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HOUSEHOLD ARCHAEOLOGY AT CERÉN, EL SALVADOR

Payson D. Sheets,[a] Harriet F. Beaubien,[b] Marilyn Beaudry,[c] Andrea Gerstle,[d] Brian McKee,[a] C. Dan Miller,[e] Hartmut Spetzler,[f] and David B. Tucker[a]

[a]Department of Anthropology, University of Colorado, Boulder, CO 80204, USA
[b]Smithsonian Institution Analytic Laboratory
[c]Institute of Archaeology, University of California, Los Angeles
[d]Department of Anthropology, Western Michigan University
[e]U.S. Geological Survey, Vancouver, Washington
[f]Department of Geology, University of Colorado, Boulder

Abstract

In the summer of 1989, major discoveries were made at the site of Joya de Cerén, El Salvador, where sudden depositions of volcanic ash in A.D. 600 resulted in unusually favorable conditions of preservation. The theoretical framework for the research is household archaeology, the study of prehistoric household groups. Household archaeology, as applied to Cerén, can take advantage of the extraordinary preservation to study households in terms of their key activities of (a) *production*, including food, implements, vessels, and structures; (b) "*pooling*," including storage, distribution, maintenance, and curation activities; (c) *transmission* of knowledge and material goods including access to resources; (d) *reproduction* in both the biological and sociocultural senses; and (e) *co-residence/membership* in the functioning residential group. One of the major finds was a possible codex or Precolumbian manuscript.

The present project has its roots in the 1978 research by the University of Colorado in the Zapotitan Valley, sponsored by the U.S. National Science Foundation (Sheets 1983). Beginning early in 1978, research teams conducted a survey of the valley based on a stratified random sampling design (Black 1983) and conducted excavations in various Formative, Classic, and Postclassic sites. Other specialists studied the four major explosive eruptions of local volcanoes that had affected settlement. They also analyzed the soils that had formed on top of those eruptive materials and examined other aspects of the natural and cultural history of the valley.

During the survey, local residents informed project members of structures buried under volcanic ash near the village of Joya de Cerén (Figures 1 and 2). While removing the volcanic ash overburden to make a flat platform for grain storage silos in 1976, earth moving machinery had encountered two structures buried under some 5 m of ash. The bulldozer operator and some local residents investigated the discovery in an informal fashion and decided that the remains were recent, because the structures, their roofs, and their contents were so well preserved. Supposedly the representative of the Museo Nacional "David J. Guzmán" shared their opinion when he looked at the remains three days after their discovery. Sheets certainly shared their opinion when he observed the remains of one house (now called Structure 1) that remained in the bulldozer cut in 1978; the floor and two adobe columns were preserved in excellent condition, and some thatch was visible, collapsed down onto the floor by the weight of 5 m of volcanic ash overburden.

Although he believed the structure to be recent, or possibly historic, Sheets began to trowel along the floor to find the bits of plastic, glass, metal, or other artifacts that would help date the structure. Instead, he found a prehistoric polychrome sherd that dated stylistically to the Classic period. His initial hypothesis regarding this sherd was that the inhabitants of the house had taken an interest in archaeology and brought an ancient sherd into their recent house. However, further excavations found only Classic period sherds and no modern artifacts. This suggested that the building might be prehistoric, and that a sudden burial by the volcanic ash was responsible for its remarkable preservation. Copious amounts of roof thatching material were collected and submitted to the radiocarbon laboratory at the University of Texas. Their studies dated the structure and the eruption to about 1400 years ago (A.D. 590 ± 90).

Although the discovery came towards the end of the 1978 field season (time and resources were already committed in other directions), the project decided to launch an effort to excavate some of the main structure and associated *ramada*-like structure (Structure 1a) exposed in the bulldozer cutbank. The walls were of *bajareque* (wattle-and-daub), with the interior poles rising above the clay to support the roof. The solid adobe columns were not used for roof support; other than anchoring the corners of the *bajareque* walls, their function remains unknown. Numerous activity areas were found inside the structures (Figures 3, 4, and 5) and surrounding them, and a maize milpa was discovered 12 m to the south, with a section of the milpa under cultivation and a section in fallow (Zier 1983). The size of the corn in a nonirrigated field indicated the most likely month of the Laguna Caldera volcanic eruption: June. Work continues to determine whether the eruption occurred in the daytime or at night. Evidence to date indicates the latter.

