4*	*Str. 7*	*Str. 11*	*Str. 10*	*Str. 12*
Group 1						
Bowl	2-51			1-247 1-310	8-160 8-520	
Segment			2-204, -205, -248*	1-273** 1-303**		
Group 1-A						
Lid		4-273				
Segment		4-317				5-35
Group 2						
Bowl				1-237		5-49
Total	1	2	1	5	2	2

* Collected as three field specimens, interpreted as being from one object.
** Not extant; recorded in photographs, not described in text.
NOTE: Artifacts are listed by their field specimen numbers.

tern. There is a group of polychrome painted vessels called melon effigy bowls that mimic this same pattern (Fig. 17.2b).

Of all the gourds in this group, 2-51 shows the most complex use of registers and motifs (Fig. 17.1f, g). The red rim band is very broad and includes a repeating seated human figure (similar to Fig. 17.2a); the remaining green field has a register of geometric motifs and the radiating linear pattern on the base. In addition, a significantly broader palette is used on this bowl. Where only red, green, and to a lesser extent yellow occur on the other Group 1 objects, this object also includes blue, brown, black, white, and many pastel hues.

Group 1-A. The surviving paint layers of the lid (Fig. 17.1h) and two gourd segments appear to be monochromatic (see Table 17.2). However, each case is problematic, since only one paint layer is accessible for study and little can be said about them due to their fragmentary nature.

Group 2. Only two gourds are represented in this category; they are listed in Table 17.2 and illustrated in Figure 17.1. On the exterior, the bold motifs appearing on the red field are painted in yellow, brown, and white. While incompletely preserved on both bowls, the elements are neither organized in registers nor repeated regularly around the surface (Fig. 17.1i, j). Bars and coiled shapes arch asymmetrically across the base and near the rim. There is a free-form tradition in the ceramic corpus, as evidenced by spiral decorated Gualpopa and Copador bowls (Fig. 17.2c). However, the gourd pattern appears to be even more complicated than the ceramic one.

Provenience Observations The more prevalent decorative scheme, characterized by registers and repeated motifs, is found on gourd bowls in a domicile, the kitchen, and Structure 10, a special use building, and among the segments recovered from a storehouse. The most ornately decorated example was the only gourd recovered from a domicile. Its elaborate style may indicate the relative importance of the building's occupants or may relate to the meal represented by the serving vessels placed with it in the niche below the bench.

One of the two gourds painted in the asymmetrical style was found in the kitchen; the other was found in Structure 12, a special use building. These objects may support a gender linkage between the users of those structures. A female-oriented ritual practice has been suggested for Structure 12, a building notable both for its eccentric architecture and ceremonial artifact assemblage.

PALM FRUIT ENDOCARP

The endocarp of a palm fruit (*Acrocomia aculeata*) was carved and perforated to create a spindle whorl. The charred whorl still retained its charred wooden spindle wrapped with thread when recovered from Structure 7. (Similar whorls were recovered from

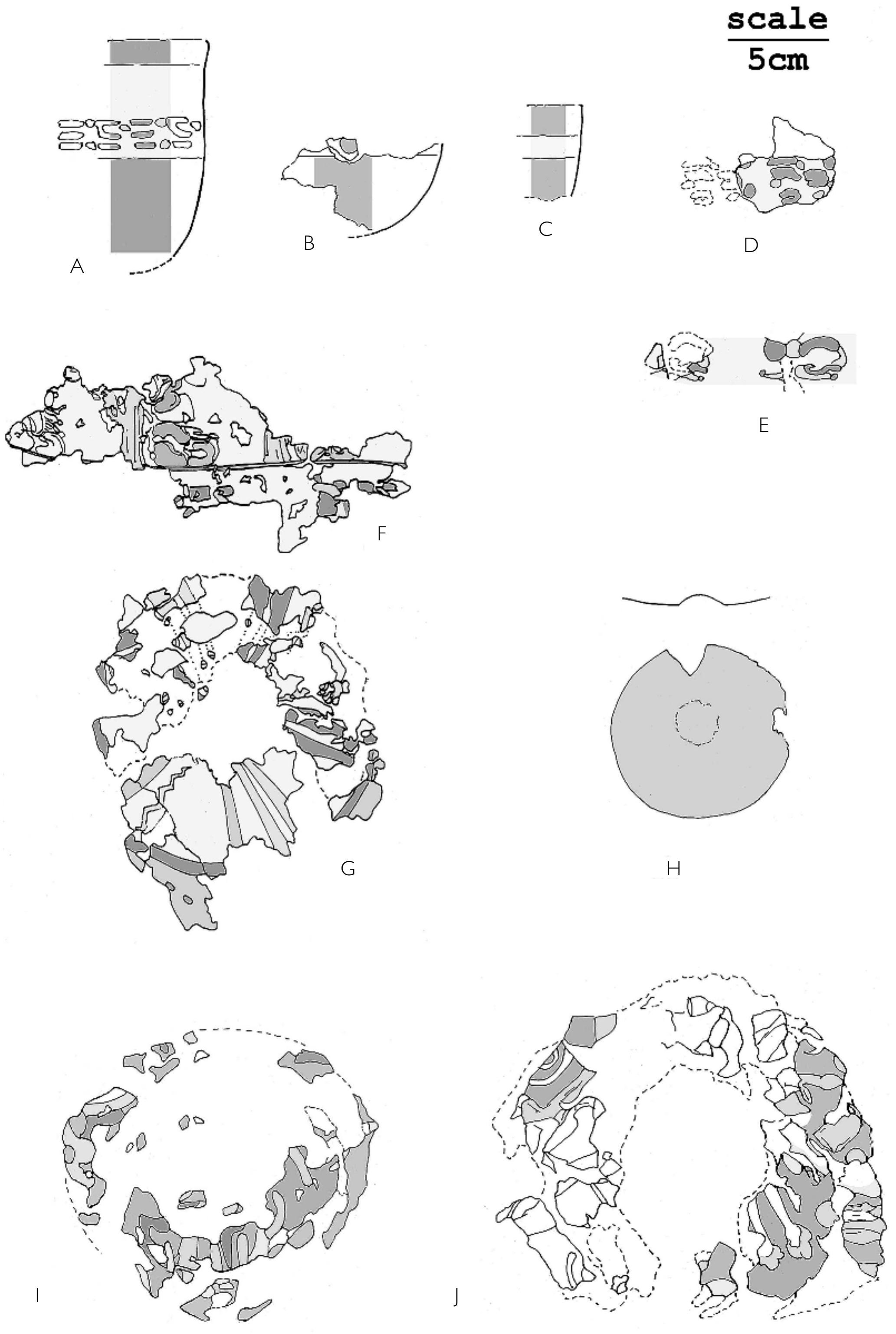
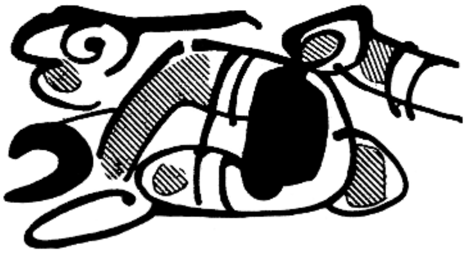


FIGURE 17.1. Gourds grouped by decorative scheme. Group 1: (a) 1-247, partial profile; (b) 1-310, partial profile; (c) 8-520, partial profile; (d) 2-205, body; (e) 8-160, body below rim; (f) and (g) 2-51, rim area and plan view of base. Group 1-A: (h) 4-273, profile and plan view. Group 2: (i) 1-237, plan view; (j) 5-49, plan view.



A

B

C

FIGURE 17.2. Ceramic motifs and design layouts similar to gourds: (a) seated figure on Arambala recurved bowl (after Beaudry 1984:285); (b) Gualpopa melon effigy bowl from Cerén (3-6); (c) spiral decorated Gualpopa bowl from Cerén (1-94).

the cenote at Chichén Itzá [Coggins 1992: 359–360].) Fragments of a possible endocarp were found in Structure 10, but whether this was worked is unknown.

FIBERS AND FINE STEMS

Vessel Support Rings (Yaguales) These circular objects are used as stands for round-based ceramic vessels and can be found in village markets today throughout Central America. They served the same function at Cerén, where examples were found directly preserved in the kitchen and in Structure 10. In one case, fibers had been twisted as a mass to form the ring. In another case, flexible branches or vines about 2 cm thick had been bent and coiled at least three or four times.

Basketry Containers made of fibers or fine stems were found, including portable baskets and a maize crib built into Structure 4. The crib's floor was made of several overlapping layers of preserved fibers with mud on the outside. The portable baskets seem to vary in construction. One was formed of concentric spiral fiber bundles (*Tithonia rotundifolia* stems tied with *Agave* sp. fiber). Another was made of monocot stems, possibly *Cyperus,* a sedge called tule. It probably had a quite bulbous shape with a small mouth and had collapsed flat on the floor of the kitchen.

Matting Woven coverings (petates) were found in all types of domestic structures at Cerén. The manufacture of woven straw mats and other fiber items such as baskets is mentioned by Fowler (1989: 154) as being an important industry among Pipil-Nicarao commoners. He cites ethnohistorical sources that report the use of straw mats by caciques and nobles and that list petates as tribute items. Petates remain in widespread use today in Central America. They have the advantage of being inexpensive, lightweight, and easy to transport. They can be taken up quickly for household maintenance and are themselves cleaned easily. As Osborne stated (1975: 282), "Today mats serve as walls for the Indian huts, as beds, and as tables. They play an important role on ceremonial occasions when they are placed under the sacred figures or used by the shamans for their rites. . . . They are an almost indispensable household furnishing from the time an Indian is born on a mat till the time he dies and it becomes his shroud." McBryde (1947: 68) described three major fibers used for mats—palm, rush (tule) and alpine bunch grass (*Muhlenbergia*)—and states, "The uses of them are manifold."

It is probable that at Cerén they were used on floors, shelves, and benches. The one associated with Structure 1 was found burned just east of the building, under the house eaves; another one, associated with Structure 7, covered a burned wooden pole shelf.

In addition to the petates, another kind of matting was found around the neck of a ceramic vessel in Structure 12. The function of this tightly fitted 3 cm strip is unknown. It may have served to improve the grip on the vessel, to allow for suspension, to impart something symbolic, or to fulfill another purpose.

Cloth One example from Structure 4 seems to have been a loosely woven cloth with about eight threads per centimeter which covered a jar containing a variety of seeds. Another example from the same structure, thought to have been cotton, is finer, with an estimated sixteen threads per centimeter; this was recovered as a plaster cast. The final example was found adhering to several contiguous sherds in Structure 7.

String The one recovered specimen of a string bag has a tight two-ply construction and was found carbonized, along with portable fencing, in Structure 4. Many examples of string cordage were located during the various field operations, either as carbonized specimens or cast impressions. Much seemed related to roofing and fencing components or to discard practices. One of the few in-use examples other than the architecturally related specimens was the charred single-strand piece associated with the deer headdress in Structure 10.

WOOD, ROBUST STEMS, AND WOOD ASH

Utensils Several carbonized sticks in association with donut stones are interpreted as having been digging sticks. One carbonized wood disk from Structure 2 is of unknown use.

Forked sticks used as supports for metates (horquetas) were recovered in the form of casts in or near both domestic and special purpose buildings. Thus, at Cerén, corn-grinding activities were not restricted to a certain type of structure or even to interior space, since three examples were outside Structures 1, 3, and 4. As with yaguales and petates, horquetas are still in use in rural El Salvador today. Examples seen in contemporary Joya de Cerén are located in or outside the kitchen and are tailored to the height of the user.

Fencing Plant stems of at least 1 cm diameter (*Tithonia rotundifolia*) were bound with string and used for portable fencing, for doorway closures, and to form the maize crib walls. All fencing material was recovered as plaster casts.

Wood Ash Hemispheres Throughout Middle America, maize is traditionally soaked overnight in water mixed with some lime, processed from limestone in places where it is relatively available. An alternative to lime is wood ash collected from hearths. Because the closest outcrop of limestone is near Metapán, 60 km north of Cerén, it is not surprising that households collected wood ash for this alternative soaking technique. The wood ash was placed in hard, spherically shaped organic containers, presumably gourds, and stored in elevated contexts in storehouses such as Structures 4 and 7. The containers decomposed, but the wood ash hemispheres retained their shape, having been encased in the volcanic ash.

Conclusions

This brief qualitative presentation of artifacts made from plant materials affirms eruption-period inhabitants' wide exploitation of their natural environment to make household commodities. It also provides solid evidence of industries that usually leave no direct archaeological trace. For the items known from ethnohistoric sources, including tribute lists, the Cerén assemblage provides a direct link into the prehistoric past, at least as far back as the sixth century A.D.

We would suggest that the continuity in usage can be extended to include a continuity in production mode as well. Fowler (1989: 152) has hypothesized that many of the craft products in Pipil-Nicarao communities in Southeastern Mesoamerica around the time of contact involved various levels of specialization on the part of both women and men. It seems probable that gourd processing and painting, as well as fiber crafts and palm fruit carving, were done by talented individuals either as part-time or full-time specialized activities.

We can only guess at the prevalence of these crafted objects in the overall settlement. However, their mere presence emphasizes again the overwhelming impression of Cerén as a thriving agricultural community before its well-supplied households were crushed under the Loma Caldera ashfall.

Acknowledgments

The identification of the plant materials used in the fabrication of these artifacts is part of a larger study of Cerén's botanical remains, carried out by David Lentz with the assistance of María Luisa Reyna de Aguilar and others. Their contributions are gratefully acknowledged, with particular thanks to David Lentz for his assistance with this chapter.

PART FIVE

Topics and Issues of Cerén Research

In this final section of the book, some of the topics that are of importance to Cerén Project researchers are considered. One topic, examined by Scott Simmons and Payson Sheets, is economics viewed from the household and village perspective. As one would expect, individual households apparently built and maintained their own structures as well as provided themselves with food. What we found that we did not expect is that every household investigated to date produced more of at least one commodity than it needed for its own consumption and used that surplus for exchange. This provided an economy of production, as each household did not have to maintain the knowledge and equipment to produce all of what it consumed, and the economic network of course provided social benefits to the traditional society. All households could exchange surplus production for long-distance traded goods they needed, such as obsidian, jade, hematite, and presumably salt. We believe that the commoners had choices, as the above products would have been available at San Andrés or at smaller elite centers scattered around the valley. With choices would have come at least some empowerment, as an elite center that was judged as setting an unfair exchange ratio could have been avoided for one that was considered more fair. Thus, viewed from the bottom up, the elite did not wield thorough economic power, and centralization was incomplete in the sixth-century Zapotitán Valley.

Michelle Woodward and Payson Sheets present evidence for an intensive and sophisticated agroeconomic system in Cerén based primarily on maize cultivation, with *Xanthosoma* and beans as secondary crops. In addition to these, squash, manioc, cotton seeds, cacao, and numerous orchard fruits were locally produced and consumed. Ancient Cerenians even grew the canes used in their bajareque construction and the maguey that provided them with fiber for twine and bags. Instead of engaging in part-time craft specialization, Household 4 specialized in agronomic overproduction and exchange of agave, chiles, and other products.

Carlos Lara and Sarah Barber consider continuity and change as they compare Precolumbian Cerén with present-day Joya de Cerén, only a kilometer away. They do not take an extreme position of emphasizing continuity from the Classic Period to today, nor do they go to the opposite extreme. Their balanced account does point out some interesting continuities, such as today's practice of elevating metates on horquetas (pronged supports) in a fashion virtually identical to the Precolumbian examples. On the other hand, the invasions by the Pipil and the Spanish, as well as globalization and family members working in the United States, have contributed to the many differences between the households of contemporary Joya de Cerén and those of ancient Cerén.

P.S.

The Conservation Program at Cerén

Harriet F. Beaubien

Introduction

Conservation's primary purpose is the preservation of materials of cultural and natural value, so that they are available for future study and enjoyment. At Cerén, the particular circumstances of burial have enabled an unusually complete body of material evidence to survive, providing an exceptional resource for research and ultimately for public edification. Yet many of the materials—e.g., the earthen architecture and items of organic origin—are inherently vulnerable, and neither fare well over the short term in tropical conditions nor survive long-term burial without significant deterioration. Ash inundation conferred some protection in this case, but their exposure by excavation puts these materials once again at risk. As a result, conservation has been of necessity an integral part of the archaeological process at Cerén since the inception of the project.

Development of the Project's Conservation Infrastructure

SALVADORAN PARTNERSHIP

The development of full Salvadoran partnership in site development decisions was considered of critical importance for the successful realization of preservation goals. From the public sector, key participation has come from the Consejo Nacional para la Cultura y el Arte (CONCULTURA) of the Patrimonio Cultural, and from the Museo Nacional David J. Guzmán (MNDG); from the Patrimonio Natural and the Jardín Botánico La Laguna (JBLL); as well as from the Ministerio de Educación, the sponsoring agency. From the private sector, the Patronato Pro-Patrimonio Cultural, a nongovernmental organization, has provided unprecedented leadership—visionary, practical, and financial.

PROFESSIONAL CONSULTATION

Assistance initially sought in 1989 from the author (regarding conservation of a fragile object once thought to be a codex and subsequently identified as a painted gourd) developed into a full-fledged collaboration with the Smithsonian Center for Materials Research and Education (SCMRE) (formerly Conservation Analytical Laboratory [CAL]). This resulted in the establishment and staffing of a field conservation laboratory and formation of an advisory committee. Naturally, the site's spectacular earthen architecture drew the attention of specialists, from the Getty Conservation Institute (GCI) in March 1990, and from the site of Chan Chan, Peru, during the 1990–1991 season (Del Mar and Benites 1991). Members of the advisory committee, representing SCMRE, the National Park Service, and the World Monuments Fund, visited the site in January 1992. Their report (Charola et al. 1992) took a holistic approach to the site's conservation issues and offered specific recommendations that have formed the basis for actions taken by the project in subsequent years. The architectural and regional planning issues were at the core of a multiyear contract signed in 1998 between the GCI and CONCULTURA.

