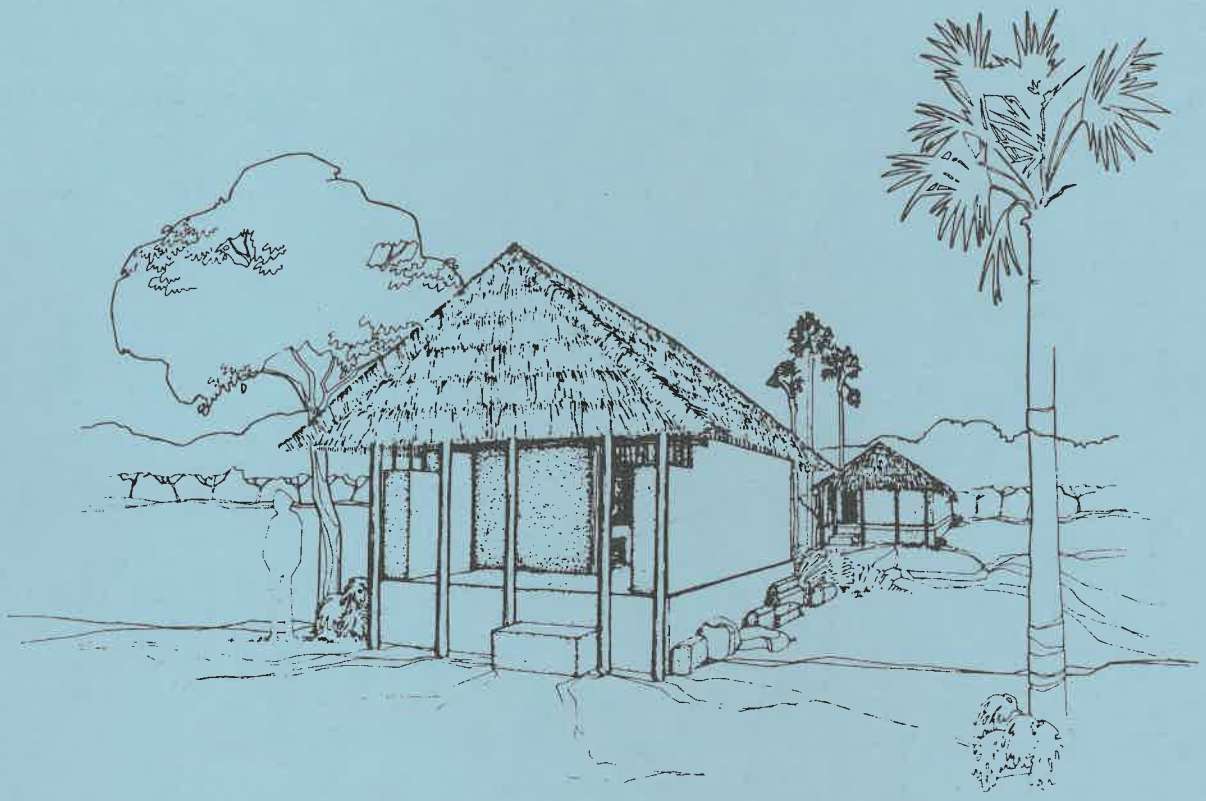
1989 Archaeological Investigations at the Ceren Site, El Salvador: A Preliminary Report



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1989 ARCHAEOLOGICAL INVESTIGATIONS AT THE CEREN SITE, EL SALVADOR: A PRELIMINARY REPORT

edited by Payson D. Sheets

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Patrimonio Cultural

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National Science Foundation

Patrimonio Natural

Preliminary Report: Cerén Project 1989

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Chapter 1. INTRODUCTION *Payson D. Sheets*

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

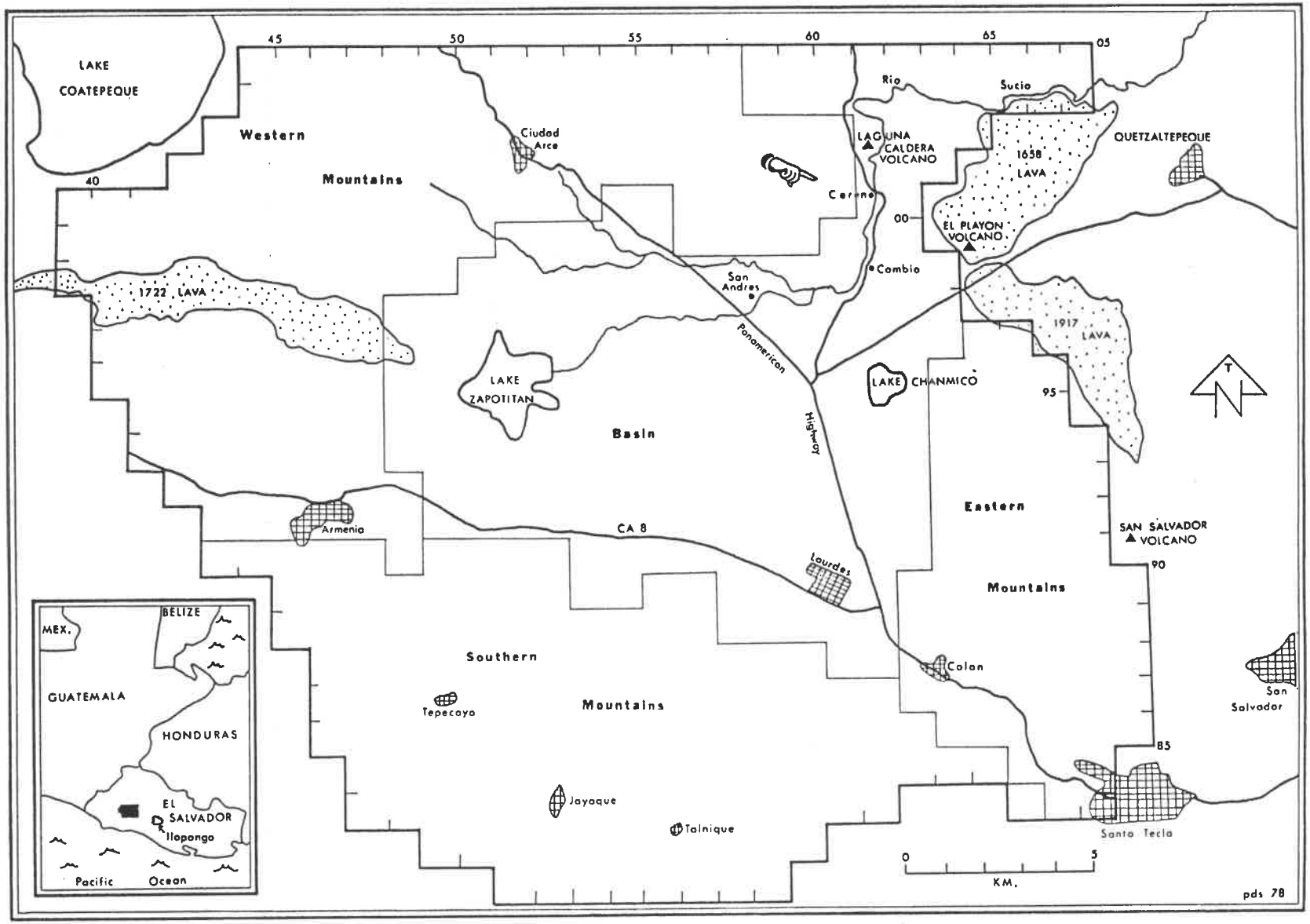
It was during the survey that I heard the story of the bulldozer working near Joya de Ceren (Fig. 1) and their discovery. The story was that the bulldozer removing the volcanic ash overburden to make a flat platform for the IRA grain storage silos had encountered two houses buried under some 5 meters of volcanic 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. Guzman shared their opinion, when he looked at the remains three days after their discovery. I certainly shared their opinion when I observed the remains of one house (now called Structure 1) that remained in the bulldozer cut in 1978, as the floor and parts of two adobe columns were preserved in excellent condition, and some thatch was visible, collapsed down onto the roof because of the weight of 5 m of volcanic ash overburden.