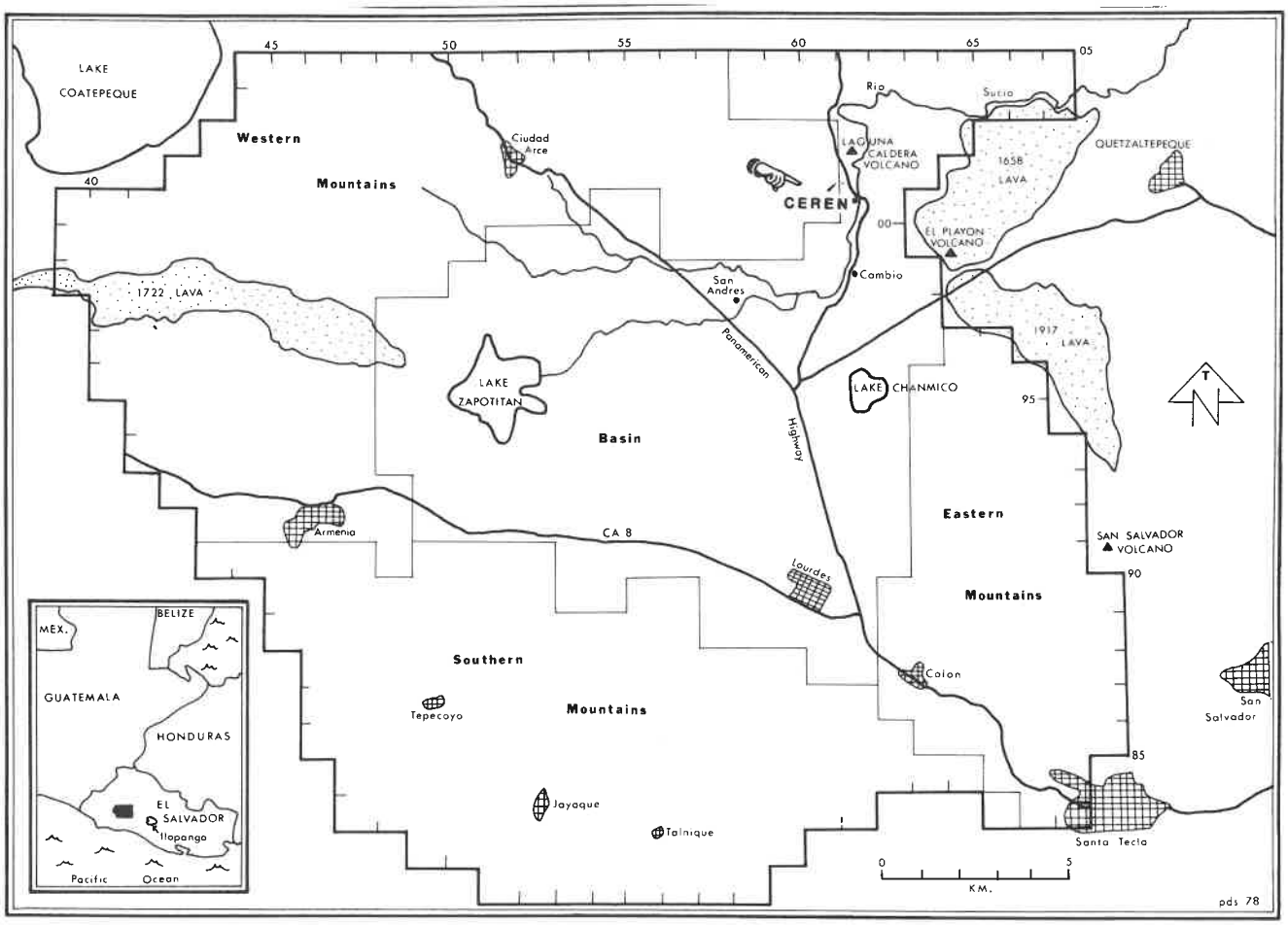

Figure 1. The Zapotitan Valley, El Salvador, with the Cerén site pointed out.

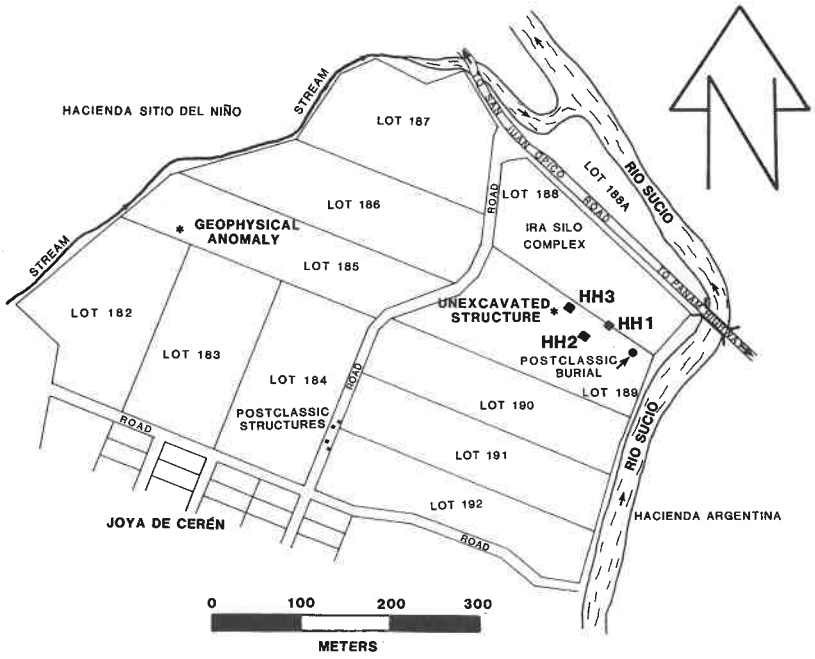

Figure 2. The Cerén site, consisting of three households and a confirmed but yet unexcavated structure. A strong geophysical anomaly has been located on top of a hill, toward the west end of Lot 185. Map by Brian McKee.

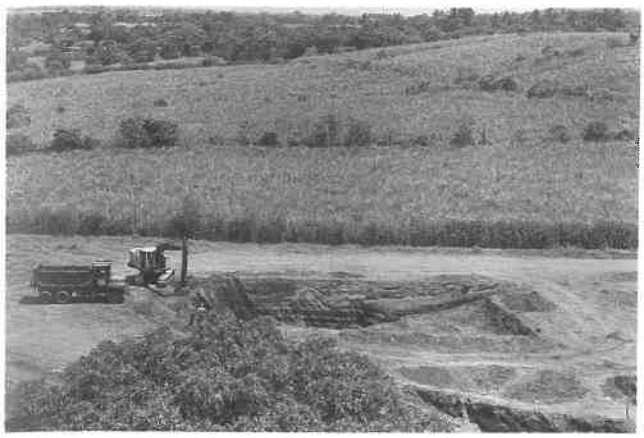

Figure 3. View of site, looking south. Classic Period landscape is 5 to 7 m below present ground surface, having been buried by volcanic ash from the A.D. 600 eruption of Laguna Caldera volcano, and some ash from two later eruptions. The excavations of Household 3 are at the extreme lower right; the power shovel is removing volcanic ash from Household 2, and the dump truck is hauling ash into the town of Joya de Cerén. Both households were detected as anomalies by geophysical instruments (ground penetrating radar and resistivity) and later confirmed as prehistoric structures by core drilling.