LABORATORY FACILITIES AND STAFFING

A basic laboratory and storage structure was built at the site in 1990. Since then, the lab has been staffed by conservators each season through an advanced internship program at SCMRE specializing in archaeological conservation. Additional work has been carried out in collaboration with restoration workshop staff at the MNDG in San Salvador. At the site, a skilled Salvadoran team, hired on a permanent basis by the Patrimonio Cultural, cares for the architectural monuments year-round.

CONSERVATION TRAINING

Conservation awareness and a strong experience base among team members have been built through daily collaboration with lab staff as well as through more structured training activities, including demonstrations in practical techniques such as block lifting and ceramics reconstruction. More extensive hands-on training has been offered to MNDG personnel, including staff members and volunteers from the restoration workshop. In the fall of 1993, the architectural team benefited from an on-site training course funded by the United States Information Agency (USIA), which examined the interaction between the adobe construction materials and climate conditions in the interest of preservation planning (Charola 1993).

FUNDING FOR CONSERVATION

Direct grant funding for conservation has come from the Samuel H. Kress Foundation, the Smithsonian Institution's Office of Sponsored Projects, USIA, and the Getty Conservation Institute, in addition to local funding and contributions-in-kind from the Patronato and CONCULTURA. Project overhead support for the conservation program has come primarily from the National Science Foundation and from team members' institutions.

Conservation Components and Goals

Cerén's program of conservation consists of a number of integrated activities which further the long-term preservation of the site and its contents. These fit within a general framework of conservation professional practice (AIC 1994), outlined below.

CONDITION ASSESSMENT AND RELATED TECHNICAL STUDIES

Careful examination, supported by technical investigation, is carried out in order to gain a better understanding of a particular material and to assess its current state. This forms the basis for devising an appropriate course of action.

CONSERVATION ACTIONS

Conservation actions are undertaken first and foremost to prolong the useful life of the material in question, interfering as little as possible with its material nature, appearance, and evidence of past use. Excavation in particular may pose immediate risks of damage or loss, or set changes in motion, given materials that are already compromised by use, age, and long-term burial, and that are exposed to new ambient conditions. As a result, the need for conservation action may begin at the time of exposure; other conservation actions may be necessary at subsequent times.

Interventive Measures for Stabilization When the physical integrity of artifacts or architecture is at risk, it may be necessary to introduce new materials in order to strengthen the original (with consolidants), to reconstruct (with adhesives), or compensate for losses (with fills). These conservation actions, whose purpose is to improve the physical stability of the material or to aid in its comprehensibility, are considered interventive. Wherever possible, materials of known stability, compatibility, and reversibility are used. In an archaeological setting, when much depends on the original's potential research value, a minimalist approach is favored. For display purposes, however, more extensive restoration is often carried out in order to improve the aesthetic effect of the material.

Noninterventive Measures for Stabilization Whether intended for public access or research, original materials are best protected by limiting direct contact and exposure to damaging environments. Those measures which address the material's immediate surroundings are increasingly recognized as the most effective as well as cost-efficient in enhancing long-term preservation, promoted as preventive conservation. For immovable features such as architecture, these include physical protection and environmental regulation; for movable materials, the issues of handling, packing, and transport are additionally of concern. Materials and techniques must be selected carefully, as poor choices, such as unstable housing materials, may eventually force the need for interventive conservation measures.

Replication Replication is an effective conservation measure when it is undertaken to limit the handling or exposure of the original material, particularly if its potential use is heavy and when a replica (or similar object) would serve for study or didactic purposes. Consideration must be given to the potential for damage to the original by some replication processes.

DOCUMENTATION

Documentation generally includes written and illustrative information about the original material's nature and condition, conservation interventions, and any materials introduced. These records aid conservators by providing a basis for monitoring change and evaluating treatment. This information may take on critical importance to researchers in interpretation and future scientific analysis, as well as in the event of loss. As such, the documentation itself becomes an invaluable part of the history of the original material.

Artifact Conservation

At Cerén, all materials lifted from the site, identified as field specimens (FS), are processed through the field laboratory. Analytical goals, general conservation procedures, and individual interventions are routinely discussed by the archaeological and conservation staff. In general, artifacts receive basic cleaning as appropriate, are labeled, and are given some form of protective housing. Those toward which more extensive conservation attention is directed include artifacts whose particular fragility necessitates treatment in order for them to be successfully lifted, stabilized, and studied, and artifacts composed of numerous components whose reassembly requires some skill.

CONDITION

Stone, ceramics, and bone generally survive in good condition at Cerén, although affected by the circumstances of their deposition. Ceramics are frequently shattered, having fallen from elevated storage or been crushed by overburden. Many also show some stress-cracking or -springing, related to sudden exposure to heat and the release of fabrication stresses. Shell (composed largely of calcium carbonate) and mineral-based paint materials tend to be powdery and fragile as a result of long-term moist burial.

The complete disintegration of organic materials is not unexpected under these conditions. Those which survive directly are most often carbonized. These retain their morphology but are in exceedingly fragile and friable condition. Surprisingly, some uncharred fibrous materials resist complete decay, notably thatch and some basketry, although these too are severely weakened and embrittled.

To understand more fully the nature of some of these materials, technical analyses have been carried out, such as neutron activation analysis (NAA) of ceramic paste (see Chapter 13) and characterization of paints and pigment materials. Results of analyses carried out to date are reported in Table 18.1.

CONSERVATION ACTIONS

Interventive Measures for Recovery and Stabilization *Fragile Artifacts.* A number of artifacts required in situ interventions in order to permit excavation, including consolidation and the use of subsidiary supports during lifting. A notable group of these are the remains of painted gourds, indicated only by their paint layers. Eight relatively complete forms were recovered, one of which was brought to SCMRE for analysis and treatment during the 1989 season and returned in 1992 (Beaubien 1993); additional gourd segments and associated fragments were also found. Other objects whose conservation began in situ included a deer skull headdress and two baskets. Treatments continued in the lab with further consolidation, reassembly of pieces, and use of reinforcing supports (such as facings) where required. Also treated in the lab were a turtle carapace and plastron; worked and unworked shell; worked bone or antler items and a tooth pendant; carbonized organics, including a carved palm fruit endocarp and several pieces of twine; and uncarbonized fibrous items, including a ring support (yagual) and woven remains around the neck of a ceramic vessel. Paint traces on a variety of objects were consolidated, and four objects of stone were reconstructed. One in situ artifact, a built-in corn crib composed of fibrous matting and plant stem walls (casts), was sparingly consolidated and protected with a removable wooden hood. These activities were carried out by field conservators or by others under their direct supervision.

Materials commonly used to aid lifting include

TABLE 18.1. Technical Analyses of Cerén Samples, Carried Out at the Smithsonian Center for Materials Research and Education (SCMRE/CAL Reports)

FS#/Location	*Sample Description*	*Results [Technique]*
A. Paints and pigment materials		
Artifacts		
1-40	Pigment cylinder, red	Hematite + quartz [a]
1-41	Pigment cylinder, red	Hematite + quartz [a]
1-158	Pigment cylinder, red	Hematite + quartz [a]
1-275	Pigment cylinder, red	Hematite [a]
1-275	Pigment cylinder, micaceous	Muscovite [a]
2-329	Pigment cylinder, red	Hematite + quartz [a]
1-65	Pigment in pot, red	Hematite + quartz [a]
2-213	Pigment in pot, red	Cinnabar [a]
2-214	Pigment in pot, red	Cinnabar [a]
2-215	Pigment in pot, red	Cinnabar [a]
2-222	Pigment in pot, red	Cinnabar [a]
2-230	Pigment in pot, red	Cinnabar [a]
1-247	Paint on gourd, white ground	Kaolinite + opal/silica [a]
1-247	Paint on gourd, red	Ferropyrosmaltite + hematite [a]
1-247	Paint on gourd, green/white	Palygorskite?, kaolinite, opal + other [a]
1-247	Paint on gourd, yellow	Goethite [a]
2-51	Paint on gourd, white ground	Kaolinite [a][c]; binder inconclusive [d][e]
2-51	Paint on gourd, red	Hematite + other [a]
2-51	Paint on gourd, red	Cinnabar + other [a][b][c]
2-51	Paint on gourd, yellow	Goethite + other [a][b][c]
2-51	Paint on gourd, green	Clay minerals/"green earth" + other [a][c]
2-527	Paint fragments, red/white	Cinnabar + kaolinite [a][c]
2-533	Paint on sherd, green/white	Green earth, illite, kaolinite [a][c]
2-579	Paint on sherd, pink/white	Kaolinite + other [a][c]
8-34	Paint on deer skull, red	Hematite + silica, illite, albite [a]
8-34	Paint on deer skull, white	Kaolinite + cristobalite [a]
Architecture		
Str. 10	Paint on door jamb, red	Hematite + quartz [a][c]
B. Efflorescent Salts		
Op. 1	Salts on Unit 14 tephra	Gypsum [a][c]
Str. 1	Salts on bench	Gypsum [a][c]
Str. 1	Salts on SE column	Gypsum [a][c]
Op. 2	Salts on Unit 14 tephra	Gypsum [a][c]
Str. 2	Salt on S wall tephra	Gypsum [a]
Str. 3	Salts on Unit 4 tephra	Gypsum [a][c]
Str. 3	Salts on E side platform	Gypsum [a][c]
Str. 7	Salt on SE corner wall	Gypsum [visual comparison][c]
Str. 12	Salts on W wall	Gypsum [a][c]

TABLE 18.1. Continued

FS#/Location	*Sample Description*	*Results [Technique]*
C. Ash Composition		
—	Tephra, Unit 1 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 2 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 3 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 4 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 5 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 6 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 7 ash	Plagioclase feldspar + pyroxene [a][c]
—	Tephra, Unit 8 ash	Plagioclase feldspar + pyroxene [a][c]
D. Mucilage Composition		
—	Mucilage evaporate	Inconclusive [d]

Key to analytical techniques:
[a] X-ray diffraction of powdered sample, using a Gandolfi camera with a Philips PW 1720 XRD unit.
[b] Polarized light microscopy of sample dispersed in Aroclor 5442, examined with a Leitz microscope.
[c] Scanning electron microscopy/energy dispersive x-ray analysis of carbon-coated sample mounted in cross-section, using a JEOL JXA-840A Electron Probe Microanalyzer and Tracor Northern SEM/EDX in backscatter mode.
[d] Fourier Transform Infrared Spectrophotometry, using a Mattson Cygnus 100 FTIR with a Spectratech IR-plan microscope.
[e] Ultraviolet fluorescence microscopy of sample in cross-section, examined with a Leitz Dialux illuminator.

plaster of paris, with barriers of aluminum foil or plastic wrap. Japanese tissue paper and spunbonded nylon tissue are used for facings and backings, and aqueous methylcellulose and acetone-soluble acrylic resins for adhesives and consolidants.

Ceramics. One figurine and more than fifty vessels were reconstructed by field conservators or MNDG personnel to enable formal and stylistic analyses to be carried out; additional pieces were preliminarily reconstructed by archaeological staff. This was done after the ceramic paste had been sampled for NAA, usually from break faces where drill marks would not be visible after reassembly.

During the initial season, the use of a water-based polyvinyl acetate emulsion adhesive was eliminated because of the glue's poor aging characteristics and eventual insolubility. It was replaced by an acetone-soluble acrylic resin adhesive (Rohm & Haas Acryloid series). This adhesive is strong, reversible in acetone, and has excellent long-term stability. Fills were made where missing pieces affected the vessel's physical stability or where NAA samples were taken from the base, using toned plaster of paris after original surfaces were isolated with a consolidant application. More extensive filling and inpainting was carried out by museum personnel on a number of ceramics selected for museum loan or display.

Casts of Decomposed Organics. Many organic artifacts or plants which decomposed in the course of burial "survive" as voids in the tephra. As they are encountered in the course of excavation, the hollows are investigated with a fiber-optic proctoscope. The form of the artifact is then recovered by pouring a fine dental plaster (plaster of paris) into the cavity and removing the surrounding tephra (Murphy 1989). If left in situ, however, the casts are susceptible to breakage from animal tunnels undermining the supporting ash, and are unstable over the long term when exposed to groundwater. As a result, the casts are routinely removed for storage after careful documentation. The casting activities are primarily carried out by excavation personnel, with further cleaning, consolidation, or adhesion of parts taking place in the lab.

Noninterventive Measures for Stabilization *Housing and Storage.* A restricted storeroom at the MNDG is reserved for Cerén material, including plant casts which were initially housed at the Jardín Botánico La Laguna. Given ceramic and lithic dominance in the artifact inventory, the museum's lack of environmental controls has been less of a concern than physical protection and inventory control. Each season, as new materials are added to the stored collection, improvements are made in the organization of the storeroom's limited space and in housing. It should be noted, however, that a new museum with environmental controls is currently under construction, and by the time this book is published, Cerén materials will be maintained in a stable storage area.

Small finds are housed individually in transparent polyethylene self-closing bags or in fitted boxes with protective supports and padding. These are stored within modular lidded plastic containers, organized by material type and by operation. Larger objects are housed in fabricated boxes; foam support props and padding are provided for these and for unboxed items such as reconstructed ceramics. Any deteriorating plastic bags, temporary cardboard boxes, and unstable padding materials are systematically replaced with archivally sound materials. Bags and boxes are clearly labeled on the outside with FS numbers using a permanent black marking pen. Finally, metal and wooden shelves are lined with thin polyethylene foam sheets where objects are in direct contact, and canvas strips are attached along the sides of open shelves to protect against earthquake movement.

Display. The thoughtfully designed site museum occupies a building whose primary environmental regulation is through two roof-mounted extraction fans. Although display decisions and installation occurred when no conservator was available for consultation about mounting, the selected artifacts are generally stable to ambient temperature and relative humidity levels and are exhibited in vitrines.

Replication Activities Because the plaster casts cannot be left safely in situ, tests are ongoing to find suitable synthetic materials and techniques to make replicas (from the casts or from plants which resemble the originals) that can be used for display.

DOCUMENTATION

Written conservation records are kept in hardbound notebooks, which are stored with all excavation documents in the project house library in Joya de Cerén; photocopies exist at SCMRE (SCMRE/CAL Reports). Photographs of treatments in progress are also taken as is necessary or desirable. Lab notebook references are inked onto tags or bags of treated objects, and computerized project inventories, maintained by FS number, are updated to include lab as well as other reference numbers such as sample or MNDG accession numbers. Detailed reports of laboratory activities are submitted to CONCULTURA (in Spanish) and to project personnel and interested colleagues (in English), and an abridged version is included in the preliminary reports published by the project each season (Beaubien 1989, Beaubien 1990a, 1990b, Beaubien and Fenn 1992, Beaubien and Lundberg 1993, E. Kaplan and Beaubien 1996, Rosenthal and Beaubien 1996, Peschken 1997).

Conservation of the Site and Its Architecture

The conservation of earthen structures, surrounding gardens, and other occupation surfaces requires an integrated approach that addresses both the needs of the material and the implications of public access. The activities begin before exposure and continue with ongoing maintenance activities, primarily carried out by the year-round team (Murcia and Sheets 1993).

CONDITION

Earthen materials are susceptible to weathering on their surfaces (e.g., from rain and windblown debris), damages from the support of biological growth when damp, and physical changes related to moisture content, such as shrinkage cracking from wind- or sun-induced drying. Cerén's structures were additionally affected by the variously erosive and hot eruptive events; some areas show color alterations from differential oxidation of iron-bearing constituents, which apparently correlate with hardness changes in the surface. Burning as well as long-term burial significantly compromised the structural stability of the architecture by destroying key constituents made of organic materials.

To aid in condition and treatment assessment, climate data were collected over a period of 2 years of ambient conditions both at ground surface (from a weather station located between Operations 1 and 3) and in Structure 3, one of the excavated structures in a deep trench. Despite problems with the instruments, diurnal fluctuations of temperature and relative humidity measured in Structure 3 were half of that at the surface, demonstrating a buffering effect conferred by roofing and trench depth. Records from the first quarter of 1990 noted 750 seismic events, indicating continued risk to unstabilized structures. Under the Getty Conservation Institute/CONCULTURA contract, structures currently under protective roofs are being monitored over several years to evaluate environmental factors such as relatively humidity, temperature, ultraviolet light, and air movement. These data will be used in designing future roofing.

Materials studies carried out thus far have included characterization of the adobe (Coffman et al. 1990), tephra (identified as a plagioclase feldspar), and architectural paints (identified as hematite, as well as TBJ) (see Table 18.1). Salts, not a severe problem but noted on several structures, are deposited through capillary rise and subsequent evaporation of groundwater; these were sampled and identified as gypsum, or calcium sulfate.

CONSERVATION ACTIONS

Interventive Measures for Structural Stabilization
Consolidation. Stabilization of the earthen structures begins at the time of their exposure with the systematic application of a diluted extract from the escobilla plant (*Sida rhombifolia*) (Murcia and Sheets 1993). The solution is prepared by soaking the chopped plants in water for several hours to extract the sap, then filtering the soak water through a sieve and a fine cloth; a 2% solution of phenol is added as a biocide. Once the mucilage solution has fermented for at least 6 months, it is applied by pipette onto the exposed earthen surfaces until they are evenly and well saturated. The procedure is repeated daily until the adobe becomes very hard, and subsequently once a week or less often.