Still believing the structure to be recent, I began to trowel along the floor to find the bit of plastic, glass, metal, or other artifact that would help date the structure. Instead, I found a prehistoric polychrome sherd that dated stylistically to the Classic Period. Still believing that it was a recent structure, I thought that someone had taken an interest in archaeology and brought an ancient sherd into their recent house. However, finding only Classic Period sherds and no modern artifacts led me to the possibility that it might possibly be prehistoric, and that a sudden burial by volcanic ash was responsible for its remarkable preservation. I collected copious amounts of roof thatching material to submit to the radiocarbon laboratory at the University of Texas, which dated the structure and the eruption to about 1400 years ago (AD 590 with a standard deviation of 90).

Although the discovery was toward the end of the 1978 field season (time and resources were already committed in other directions) I decided to launch an effort to excavate some of the main structure and an associated ramada-like structure (Str. 1a) exposed in the IRA bulldozer cutbank (Fig. 2). 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 bajareque walls, their function remains unknown. Numerous activity areas were found inside the structures (Figs. 3,4, & 5) and surrounding them, and a maize milpa was discovered a dozen meters to the south, with a section of the milpa under cultivation and a section in fallow (Zier 1983). The shortness of the corn, in a non-irrigated field, divulged the most likely month of the Laguna Caldera volcanic eruption: June. Work is still ongoing to explore whether the eruption occurred in the daytime or at night.

The possibility of future research hinged on devising a method to find more structures under some 5m of volcanic ash. Financing the kind of random bulldozing that had encountered the structures in the IRA property would be

Fig. 1. The Zapotitan Valley, El Salvador, with the Ceren Site pointed out.



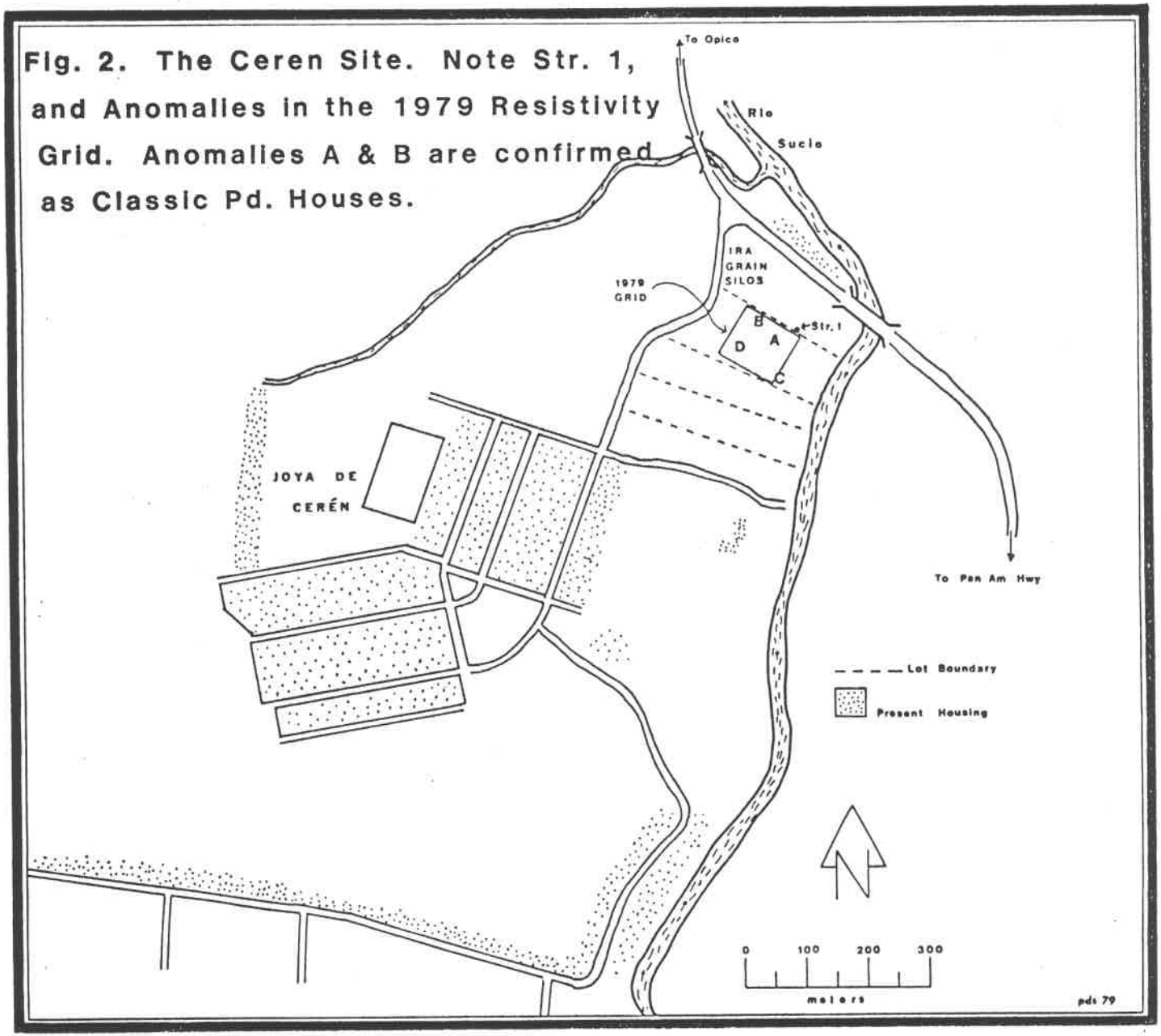


Fig. 2. The Ceren Site. Note Str. 1, and Anomalies in the 1979 Resistivity Grid. Anomalies A & B are confirmed as Classic Pd. Houses.