The 1989 field season began with a geophysical survey of the environs of the 1 ha grid surveyed in 1979 and 1980. Resistivity was employed, based on our previous success in finding M-shaped anomalies and confirming them as structures. The M-shaped anomaly apparently is caused by variations in electrical conductivity that derive from the buried structure and by differences in moisture retained in the Laguna Caldera tephra layers bowing up over the structure.

With the assistance and advice of Proconsa, a construction firm in San Salvador, we decided to use a power shovel to lift the volcanic overburden from the buried structures (Figure 3), but without placing weight or vibration immediately above them. The power shovel removed over 5000 m^3 of volcanic ash, in scoops of about .75 m^3. Later, we transported the tephra from the area with a dump truck. Without the truck, we would have had difficulty finding suitable dump spots nearby. By arrangement with the town council of Joya de Cerén and its residents, the dump truck placed the tephra on eroded roads, the irregular surface of the school yard, innumerable patios, and on some earthfill bridges in the region. What could have been a significant backdirt problem became a community assistance project, and each morning townspeople jockeyed for position to go with the dump truck to their place of need. Even the local military base donated the use of a truck to move tephra from the site to town.

During the resistivity surveying, core drilling, and power shovel removal of tephra overburden, excavations in House 1 were reopened. The 1978 excavations of House 1 extended to within 1 m of neighboring property. The 1989 excavations were intended simply to complete excavation of the remainder of the house (Figure 4). That was completed, but a bodega, or storeroom (Structure 1b), was encountered at the southern end of the excavations (Figure 5); this area was so productive in artifacts and information that it was largely excavated as well.

The power shovel shifted to tephra removal above and around Structure 2 and was initially used with caution, removing only the topmost two and a half meters. It later returned again to Structure 2, when the magnitude of removing the huge amounts of remaining volcanic ash by hand became clear (Figure 6).

The power shovel removed tephra from all four sides of Structure 3, successfully pedestalling the entire 5 × 8 m structure. Unfortunately, it dug too deeply in one location, removing part of the northern wall. However, given the good preservation of the rest of the walls, the structure can be accurately reconstructed.

The change in heavy equipment from bulldozer to power shovel allowed for deeper household excavations and further work on the cornfield south and east of Test Pit 2, first excavated in 1978 (Zier 1983). Previously we thought only one seed had been planted, and sprouted, at each locality. But the 1989 research clearly indicated that 4 or 5 seeds were planted and sprouted per digging stick hole, a practice more common in traditional agriculture in El Salvador and Guatemala.

An apparent codex (Figure 7), a painted screen-fold document, was found in the niche under the bench of Structure 2a (Figure 8). Although the chances are not good of rescuing much of the original document, which is in poor condition, it is of such potential significance that we decided to do everything possible to save it, or at least a part of it. This find will be discussed in further detail later.

The only disappointment in an otherwise successful season is that no human remains were found. According to an informant's reports in 1978, human bones were found on the floor of Structure 1 in 1976, but that building was bulldozed away two years before our arrival. We had hoped to find human remains in Households 2 and 3, but during the 1989 season we were able to excavate less than half of the structures in each household cluster, so the chances are still good for further discoveries.

An absolutely key factor in the success of the project was the effective combinations of geophysics, core drilling, and power equipment for tephra removal. At the beginning of the season we were not completely confident that the geophysical instruments were in fact able to detect prehistoric structures under 5 to 6 m of tephra, and that the small sample of the core drill was in fact bringing up samples of floor, and thus confirming the anomalies as prehistoric structures. Also, we did not know how successful we could be in employing heavy power equipment in massive tephra removal; our calculations of the sheer volume of tephra to be removed proved to be reasonably accurate: 5000 m^3. Thus, we were ecstatic when Structure 3 was uncovered by power equipment soon after it had been detected as an anomaly by the ground-penetrating radar and resistivity instruments, and after it apparently had been confirmed as cultural by the drill rig samples. By using a power shovel instead of a bulldozer, we shifted the pressure and movement of the heavy equipment away from the structures, allowing much closer excavation.

Previous volcanological research had identified Laguna Caldera Volcano as the source of the ash that buried the Cerén site. Miller's microstratigraphic approach has refined our understandings of the various components of the Laguna Caldera eruption which occurred about A.D. 600. Previously we had thought the eruption began with an airfall deposit, represented by Unit 1 at Cerén, but Miller has convinced us that the initial deposition was a base surge. It arrived quickly, propelled by winds between 100 and 200 km/hr, at a temperature approach-

Figure 4. The southern corner of Structure 1, the communal building of Household 1. The bench is visible at the top, and the column anchoring the corner of two *bajareque* walls is at the upper right. The column rests on the corner of the fired clay platform. The ceramic vessel to the right was in roofing material under the eaves of Structure 1, the principal communal building area of Household 1. It was above a maize-grinding area, where a metate was found still elevated above the ground by two forked sticks. The activity area was under the roof, but outside the structure.

ing 100°C. Because it was moist and fine-grained, it often packed around things in its path, such as buildings, posts, sticks, pottery vessels, and trees. This deposit was followed by Unit 2 with its hot clasts, at about 600°C. Those were followed in turn by a series of fine moist and coarse-grained hot beds, generally deposited by rapid, hot, and turbulent clouds, but occasionally deposited by direct vertical airfall.

Miller also studied the relationships between structures, structural collapses, and tephra units. The direction of collapse of most walls and columns was away from Laguna Caldera, but a few exceptions exist (e.g., part of the north wall of Structure 2b fell toward the northeast), and these apparently were caused by the backflowing turbulence. *Bajareque* walls and columns evidently were built as separate structural units, without reinforcements interconnecting them with each other or with the floor of the buildings. They were strongly interconnected from above, however, since the vertical posts went into the ceiling support system for the roof. Evidently the buildings were quite resistant to lateral blasts so long as the upper structural integration remained intact. When that was lost, individual structural members became vulnerable to collapse where exposed above the layers of accumulating tephra.