This consolidation procedure was initially developed for use at the site of Tazumal and modified for Cerén (Murcia 1991). Attempts during the initial season to consolidate using an aqueous acrylic dispersion manufactured by Rohm and Haas were soon abandoned, as it concentrated at the surface to create a plastic film with dubious consolidative effect. In September 1989, the film was mechanically removed from the structures, and these along with all subsequently excavated structures have been consolidated with the escobilla mucilage solution. Although its consolidative effect is not well understood, the regular application of the solution to the structures seems to have contributed significantly to their relatively sound condition.

Structural Compensation. The most fragile walls are those which were originally made by applying an earthen dab over an armature of *Tithonia rotundifolia* stems, termed bajareque locally and generally referred to as wattle and daub. Their rigidity was maintained by anchorage in the adobe platform and linkage to the roofing superstructure. Through carbonization or complete deterioration of the organic components and fracture along adobe joins, these walls have lost their structural integrity. They are stabilized by inserting new canes of slightly smaller diameter into the voids and securing them with a pastelike mixture of clay and the escobilla consolidant solution. The mixture is also used to fill cracks, to cap walls with vulnerable upper surfaces, and to secure replacement wooden beams that are sterilized before insertion. This treatment has the advantage of compatibility with the wall material and physically prevents moisture or animal pests from entering the wall structure.

Structural Support. Other approaches to stabilization include the use of supports, such as wooden posts with foam padding, to prop up fragile walls, cornices, and earthen doorway lintels; in one instance (Structure 4), buttresses of volcanic rock and clay mortar have been used against a fragile dividing wall. Ash is also judiciously retained to support vulnerable elements, such as bajareque walls that detached during the eruption and splayed outward as an intact entity. Some of the ash deposits have been additionally strengthened with the mucilage solution or, in particularly loose airfall units, solidified with a pastelike application of clay, volcanic ash, and small stones.

Noninterventive Measures for Structural Stabilization *Backfilling.* Since partial exposure of features puts them at risk through differential drying and erosion, backfilling is used as a temporary protection measure until full excavation can be carried out systematically. This approach was used first for Structure 6, exposed in 1989 and not systematically excavated until 1991. At the end of the 1989 season it was covered with black plastic and TBJ ash but not well roofed, which resulted in some biological growth from entrapped moisture. The backfilling method subsequently was modified with the substitution of geotextile and screened volcanic ash, and was successfully used for Structure 10 in 1991 and Structure 12 in 1992, each of which was excavated the season following backfilling. Similarly, the open areas of Operations 1, 2, and 4 have been covered with geotextile and a 5 cm layer of TBJ to protect these occupation surfaces from excavation-related foot traffic.

Shelters. The erection of adequate shelters against the weathering effects of rain, sun, and wind has been a priority since the first season. In 1989 the Patronato provided crucial help in obtaining large tarpaulins, protective roofing, and chain-link fencing, and the Ministry of Education donated twenty-four roofing modules with steel posts and beams. These were extremely useful as initial roofing, since the support posts penetrated only 1 m, leaving cultural material undisturbed; they could be situated with some flexibility for maximum effectiveness and, with side screening, provided effective shelter. They were gradually replaced by permanent aluminum roofs, which have been found to reflect heat better. Four large roof units were donated by then First Lady Margarita de Cristiani and erected in 1993 over Operations 1, 3, 5, and 8. They are positioned with utmost care, as their posts are set in concrete down to bedrock, 2–5 m below the occupation surface.

Drainage. Because of the heavy rainfall during each year's rainy season and natural runoff collection in the deep trenches, control of water flow is integrated into site planning. Roofs are pitched to funnel runoff through gutters, and the ground surface is graded to direct flow away from the trenches and vulnerable surfaces. These feed into ditches which drain into the Río Sucio.

Air Circulation. Maintaining a stable microclimate is achieved in part by appropriate trench size. Control of airflow around the structures minimizes damage caused by either overly fast drying or the retention of excessive moisture. Experience has shown that at least 2 m cleared away from walls reduces excessive dampness. Side curtains of geotextile, canvas, and plastic are also used to control drying and additionally provide some protection from wind erosion.

Biological Control. While excavation during the rainy season slows the drying rate to some advantage, the climate is conducive to fern and moss growth, particularly in the deep trenches; this is moderated by good air circulation. Parachutes are hung over two structures as protection from bird and bat droppings, but animals and destructive insects are naturally difficult to exclude. Fragile materials, including plant casts, are removed from the site, and nest building is controlled by routine maintenance.

Site Management for Public Use Plans for public access to the site were developed by project archaeologist Andrea Gerstle in conjunction with the Patronato and CONCULTURA (Gerstle 1992b). With additional Fulbright funding, retrofitting of existing buildings and new construction were carried out from 1992 to 1993, and in June 1993 the archaeological park was opened to the public. It continues to be maintained by the Patronato. The public entry from the paved San Juan Opico road is marked by several signs and opens onto a parking area, picnic ground, and visitor facility that includes a refreshment stand, rest rooms, and park offices.

The site museum, occupying a remodeled agricultural storage building, introduces visitors to the history of the site, its excavation, and its conservation through color photographs, artists' renderings, and wall text; vitrines with a comprehensive sample of the artifacts yielded by the site; and a re-created kitchen structure. A model of Structure 3 is located just outside the museum, replicating its adobe construction and thatch roofing and surrounded by a garden with a selection of the plants identified from plaster casts.

A walkway leads from the museum past the replica structure to an overlook of the Río Sucio, and then follows the original bulldozer cut which currently defines the northern edge of excavation. Separated from the structures by an unobtrusive fence, visitors have a clear view of Structures 1, 6, 10, 11, and 12, located close to each other, and, slightly apart, Structures 3 and 4; access to Structures 2, 7, and 9 should be open to the public early in 1997 when additional pathways are completed. The circulation pattern does not impinge on excavated areas or otherwise interfere with ongoing excavation activities. Informative signage is placed at useful points along the path. Guides are also available to accompany visitors and provide more extensive information.

Site Protection The excavated area of the site and the public archaeological park are each surrounded by protective fencing with controlled access. One gate opens to the public area, one provides access to the excavation zone from the unpaved Joya de Cerén road, and one adjacent to the service building links the two areas. The site is guarded 24 hours a day, 7 days a week by five armed police officers and one project worker. Because the project has worked collaboratively with the local community at all stages, an informal neighborhood watch has emerged to assist in site protection.

DOCUMENTATION

Site maintenance activities are documented by the year-round team, whose efforts are supplemented by extensive photodocumentation of the structures carried out annually by project personnel. These records are archived in the architecture conservation office located on the site.

Implications

In 1993, soon after the site and 10 hectares to the south and west were officially recognized as a national archaeological park, Cerén was added to the World Heritage Monument list. With this designation comes the responsibility for meeting UNESCO's preservation guidelines (Feilden and

Jokilehto 1993). Among these is a site management plan which addresses issues of preservation and tourist development.

First written in 1990, Cerén's much revised plan articulates its development as part of a regional strategy which links it with several important nearby sites. These include the volcanic remains of Loma Caldera, 0.7 km north of the site, and the ceremonial center of San Andrés, a small but established archaeological park 5 km away. Featured in the plan are an expanded site museum at San Andrés (which opened in 1997), a system of self-guided trails, coordinated through a visitors' center, and didactic materials including detailed signage, publications, and school programming. The recent collaboration of CONCULTURA with the Getty Conservation Institute to produce a detailed version of both site and regional management plans is an indication of CONCULTURA's commitment to this important aspect of conservation.

With such strong support, Cerén is well positioned to continue in good condition, an asset to El Salvador and a resource for visitors and researchers worldwide. At the same time, its success argues forcefully for the proactive provision of conservation care. In contrast to situations where exposure or neglect exacerbates problems to critical levels before conservation measures are introduced, Cerén showcases the results of a well-integrated approach to site conservation—one that addresses both the immovable features of the site and its artifact inventory, and one that balances the site's research value, material needs, and public usage.

Household Production and Specialization at Cerén

Payson Sheets and Scott E. Simmons

Introduction

The theoretical framework for this chapter, and for much of the Cerén research, is household archaeology, the rapidly expanding subfield of archaeology that focuses on the domestic social and adaptive unit. More specifically, the objective of this chapter is to understand craft and agrarian production and specialization in households within the village context. Thus the activities in suprahousehold institutions such as the Structure 10 religious association or sodality, the divination in Structure 12, and the sweat bath (temascal) are not included in this chapter. However, there are indications that Cerén households provided services to these adjacent specialized facilities, and thus brief references to them are appropriate in this chapter.

Household archaeology traces its origins in settlement archaeology (Willey et al. 1965, Chang 1968), ethnoarchaeology (Kramer 1982b; Wauchope 1938), ethnography (Wilk 1988, Wisdom 1940), and affiliated social sciences (Arnould 1986). It is now a field with ethnographic and ethnoarchaeological sophistication, improving field techniques (Hayden and Cannon 1984), and an emerging corpus of appropriate method and theory (Netting, Wilk and Arnould 1984; Wilk and Rathje 1982; Ringle and Andrews 1983; Wilk and Ashmore 1988). Sufficient comparative cases have been examined to allow for generalization and theory building (Blanton 1994).

Households in sedentary societies are immersed in material culture (Wilk and Rathje 1982), facilitating the identification of household activities, particularly where preservation is relatively good. The household is here defined as the generally coresidential, task-oriented social and adaptive unit intermediate in level between the individual and the neighborhood. Behavior is spatially focused in and around the house structures.

The Theoretical Focus: Craft Specialization in Households within the Village

Defining, recognizing, and understanding craft specialization have all proven challenging for archaeologists. Early scholars assumed craft specialization was found only in states and civilizations (Childe 1951), but Costin (1991) shows it occurs in less complex societies in a variety of forms. Scholars have tried to identify it in archaeological remains by searching for standardized products (Torrence 1986) and increasing efficiency of production (Rathje 1975), yet standardization and productive efficiency do not necessarily correlate with specialization (Costin 1991).

Considerable progress in understanding craft specialization has been made in recent years. Specialization is but one means of production (Costin 1991). Torrence (1986) associates craft specialization with maximization of output and labor force specialization. In the latter, she distinguishes craft production from industrial specialization on a presumed continuum. She documented nonspecialist production and exchange of Melos (Greece) obsidian implements, in contrast to the earlier literature arguing for mass production by state specialists. Hester and Shafer (1991) define a craft specialist as one who "repeatedly manufactures a craft product for exchange." Similarly, Clark and Parry (1990: 297) emphasize "production of alienable, durable goods for nondependent consumption." Michaels (1989: 141) discusses "the relatively regular and standardized mass production of a nonfood item in quantities clearly higher than those necessary for household consumption, by persons having restrictive access to specific technology, knowledge, skills, or raw materials, and characterized by a vertical division of labor." We believe Michaels is too restrictive by eliminating food items. A thorough but demanding definition by Costin (1991: 3) involves the "regular, repeated provision of some commodity or service in exchange for some other." Full archaeological documentation requires that each end point of commodities and services be known, as well as the frequency of exchange. An ethnographer observing an exchange can readily document both ends and the exchange frequency, but we believe it to be difficult to do so with precision at even the best-preserved archaeological sites. However, in a slightly more generalized sense, Costin's definition is operational at Cerén in that the items leaving the households and the items arriving after exchange can be identified, and those such as obsidian can be identified as to the source (e.g., Ixtepeque) but not the specific nodes of production and transport between that source and the obsidian's arrival at Cerén. Thus, emphasizing a node of the production and exchange equation, following Hester and Shafer, Michaels, and Clark and Parry, is more reasonable in most archaeological research. The definition used here is that specialization is production for exchange, or provision of a service.

In this chapter we use Cerén research to compare the usefulness of three recent definitions of occupational specialization. (1) The Costin (1991) definition is the most demanding, requiring both end points of regular exchanges to be identified, and for services provided to be identified. (2) The Hester and Shafer (1991) and Clark and Parry (1990) definitions focus on identifying the beginning or the end points of exchanges, but they do not include services. (3) Michaels (1989) also focuses on single points of exchanges, and he excludes both food and services. At Cerén we can readily identify the specialized items entering the three households from outside the village (e.g., obsidian, hard greenstone, shell, hematite, limonite, cinnabar). At Cerén, with a reasonable degree of confidence, we can identify the craft specialty goods produced within the households for the exchanges. Household-produced commodities include the groundstone tools and cotton thread from Household 1, possibly the decorated gourds from Household 2, and the agave fiber and cacao from Household 4. It appears that at least two of the households may have provided services to adjacent specialized structures and that one household resharpened axes. Thus, the Cerén database can identify craft specialization as defined by the least demanding of the definitions, that by Michaels (1989). The database is sufficiently detailed to handle the requirements of the intermediate-level demands of the Clark and Parry (1990) and the Hester and Shafer (1991) definitions. And the database is sufficiently robust to largely satisfy Costin's requirements of identifying both end points of exchanges and services.

Craft specialization varies in context, intensity, scale, centralized control, and spatial concentration (Costin 1991). Specialists may be attached, with an authority supporting them and controlling the distribution of their products (Brumfiel and Earle 1987; Earle 1981; Arnold and Munns 1994). Or, as at Cerén, commoner specialists may be independent, own their products, and make their own decisions regarding exchange outside the unit of production, and thus achieve a level of empowerment often overlooked by political economists. The amount of time and effort (intensity) ranges from ad hoc specialization through part-time (as at Cerén) to full-time specialization. As Costin argues, this range to some degree correlates with social complexity, ranging from egalitarian to highly complex societies. The ad hoc and part-time specialists may be found in the simplest to the most complex of societies.

Craft specialization may be investigated on the regional scale, at the level of individual sites, or within a particular site at the household level. At the regional level, Santley (1984) interprets Teotihuacán specialized workshops as the economic engine driving Teotihuacán expansionism throughout Mesoamerica, but John Clark (1986) notes that the majority of obsidian blades found at Teotihuacán were used to modify or produce other items, rather than being manufactured for exchange. Also working regionally, Shafer and Hester (1991) demonstrate that Colha was the area's principal manufacturing site of chert implements, and they identify numerous Classic Maya lowland sites where the products were consumed. At the site-to-site level, Feinman (1982) studied ceramic production, exchange, and consumption in the central-southern Valley of Oaxaca. In contrast, we here exploit the unusual preservation at Cerén to examine craft specialization at the *household* level by distinguishing production for consumption within the household from production for exchange outside the household. An extrahousehold exchange involved other households and institutions within the village, as well as socioeconomic components outside the village such as possible market exchanges at San Andrés or a secondary center. A household choosing San Andrés or a secondary center for its exchange could affect exchange values.

The preservation at Cerén offers an opportunity to study household craft specialization in inorganic and organic materials. Methodologically, the first step in investigating household craft specialization is to complete and compare household inventories of all commodities in their spatial and functional contexts. The database is small, but it is sufficient to initiate the comparison, as one household is well documented and two others are sufficiently excavated to provide information on specialization. Thorough evidence of specialization includes finding workshops with the tool kits used to make items for exchange, characteristic wastage, some in-process items, and a stock of finished items clearly beyond the quantity needed by the household. The Costin model is satisfied by identifying those specialist goods entering the receiving household(s). Additional indications of surplus production are stored tool kits and materials beyond what was needed for infrahousehold consumption. Distinguishing between infra- and suprahousehold production and consumption is based on understanding what is the standard household inventory for internal production and consumption, and then exploring whether the unusual items may have been used for exchange.

Costin (1991) suggests that the intensity of production can be estimated by identifying the range of economic activities of a household and assessing the proportion of time and effort given to the craft. She notes that it is rare that household inventories are sufficiently complete to assess a household's activities; Cerén, however, is a fortunate exception. In Household 1, the majority of craft effort was for internal consumption, but groundstone production for exchange apparently occurred, the high frequency of spindle whorls may indicate surplus cotton thread production, and maize was evidently ground in quantities well beyond what was needed for internal consumption.

Although the sample is very small, it provides a beginning for identifying the standard Cerén household inventory: storage, cooking, and polychrome ceramic serving vessels, an incensario, a celt, about five obsidian prismatic blades in use and another five in storage, a scraper, a macroblade, a mano and metate, a hammerstone, two to three donut stones, an antler tapiscador (maize husker), a few bone needles, a few lajas as portable grinding stones, and a few smoothing stones. These basic household items are strikingly similar to the basic household assemblage of the Coxoh Maya today (Hayden and Cannon 1984). Each Cerén household investigated so far shares these common items, yet each has certain items that are unusual and may be involved in specialist production.

In addition to the relatively standard household tool kit, each household had unusual items that often reflect their specialization, the craft generating a surplus beyond that needed for their own internal use, that they could exchange for exotic materials from a distance or for items produced by other households. As developed in greater detail below, Household 1 apparently produced groundstone items well beyond its own needs, and it probably produced ground maize in large amounts when needed by the adjoining religious association. Household 2's specialization probably was making painted gourds, and it may have had a service relationship with the sweat bath. Household 3's specialization is not known, as only a fraction of the kitchen has been excavated. Household 4 engaged in an agrarian specialization by greatly overproducing maguey plants and depulping the leaves at a corner of the storeroom, as well as by growing surplus chiles.