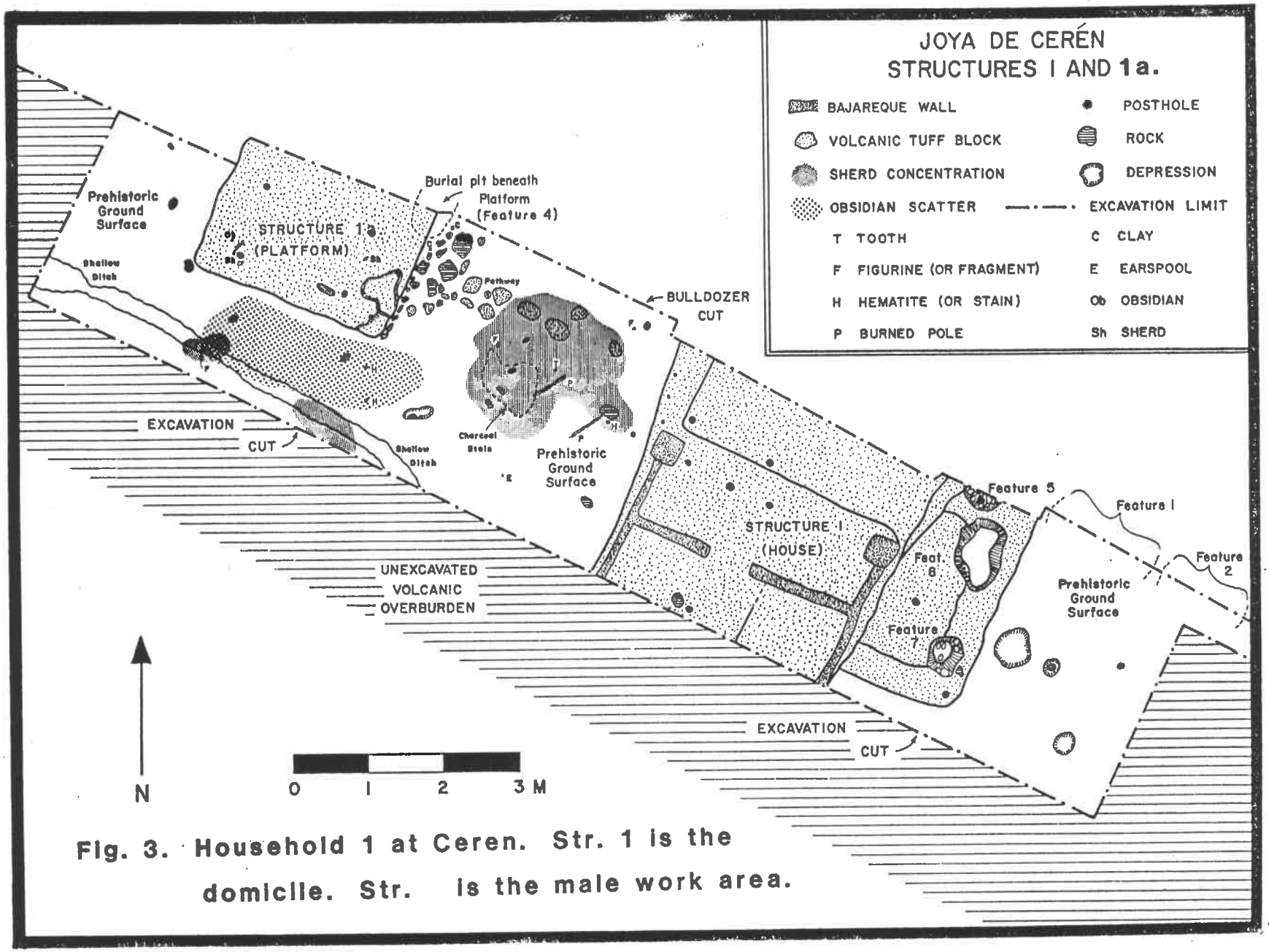
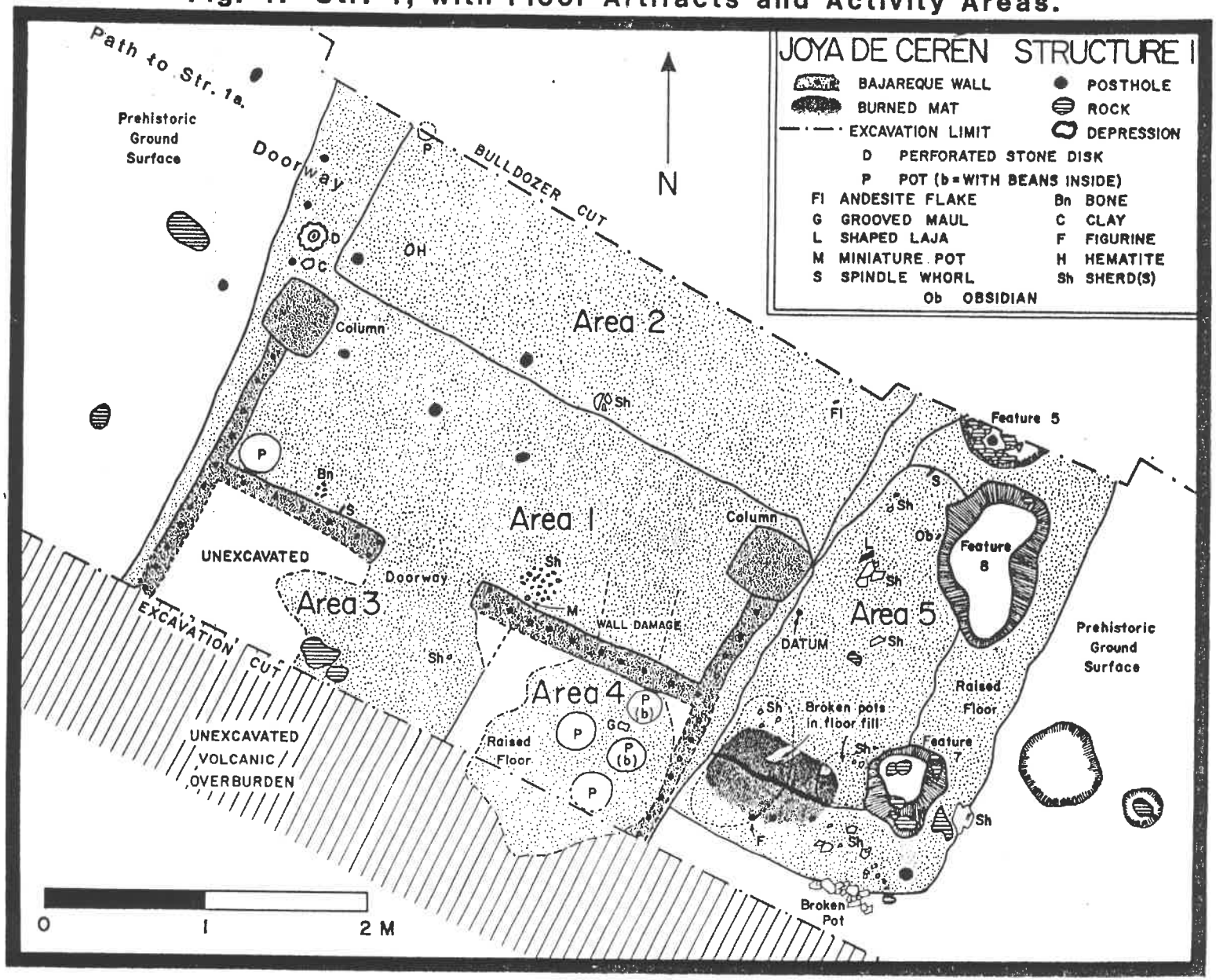