All structures excavated to date are oriented 30° clockwise from our magnetic directions, that is, 30° east of magnetic north. Although we probably have the material remains of three separate households, they are not independent. They were economically interrelated and similar in orientation. In contrast to our thinking in 1978, these clearly were not isolated agrarian households. Rather, they formed part of a village of undetermined size.

The cultural affiliation of the Cerén residents is of interest. This is a difficult research problem, but some progress has been made. The chipped stone and ground stone artifacts probably are less sensitive to cultural affiliation than ceramics or architecture (Sheets 1989). Both chipped and ground stone artifacts are clearly southern Mesoamerican in their form, function, and sophistication, but it is difficult to be more specific. Whether they are Maya or Lenca requires a more detailed archaeological record. The architecture appears to be more Maya (Ed Shook, personal communication, 1989), with its porches, plat-

Figure 5. Structure 1b, the *bodega* of Household 1. Note metate on left, still elevated above the ground by two forked sticks. The storehouse was densely packed with ceramic vessels (many with stored grains), obsidian blades, manos, doughnut stones, and other artifacts. The low *bajareque* wall visible on the right, was blown over by the force of the eruption.

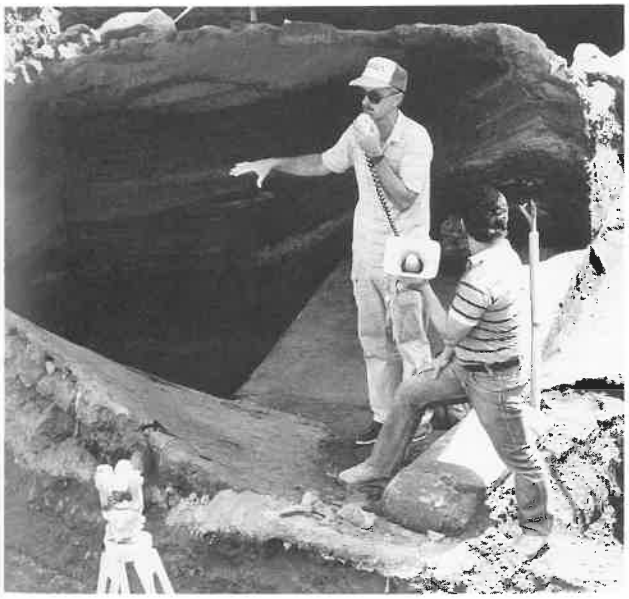

Figure 6. Structure 2a, the communal building for Household 2. The elevated bench and the floor to its left constitute the inner room. The niche which contained the codex and the three polychrome vessels is in the bench. The structure's southern *bajareque* wall is partially blown over by the eruption; the solid adobe column and the eastern wall, visible on the right, have toppled completely. The volcanic ash layers visible behind Sheets have been left to support the *bajareque* wall separating the inner room from the porch.

forms, large benches, cornices, niches, and spatial segregation of function. Continued research in the future, particularly on the fragments of the codex, may assist in answering the question of cultural affiliation.

The chipped stone implements were dominated by prismatic blades, with a scattering of macroblades and scrapers. All undamaged obsidian tools (i.e., tools that were in use or that were being stored for future use) were hidden away. The favored location for them was the roof inserted into the roofing thatch, but instances were also found where an obsidian implement was hidden in a crack under a wall, up on top of a wall, or behind a post in the opening of a posthole. The fact that some blades still retained traces of organic residues, presumably from their last use, is encouraging. Laboratory forensic examination at the Institute of Pathology, Walter Reed Hospital, is planned, with the objective of determining the substances on which they were employed.

Some ground stone implements also retained organic substances and fragments of these will also be subjected to forensic laboratory examination. Doughnut stones, more formally known as biconically perforated stone disks, commonly had organic residues, and some apparently functioned as perforated mortars. Two metates were found still on top of the forked wooden posts that supported them during the Classic period. Both were quite low, less than .5 m from grinding surface to the ground, indicating that most likely they were designed for a short female. Both were fairly new, judging from the very slight degree of use wear on both. We would like to determine if she

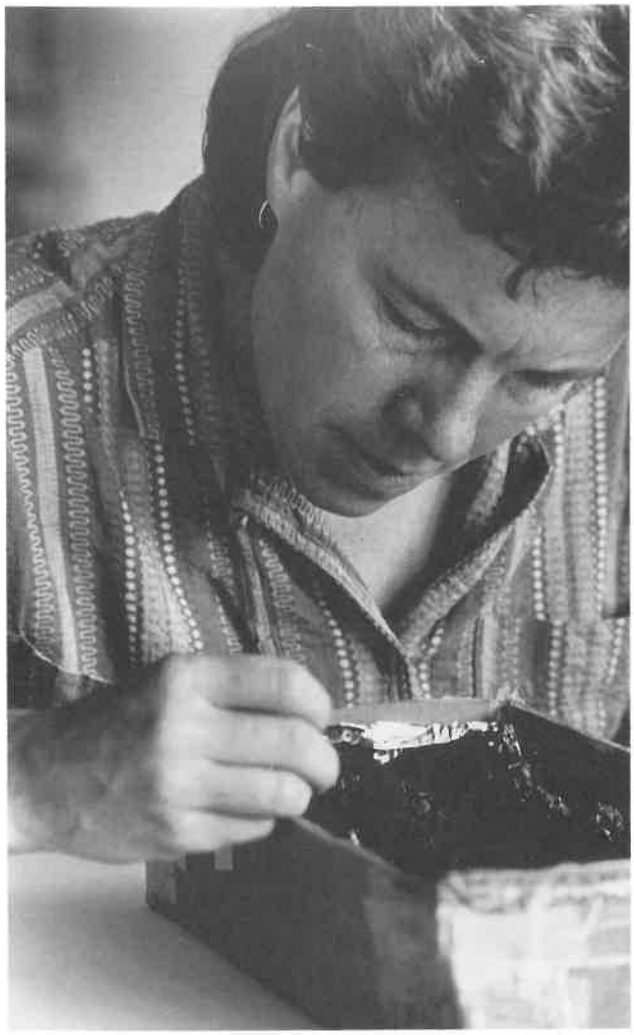

Figure 7. Harriet "Rae" Beaubien, of the Smithsonian Institution's Conservation Analytic Laboratory, in the laboratory, working on the codex after it had been block-lifted from the niche of Structure 2a.

was short enough to use the 1.5 m high doorways without ducking, but without a body, we do not know.