Household Production

Although the sample is small, we believe we are beginning to understand what households routinely produced for their own use, without significant assistance from outside. Weaving may have taken place within the household, but we have yet to find weaving artifacts. Each household probably built and maintained its own architecture from locally available materials, and likely provided most of its own firewood. Clay deposits for construction, as well as for ceramics, are exposed along the banks of the river and its tributaries. Poles and sticks used for horizontal reinforcements grew locally. The grass (*Trachypogon plumosus*) used for thatching presumably used to grow locally but apparently has been eliminated from the valley by Old World grasses, grazing, and agriculture during the past 5 centuries (Lentz et al. 1996). Each household produced maize, beans, squash, chiles, and seed and root crops from nearby gardens and fields, and each probably farmed more distant plots in an infield-outfield agroeconomic system. Each household stored and processed basic foods in similar manners, and consumed them with polychrome cylinder and hemispherical vessels, as well as with painted and unpainted gourds. Each household had about a dozen or more polychrome serving vessels, a much larger number than we would have expected. The seventy-three ceramic vessels that Household 1 had are greater than we would have predicted for a household in a rural Classic village in southern Mesoamerica, but Ken Hirth is encountering similar abundance at Xochicalco (personal communication 1995). It appears that at least a few undecorated utilitarian vessels were manufactured in Household 1, based on finding a lump of clay that petrographically matches utilitarian ceramics in the household (Southward and Kamilli 1983) and a smoothing flake in the same craft area.

Household Specialization

Household 1 apparently manufactured groundstone implements in considerable numbers, supplying their internal needs as well as probably exchanging them with other households in the community and perhaps at more distant localities. The evidence for manufacture is the finding of the majority of the hammerstones at the site within this household. As little chipped stone manufacture apparently was done within the site, the hammerstones seem to have been used for pecking and shaping vesicular andesite groundstone implements, particularly metates, manos, and donut stones. As mentioned in the groundstone chapter above, Household 1 is conspicuous for the abundance of hammerstones and groundstone implements of all types, including a donut stone in the process of manufacture. What has not been found is the actual locus of manufacture, where we would expect to find abundant andesitic dust and particles on the Classic Period surface. The workshop may have existed in the northern part of the household that was bulldozed away in 1976, or in a yet-to-be excavated household area to the west or south of the structures.

The well-used metate-mano set that evidently served as the Household 1 principal maize-grinding implements was on the floor of the kitchen, adjacent to the vessel soaking maize kernels, and adjacent to the three-stone hearth. The other four metates, with their forked sticks (horquetas), had only slight use-wear. Households in traditional communities in Central America today rarely have more than one mano-metate set, so we suspect that Household 1 occasionally ground large amounts of maize for special occasions. We suggest the reason for this unusual maize-grinding capacity is located across the household's patio: Structure 10 had only one mano-metate set in the building but episodically may have required large amounts of ground maize to feed participants in ceremonies.

Thus, it appears that Household 1 not only made and exchanged their surplus groundstone implements as a means of obtaining other commodities, but they also provided ground maize episodically to participants in religious ceremonies at Structure 10. And they may have loaned their tapiscadores to Structure 10. What they may have received in exchange for their services is not known, but the exotic items coming into the household are obvious: hematite pigment cylinders, limonite pigment, shell, a greenstone axe, and obsidian implements.

Household 1 had virtually all of the hammerstones found at the site (most kept in the storehouse) and one unfinished and numerous finished donut stones (of which some were used). This probably indicates some donut stones were made for exchange, particularly because other households had donut stones but no evidence of their manufacture. Household 1 also had five metates, probably manufactured in the household. Five metates are well beyond the grinding needs of the usual household, given the ethnographic observation that most Maya households today have one or possibly two mano-metate sets, as a set belongs to an economically active female (Hayden and Cannon 1984, Vogt 1990). It is likely that Household 1 members were producing surplus masa, or maize dough. Because this household is adjacent to Structure 10, which belonged to a religious association, it may have episodically produced masa for ritual participants. Structure 10 has only one metate and thus had limited grinding capacity. Household 1 probably provided masa as a service, but the evidence is circumstantial. Because all the spindle whorls found at Cerén to date have come from within or near Household 1, it is probable that this household made abundant amounts of thread. Based on the small size of the whorls, the thread probably was cotton. It is likely that the household produced more thread than it consumed, providing another commodity for exchange outside the household. This whorl distribution matches the Household 1 Structures 10 and 12 ceramic paste distribution, indicating closely integrated functioning.

It appears that Household 2 made decorated gourds, based upon two lines of evidence. Five miniature ceramic vessels were kept in the storehouse, each containing slightly varying hues of cinnabar pigment (HgS). The only use of cinnabar discovered at the site to date is in painting the outsides of gourds; hence we propose this is a paint set for that purpose. In addition, as Simmons (1996) has noted, the use wear on obsidian blades from Household 2 matches experimentally produced use wear on obsidian tools used for cutting gourds (Lewenstein 1987). Further substantiation of gourd processing in the household is provided by the large bag of wet Ilopango volcanic ash that would have served as an efficient abrasive in cleaning the gourds' inner surfaces (Simmons 1996). Additional evidence not yet excavated to confirm gourd processing would include finding gourds in process, the actual workshop, and stored kaolinite used to coat the gourds prior to painting. Household 2 has the same exotic materials that arrived as a result of craft exchanges as did Household 1.

In addition to the gourds, the stored tobacco seeds in Household 2 might possibly indicate an agrarian specialization, but that awaits confirmation. We hypothesize that Household 2 was providing a service for the temascal (sweat bath) in the form of firewood and/or water to pour over the firebox to make steam, testable in future excavations. Services are notoriously difficult to document archaeologically, but it is possible at Cerén to make some progress.

So little of Household 3 is presently known—only a part of the kitchen (Structure 16)—that production and specialization there are unknown.

Considerable evidence of craft production and specialization exists for Household 4. Some seventy agave plants were growing in the area. Because a household only needs about five mature agave plants for its fiber needs (V. M. Murcia, personal communication 1995), an additional dozen households could have been supplied from this garden. The depulping of the agave leaves evidently was done on the north side of Structure 4. Three pairs of sticks were found at that corner, and the clay floor around the northeast pole supporting the roof had gone through numerous wet-dry cycles, which generated cracking and resulted in organic staining and darkening. The traditional Salvadoran technique of agave depulping uses pairs of sticks attached to a post; the leaves are pulled through the sticks, which separates the fibers from the rest of the leaf. Thus, the considerable surplus of agave fiber presumably was used to exchange for the exotic lithics found in the building, including a hard greenstone ax and obsidian blades.

Additional evidence that Household 4 may have focused on agrarian specialization is provided by the cotton seeds that were found in storage within the building, in a ceramic vessel, and fragments of ground cotton seeds on the metate mounted on horquetas under the northwest corner of the roof. Also, it is possible that special foods or sauces were grown and prepared in the household. Cacao plants have been found growing south and west of Structure 4, and cacao seeds were stored in ceramic vessels in the building. One had cacao seeds in the bottom and chiles above, separated by a layer of cotton gauze. It is possible that they would have been prepared into a kind of mole sauce. Both the cottonseed oil and the cacao may have been produced in amounts greater than that consumed within the coresidential group. Household 4's garden provided primarily production for exchange, in contrast to the production primarily for consumption of the kitchen garden of Household 1.

The craft specializations of Households 1 and 2 apparently led to commodity production, but these households may also have been involved in providing services or perishable goods. In contrast, the household of Structure 4 was more specialized in agriculture, in the overproduction and exchange of agave, cacao, cotton, and maize.

The Comparative Framework: Other Mesoamerican Household Archaeology

Research in Oaxaca provides comparative data and pertinent methods and concepts (Flannery 1976; Winter 1976). Marcus (1989) presents numerous Formative floor plans with piece-plotted artifacts, as well as a patio area with artifacts. Winter (ibid.: 25) defines a "household cluster" as the houses, storage pits, graves, and associated ovens and middens. The household included these features, along with the activity areas inside and directly outside the house. Thus Winter's household concept includes the physical data and the interpretations of past human behavior of the functioning social unit. Oaxacan households varied somewhat in their features and were commonly spaced 20 to 40 m apart. Winter estimates the individual Tierras Largas household cluster occupied 300 m^2, less area than Cerén households. Flannery (1976: 5) critiques the cluster concept and favors "household unit."

Whalen (1981) excavated one of the best-preserved Mexican houses; most of the house floor and contact artifacts were preserved by the adding of fill for a new floor. There are disagreements about which artifacts were in situ, which were somewhat misplaced, and which were inadvertent inclusions in construction fill, with Spencer (1981) conservatively analyzing only artifacts partially impressed into the floor. Parry (1987) argues for a more inclusive approach. Fortunately, Cerén conditions obviate this problem.

Blanton (1994) provides a peasant household comparative database. Mesoamerica is notable for relatively small house sizes (mean $62m^2$ ±67) and relatively few rooms per household (mean 4 ±3). Cerén households are slightly above the mean in area and number of rooms but smaller than Copán. Cerén is slightly below the worldwide mean in number of rooms and roofed areas per household (Blanton 1994).

Although still small, the number of excavated southern Mesoamerican houses has increased in the past decade. Ringle and Andrews V (1983) recorded Formative residences at Komchen. Eaton (1975) has identified farmsteads as one-room stone-walled houses with fenced enclosures, and house mounds as raised platforms supporting perishable structures in the Río Bec area. Blake's (1987) excavations at Paso de la Amada, Chiapas, uncovered surprisingly large houses of an Early Formative chiefdom.

At Copán, significant advances in household archaeology are being made (Webster and Gonlin 1988). Maya commoners, as agrarian "producers" living in the peripheries of Copán, had very basic housing, usually consisting of multiple small rectangular structures, sometimes on a platform, with active use of the peripheral spaces surrounding each structure. Structures were consistently aligned. Maya households in Copán proper had more substantial construction and more ideal Maya architecture consisting of rectangular substructures with steps in front, terraces, and interior benches, some of which had niches (ibid.: 186). In built space, Cerén shares architectural similarities with Copán's residential core and its agrarian periphery.

Summary and Conclusions

Cerén has contributed to our understanding of household production, as each household produced the bulk of its food, its architecture, and some of its implements. These involved a wide range of activities, including field preparation and maintenance, storage, architectural and artifactual maintenance, food preparation, and others. Each household had a relatively standard tool kit of chipped-stone, groundstone, ceramic, gourd, and wooden tools and vessels. Beyond these standard items and activities, each household engaged in at least one productive activity that generated material items in excess of what was consumed within the domestic unit, and these items were used as exchange for desired items produced elsewhere within the village or in the valley. These part-time craft specializations included making groundstone and gourd products; making agave fiber and perhaps cotton thread and cottonseed oil; and raising cacao, chiles, and other agroeconomic specialty products.

Viewed not from Cerén but from the other end of the social hierarchy, we can see how the elite at major centers such as San Andrés supported themselves. It was not by political centralization, not by dominating religious belief and activity, but by economic means. Because households had choice concerning the center in which they would do their exchanges, elites were circumscribed in setting steep or exorbitant exchange values. The elite arranged for the long-distance import of materials and artifacts that every household needed, and exchanged them for the locally produced items that the elite required. Coming from a distance were obsidian, jade, shell, hematite, cinnabar, and presumably salt. What the elite received in exchange for those items must have been food, drink, vessels, thatching, wood (for architecture, artifacts, and firewood), and labor for construction and services. Thus the economics of convenience, necessity, and symbiosis composed the fabric that interwove commoners with elites in the Zapotitán Valley.

Because it is possible to document both end points of the specialized production-exchange system using data such as these from Cerén, we believe that Costin's (1991) definition of occupational specialization has largely been met. Craft items produced at each of Cerén's households, along with various items brought into the community from outside sources, have been identified, thereby satisfying the first part of Costin's (1991) definition. In addition, special service relationships that existed between Cerén's households have been documented, and the identification of these service relationships satisfies the second component of Costin's (1991) demanding definition of specialization. Both commodity and service relationships at Cerén were significant components of the domestic economy, which appears to have been intimately linked to larger economic forces operating throughout the Zapotitán Valley and probably beyond.

Cultivating Biodiversity: Milpas, Gardens, and the Classic Period Landscape

Payson Sheets and Michelle Woodward

Introduction

Cerén inhabitants developed intensive methods of permanent agriculture to maximize their production of food. At Cerén, maize (*Zea mays*) clearly was the principal crop, followed by beans (*Phaseolus vulgaris*) and malanga (*Xanthosoma violaceum*), squash (*Cucurbita* sp.), guayabas (*Posoqueria latifolia*), nance (*Brysonima crassifolia*), manioc (*Manihot esculenta*), cacao (*Theobroma cacao*), chiles (*Capsicum annuum*), and others.

The use of ridges in fields and kitchen gardens and the cultivation of diverse plant species in zones are components of the intensive agriculture found at Cerén. In addition, there are strong correspondences between the plants growing near households and the foods stored in ceramic vessels in the households (Lentz et al. 1996). Household 4 is a good example, as a young cacao tree was growing in the garden and cacao beans were stored in a vessel in the storeroom nearby. The inhabitants of Cerén were growing and storing a variety of edible plants. Furthermore, these plants grew in specific, circumscribed areas, which we describe as zoned biodiversity.[1] Figure 20.1 illustrates the agricultural zones identified at Cerén.

The estimates for crop yields for Cerén indicate very high productivity per unit area. We estimate that in a good year the household could produce all the food it needed from its contiguous territory. But in an average or poor year, it would need production from outfields, presumably outside of the village, where slash-and-burn may have been used. Zier (1992) and Sheets (1982, 1992a) summarize earlier understandings of agriculture at Cerén.

Permanent Agriculture at Cerén

Archaeological evidence at Cerén indicates the inhabitants practiced intensive, permanent diversified agriculture to sustain their families. According to Netting (1993: 28), permanent agriculture generally involves several characteristics, including the presence of a diverse array of plant species, the moving and manipulating of soil to foster growth and to control erosion, the regulation of water, and the maintenance of soil fertility. Not only is field ridging present at Cerén, but also the archaeological record provides evidence for the rarity of agricultural fields lying fallow.[2] The rarity of milpas (maize fields) lying fallow indicates the high intensity of agriculture at Cerén. Of the eight milpas excavated, only one appears to have been fallow. Collectively, this evidence supports the practice of permanent infield agriculture at Cerén. Present-day traditional agriculturists in Central America continue to use these techniques to maintain permanent agricultural fields.

Milpas

Milpas are one form of permanent agriculture found at Cerén. The milpas at Cerén are most similar to the "high-performance milpas" located throughout Mexico and Central America today and described by Wilken (1971: 442). The maize of a milpa is generally interplanted midway through the growing season with beans and often squash. Planting often is done on the tops of low ridges spaced 60–80 cm apart to facilitate the infiltration of rainwater and to avoid compaction of soil around the roots. High-

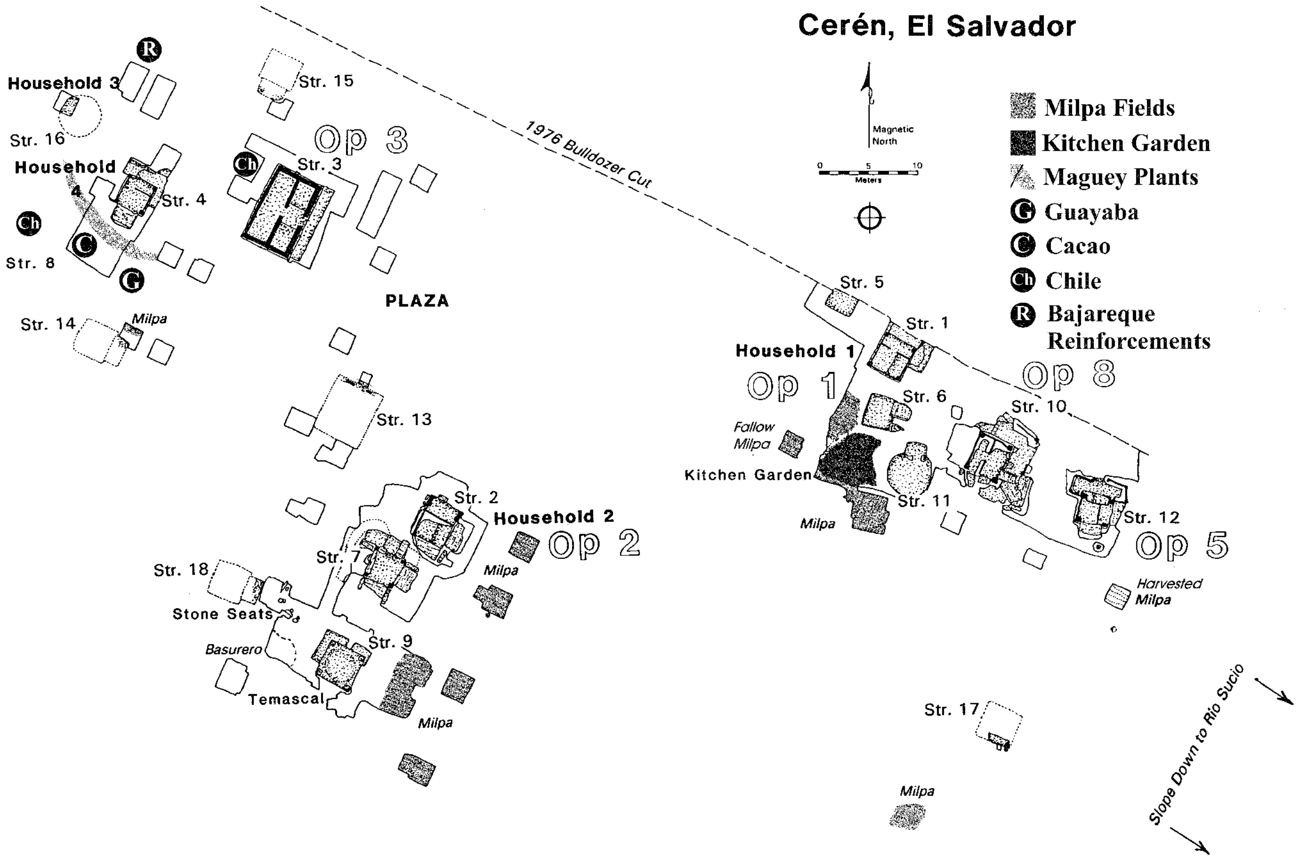


FIGURE 20.1. Agricultural zones at Cerén.

performance milpas are characterized by high productivity per unit area, high labor investment, and few or no fallow periods.