Fig. 3. Household 1 at Ceren. Str. 1 is the domicile. Str. is the male work area.

Fig. 4. Str. 1, with Floor Artifacts and Activity Areas.



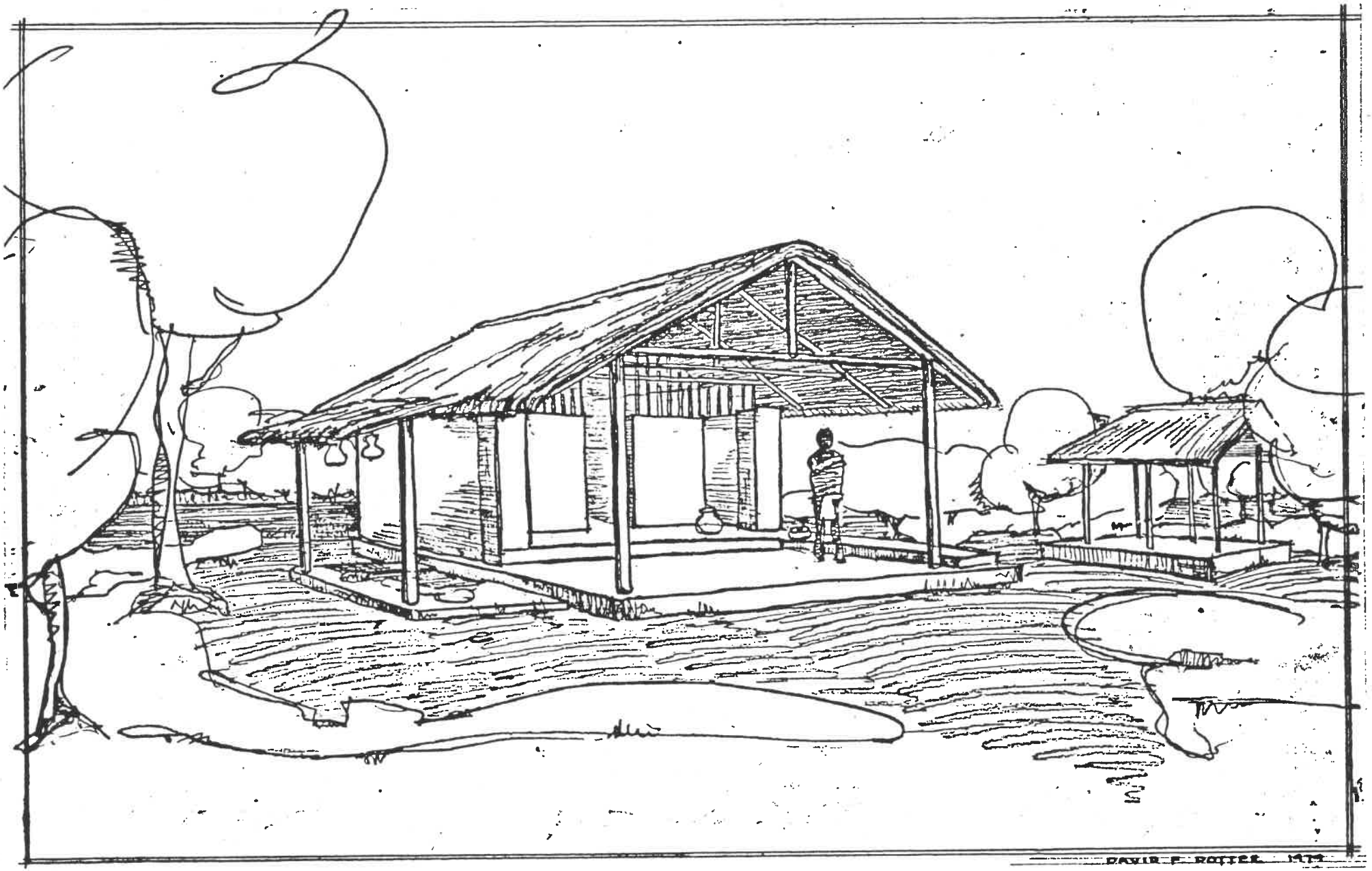


Fig. 5. Architect's Reconstruction of Structures 1 and 1a, Household 1.