The Laguna Caldera eruption was sufficiently sudden, and of a nature that led to good organic and structural preservation. A wide range of fauna was preserved, including a dog's tooth, two species of ants eating grains stored inside ceramic vessels, a duck (apparently domesticated), snails, and some probable deer bone made into spatulate instruments. Flora include a palm tree some 12 m west of Structure 2a, *uhushte* seeds, chiles, corn, beans, and numerous other items.

The architecture exhibits sophisticated use of reinforced and massive adobe hitherto unsuspected in the domestic architecture of southern Mesoamerica. Builders were able to construct out of massive adobe, vertical walls over 3 m tall and platforms up to 5 × 8 m. They usually decorated the walls with sizeable cornices, and even decorated some internal benches and *bajareque* walls with the same cornices. These walls were well made, with the vertical poles continuing upward to help support the roofs. The corners where two *bajareque* walls met were generally anchored with massive adobe columns. The columns were sometimes employed as bases to support vertical wooden posts that sustained the roof. However, a remodeling of the roof, particularly when it involved new *bajareque* walls (e.g., Structure 1), could evidently bypass the columns and leave them without function in roof support. The columns evidently were made elsewhere, probably horizontally, and then erected and attached to the walls and floor with fine adobe mortar.

The builders at Cerén often placed niches inside of massive adobe walls, and sometimes in benches. They even had doorways, usually some 1.50 m high, in massive adobe and *bajareque* walls, with wooden lintels and adobe caps above the lintels. Although they manufactured adobe bricks, we have no evidence of their use. One interesting feature was the presence of the handles of large broken ceramic vessels, "ollas," near doorways. They were embedded into and partially plastered over with adobe. They may have served as attachments for drapes, or functioned to hang curtains or mats across the doorways. The tops of the walls were favored locations for storing special items, such as pottery vessels, doughnut stones, a whetstone, or obsidian tools. Deer bone spatulae were found on benches or niches. A part of Structure 2a had a *tabanco* (Figure 8), an elevated wooden platform made of horizontal poles spanning from one *bajareque* wall to the other, resting on small notches made for each pole. That *tabanco* extended outside at least one wall, where it was capped by a wet-laid layer of adobe to make a solid elevated platform surface. The step in front of the porch and the doorway were generally offset from the midline of the structure (Figure 8), probably an indication of the direction of the majority of foot traffic into and out of the building.

The most solidly constructed architectural elements at the Cerén site are the platforms for each structure. Platforms were made of high-quality clay mixed with grass or other organic material to minimize cracking when drying. It appears that they were fired after they dried, to solidify the platform. Massive adobe walls and columns were similarly well-made and survived the 14 centuries since they were constructed in good condition. *Bajareque* walls did not survive quite as well, as they were vulnerable to collapse under the buffeting of the strong winds of the tephra clouds from Laguna Caldera volcano. The *bajareque* walls were structurally interrelated only at the top, where they were tied together where they joined and supported the roof. Porches that were not a part of the platform were constructed less well and may have been remodeled more often. Preservation is sufficient to detect the predominant patterns of foot traffic on or near structures. These will be used in future field seasons to recover all the structures and activity areas of Households 2 and 3.

Grafitti in the back room of Structure 3 were made by incising and punctuating lines, and they may well be the scratchings of a child. The fact that more artifacts were found outside Structure 3 than inside, as well as the existence of large floor and bench areas, support Gerstle's interpretation that Structure 3 was the sleeping area for the family at night and the eating and other family activity area during the daytime. It is probable that Structure 1 and Structure 2a also served the same general functions for their families, but those families may have been smaller or less affluent than Household 3. In general, there is an inverse relationship between the massiveness of construction and the number of artifacts found within the structure. Structure 3 was the most imposing building excavated so far at Cerén, yet it had the fewest artifacts inside. Structure 1b, the