Milpas were caught by the volcanic ash in different phases of the crop cycle in eight different localities at Cerén, with the most common phase being maturation of the first planting. The other crop phases included juvenile second plantings and a milpa lying fallow. One milpa had been harvested just before the eruption, and it is unknown if it was to be replanted (Test Pit 17, Gerstle 1992c). Another milpa, planted in a previous year but not in the year of the eruption, indicates the presence of a true annual (short) fallow (Zier 1983). At two other field locations, the first crop had been harvested and replaced by the second planting. One of the replantings was done with multiple seeds per locality, while the other was more dispersed, with a single plant growing in each locality.

Three milpas still had the mature plants of the first planting in the field at the time of the eruption, and in one of them the plants were doubled over to dry in the field. This practice is still common in Middle American traditional agriculture. Yet another locality had young but tall maize plants with ears approaching maturity, which probably was a first planting that was done slightly later in the season than in the three milpas with mature plants. Finding milpas at these stages indicates the midpoint in the growing season was probably August.

Maize seeds at Cerén generally were planted in clusters, from which two to five plants germinated and grew together on the tops of low ridges. The exception is one second planting in which single seeds were planted (Zier 1983). The ridges are 10–20 cm high and are spaced about 60–80 cm apart. The agrarian landscape is surprisingly ordered, with the maize ridges lining up with the dominant architectural orientation of civic and household buildings 30° east of north, or 30° south of east. We do not know why. That planting density (McKee 1990a: 102), averaging about 1.3 clusters per square meter, means a conservative average of 3 mature ears per cluster and yields an estimated 3.9 ears per square meter. If we assume a 20 m radius as a rough estimate of the immediate territory around a household before touching the territory of adjoining households, each household cultivated some 1,200 m^2 of high-performance milpa. Of the 1,200 m^2, we estimate two-thirds were agricultural, with the other third being patio and structural space. That provides a very rough estimate of productivity per household at about 3,120 ears of corn, or 468 k, produced by the first planting from immediately contiguous land.[3] Extrapolated, this is a density of approximately 52,000 maize plants per hectare,[4] a figure that compares favorably with the 41,667 plants per hectare in the western Guatemalan highlands (Stadelman 1940). Collier (1975: 32) reports clusters spaced a meter apart in highland Chiapas, which yielded a density between the above two numbers.

According to Carlos Lara (1998b: 107) a traditional family of six living in Joya de Cerén today consumes 900 k of maize per year. That is close to the general figure of 1,300 k per year that is common in Mexico and Central America today (David Lentz, personal communication 1998). If we take a conservative middle figure of about 1,000 k per family, it appears that the first harvest of infield milpas equaling approximately 468 k supplied less than half the maize needed per year. However, in a good year the substantial second harvest in November would have closed much of that gap. An average or poor year's second harvest would have done little to close that gap. Based on evidence at hand, it appears that Cerén households cultivated outfields beyond the village that probably contributed approximately a third to a half of the food a family consumed in an average to poor year. Thus the outfields could have been of a shifting, slash-and-burn nature.

In comparison to modern maize production, the estimated yields from the first planting at Cerén appear to have been highly productive. For highland northwestern Guatemala, Stadelman (1940) reported figures ranging from about 1,000 to 3,000 k of maize per hectare. Table 20.1 summarizes the estimated crop yield from Cerén based on the description of agricultural fields given above and assuming each cob contained 150 g dry weight of corn kernels (Lentz, personal communication 1997). This exceptionally high productivity figure does not take herbivory into account. Table 20.2 provides crop yields gathered from ethnographic research throughout Mexico and Guatemala, and Table 20.3 provides additional studies of maize yields.

Olson (1983) found the volcanically derived soil that underlies the Ilopango tephra throughout the Zapotitán Valley—well-developed, reddish, and clayey—to be excellent for crop growth. The pH is close to neutral, ranging from 6.9 to 7.4, with good structural development and water retention capability. He found it more fertile than any of the soils developed on volcanic ash layers deposited in the valley during the past two millennia, including the contemporary soil. It is notably high in various key elements (P, K, Mg, Ca, and Zn), with a range of organic matter from less than 1% to over 4%. Because the Ilopango TBJ is relatively thin at Cerén, often 10–20 c, many crops grown there before the Loma Caldera eruption must have rooted in the fertile old soil. Thus, the Ilopango tephra (TBJ) would have acted as a volcanic ash mulch, further improving the moisture retention of this soil as well as supplying some nutrients. These factors may be part of the explanation for the very high productivity per unit area achieved in Cerén milpas.

TABLE 20.1. Calculated Maize Yields for Cerén

Area	*Average kg per hectare*	*Sources*
Cerén	5,850 kg/ha	Zier 1983 Lentz, personal communication 1997

NOTE: Average kilogram per hectare was calculated assuming each cob yielded approximately 150 g dry weight of maize. The estimate does not take herbivory into account.

Based upon plant maturation, particularly of maize, guayaba, and the annual plants in the kitchen garden, the eruption probably occurred in August (Sheets 1992a). That would be the time that traditional agriculturists would have been planting beans in their milpas. Vines have been discovered interplanted with mature maize plants in two locations, and some may be bean plants. One is south of Structure 9 (David Tucker, personal communication 1994) and the other is in Pits 54 and 55 to the north and northwest of Structure 4 (Cackler 1996). Staff botanists of the Jardín Botánico La Laguna field-identified one of the vines in Pit 55 as Rubiaceae. Historically, Rubiaceae has been used for medicinal purposes, and it continues to be used in traditional areas of El Salvador today.

Agave (Maguey) Garden

Maguey plants (*Agave americana*) were growing in a garden to the south of Structure 4, and the central part of the garden was excavated in 1990. Fortuitously, one plant even had a two-ply agave fiber rope looped over one of its lower leaves, either tossed out by someone just before the eruption or blown onto the leaf during the emplacement of the

TABLE 20.2. Maize Yields Compiled by Wilk (1985)

Group/Area	R Value[a]	Average (kg per hectare)	Range (kg per hectare)	Notes	Source
Kekchi/Toledo	< 7	1,515 kg/ha	1,097–2,820		Wilk 1985
Jacaltec/Highlands	< 9	1,845 kg/ha	1,024–3,102		Stadelman 1940
Yucatec/Yucatán	16.7	1,303 kg/ha	1,054–1,551		Morley 1946
Ladino/La Venta	20.0	1,050 kg/ha	800–1,100		Drucker and Heizer 1960
Mopan/Petén	c. 30.0	877 kg/ha	Not given		Cowgill 1962
Kekchi/Izabal	11.1–67.0	846 kg/ha	Not given		Carter 1969
Mam/Highlands	c. 36.0	1,024 kg/ha	620–1,240		Stadelman 1940
Kekchi/Toledo	64.1	839 kg/ha	234–1,943	Dry season	Wilk 1985

[a]The smaller the R value, the less intensive the agricultural system. A value of 1 means a field is rested for 100 years for each year of use, while the maximum value is 100, when a field is in continuous use. According to Joosten (1962):

$$R = \frac{\text{Number of years of cultivation of a plot} \times 100}{\text{Number of years of fallow + number of years cultivation}}$$

TABLE 20.3. Average Crop Yields Derived from Additional Ethnographic Data

Area	Average (kg per hectare)	Notes	Source
Maya Lowlands			
First year	1,600 kg/ha	Moist, drained; April/May planting	Wiseman 1978
Second year	1,134 kg/ha	Moist, drained; April/May planting	Wiseman 1978
Third year	468 kg/ha	Moist, drained; April/May planting	Wiseman 1978
Mexico	4,000 kg/ha	Terraces/ irrigation; May planting	Patrick 1985

FIGURE 20.2. Maguey (*Agave Americana*) growing in the special garden south and west of Structure 4, cast in dental plaster. Note the two-ply twine in foreground, which was resting on a leaf when the eruption struck.

FIGURE 20.3. Macoyas, identified by David Lentz as *Xanthosoma,* on ridge in kitchen garden of Household 1.

Unit 1 ashfall. It appears that the eastern end of the maguey garden was discovered in Test Pit 15 and the western end in Test Pit 55. The total plant density (including mature and juvenile plants) is 10 per square meter, but a more useful figure is 5.2 mature plants per square meter. A household would need about 5 mature plants to supply its sustained needs (V. M. Murcia, personal communication 1996). Thus, including the 13 mature plants discovered originally, the additional 11 m^2 of recently discovered maguey would contain an estimated 57 more plants, for a total of about 70 plants. That would have been sufficient to provide fiber for some fourteen households. Thus Household 4 must have been using maguey fiber for exchange within the village and region. In contrast to the large species of maguey cultivated in highland Mexico for food and drink as well as for fiber, the Central American maguey was grown only for its fiber.

Maguey is the only cultigen found extensively at Cerén that did not align with the dominant orientation of the site, 30° east of north. This lack of spatial arrangement does not seem unusual, because maguey propagates itself by roots sprouting into a new aboveground plant.

Kitchen Garden

At Cerén, kitchen gardens have been found adjacent to household buildings. Although the ancient inhabitants grew small amounts of produce in these areas, the archaeological record of Cerén contains a large diversity of plant species. The kitchen garden associated with Household 1, found south of Structure 6 and west of Structure 11 in Operation 1, is bordered by a 1 m walkway separating the structures from the garden. In this garden, four species were planted on top of relatively short ridges running east-west, with ridges averaging 80 cm from each other and plants spaced an average of 70 cm apart along the ridgetops. Each ridge had a different species (field identifications by Reyna de Aguilar 1991b). One likely cultigen is piñuela (*Bromelia karatas*), which is still cultivated by traditional Salvadoran households for its edible inflorescences and young buds, and for making the drink atole de piñuela. Another prominent plant, with entire ridges devoted to it, are macoyas, annual plants that grow in tight clusters of ten to twenty plants and produce edible roots. David Lentz (Chapter 4) identified them as *Xanthosoma*, a root crop (Fig. 20.3). Another plant was identified as cebadilla (*Schoenocaulon officinalis*), which is widely used in Middle America as a medicinal plant to alleviate upset stomachs. Manioc occupied half of one row. This kitchen garden is characterized by high species diversity, but with each species organized in zones along cultivation ridges, it is the best example of zoned biodiversity at Cerén. That the ridges are perpendicular to the ridges in the milpa to the south (also found in Test Pit 1 by Zier 1983) indicates microtopographic slope management for the infiltration of rainwater and to minimize erosion. Another form of water control found at Cerén is a ditch constructed to carry excess precipitation and runoff from the roofs and patio of Household 1. Figure 20.4 illustrates the Household 1 kitchen garden.

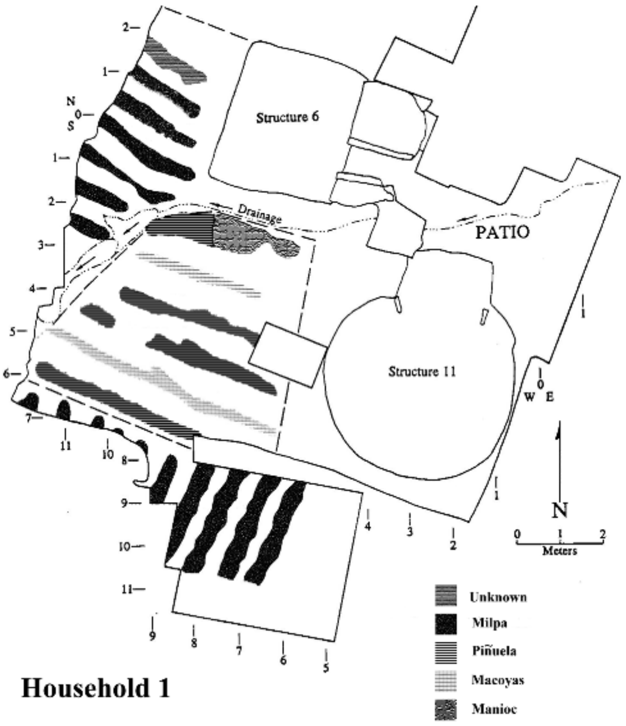


FIGURE 20.4. Kitchen garden of Household 1, with maize milpas to the north and south.

Tree and Root Crops

Numerous trees have been found throughout the excavated portions of the site, and most if not all of them were economically important. Minimally, trees found in the area provided firewood and construction material, and in many cases food. More specifically, a guayaba tree with fruits the size expected in mid-rainy season (i.e., August) was growing south of Structure 4, and the eruption knocked dozens of the fruits onto the ground. To the west of the guayaba tree, a young cacao tree was growing (Fig. 20.5). From its trunk, a flower bud was just starting to open when the eruption buried it. Had the eruption not occurred, the flower would have matured into a cacao pod. Three ceramic vessels in nearby Structure 4 contained cacao seeds (Lentz et al. 1996), presumably grown by Household 4 residents and perhaps used for both consumption and exchange purposes. In addition to the above-mentioned trees, three mature palm trees have been discovered, two on the west side of Household 2 and one south of Structure 4. As the species are not known, it is unknown if they provided edible fruits. No evidence for the consumption of palm products has been found in households or the Operation 1 midden.

A line of manioc plants occupied half of the northernmost ridge of the Household 1 kitchen garden (Fig. 20.6). Manioc (or yuca) is a large shrub that yields a great amount of carbohydrates in a relatively small area. The roots of the manioc produce edible tubers that provided ancient inhabitants an additional source of carbohydrates.

Zoned Biodiversity

The agronomic strategy at Cerén evidently was to create specific zones for particular species. The most commonly encountered biodiversity zones to date are the broad zones that contain multiple maize plants arranged on the tops of ridges located within milpas. Later in the growing season, these broad zones probably would have been interplanted with beans and squash. In addition to the broad zones, narrow bands of species-specific zones are found at Cerén. These zones tend to be close to households.

Zoned biodiversity at a micro scale is evident in the kitchen garden of Household 1. Immediately west of the kitchen, Structure 11, are six low ridges, and each ridge was devoted largely to a single species. They were manioc, piñuela, and *Xanthosoma*. The northern ridge had two species growing: man-

FIGURE 20.5. Young cacao tree trunk, with flower just beginning to open. Had Loma Caldera not erupted, the flower would have grown into a cacao pod. Nearby Structure 4 stored cacao beans in pottery vessels.

FIGURE 20.6. Manioc stem in northernmost ridge of Household 1 kitchen garden. Vessel rim was placed in soil nearby, for unknown purpose.

ioc on the eastern half and piñuela on the western half. That row is followed by a row devoted to *Xanthosoma.* The third row was almost entirely *Xanthosoma,* with one piñuela plant at the west end. The fourth row was exclusively piñuela, while the fifth was evenly divided into piñuela on the west and *Xanthosoma* on the east. The sixth row was exclusively piñuela.

A similar area of zoned biodiversity is represented by the very different species around Household 4. The most prominent garden was devoted to maguey, to the south and west of Structure 4. Within the boundaries of the maguey garden the plants grew in no organized fashion. As the two-ply twine found near Structure 4 indicates, it is apparent the inhabitants of Cerén were using the maguey leaves for fiber. The depulping of the pencas (leaves) was apparently done at the northeast corner of Structure 4, where extensive cracking in the clay floor surface was observed around the northeastern post for about a meter in diameter. In addition, three pairs of sticks were found placed against the northeast corner of the building. In traditional households today, people use a pair of sticks tied to a post to depulp the agave leaves. As one hand squeezes the sticks on the penca, the other hand pulls the penca between the sticks to liberate the fibers.

South of the maguey garden was an orchard (a zone of tree crops) with a mature guayaba tree and a juvenile cacao tree. To the southwest of the maguey was a zone of mature chile bushes with stem diameters of about 5 cm. North of Structure 4 was a zone containing a plant used for horizontally reinforcing members in wattle-and-daub (bajareque) architecture.

Thus, the agricultural strategy of Cerén was to create broad to narrow zones of particular species that were cultivated continuously year after year with no fallow periods. The broad milpa zones contained maize, which probably was interplanted with beans and squash later in the growing season. The narrow kitchen garden zones were species-specific, devoted to manioc, piñuela, *Xanthosoma,* maguey, chile, and tree crops.

The Classic Period Landscape

It is likely that the yet unexcavated zones within the site area and surrounding it will prove to contain a mixture of architecture with public and private open spaces (patios and plazas) and agricultural fields. Geophysical investigations (Chapter 3, this volume; Conyers 1995a), using resistivity and ground-penetrating radar (GPR), provide information on the general morphology of the Classic Period landscape. At Cerén, such investigations have detected numerous anomalies interpreted to be buried architecture. In addition, some deeper depressions detected by GPR 20–40 m south of Structure 4 may be clay mining pits for earthen architecture construction, or they may be a form of agriculture yet unknown at Cerén.