difficult to justify in a proposal to the National Science Foundation (NSF), so with a mixture of some optimism and a good deal of desperation I turned to geophysics to try to discover anomalies that might turn out to be buried prehistoric structures. The geophysical research in 1979 and 1980 was sponsored by National Geographic, NSF, and the University of Colorado, and involved two geophysicists, Hartmut Spetzler and Randolph Ware. Three instruments were used, radar, resistivity (Fig. 6), and seismic refraction. The idea with the radar is that the floor of a house should be a good reflector, and that the tephra layers bowing up over a buried structure could be detected. That in fact turned out to be true. Employment of the resistivity was based on the hope that a buried house would conduct electricity differently from a place where there was natural volcanic stratigraphy, and that in fact turned out to be true. Figure 7 depicts the resistivity data as processed by the Surfer software program on our computer to display the data in a 3-dimensional format. Anomalies A and B were excavated during the 1989 field season. Seismic refraction was employed to see if a house would transmit impact energy more readily than places where there were no buried houses, and that actually worked too. However, the seismic work generated data that were more equivocal and difficult to interpret, so our efforts focused on using radar and resistivity. Within the 1 hectare (100 x 100 m) grid a number of anomalies were detected, but for them to be considered confirmed as prehistoric structures an actual sample of that structure would have to be obtained. To avoid excavating very deep test pits, a core drilling rig and crew were borrowed from the Centro de Estudios Geotecnicas, and samples of definite prehistoric floor were obtained at two locations (now called Structures 2a and 3). In both cases, what appeared to be prepared samples of flooring material were found on top of the white volcanic ash from the Ilopango eruption. Because the source of that clay is the well-weathered soil surface below the Ilopango tephra, it seemed to be human activity that raised that clay in the stratigraphic section, and both anomalies were considered confirmed as cultural. The excavations this season have made abundantly clear that the geophysical survey-core drilling reseach strategy was successful, as both anomalies confirmed as cultural by the drill samples have been proven to be components of prehistoric residental complexes.

Much of 1980 was spent in preparing a proposal to the National Science Foundation to fund extensive excavations at the Ceren site, and that proposal was awarded $120,000. However, the increasing political violence in the country rendered further research somewhat hazardous, and the money had to be returned to NSF. The same funds were made available the succeeding year, but they also had to be returned unused to NSF. I was able to make occasional visits to El Salvador in the years between 1982 and 1988, to monitor conditions and to maintain contacts and decided in 1988 that conditions had improved sufficiently to allow for a resumption of research. A revised proposal to NSF for $90,000 was funded for the 1989 field season, from mid-May to mid-August, to cover the excavations of the remainder of Structure 1, and to excavate the pristine Structures 2a and 3. With extraordinarily good fortune, the 2-inch diameter sampling pipes brought up samples of the prepared ground surface just outside Structures 2a and 3, leaving the structures themselves untouched.

The 1989 field season began with a geophysical survey of the environs of the 1-hectare grid surveyed in 1979 and 1980. Resistivity was employed, based on the previous experience of successfully finding M-shaped anomalies and confirming them as houses. The M-shaped anomaly apparently is caused by variations in electrical conductivity which derive from the buried structure

Fig. 6. Resistivity Data (Ohm-meters) with contours, 1 Hectare

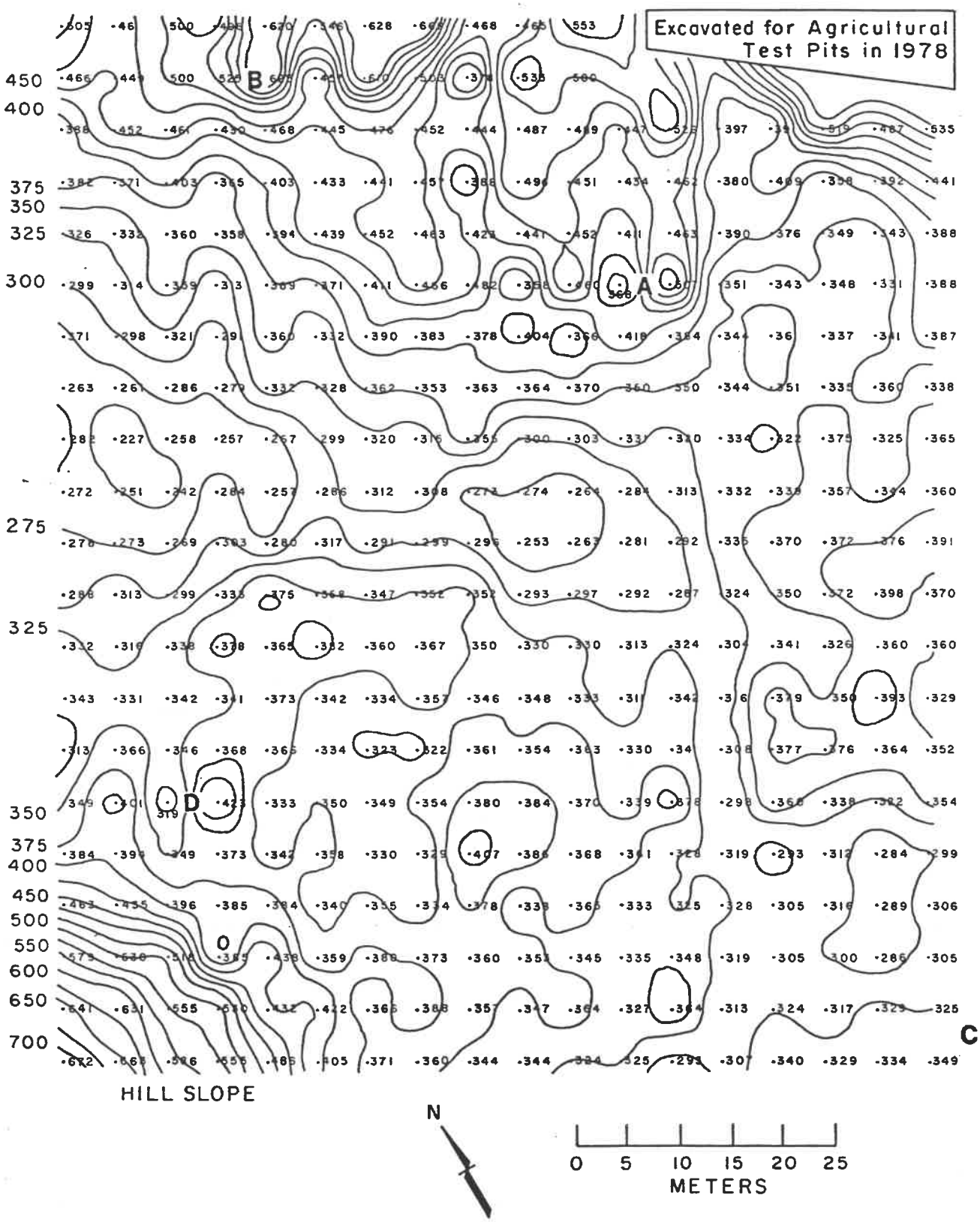
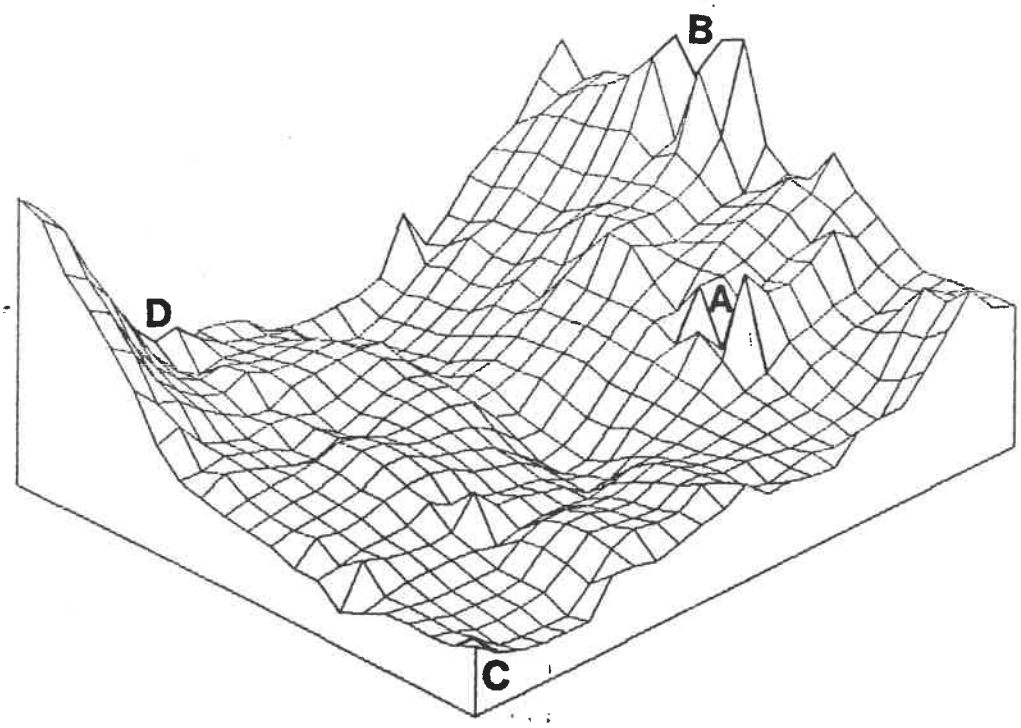