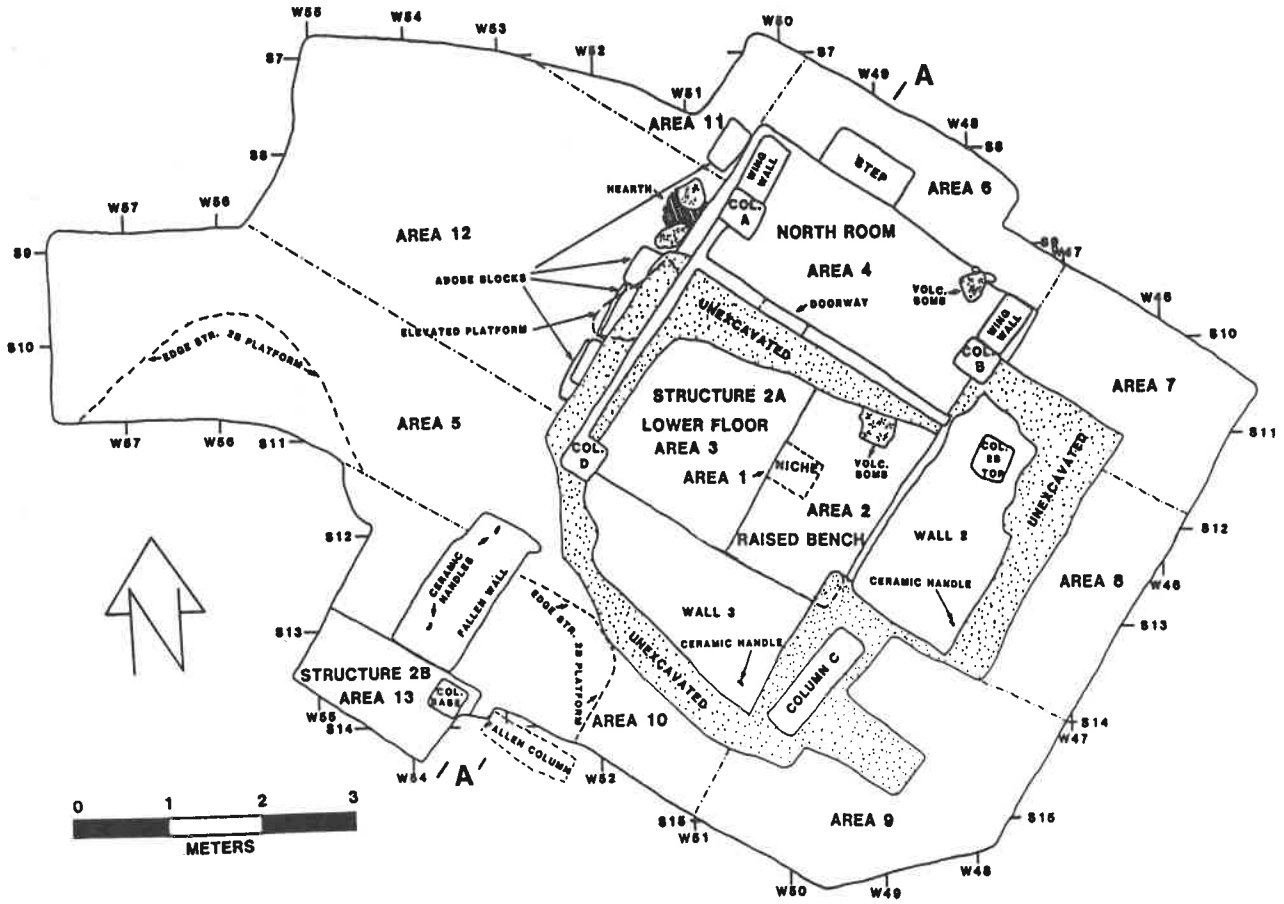

Figure 8. Plan of Structure 2a, the communal building of Household 2. Inner room has floor and elevated bench with the niche that contained the codex, the northern room is the porch. Area designations are provisional, for initial artifact sorting. Plan by Brian McKee.

bodega behind Structure 1, was the most humble yet found at Cerén, yet it contained by far the most artifacts. Structures 1 and 2a are intermediate in massiveness of construction and in number of artifacts. Somewhat more specifically, a ranking of the massiveness of construction of all buildings excavated in 1989 would begin with the humble Structure 1b, followed by 2a, then 1, and finally end with the massive Structure 3. A ranking of the structures by abundance of artifacts would begin with Structure 3 almost devoid of artifacts, followed by Structure 2a, then Structure 1 followed by the densely-stocked Structure 1b. It will be important to compare the nature and organization of the *bodegas* for Households 2 and 3, and of other Cerén households excavated in the future.

Structure 2a (Figures 8, 9, and 10) does share some general characteristics with Structure 3. Both have inner porches, doorways (wooden lintels capped with adobe) leading into inner rooms, large benches, niches, thick thatch roofs extending well beyond the walls, and many family activity areas kept clear of floor-contact artifacts. However, they differ in how these elements are arranged, as well as in their size and other factors. Structure 2a was much smaller, used *bajareque* construction for walls, and had a porch as part of its platform. Although it was not the largest building excavated at Cerén, Structure 2a had a richly stocked niche under the bench.

The niche in Structure 2a contained three polychrome vessels, a clam shell, and the codex. One of the three vessels, a hemispherical bowl, was upside down on top of another. To our surprise, when inspected inside, the vessel had not been washed since its last use about A.D. 600. It still bore the finger impressions from the swipes of someone using three fingers to eat their food. It had been placed in the niche still dirty, perhaps hurriedly, and the sealing of the niche by the layers of hot, moist volcanic ash helped preserve the food swipes for 14 centuries.

A few items were encountered which have yet to be explained, and two are mentioned here. These are our "puzzles." Each of the structures excavated to date (1, 1b, 2a, and 3) had a sizable container (.5 m in diameter or greater) in or near the center of the building, suspended from the ceiling. The container was full of fine silicic volcanic ash that had been mixed with water and grass. It was made of an organic substance which did not preserve. We have heard a number of bizarre-to-eccentric suggestions as to its use, but have yet to hear a reasonable suggestion. The other puzzle is that the porch of both Structures 2a and 2b had a small feature made of vertical small sticks or cane, tied together at the top and bottom with twine, and forming a rough U shape. The features are small, perhaps 10 cm high, 40 cm long, and 30 cm wide. The sticks were approximately 1 cm in diameter. Their function is still unknown.