Summary, Conclusions

Agriculture at Cerén was strikingly permanent, productive, and sophisticated, and exhibited zoned species diversity. Why most crops were planted in rows to conform to the dominant architectural orientation of the village is unknown. At least one maize crop per year was obtained from milpas, and most milpas were replanted a second time during the same growing season, in spite of the risk of crop failure in a poor year. Second plantings varied in plant density from field to field. Beans may have been interplanted with mature maize to the west of Household 4, but not in most milpas found at the site to date; apparently the eruption occurred just before interplanting time in the mid-rainy season. The variety of tree and root crops is fairly extensive, including manioc, cacao, guayaba, and others. Thus, the signature of Cerén agriculture is high-performance milpas and specialized gardens in permanent cultivation, with zoned species in a carefully maintained landscape and a reasonably high degree of biodiversity.

Notes

1. A methodological note on plant preservation is in order here. During the Loma Caldera eruption, most plants were coated and covered by the fine-grained and moist tephra of Units 1 and 3, and some smaller or thinner plants were blown over by the lateral blasts. Although the plants decomposed within months or years of the eruption, the tephra retained the hollow cavities for centuries, until we encountered them during excavations. Using a fiber-optic proctoscope to explore these dark cavities, project conservationists determine the appropriate preservation techniques before we uncover them. Generally, we create a precise replica of the buried plant, using dental plaster mixed to a specific viscosity to conform to the volume and morphology of the cavity. Because dental plaster is not stable in contact with groundwater in the long run, the plant casts are documented and removed for museum storage.

2. A fallow field is one left unplanted, thus allowing the natural vegetation to regrow.

3. Each ear of corn yielded an estimated 150 g of corn (dry weight); therefore, 3,120 ears would have yielded 468 k of corn.

4. The smaller figure of 28,800 plants per hectare previously reported for Cerén (Sheets 1982) was extrapolated from the second planting encountered in Test Pit 2 (Zier 1983), where dispersed single juvenile maize plants were found.

Continuity and Change in the Contemporary Community of Joya de Cerén

Carlos Benjamín Lara M. and Sarah B. Barber

Introduction

In this chapter, we present a brief ethnography of the modern cantón of Joya de Cerén, within which the Cerén site is located.[1] The cantón is an administrative unit consisting in this instance of five villages, of which the colonia Joya de Cerén is the central unit. According to our data, 5,834 people, living in 680 domestic groups, make up the cantón's population. On the following pages, we discuss the economic and material life of Joya de Cerén's households. Our objective in this chapter is to demonstrate the strength of Mesoamerica's traditional subsistence economy and its material correlates, despite the wide array of changes that have occurred over the last several hundred years in this region.

The Founding of Joya de Cerén

Through the nineteenth century, twenty-two haciendas operated in the municipality of San Juan Opico, the location of the modern cantón of Joya de Cerén. Major crops during this time were coffee, sugarcane, indigo, cotton, banana, rice, yuca (manioc), corn, and beans. Both small and large landholders cultivated these crops, also maintaining some land for cattle. In addition to privately held lands, the Catholic Church and its associated cofradías (sodalities) oversaw some communal properties in the region. This latter type of property was eliminated by the federal government at the turn of the twentieth century, which strengthened the regime of private property, although the land remained under the control of the campesinos.

In 1942, the government purchased lands from the Hacienda San Andrés, in the municipality of San Juan Opico, to improve the living conditions of smallholders in the area. While the original property consisted of 5,509 hectares, over half of the hacienda was sold to the federal government. The purchased land totaled 3,309 hectares, within which the cantón Joya de Cerén and the community of Sitio del Niño were organized. Later, in 1954, the federal Instituto de Colonización Rural (ICR) initiated an agrarian reform program on these lands.

Over a period of several years, the ICR built and sold approximately 160 houses to smallholders. House lots were 1,000 m^2 each, sold at the cost of 3,000 colones (US $1,200), to be paid over 20 years. Most of the families benefiting from this program were from the Opico municipality, and were living in the Joya de Cerén area at the time. The ICR planned the project to benefit domestic groups, not individuals. It is possible that this emphasis on assisting functioning households has contributed to the social stability of the community.

In the village of Joya de Cerén itself, the ICR created a cooperative association with the objective of cultivating sugarcane and basic grains. The members were to work within the cooperative as a community organization. The land belonged to the ICR, and people obtained use rights from the cooperative. The ICR provided technical assistance and machinery for sugarcane production, although the cooperative was obligated to pay for these services and to rent the land from the ICR. Agriculturalists received a salary for their work on ICR land, and after the sugarcane harvest, they subdivided the profits. In addition, any maize and beans produced were subdivided among associates. A health clinic, a school, and a community center were also built for the use of cooperative members.

By 1961 the cooperative had failed. Some cooperative members accused ICR representatives of appropriating for themselves a majority of the benefits, while others accused the directors of the cooperative of receiving excessive benefits. These disputes eventually led the government to divide the cooperative lands among the member households, establishing a system of private small landholdings. Each household received between two and three manzanas (1.43 to 2.14 hectares) of land, at a cost of 3,000 colones, again to be paid over 20 years.

From the point of view of Joya de Cerén's residents, the cooperative failed for two main reasons. First, most cooperative members felt that corrupt acts were impeding the fair sharing of all benefits to all members. Second, most agriculturalists expressed a desire to own their own land and to make independent decisions regarding what to cultivate and how. Within the collective framework, most decisions were made by a group of leaders, removing decision making from the direct producers.

The Economic Life of Joya de Cerén's Households

Since the dissolution of the cooperative, Joya de Cerén's domestic groups have practiced small-scale subsistence agriculture. The majority of domestic groups (78%) own between one-fourth and two manzanas of land (a manzana is 0.715 hectare). When the community reverted to private landholdings, nearly all households shifted to the production of maize and beans for consumption, known as milpa farming. Sugarcane, still cultivated by some domestic groups on a small scale, is and has been a source of supplemental income only. At present, 73% of agriculturalists produce maize and beans as their primary crop. These crops are fundamental to the diet of modern campesinos and form two branches of the Mesoamerican trinity of maize, beans, and squash that have been central to the diet of the inhabitants of this region for over 2,000 years (Fash 1993). Much as in Precolumbian times, Joya de Cerén's milpas represent a type of polyculture that combines the planting of beans and various kinds of squash (pipián and ayote) on the same plot of land as maize.

Mechanized farming is still relatively uncommon in Joya de Cerén. Most fields are burned, planted, and harvested mainly by hand, using traditional agricultural tools. According to our data, only 19% of the small farmers in the area use plows or tractors. The majority of farmers rely upon a tool kit comprised of the chuzo (a type of hoe), the cuma (a short, curved blade with a long handle), and the machete. Although these tools, like the ox-driven plow, were introduced during the Colonial Period, analogous forms existed during the Precolumbian Period (Hayden and Cannon 1984). This tool kit is ubiquitous among smallholders in the region, as oxen remain expensive and scarce among Joya de Cerén's modern farmers. In recent years, the most notable change in farming practices has been the introduction of hybrid seeds, as well as agrochemicals such as herbicides, fertilizers, and insecticides.

Most households also attempt to supplement income through economic diversification. In addition to raising crops, all households maintain domestic animals, like chickens, turkeys, and pigs. They also participate in the local exchange of goods and services. Some households maintain small stores where soda, bread, and other basic products are sold. Various households also have members who have gained employment outside of the domestic group itself. Jobs in the industrial and service sectors are highly coveted (currently, only 12% of the working population of the cantón have obtained full-time employment). Additionally, some young people are migrating to the United States.

The Material Life of Joya de Cerén's Households

In this section, we describe the material culture of Joya de Cerén households in order to acquaint the reader with the form and function of material objects in the everyday life of the smallholders in this agricultural community. Several supralocal factors have influenced the nature of domestic architecture, artifacts, and space use in the cantón of Joya de Cerén. Most important, the village of Joya de Cerén proper was built by the Salvadoran federal government. In this community, the architecture and spatial planning of domestic units were determined by outsiders who were not destined to live in the structures they created. The layout of these domestic units is distinct from the vernacular design and construction of domestic groups that are common in the other villages of the cantón. The architecture and layout of the vernacular domestic units is the result of local design and use, although the size and shape of the land on which these units have been situated was predetermined by the state. The government determined the size of house lots throughout the central village, the colonia Joya de Cerén, during the Instituto de Colonización Rural project. With only a few exceptions, all houselots in the colonia Joya de Cerén are the same size, 1,000 m^2.

Nearly all domestic structures in Mesoamerica are centered around a patio (Rapoport 1969). The patio, an area of the house lot kept clean of dirt and garbage, represents the core area in which most daily activities occur. Because domiciles and other domestic structures are generally small and dark, most tasks are performed outside where there is better lighting and airflow. This pattern of space use is common in both indigenous and ladino communities throughout modern Mesoamerica (Rapoport 1969). It also has great time depth, as the inhabitants of the Cerén site used outdoor spaces for many domestic activities (see Chapters 5, 6, 8). The importance of the patio is emphasized by the fact that many domestic groups orient their structures around the patio, as opposed to the street. The center of domestic structures and household activity in Joya de Cerén is the patio, and domestic architecture reflects this.

Domestic structures themselves, while taking a wide range of forms, generally share several characteristics. Most important, all households maintain an external cooking area. This space may take a variety of forms. In many cases, this area is in fact a well-constructed kitchen with a woodstove, oven, and shelf space for storage of cooking vessels. Some external kitchens are merely adobe-covered wood-frame stoves covered with a corrugated tin roof, and others are converted oil barrels sitting outside or on a porch. As propane gas stoves become more prevalent, some households now cook inside the living or sleeping rooms of the house. The placement of propane gas stoves within the house generally stems from a fear of theft, as most external kitchens do not contain locking doors.

The domicile itself shows the greatest variation in size and form among households. Most domiciles have porches, usually with a low wall around one or more sides. In some instances, the porch has been altered so that it is reminiscent of a sunroom; it is walled in on three sides, but the nonwalled area contains chain link fencing that fronts on the patio. Most domiciles contain one large room at the main entrance. This "family room" is in most instances a bedroom, although it may also serve as a kitchen, eating area, or television room. Additional bedrooms and storerooms connect to this main chamber.

Several other structures are frequently found on a house lot. Storage structures, known as bodegas or galeras, appear in a variety of forms and are built to protect household granaries from the elements. They may appear as freestanding structures or as lean-tos added to the exterior wall of the domicile proper. All domestic groups have at least one pila—a large, open cement water storage tank common in households throughout Central America. In the past 20 years, the Salvadoran government has constructed water tanks to provide water to the colonia Joya de Cerén. Usually, water is delivered by subsurface pipes to households every other day. Pila water is not used for drinking, as pilas are too large to cover and so provide an excellent home for insects. Instead, drinking water is stored in large ceramic or plastic jugs (see below).

Quite a few house lots contain more than one domicile. Supplementary domiciles usually house adult children of the house lot's owner. Households that own livestock may have pens or barns for these animals. Finally, roofed piles of firewood grace most house lots as well. Firewood is essential for many cooking activities, despite the growing availability of propane gas stoves. Most women cook tortillas on comales over a fire, since they prefer the taste.

Construction materials vary throughout the cantón, and also serve as local indicators of economic success. Most domestic structures are built of red (fired) or adobe brick. Adobe structures are made of sun-baked bricks set on a stone or cement foundation, and in some instances the adobe is coated with cement or lime plaster to protect it from the elements. Most residents of the cantón prefer red brick to adobe as a construction material; it is both costlier and more durable than all other materials used in the community today. In addition to red brick, glass windows are strong markers of wealth. Most domiciles either have no windows or use chain-link fencing for openings in domicile walls. In one sample of twenty-three domiciles, only two had glass windows, making them nearly as rare as automobiles.

Portable domestic artifacts reflect a blend of traditional, local, and imported goods. In the second half of the twentieth century, the government of El Salvador opened the country up to a wide range of imported goods, especially from the United States. Portable radios are the most prevalent imported good, although televisions are also popular (32% of the households in the whole cantón and 72% of those in the central village own televisions). Some households also own bicycles, sewing machines, refrigerators, and propane stoves and ovens. Traditional artifacts such as the mano and metate are present in all households, although most pay to have their corn ground electrically.

For cooking, many Joya de Cerén households have three options: a woodstove (used with a comal), a propane gas stove (sometimes with an oven, like a traditional United States unit), and a wood oven. The comal is a traditional shallow, saucer-like cooking vessel made from ceramic or iron. Propped up on rocks or some other fire-resistant material, comales are placed above an open flame for cooking a variety of foods. Other important kitchen artifacts include:

- hand grinders for coffee
- storage racks for dishes
- guacales (large plastic basins for holding corn and other foods)
- large ceramic or plastic water vessels
- ceramic or metal pots for cooking corn and beans

Several of these artifacts have very specific uses. For instance, most women use one pot and no other for cooking beans. Bean pots are easily recognizable due to their shape and distinctive purple stain on the inside. Guacales come in a variety of shapes and sizes. Their primary uses are for transporting husked corn to the mill and for keeping masa (corn dough). Water vessels also have a very specific shape that is directly modeled after Precolumbian vessels. Most women rely upon these vessels, called ollas or cántaros, to transport water.

Among the most important items for any household are those related to agriculture. Nearly all the households in Joya de Cerén derive their primary income from farming. Those households which obtain their primary income from other sources—usually wage labor—generally cultivate some land for additional support. Thus most households own tools and other artifacts necessary for cultivation. As we have mentioned above, the standard cultivation tool kit includes three steel items: a chuzo, a cuma, and a machete. Two of the three items are sharp and potentially very dangerous. For this reason, most households keep their cumas and machetes either in elevated contexts such as roof beams (as at the Cerén site) or beneath furniture. The chuzo, because of its long handle, is kept in the corner of a domestic room or in the storehouse. Each of these items is a standard artifact among households in Joya de Cerén.

In addition to these tools, most households own items for storing cultivars. A majority of domestic groups own at least one granary. Granaries are cylindrical containers of varying size, though usually over 2 m in height, built from galvanized metal. Most households own a granary that holds about 400 k of husked and shelled corn. Some households also use granaries to store beans. Interestingly, the ownership of a granary does not necessarily indicate land ownership. Even landless households have granaries in which a year's supply of corn may be stored. By having a granary, landless households are able to purchase large quantities of corn at harvest time when the price is low. Beans, on the other hand, are normally stored in sacks. These burlap bags each hold 200 pounds of shelled beans. They are the standard means by which households store, sell, or buy their bean supply. Sacks, because they are not waterproof, must be kept dry and safe from pests. Households usually store sacks of beans in the house on a low table or on cinder blocks.

Continuity and Change

The preceding pages present a brief introduction to the historical context within which the households of the cantón Joya de Cerén are situated, as well as a description of their economic and material life. In order to fully understand the nature of the domestic groups studied here, one must understand some of the forces which act (and have acted) upon them. Perhaps most important, postwar El Salvador is changing rapidly, both economically and culturally. Intense contact with the United States in the form of emigration and aid ($75 billion as of 1996) has had profound effects at the household level (Lexis-Nexis 1998). For instance, 29% of households in the cantón have family members living in the United States. This contact has created a relatively cosmopolitan culture among El Salvador's campesinos.

Household organization and its related material culture represent an unusual blending of traditional campesino patterns and this new international contact. Most households in the colonia Joya de Cerén have their own television; some also own refrigerators. Nonetheless, automobiles remain elite items to which very few campesinos have access. At the same time, all households visited also owned a mano and metate—indistinguishable in form from that of similar artifacts from the Cerén site (Fig. 15.2). Since water service is irregular, all households utilize large water storage vessels to maintain a sufficient supply.

Because the colonia Joya de Cerén was developed through a federal initiative, household artifacts and architecture have been influenced to varying degrees. In the colonia Joya de Cerén, most domestic structures reflect the standardized and imposed form of a building project directed from afar. Domiciles in the town are small brick buildings without porches. In their original form, they did not include separate kitchens or external storehouses. With time, the inhabitants of Joya de Cerén's original domiciles have altered the form of their domestic spaces to make them more meaningful and useful for household activities. However, the initial government-imposed form still lies at the core of these residences. In the cantón's other communities, the form of domestic structures reflects government influence only through standardized land allotments. Otherwise, architectural forms reflect the local cultural, economic, and adaptive influences that apply to all forms of vernacular architecture (Oliver 1987).

Many household artifacts are reminiscent of Precolumbian forms. Most important, the comales and wood-burning stoves present in most domestic groups are features that can be traced back well before A.D. 1500. The comal, although a common Precolumbian artifact used in cooking, is not present at the Cerén site. It was most likely brought to this part of El Salvador by Nahua speakers who immigrated from Mexico (Sheets 1992a). Other indigenous food items that likely do date to as far back as the Classic Period, however, are still consumed at Joya de Cerén. Tamales of cornmeal wrapped in corn husks and boiled are a common feature of harvest-time meals throughout the cantón. A traditional corn beverage, atole, is also prepared at harvest time.

At the level of domestic economics, Joya de Cerén's smallholders have maintained and even strengthened their reliance on small-scale subsistence agriculture in the last 100 years. Despite technical assistance and government encouragement to develop a commercial agricultural system, the community's residents ultimately resisted attempts by the Instituto de Colonización Rural to create a cash crop economy in the area. Their subsistence economy, although it has experienced vast changes since the Precolumbian Period, retains an important tie with the region's past.