Fig. 7. 3-Dimensional Graphics Version of Resistivity Data from Fig. 6. Anomalies A-D Indicated.



CEREN.RESISTIVITY.NW.30

and in moisture differences as the lower Laguna Caldera tephra layers bow up over the structure.

The core drilling began as the resistivity survey was continuing, and the Centro de Estudios Geotecnicos decided that the project was sufficiently significant to devote a major effort to assist us. Although we had initially hoped for just a few perforations during about a week of work, we took advantage of their good will and commitment to investigate a couple anomalies more thoroughly than we had done in the past. Both turned out to be natural, as far as we can tell.

With the assistance and advice of Proconsa, a construction firm in San Salvador, it was decided that a large power shovel would be employed to lift the volcanic overburden from the buried structures without placing weight or vibration immediately above them. The power shovel removed over 5000 cubic meters of volcanic ash, in scoops of about 0.75 cubic meters, and removing the tephra from the area with a dump truck. Without the dump truck, we would have had difficulty finding areas to place the volcanic ash within our territory. By arrangements with the town council of Joya de Ceren and with individual residents, the dump truck placed the tephra on eroded roads, the irregular surface of the school yard, and improved innumerable patios and 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, the actual excavations began in House 1. The 1978 excavations of House 1 were done to within one meter of the IRA-ISTA property boundary. The 1989 excavations were intended to simply complete excavations of the remainder of the house extending into ISTA territory. That was completed, but the bodga (Str. 1b) was encountered at the southern end of the excavations, and the bodega was so productive in artifacts that it was largely excavated as well.

The power shovel shifted to tephra removal above and around Str. 2, and initially was very conservative, only removing the topmost two and a half meters. It was later placed again in Str. 2, when the magnitude of hand removal of huge amounts of volcanic ash was realized. The excavations of Str. 2 are described by Brian McKee below in detail.

The power shovel removed tephra from all four sides of Str. 3, successfully pedestaling the entire 5 x 8 meter structure. Unfortunately, it dug too deep in one location, removing part of the northern wall. However, given the good preservation of the rest of that wall, and all other walls, an accurate reconstruction can be done. Andrea Gerstle describes the House 3 excavations in detail below.

Given the change in heavy equipment from bulldozer to power shovel the decision was made to place resources into household excavations and not place a major effort in a long trench looking for agricultural variation between households. Instead, more work was done to the south and east of Test Pit 2 excavated in 1978 (Zier 1983). A significant adjustment to the previous research findings is that multiple seeds were planted and sprouted at each locality, and thus is more comparable with standard indigenous cultivation than the previous view that only one corn plant had sprouted at each locality.

A microstratigraphic descriptive and interpretive approach was taken by Dan Miller, and presented in considerable detail in his chapter. He was able

to determine the nature of, and estimate the temperatures of emplacement, of the various stages of the Laguna Caldera eruption. Also, he was able to study and understand their various effects on structures, and how structures affected their thicknesses as they blew past. The volcanological data are an integral part of understanding the Ceren site.

An apparent codex, or more appropriately called a folio, or screen-fold painted item, was found in the niche in the center of Structure 2a. Harriet Beaubien describes the discovery and the early stages in the effort to save and preserve at least some of it.