Just as the excavation of such a site provides the archaeologist with an extraordinary opportunity to study family life, adaptation, and village economics, so does it provide an unusual opportunity to conserve the structures and to make them avail-

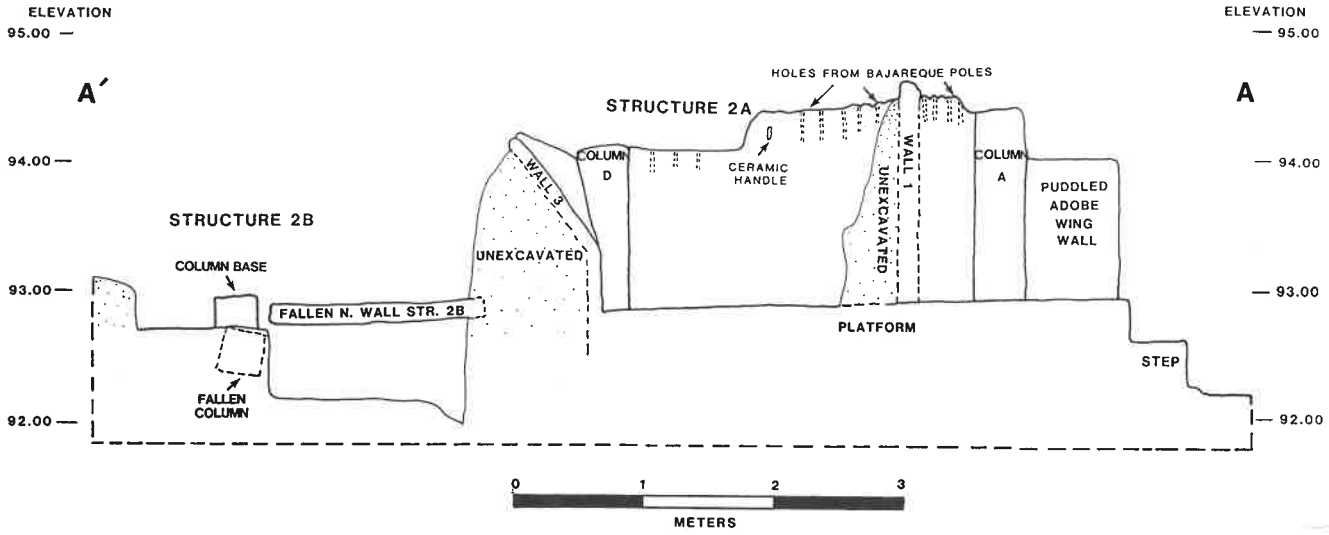

Figure 9. Cross-section of Structures 2a and 2b, facing northwest. Section line runs through center of Structure 2a. Structure 2b may be the bodega for the household. Drawing by Brian McKee and David Tucker.

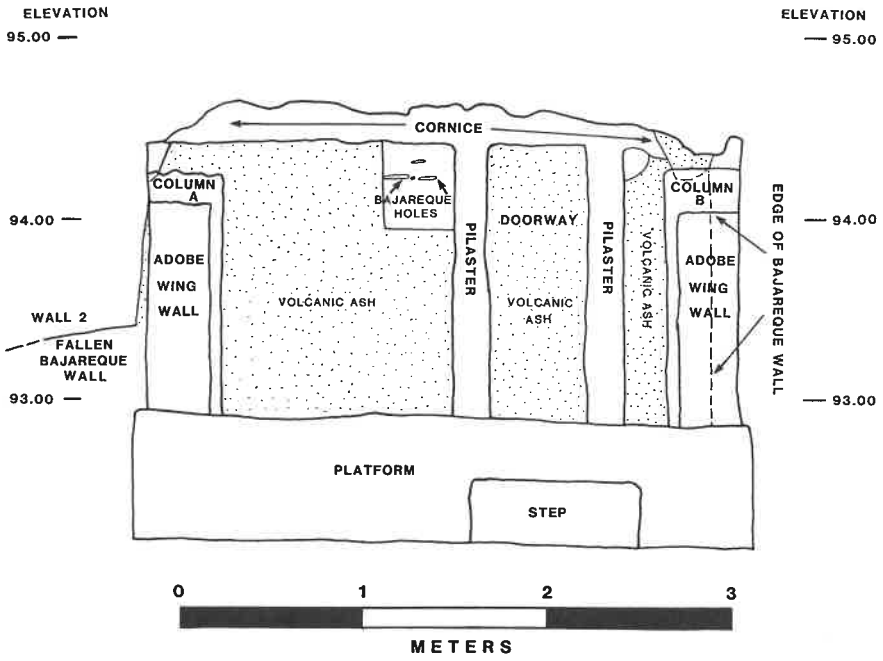

Figure 10. Profile of north wall (Wall 1) of Structure 2a, looking south. Volcanic ash left to support wall and doorway. Drawing by Brian McKee.

able to the public. There is potential for conflict in values, since the archaeologist needs to excavate all activity areas to record architecture and artifacts, and to test the inside of structures to understand their construction and refurbishings. In contrast, the structural conservator does not wish the buildings to be disturbed, and architecture needs to be consolidated and left as it was found. Fortunately, the people involved in the conservation program at Cerén have understood the potential conflict in values, and we have decided that mutual respect, discussion of alternatives, and compromise will result in the best combination of archaeology and conservation. The participation of the *Patronato pro Patrimonio Cultural* and of the Choussy construction firm are greatly appreciated.

CONSERVATION ON THE CERÉN FOLIO

As noted earlier, excavation of a niche in an interior bench in House 2 yielded three complete polychrome vessels, an oyster shell, and a dense distribution of thin white, red-on-white and green-on-white paint fragments (Figure 7). These appeared in

a generally horizontal plane approximately 3 cm above the adobe floor and occupied a roughly rectangular zone measuring 13 × 17 cm. The rectangle was oriented with the longer dimension running east–west, slightly skewed from, but generally contiguous with, the northern wall of the niche. This was tentatively interpreted as the remains of a painted codex, and that has been substantiated by laboratory analyses. Although representations of books appear throughout the Classic Maya period, few have ever been excavated. Most are made of a long sheet of *amate*, a fig bark paper, folded like an accordion with each pleat measuring 10 to 13 cm × 20 to 22 cm. The two sides are painted first with a thin white sizing or ground layer of lime plaster ($CaCO^3$) or kaolin, followed by figural and glyph decoration using various mineral pigments (red, black, etc.). The Cerén codex joins a short list of codices encountered by archaeologists. They have been found at a few Maya sites, including Uaxactun, San Agustín Acasaguastlan, Nebaj, Piedras Negras, Santa Rita, and Kaminaljuyu. Most of these had decomposed into tiny paint fragments. However, the volcanic ash matrix at Cerén may have preserved parts of the Cerén codex so that a plane or planes of painted surface may be recovered. The possibility of recovering some intact painting resulted in a decision to remove the object from the niche immediately for safe-keeping and to bring in a conservator for proper treatment.