Conclusions

Joya de Cerén, like many communities in modern Central America, presents a combination of modern and traditional elements in the everyday life of its residents. El Salvador as a nation has undergone vast changes since the occupation of the Cerén site 1,400 years ago, which has strongly affected the form and behavior of domestic groups. These changes are manifest in the omnipresence of Chicago Bulls T-shirts, Japanese televisions, and a wide array of foreign consumer goods. The households of Joya de Cerén are today clearly interacting with global forces. As a result of two separate invasions—the Precolumbian influx of Nahua speakers and the Spanish Conquest—the indigenous population of El Salvador is not ethnically related to the country's Classic Period inhabitants. Nevertheless, many elements of modern life can be seen as analogous to older forms. Subsistence farming dependent upon maize, beans, and squash is a very old pattern. Despite a hiatus during the height of El Salvador's coffee boom, the small-scale cultivation of these plants has supported domestic groups in this region since the Cerén site was occupied. Like the Cerén site's residents, Joya de Cerén's households also utilize other means of income to augment the domestic economy and provide additional income. Many households provide goods to their neighbors on a small scale, creating a local economy that is largely self-reliant and carried out without the oversight of the Salvadoran government. The domestic economy has also resulted in some continuities and analogies in artifact forms and functions. In Joya de Cerén, just as at the Cerén site, metates are mounted on forked sticks and set in kitchens or outside for grinding corn. Water vessels retain a Precolumbian jar shape. Manual cultivation means that most modern households own a standard set of agricultural tools that are analogous to those of the Cerén site, with similar storage.

Ultimately, Joya de Cerén provides a source of insight for researchers studying the region's Precolumbian past. While the vast changes this community—and indeed all of Mesoamerica—has undergone have altered all aspects of domestic life, the stability of the milpa economic system reiterates its efficacy and continuity. Direct cultural continuity is certainly not present between the Cerén site and the area's modern inhabitants. Yet milpa agriculture and some of its associated artifacts have continued through the millennia.

Note

1. All information presented in this chapter is derived from *Joya de Cerén: la dinámica sociocultural de una comunidad semi-campesina de El Salvador,* by Carlos B. Lara M. (1998a), and "Ethnoarchaeological Approaches to Household Wealth in an Ancient Agricultural Community: Storage and Food Production at Cerén, El Salvador," by Sarah B. Barber (1999), unless otherwise noted.

Summary and Conclusions

Payson Sheets

Introduction

The Cerén Research Project has dedicated itself to understanding household and village life during the middle of the Classic Period. Located in a volcanically active area of the monsoon tropics, the Cerén site has taught us much about commoners in the southern periphery of Maya culture. In order to investigate the Cerén village, buried deeply by the eruption of Loma Caldera Volcano, it has been necessary to involve numerous other disciplines and specialties with archaeology, including volcanology, ethnobotany, geophysics, and artifactual and architectural conservation. These research activities are integrated to a public outreach and educational program that includes an on-site museum, trained guides, educational pathways, and involvement of the contemporary community of Joya de Cerén.

The overarching theoretical framework that guides and informs research is human ecology, as peoples and their cultures adapt to the beneficial and detrimental aspects of their environments. A more specific body of theory that assists in inferring human behavior from the material culture is household archaeology, a thriving subfield of archaeology.

Summary of Research Accomplishments

This summary of research accomplishments includes the initial seasons of 1978, 1979, and 1980 and emphasizes the major seasons of 1989, 1990–1991, 1992, 1993, and 1996.

VOLCANOLOGY AND GEOPHYSICS

Beginning with volcanology, Dan Miller (Chapter 2) and his colleagues have shed considerable light on the nature of the eruption that buried the village only 600 m away. The eruption was caused by the hot magma working its way upward in the Loma Caldera fissure and coming into contact with water of the Río Sucio. A mild earthquake gave some warning but would not have caused abandonment of the village, given the frequency of earthquakes in this area. I suspect the initial loud hissing steam emissions frightened villagers sufficiently to cause them to flee, as we have yet to find anyone killed by the eruption. The eruption really began with a massive series of steam explosions that deposited fine-grained, moist ash at about 100°C on the village and surroundings, which resulted in what we call Unit 1. That was followed by Unit 2, a dry phase of airfall materials, including larger pieces that were hotter than 575°C as they fell (Hoblitt 1983). When the large pieces—the lava bombs—penetrated thatched roofs, they caught the underside of the roofs on fire. The tops of the roofs did not burn because they were coated with moist Unit 1 tephra. Unit 3, a thick deposit composed of many fine-grained moist surges, accumulated on top of the burning roofs and collapsed them. It rained heavily at least twice during Unit 3 deposition. The remaining eleven Loma Caldera layers are alternating steam explosion surges and airfall deposits that continued until the village was buried by some 5 m of tephra and then forgotten for 14 centuries.

Four geophysical exploration instrument systems have been utilized at Cerén since 1979 in the attempt to detect structures or other cultural features buried below some 5 m of volcanic ash. The focus here is on the two most effective instruments, resistivity and ground-penetrating radar. In the early years of research, resistivity was the most successful, detecting buried buildings as M-shaped anomalies. Resistivity is relatively simple to operate and interpret, and works best in the rainy or early dry season. Ground-penetrating radar instrumentation and software have improved in recent years, and it is now the system of choice. In contrast to resistivity, ground-penetrating radar works best at Cerén toward the end of the dry season. As Larry Conyers and Hartmut Spetzler point out (Chapter 3), ground-penetrating radar is capable of subsurface three-dimensional imaging, assuming the person conducting a survey does thorough calibrations in the field, knows how to handle the very complex instrumentation and data processing, and can do extensive field verification.

Both resistivity and ground-penetrating radar detected Structures 2, 3, and 4 as anomalies, and they have been excavated. Over twenty anomalies that range from highly probable to possible structures have been detected by both instrument systems but have yet to be excavated. The recent improvements in ground-penetrating radar have allowed Conyers to map the Classic Period landscape and to detect not only structures but the civic plaza, patios in households, and other more enigmatic features that will require excavation to understand. A major result of ground-penetrating radar surveys south of the currently excavated site is the discovery of a swath of anomalies that probably are household structures, as well as a sizable area with no apparent structures even farther to the south. The area with no structures is probably beyond the southern architectural boundary of the site. Ground-penetrating radar research in 1998 attempted to discover the western boundary of the architecture, with some success. Once geophysical research has discovered the apparent architectural limits, the Salvadoran government will act quickly to enlarge the protected area to preserve the site in perpetuity.

PALEOETHNOBOTANY

David Lentz notes the wide range of plant remains found in storage in buildings, as a part of the buildings, or growing within the village (see Chapter 4). He has identified maize (the Nal-Tel/Chapalote rapid-growing variety), two species of beans, squash, abundant chile peppers hanging from rafters in many buildings, manioc, *Xanthosoma*, avocado, capulín, guayaba, and nance. Also preserved were pole fences and pole doors of buildings. Maize was stored in a granary in husked form on the cob, not shelled. Notable by its absence was ramón (breadnut, *Brosimum alicastrum*), and notable for its almost complete absence was palm. Although the bases of three palm trees growing at the site at the time of the eruption have been found, the only evidence of the use of a palm product at Cerén to date is the one coyol palm endocarp used as a spindle whorl. The absence of palm nuts used for oil or palm fronds in thatching is striking. The principal thatching material is grass (*Trachypogon plumosus*), a species that obviously was abundant in the Classic Period but has been virtually eliminated from El Salvador by Old World grasses, animal husbandry, and intensive agriculture during the past 5 centuries.

THE VILLAGE ORIENTATION

The orientation of 30° east of north, or more probably 30° south of east, was of great importance to Cerenians, as they aligned their civic and domestic architecture to that, and even the rows of their cultigens. The reason is unknown. That orientation does not derive from San Andrés, and it does not orient to any volcanoes or other prominent physiographic features. It may be an astronomical orientation. That Cerén's azimuth is different from that of San Andrés may indicate more autonomous decision making in villages in the valley than most Mesoamericanists would expect.

THE HOUSEHOLDS OF CERÉN

Excavation has been done at four households at Cerén to date, but only Household 1 has been excavated completely. Household 2 has been largely excavated except for the kitchen, but all that is known of Household 3 is a fraction of its kitchen, and only the storehouse-workshop has been excavated at Household 4. In spite of the small sample, it is becoming clear that the households have some shared characteristics, such as the same azimuth orientation, architectural techniques, and basic set of ceramic, chipped stone, and groundstone artifacts. They all have at least three structures, the principal being the domicile, which has an inner room with a sleeping bench that was used for food sharing and other activities during the day. Domiciles measure 3 × 4 to 4 × 4 m, with their floors being the tops of solid, fired earthen platforms and their bajareque (wattle-and-daub) walls abutting solid earthen columns at the corners. The grass-thatched roofs are supported primarily by the vertical bajareque-reinforcing (wattle) poles, with some support from posts atop the earthen column tops. The frequency of mice in the thatched roofs is directly proportional to the amount of food stored in the buildings, not surprisingly.

Storehouses are similar in size to domiciles but are not as solidly constructed. Structure 4 may well have been converted from a domicile to a storehouse. Kitchens, with their thin thatched roofs (for smoke egress) and thatched walls, probably were built as detached buildings so they would cause limited loss in case of fire and could be readily rebuilt. Their floors of TBJ tephra could be replaced when they became too laden with organic matter from spills.

The material culture found in households is astonishing. Household 1 owned over seventy ceramic vessels, along with numerous gourd containers and baskets. Almost a quarter of its ceramics were polychrome painted, a high percentage if the numerous indications are correct that it was the poorest of the households excavated so far at Cerén.

Individual households appear to have been largely self-sufficient in terms of food, as each household cultivated milpas and kitchen gardens and probably had outfields near the village. Based on productivity calculations, a good year would have provided sufficient maize from a household's adjacent fields to supply its needs. But an average or poor year would have required food to be produced from outfields.

Individual households also appear to have been self-sufficient in building and maintaining their own structures. The amount of time and effort needed to build them was not great; Víctor Manuel Murcia (personal communication 1995) estimated 62 person days were needed to build the substantial domicile of Household 2, and the domicile of Household 1 would have required about two-thirds of that.

Household 1 Household 1 is the most completely excavated domestic complex at the Cerén site to date, with Structures 1, 6, 11, and 5 representing the domicile, storehouse, kitchen, and outbuilding, respectively. As Structure 1's northern portion was sectioned by the bulldozer, it is the only building at the site where we have seen architectural stratigraphy, and a significant amount of remodeling had taken place. It appears that a few generations had lived there, perhaps over a time span of a century or so.

The Household 1 storehouse was being remodeled when the eruption struck; only the eastern wall with doorway had been completed. Because small valuable artifacts that otherwise would have been stored in the storeroom had been moved to the kitchen and the domicile, it would appear that theft within the community was a problem. The ladle censer with a unique animal figure indicates the vitality of religious activities within the household. Each household had a stylistically unique censer with a distinctive animal figure that may have been made within each domestic unit, judging from their irregularity and the small ceramic manufacturing area in Structure 1.

The seasonally sensitive plants of the kitchen garden and other areas indicate the eruption occurred in the middle of the rainy season, probably in August. The artifact patterning within all households indicates the eruption occurred shortly after the evening meal was served. Those patterns include the pot removed from the hearth, yet-to-be-washed serving vessels with finger-swipes of food, maize kernels soaking by the kitchen metate, digging stick back from the fields, hackberry pits yet to be discarded, and a bench yet to be cleared of vessels from daytime activities to convert it to sleeping. Thus the eruption probably occurred around 6:00 to 7:00 P.M.

The kitchen was loaded with artifacts and food. The kitchen was organized into functional zones of vessel storage, food storage, and food processing areas. Both the kitchen and the domicile stored hematite mixed with mica, perhaps a poor man's imitation of specular hematite pigment.

Tracy Sweely (1998) speculated that the positioning and orientation of metates in Household 1 and the Structure 10 religious building are indicative of the relative authority of the women using them to grind maize. Certainly there are many indications of the close relationship between Household 1 and the religious activities at that special building.

Household 1 functioned in an ordered built landscape, with carefully oriented buildings clustered around a patio and clean walkways bordering oriented ridges of milpas and the kitchen garden. The latter was organized into zoned biodiversity with a single species dominating one ridge and another species on the next ridge (Chapter 20).

All the spindle whorls found at the site to date come from within or near Household 1, indicating that household members made their own cotton thread and likely traded thread with others in the community or beyond. Most of the site's hammerstones came from this household, indicating that they also had a part-time craft specialization in making manos, metates, and donut stones. It is possible that a transition from trough metates on the floor to metates mounted on horquetas (forked sticks) was occurring, but it is more likely that they functioned in different social contexts. The well-used trough metate on the kitchen floor, adjacent to the soaking maize kernels and the hearth, may have been the principal grinding tool for the household, and the horqueta metates may have been used for special occasions, such as feasting ceremonies at Structure 10.

Household 2 Household 2 is known for its domicile, storeroom, and adjoining milpa, but its kitchen remains undiscovered. The architecture is more substantial than that of Household 1, and some of the artifacts are more valuable and difficult to obtain (e.g., jade necklace, miniature pots containing cinnabar), yet both households share basic characteristics in their buildings and artifacts. The wealth difference could derive from the household maintaining and benefitting from community use of Structure 9, the large sauna with patio and stone seats. Household 2 may have specialized in the manufacture of painted gourds, which could have contributed to their affluence. The bag of TBJ tephra in the household could have been used for scouring gourd interiors. And their whetstone could have done ax sharpening for more than their own needs.

The Operation 2 midden consists of domestic trash and large amounts of charcoal and wood ash, presumably from the firebox of the sauna. Why the wood ash was not used as fertilizer is unclear. Most midden obsidian prismatic blade edges were still sharp, but segments were short, indicating the principal reason for discard was not dulling but breakage into segments too short to handle easily. Once the midden is significantly excavated and analyzed, the relationships of artifacts in everyday use to the midden artifacts will be useful to researchers excavating middens at other southern Mesoamerican sites and wishing to reconstruct human behavior and understand the household and village using the midden.

Household 4 Structure 4 was the storehouse for Household 4, and it shares many artifactual similarities with the other storehouses. As it has most features of a domicile, probably it was originally built as one and the bench was removed when its function was shifted to storage. It also served as a craft area, with agave growing behind the building and being depulped at its northeast corner. Cotton seeds were stored within the building and ground on the metate at its northwest corner. Cacao grew south of the building and the seeds were stored in ceramic vessels inside.

PUBLIC BUILDINGS

Structures 3 and 13 were built on the west and south sides of the formal village plaza (Fig. 1.1) and form part of what apparently was the civic center. Radar detected what probably are two more buildings on the east side of the plaza. The two confirmed plaza buildings were placed on high solid platforms, with solid earthen walls, in contrast to the bajareque walls of households. Structure 3, with its large benches in the front (east-facing) room, probably was used as a locus for ajudicating disputes. It is likely that village authorities, perhaps village elders, sat on the front room benches and listened to the sides of the problem. The large scraped-slip vessel on one bench probably held a liquid (chicha?) used to seal the resolution of the dispute. A hemispherical polychrome bowl was on the wall top above the vessel and likely was used to scoop out and distribute the liquid. The paucity of artifacts bespeaks a public building used by various people during the day.

Structure 13, at the south end of the plaza, is almost an architectural clone of Structure 3, but it is apparently loaded with artifacts. It had a turtle-shell drum on the wall top, so it might contain musical instruments and other items used in public performances. Although we consider the principal function of this architectural complex to be civic, it is probable that religious belief and practice intertwined with almost everything that took place there, and social and economic aspects probably were also included. Finding such a well-developed civic complex in a village only 5 km from the big site of San Andrés leads one to question how much political influence or control that principal site exerted over other valley settlements. Mesoamericanists often assume that the elite exerted strong economic, political, and religious control over their entire society, but the data from Cerén indicate that reconsiderations are in order.

Architecturally, Structure 9, the sweat bath south of Household 2, is fascinating, with its large bajareque shell dome protected from the elements by a large grass-thatched roof. It would be erroneous to expect its function to have been only physical cleansing. It probably also included spiritual cleansing and healing. The concentrically oriented stone seats that face the entrance on the west side probably were involved with ceremonies before or after using the facility. The sharp rodent's tooth found with the seats might have been used for bloodletting, as still is done in some highland Maya communities today. Two lava bombs that penetrated and destroyed parts of the roof did permit exploratory excavations inside the structure. These revealed a sunken beehive-shaped firebox in the center, surrounded by an ample bench for seating. The bench was constructed of clay covered by lajas (stone slabs), overlain by a thin blanket of TBJ volcanic ash from the Ilopango eruption. Water was poured on the firebox to make steam, as evidenced by a small water channel from the firebox to the exit. A circular donut was built into the dome above the small entryway; it probably functioned as a ventilator to allow the smoke to escape before water was poured over the firebox. Because some ten people could use the sweat bath simultaneously, it is likely that it was a neighborhood or community facility maintained by Household 2, rather than a sweat bath only for that household. The household may have maintained the building architecturally as well as provided water and firewood.

THE RELIGIOUS BUILDINGS

The village religious complex was built at the highest elevation of the Cerén site, at its easternmost end. Structures 10 and 12 share some characteristics, including that they were painted white (using TBJ volcanic ash and an unknown organic binder) with some hematite red decoration, they had special column construction, they had extensive antechamber walls and roofs added to the regular portion of the building, and they are the only buildings yet found at the site that do not follow the usual 30° right-rotated azimuth. The buildings were made to be set apart for special use.