The Ceren site continues to provide unusually detailed botanical preservation, and the chapter by Andrea Gerstle and Edy Montalvo describes the discoveries. The site also provides an abundance of ceramics, both in complete and partial vessels, in their locations where they were placed by occupants some 1400 years ago. The bodega to Structure 1, called Structure 1b, was very productive in vessels, and many had their contents still preserved. At the close of excavations during this season, it appears that one corner of what may prove to be the bodega to Structure 2a may have been found. It is slated for excavations during 1990. The bodega associated with Structure 3 should be very productive as well, and it will be sought during the 1990 field season. The fact that most of the traffic exiting Structure 3 made a left-turn may indicate the direction to the bodega and to cooking and food processing areas.

The analysis of the chipped stone and the groundstone artifacts took advantage of the fact that there were relatively few of these items recovered, compared to most Mesoamerican field research projects. Often, projects are faced with tens to hundreds of thousands of these artifacts, so very little time can be spent on the individual item. In contrast, the exceptional preservation at Ceren allows for detailed information on context, and occasionally for direct preservation of organic residues which could provide evidence of the nature of use. Thus, individual items are described in more detail than usual for a preliminary report, and contextual and functional interpretations will be emphazed during laboratory analyses.

The only disappointment in an otherwise very successful season is that no human remains were found. The disappointment was particularly strong, given the talent and dedication of the biomedical-pathology team (Frank Saul, Julie Saul, and Terese Bockladge). We have no doubt that people were present at the time of the Laguna Caldera eruption, and residents who witnessed the 1976 bulldozing described seeing human remains in the form of human bones and possible body casts.

Acknowledgements

It is entirely appropriate that this section, giving credit to many fine people and institutions, is long and detailed. I have participated in many archaeological projects, in various parts of the world, but I have never before seen such a willingness of so many to assist our project.

The US National Foundation is gratefully acknowledged for their financial support. The grant (BNS 8819725) was ample to fund the scientific research. The Patrimonio Cultural, particularly Maria Isaura Arauz de Rodriguez, Ana Alicia de Gutierrez, Manuel Lopez, and Concepcion Clara de Guevara, were exceptionally helpful. We all found it a pleasure to work with Evelyn Guadelupe Sanchez, the person appointed to assist our relations with the community of Joya de Ceren.

The Patronato pro Patrimonio Cultural was helpful in obtaining large protective tarpaulins, protective roofing, cyclone fencing, and many other

needed supplies as the field season continued. I particularly wish to thank Mario Cristiani, Juan Carlos Choussy, Ernesto Raubusch, Pio Calderon, and the other active members. Ricardo Recinos is the finest friend an archaeological site could ever hope to have.

The construction firm Proconsa, ably run by Rene and Jose Cuenca, was extremely helpful. Their suggestion to use a power shovel instead of a bulldozer allowed us to use power equipment much closer to the structures, thus permitting us to excavate more cultural materials by hand than had we used a bulldozer. When the money ran out for heavy equipment, they kept working, donating salaries and equipment time to the research effort.

Without the assistance of the Centro de Estudios Geotecnicas in loaning is an Aker drill rig and well-trained crew, we would have had to excavate test pits some 5 to 7 meters straight down through the tephra to investigate the nature of anomalies. What would have taken us a week or two they were able to accomplish in less than a day, allowing us to determine which geophysical anomalies were cultural and which were natural. The director Julio Salazar and the sub-director Carlos Aguilar were particularly supportive.

Peter Doty continues to be a loyal friend, a supplier of computers and voltage regulators, and of surfboards at the beach during some memorable moments of hazardous relaxation.

If awards were given to landowners showing indefatigable patinence and helpfulness, Salvador Quintanilla surely would win. His help during the radar work in 1979 has already been acknowledged, but what needs mention here is his willingness to sacrifice two years of crops in Lot 189 so that the research can continue. He deserves a land exchange, and we all shall continue working toward a just resolution of the problem, so he can continue to support his family.

Maria de los Angeles, the owner and manager of the Casa Austria guest house, provided the finest field housing that any of us has ever experienced. Her sage advice and exhuberant sense of humor were appreciated often.

Zulma Ricord de Mendoza, director of the Museo de Historia Natural, was effective in arranging for able biological identifications of our multiple samples of seeds, wood, thatching material, animal bones, shells, and so forth. Her many kindnesses are heartily appreciated.

I wish to express my sincere thanks to all the many Salvadorans who assisted the research and the efforts to consolidate, protect, and preserve the site. Those include Ricardo Mathes, Roberto Murray, Alicia Marchesine de Landaverde, Ricardo Jimenez Castillo, and so many others. I only hope that political conditions improve in El Salvador so that more people can visit and appreciate the site, and learn about family life fourteen centuries ago.

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Chapter 2. DATA CONTROL AND DATA PROCESSING

David B. Tucker, University of Colorado

The archaeological site of Joya de Ceren is set on land presently about 12 meters above the Rio Sucio. The topography of the site gently slopes down toward the west-southwest. In the seventh century A.D., the Laguna Caldera volcano group buried the ancient surface in this area with about four meters of volcanic tephra. Subsequent eruptions of other volcanoes increased the depth of tephra to around five meters. Consequently, the excavations must expose a much deeper surface. Excavations in the 1989 field season included three separate excavation zones, each concentrating on a structure group. Each excavation zone was separated from the others by 10 to 30 meters, with the extent of excavations stretching to about 75 by 50 meters.

Data control at Ceren in the horizontal and vertical dimensions needed to represent fine detail as well as the overall dimensions of the site. Each artifact needed to be point plotted relative to others in the structure, as well as the structures being mapped relative to each other. Therefore, a grid was placed over the site, oriented to magnetic north, with each artifact being given coordinates; i.e. so many meters North or South, so many meters East or West, and a relative elevation in meters. The main site datum was arbitrarily placed on a high point on the east side of the site, and represented North 0, West 0, 100 meters elevation. Ideally, the grid should have represented Universal Transverse Mercater coordinates, and the elevations should have been meters above sea level. Unfortunatly, no reliably surveyed datum points could be located near the site, and one elevation bench mark located on a nearby bridge could not be found.