Our procedure for lifting the remains was as follows. The tephra surrounding the deposit was removed down to the adobe floor. A piece of thin but rigid galvanized steel measuring 15 × 30 cm was slid along the adobe surface from west to east through an apparent thin lens of tephra separating the object from the floor. Some disruption of the block occurred during the procedure, including development of several lateral cracks, separation of some chunks along the rear edge, and crumbling along the unrestrained sides. In general the block retained its shape due to the somewhat sticky quality of the fine, damp volcanic ash. It was packed to prevent the ash from becoming more solid with drying. Several layers of soft toilet tissue were laid on the surface, followed by a sheet of stiffer notebook paper; this was done both for protection and to absorb any condensed moisture. The entire block was then double wrapped in aluminum foil, leaving several openings, placed in a plastic bag, and stored in a closed drawer in San Salvador.

After the lifting, a portion of the codex remained on the adobe floor of the niche. Also rectangular, this fragment consisted of a loose jumble of pigment particles in the eastern half or rear of the niche and an extremely thin, planar, and adherent layer of white in the western half near the opening of the niche.

A number of pigment particles still clung to the northern vertical wall of the niche against which the object had apparently rested. This was left in place pending further recommendation from the conservator, gently covered with newspaper to protect it from particles. The niche opening was blocked with several large bags of volcanic ash, and the platform with the niche was completely draped with plastic.

The portion of the codex left in the niche was examined on 21 July, with a subsequent decision to lift it on 22 July. Lifting utilized methods similar to those used for the other block. A portion of the floor of the niche was removed, and a piece of sheet metal was slid underneath. Particles of ash, roofing material, and other debris were carefully removed with tweezers from the better preserved western half of the folio. Although extensively fractured, this section retains a planar form. Several fragments along the perimeter of this area were gently lifted and found to have red paint on the underside (in direct contact with the adobe floor of the niche). What first appeared to be a flat white surface was found to be attached to a second thin white layer. Seen from the side, these two white layers were clearly separated by a fine space; no extraneous material was visible in between. Several fragments of this second white later which were free of the tephra deposit showed green upper surfaces. The resulting micro-stratigraphy in the thicker patchy areas now appeared to be (from the bottom up): adobe floor, red paint layer, white layer, fine space, second white layer, green paint, and tephra.

The size of the deposit, the presence of paint, and the particular layered structure lend credence to the identification of this object as a codex. Although the absence of structural material, and the extreme fragility, fragmentation, and disturbed orientation of the surviving components do not permit much optimism for a reconstructable artifact, there is much to be gained from further analysis of this extraordinary find.

Disassociated fragments of the various colors of paint and the white ground have been analyzed by techniques such as x-ray diffraction to determine the exact nature of their mineral constituents. Two pigments have been identified to date, and others are being studied. The bright red is cinnabar (mercuric sulfide) and the yellow is limonite (hydrous iron oxide). The white sizing covering the bark paper is kaolinite, a pure white clay. The exposed white surface of the "peels" will be microscopically examined, probably by scanning electron microscope, for possible identification of the organic substrate whose imprint was left in the white ground layer. Most likely it is bark paper.

The block will be analyzed by nondestructive "imaging" techniques such as x-radiography to clarify the organization of surviving fragments within the encasing ash. Fine tephra deposited in between folding sections may allow us to distinguish these layers. The bottom surfaces (closest to the metal sheet) are likely to be the best preserved, and it may be possible, with sensitive stratigraphic excavation and consolidation, to retrieve something of the painted decoration.

With the approval of the *Ministro de Educación de El Salvador* and the *Proyecto Arqueológico de Cerén*, the two lifted segments, the codex block and folio, plus its "peels," were hand-carried to the Conservation Analytical Laboratory of the Smithsonian Institution for further analysis. On completion of the analytical work, all materials will be returned to the Museo Nacional for permanent storage.

CONCLUSION

Most archaeological sites, after abandonment by their original residents, suffer from numerous natural and cultural disturbances. The wind, rain, and sun erode and crumble structures, and plant roots as well as burrowing animals affect preservation. Gradual abandonments allow people leaving sites to carry with them their most important possessions, and subsequent people often rob sites for useful building materials, artifacts, and other items. All disturbances interfere with the archaeologist wishing to understand the patterns and variations in human behavior in the past. Unfortunately for the Cerén residents, but

fortunately for us, Laguna Caldera erupted suddenly and buried structures and artifacts intact, thus eliminating the problems driving from leisurely abandonments. The volcanic ash effectively seals the ruins from encroaching plant roots and burrowing rodents. In a sense, then, the Cerén site has yet to be abandoned; its artifacts, structures, and activity areas are still intact, providing an extraordinary opportunity to study human behavior 1,400 years ago.

SUMARIO

Las recientes excavaciones en el sitio de Joya de Cerén, El Salvador, revelaron tres estructuras bien conservadas bajo various metros de ceniza volcánica depositada hace 1400 años por la explosión volcánica de la Laguna Caldera. Un equipo de investigación multidisciplinario, que incluía geólogos y arqueólogos, reveló evidencia extraordinariamente detallada de la vida diaria en las viviendas pertenecientes al período clásico, además de los restos de un códice. En temporadas futuras se excavarán otros edificios descubiertos por las investigaciones de 1989.

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