Structure 10 was clearly built for ceremonial feasting on a multifamilial or community scale. It is a building with a large platform supporting a main room facing east and a back room. It also has a large antechamber and a narrow corridor entrance that could be sealed with a pole door. The east main room stored the most sacred artifacts, including a deer skull headdress with red paint, a caiman-faced ceramic vessel full of achiote (annatto) seeds, a deer scapula, an obsidian blade with human blood on it that likely was used for bloodletting, and other unusual items. The back room stored another deer scapula and ceramic vessels with food. The antechamber and entrance corridor were loaded with ceramic vessels; they had food-processing areas squeezed into them in the form of a metate on horquetas and two hearths (one with the vessel still on top of it). Ceremonial participants presumably approached the building from the east and stopped at the half-height wall to receive prepared food and drink. The lack of serving vessels for food and drink in the structure probably indicates that participants would bring their own ceramic or gourd vessels. The artifact pattern and amount of food within the building indicate that a ceremony had just been concluded, or more probably that the eruption interrupted the ceremony in progress.

The prominence of deer is striking and demonstrates the great time depth of deer ceremonialism in southern Mesoamerica. The association of deer with the fertility of nature, productivity of agriculture, sustenance of people, and future of society; the transformability of human blood and rain; the redness of human blood, achiote, and the hematite paint on the door jamb of the eastern room; and east as the birthing/origin direction, all are probably interlinked by the ceremonialism at this structure.

Linda Brown and Andrea Gerstle have made major contributions to our understanding of the feasting and ceremonial use of Structure 10 and environs, and of the artifacts of the two religious buildings (Chapters 11, 16). They point out the importance of feasting ceremonialism in maintaining social relationships, in initiating or fulfilling reciprocity obligations, and in alliances and networks. They find strong similarities in the four-directional (quadripartite) Maya worldview and the design of Structure 10, and the emphasis on east as primary, red, and the initiation direction. The deer ceremonialism may well be related to a harvest for the first maize that was underway when the volcano erupted. It is clear that Structure 10 ceremonialism was closely associated with Household 1 in many ways, and it is possible that it was associated with lineage or was similar to the cofradía (confraternity) institution introduced by the sixteenth-century Spanish. I wonder if a major reason the cofradía was so widely adopted is that it was quite similar to a native institution with centuries of time depth. In contrast, divination was discriminated against by the Spanish and was driven underground, into the household, rather than being enshrined in a prominent building constructed solely for its practice.

So many key elements of what the Classic Maya elite elaborated into their state religion had deep roots in household and village ceremonialism. But what Cerén clarifies is that even after that elite developed, commoner households had access to the supernatural through their incensario (censer) rituals and by village-level ceremonialism in the religious complex. Villagers certainly were not dependent on the elite in nearby San Andrés or in the secondary centers for access to the supernatural.

A number of lines of evidence suggest that Household 1 was closely interlinked with the activities at Structures 10 and 12. The ceramic paste compositional studies indicate that the ceramics within Structures 10 and 12 evidently came from the same source as the ceramics within Household 1. No ceramics of this composition have been found in other excavated components of the community. That the religious complex and Household 1 had a common ceramic source may indicate that the infrastructure for ceremonialism was more lineage-related than multifamilial, along the lines of religious associations such as cofradías. The excess of mounted metates in Household 1 probably was to supply large amounts of ground masa (maize dough) to participants during ceremonies. The enigma concerning the lack of tapiscadores to husk maize in Household 1 is resolved if Household 1 had loaned its tapiscadores to Structure 10. The curious bag of Ilopango TBJ white tephra found in Household 1 may have been the pigment base used to paint both Structures 10 and 12 white before painting details in red. Thus, the public feasting and ceremonialism may have been lineage- or sodality-based, and likely were used to set up expectations for other exchanges, improve the prestige and social position of the household, and other intangible advantages that do not preserve well in the archaeological record.

Linda Brown describes quotidian and special uses of animal remains at Cerén (Chapter 16). Deer, dog, duck, turtle, and snails were used at Cerén in a variety of ways. In addition, much more marine shell, including *Spondylus,* was found in ceremonial and household contexts. The latter clearly were not restricted to elite use in Classic southeastern Mesoamerica.

Structure 12 is the most architecturally complex building yet found at Cerén, with its antechamber and lattice window, the bench with a niche, the step up into a vestibule, the step up into the east room, and the step up into the largest and highest west room with its elevated lattice window. The building also has four vertical niches associated with its two principal (front) columns. The building does not have a single functioning assemblage of artifacts; rather, the artifacts apparently were brought and left at the building individually, in contrast to artifacts in other excavated buildings. Also, the enclosure walls are made of a fragile sandwich of Ilopango TBJ tephra coated inside and out with clay. And the enclosure columns are circular. All of these characteristics are unique to this building.

Foot traffic to the building was stopped by the double pole-door, but conversation was possible through the lattice window, and offerings were left on the lintel, column tops, or otherwise nearby. We believe the most compelling evidence that the building was used for divination consists of the mineral collection left atop the interior small partition wall in the north room, and the two collections of beans left directly on the floor of the east room and in the niche under the bench. In contrast, beans that were used for food in households were never placed on an earthen surface. The successive elevation of floors in both religious buildings probably was a metaphor for greater spiritual distance from the secular world outside, and for greater access to supernatural power as a person progressed inside. Simmons speculates on the possible symbolism of columns and narrow passageways in the building as portals (Chapter 12).

Many artifacts in southern Mesoamerica can be used by either gender, but some are gender-specific. All of the gender-specific artifacts found at Structure 12 are associated with women (e.g., spindle whorls, manos, metate), so we think the diviner probably was a woman. It seems fitting that the most delicately elegant building yet found at Cerén was for divination.

The artifacts left in the bench niche, probably the most sacred or special locus in the building, may have been the diviner's supernatural tool kit. They are two fired clay figurines, a deer antler, a ceramic ring, two shells, and a small pile of beans. The antler was not shed naturally by the deer, as skull bone was still attached. One figurine is an animal and one is a human female with red-painted details. The ceramic ring is half of a broken double ring. The beans likely were used in divination, as is commonly done today in traditional highland Guatemalan communities. If this interpretation is correct, this is the only functioning assemblage of artifacts in the building, functioning not in the utilitarian mode, as with the various artifact assemblages from household buildings, but in the supernatural realm.

The ceramic paste compositional analysis indicated that the ceramics in Household 1 had the same recipe as those in Structure 12. That may indicate that the vessels in Structure 12 were not gifts or offerings from other households but were provided from Household 1, and that the diviner herself may have come from Household 1.

The thorough ceramic analysis by Beaudry-Corbett has yielded important results, including the conclusion that the amount and nature of ceramic decoration indicates a prosperous community (Chapter 13). To that I would add that the ancient Cerenians had an aesthetic sense and appreciation of beauty greater than most archaeologists would expect from a commoner village.

VILLAGE ECONOMICS

The ceramic composition analysis indicated, on the community level, that only 19 out of 149 vessels analyzed (13%) were imported. These imported vessels are often of unusual shape or decoration, and probably represent exchanges of a specialized rather than regular economic nature. Some of these imports are cream paste pottery from the Copán Valley or nearby. Others are red paste ceramics from a lesser distance, and some are Campana polychromes that were made in the Zapotitán Valley, perhaps at San Andrés. Ceramically, the important point is that the Cerén village was largely self-sufficient, and the variation in paste recipes indicates a number of local potters. Individual potters apparently did not specialize in a form but made a wide variety of forms. Ceramic specialization by households probably was much like Household 1's specialization, part-time and informal but effective in producing commodities for exchange within the community and occasionally at more distant localities.

The Cerén villagers were dependent on outside materials and craftspeople for their cutting and scraping implements. Virtually all of these implements were of obsidian, presumably from Ixtepeque, 80 km to the northwest. The skilled macrocore shaping, macroblade removal, and pressure removal of prismatic blades were done by at least part-time occupational specialists at primary and secondary centers. A household thus would have a chronic dependency on obsidian and would have to produce some commodity for exchange, such as the groundstone tools and cotton thread of Household 1. But how deep was that dependency—that is, how many prismatic blades would a household consume in a year? We have no direct data, but the low density of obsidian artifacts around Households 1 and 2 (below 1 per m^2 within a 10 m radius) and in the Operation 2 midden probably indicates rather low consumption rates, and I would guess a household consumed fewer than a dozen blades a year, so that dependency probably was not onerous. Particularly sharp blades apparently were discarded away from human activity areas, for example, in the midden in Operation 2. Scrapers and macroblade knives must have had longer use lives than prismatic blades, perhaps on the order of a year. Both of them were resharpened occasionally at Cerén.

Four prismatic blades from Household 1 tested positive for animal protein. Two retained residues of dog, presumably cut up for food. The other two had residues of deer, presumably also for food but also useful for antlers, hide, sinews, and perhaps brain for tanning.

The obsidian blades in Structure 10 were stored in open elevated contexts on a shelf, on a roof beam, and on a wall top, in contrast to household storage in thatch. The reason for open storage is probably because many people potentially could have accessed a blade in this community structure, and storage in thatch could have resulted in people rummaging around and cutting themselves. In contrast, the one or two people in a household structure who stored a household blade in thatch would have done so in predictable locations, thus minimizing the rummaging around.

The blades of Structure 12 were also in elevated open locations, on top of the lintel and column tops and wall tops. However, they were very used and dulled fragments and may have been cuentecitos—objects picked up by a diviner for their supernatural associations—rather than usable offerings made to the diviner for services to be rendered.

As with chipped stone, there seems to have been a standard set of groundstone artifacts in each household, which consisted of a jade ax, a mano and metate set, a few donut stones, a few lajas, and some miscellaneous smoothing and abrading stones. The ax must have been the single most expensive item in the household standard inventory, because it came from so far away, is so hard, and required a great amount of specialized labor in its manufacture. The donut stones were used as digging stick weights and as perforated mortars for grinding hard food such as nuts; the larger and more decorated ones were used in at least one other function that remains unknown. The difference between households in the groundstones they possessed seems related to their part-time specializations. The overwhelming majority of hammerstones, used in groundstone manufacture, were found in Household 1, along with incompletely manufactured groundstone artifacts and a large quantity of finished groundstone implements. Occasionally the unusual groundstone artifacts indicate wealth or special status, such as the set of seven jade beads in Household 2, a domestic group significantly more wealthy than Household 1.

A wide range of artifacts made from plant materials was recovered from Cerén. They include gourds, fiber rings to support round-bottomed ceramic vessels, baskets, mats, cloth, and string. Each household had numerous gourds, some of which were painted. The painted gourds were surfaced with white or pink kaolin on the inside and outside, and then the interiors were painted a solid color of green or red. The exteriors were painted with polychrome colors, generally in registers. Some of the designs are similar to the polychrome ceramics, while others are part of a strikingly different artistic tradition. The cloth ranges from 8 to 16 threads per centimeter and probably was cotton. String and twine were used extensively in architecture and for making fences and pole doors, as well as for string bags. The dozens of hemispheres of wood ash found in Households 2 and 4 presumably were kept in gourds, which decomposed. The wood ash probably was used as a substitute for lime to soak maize kernels overnight prior to grinding, along with other uses.

CONSERVATION

The conservation of architecture and excavated artifacts has been integrated into research as thoroughly as possible, with the assistance of national and international institutions. Permanent roofing with drainage away from ancient buildings is established prior to excavation. Often architectural conservation begins when the first wall tops are encountered; at this time, the vertical bajareque reinforcement poles are replaced into their original locations. Treatment with escobilla resin begins immediately and continues for years. Later, the walls are excavated down to the floor of the building.

Objects conservation has been essential to the preservation of fragile artifacts, especially organic artifacts. Directed by Harriet Beaubien of the Smithsonian Center for Materials Research and Education, the object conservation program is integrated with every excavation. Treatment often begins prior to lifting the artifact from its locus of discovery.

AGRICULTURE, PRODUCTION, AND SPECIALIZATION

The agriculture at Cerén emphasized maize in permanent and highly productive milpas near households, with high species diversity in kitchen gardens (Chapter 20). Cerenians made considerable efforts to organize species into zoned biodiversity by maintaining some areas for maize (with beans and presumably squash) milpas, while some ridgetops were devoted to a single species such as manioc, macoyas (*Xanthosoma*), piñuelas, cebadillas, chiles, or canes for horizontal and vertical reinforcements of their bajareque architecture. Thus particular cultigens were restricted to specific zones while a rather high species diversity was maintained overall.

Household production and specialization (Chapter 19) is a topic of considerable importance. Each household appears to have been self-sufficient in the production of basic foods from kitchen gardens, milpas, and probably outfields. These foods include maize, beans, *Xanthosoma,* manioc, probably squash, and medicinal and decorative plants from the gardens. It is important that David Lentz has identified the root crop *Xanthosoma* as a common cultigen in the Household 1 kitchen garden, as well as in Operation 7 excavations, since it provided much more food than manioc, the other root crop. Rubiaceae, the shrub, he noted, provides a microbiotic substance also used for treating the skin, and is called "ix-canan" by the Maya. This shrub was raised by Structure 4 and probably had medicinal value for Cerenians.

Households differed in their specialization. Each household produced at least one item in amounts greater than its own internal needs, and thus could exchange the item for items from other households or from other communities. Because each household needed specialist-produced items not available in Cerén, such as a jade ax, obsidian cutting and scraping implements, or hematite cylinders, some of that exchange probably took place at the major sites. Thus, from the village perspective, one can perceive how the elites supported themselves.

Household 1 produced groundstone implements such as metates, manos, and donut stones. Judging from the abundance of spindle whorls in and around that household, they probably also produced a lot of fine fiber, presumably cotton. And they probably were in a service or ownership relationship with the religious buildings to the east, Structures 10 and 12. The craft specialization at Household 2 is not as clear, but it likely was the production of decorated gourds, based on a preliminary study of use wear on obsidian blades and the finding of five paint pots full of cinnabar pigment. The only use of cinnabar found to date is painting gourds. The specialization of Household 3 is unknown, as so little of it has been excavated, but Household 4 clearly was engaged in agronomic specialty production. Its large agave garden yielded sufficient fiber for a dozen other households, and household members did their depulping on the northeast corner of the building. They produced a lot of chiles, cacao, and probably cotton. They ground cotton seeds on their metate, presumably for the oil for use in cooking.

Conclusion

The Cerén site has proven to be a surprisingly prosperous commoner village in the middle of the Classic Period on the southeastern periphery of the Maya area. What remains of the village religious zone consists of a structure where a diviner practiced, along with a structure for deer ceremonialism and public feasting. Both were apparently maintained by Household 1. That household also made groundstone tools and cotton thread for its own use and for exchange within and beyond the village. Household 2 may have made painted gourds as its part-time specialization, and household members probably maintained the community sweat bath. In the center of the known site was the civic complex, with at least two and probably four structures on the sides of the village plaza. One building apparently was for hearing and ajudicating disputes, with its two large benches in the front (eastern) room symbolizing authority. Residential areas were composed of a few functionally specific buildings per household. Most were built out of earthquake-resistant wattle and daub, with the vertical wall reinforcing poles supporting the roofing members. Most household buildings had more than twice the roofed areas outside of their walls that they had inside the walls, providing extensive exterior but protected work and storage areas. Kitchen gardens and cornfields ringed the architecture but were not sufficient to feed families in average to poor years, necessitating the cultivation of outfields.

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Glossary

achiote Annatto tree; produces red annatto seed used as pigment.
atole Ground corn drink in water.
atole de piñuela Drink made with water and the native plant *Bromelia karatas.*
ayote Type of squash.
bajareque Wattle-and-daub construction.
cacao chocolate; seeds of raw natural chocolate grow in pods on cacao trees.
cántaro Water vessel.
cantón District or region.
cenote Deep sinkhole.
chicha Corn-based drink, fermented.
chuzo Type of hoe with blade parallel to the shaft (handle).
cofradía Sodality; confraternity with religious orientation.
comal Cooking griddle, often for tortillas.
cuentecito Object that acts as a medium through which shamanic dream knowledge and curative powers emanate; a diviner picks it up for its supernatural associations.
cuma Short, curved blade with a long handle used for weeding.
escobilla A diluted extract from this plant (*Sida rhombifolia*) is applied to ancient earthen structures to preserve them.
guacal Large plastic basin for holding corn and other foods.
guisquil Type of squash.
horqueta Forked prop; two are often used to hold up a metate.
incensario Censer, usually for copal incense.
jalacate Plant used for horizontal reinforcements in modern bajareque architecture.
jute Freshwater snail.
laja Stone slab that exfoliates naturally.
macoya Annual plant (usually *Xanthosoma*) that grows in tight clusters and produces edible tubers.
maguey: Agave americana. The leaves (pencas) are depulped to obtain fibers for rope, twine, net bags, etc.
malacate Spindle whorl.
mano The hand stone, slid back and forth on top of metate for grinding.
manzana Area measure, approximately a city block.
masa Maize dough.
metate The bottom grinding stone.
milpa Maize field, often interplanted with beans and squash.
olla Water vessel; pot.
penca Leaf, often fleshy.
petate Woven covering such as a straw mat.
pila Large open tank, made of cement, for storing water.
pipián Type of squash.
ramón tropical tree (*Brosimum alicastrum*); its fruit is the breadnut.
tabanco High shelf.
tapiscador Corn-husking tool.
temascal Sweat bath.
tephra All volcanic material that travels through the air in an eruption, from lava bombs through pumice to fine volcanic ash.
yagual Vessel support ring, made of fiber, for ceramics with a rounded bottom.
yuca Manioc, yucca, cassava.

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