Equipment used to place site datums included a theodolite, an Electronic Distance Meter (Hewlett-Packard model 3805A), a 2.5 meter stadia rod, and 50 meter and 30 meter tapes. Magnetic north was originally found for the first site datum with the use of a Brunton hand held compass. All subsequent datums were oriented by back-shooting to other datums. This maintained a consistent north within the site from the first day. Figure 1 shows the location of site datums in relation to the excavation pits. In addition to the main datum at N0,W0 (arbitrary elevation 100 meters), datums were placed at N0,W50 (97.387 m.); N25,W50 (98.463 m.); N25,W75 (96.978 m.); and N10,W5 (94.960 m.). These datums were located first with theodolite and tapes, then the distance was determined with the EDM. Elevations for these datums were determined by setting up a programmable calculator with a simple trigonometry program that used the distance, visual angle from level, rod height, and station elevation to calculate a true distance corrected for angle and an elevation relative to the original datum. Distances were then adjusted as necessary, and the datum checked again. The datums were marked with large wooden stakes, using a single nail to mark the exact point. The control thus found to be established was very reliable.

From these datums, the grid was extended down into the excavation pits, and various points set up for reference. For Structure 1, the datum at N10,W5 was already down in the pit, so as excavations proceeded, a line of small nails at one meter intervals was laid down due south of the datum using the theodolite for alignment, and tapes for distance. All artifacts and architecture were mapped with reference to these nails, and elevations were determined with the stadia rod and theodolite shooting level. The grid was extended down into the Structure 2 pit from the datum at N0,W50 with the theodolite and tapes. Pin flags or nails were installed at one meter grid coordinates. A separate datum was shot in with the theodolite and an

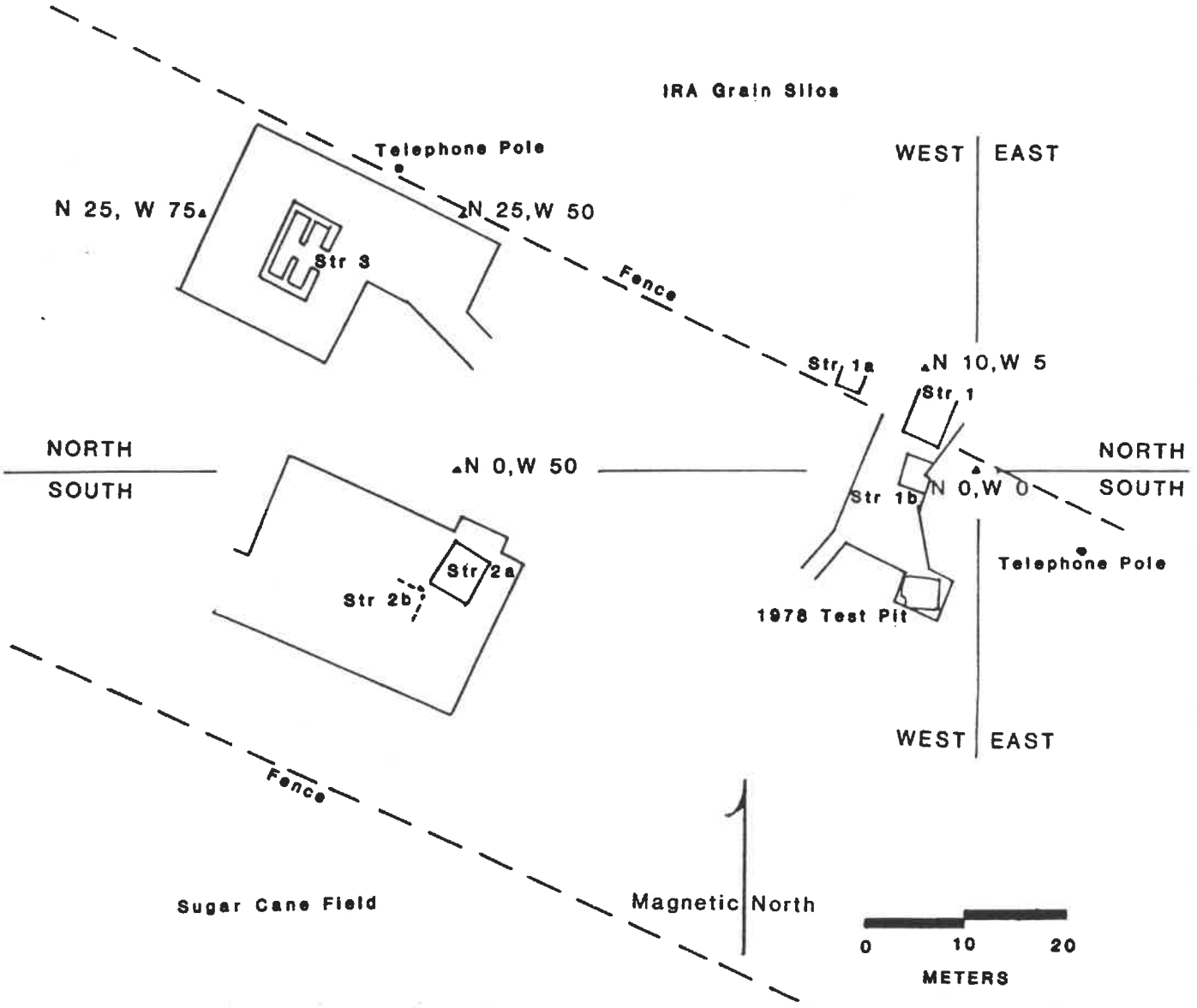

FIGURE 1 Horizontal Control grid and datum points (▲) in relation to excavated structures.

extended stadia rod that was used only for elevations. Elevations within Structure 2 were found the same way as in Structure 1. In the Structure 3 excavation pit, a line of pin flags were set running east-west between the datums at N25,W50 and N25,W75. These were aligned to even grid coordinates by measuring a point on this line with the EDM. Similar to Structure 2, a separate elevation datum was established, but elevations within Structure 3 were determined with line levels in reference to its own architecture.

A basic map of the site and surrounding area was made by shooting points around the excavation pits and along the fences with the theodolite and stadia rod. The programable calculator was adapted to convert stadia rod intercepts into distances, and elevations were figured for each point. The generated map was very rough and basic. Stadia rod intercepts are only accurate to about + or - 1 cm per each 1 meter. At this time (August, 1989), professional surveyors are making a much more acurate topographic map of the site that will be very useful in the future.

Some problems were discovered and corrected through the course of the season. Early it was noted that the vertical table on the theodolite was not properly aligned to level, so this fault was corrected and all the datums were re-shot. Another problem occurred with the Structure 2 test pit. This was a 2 by 2 meter pit dug to find the structure, with its southwest corner placed at S11,W58. Later in the season, when the structure was fully excavated and mapped in, it was noted that the original test pit was misaligned to the north and east by 22 centimeters. This discrepancy may have occurred due to the fault in the theodolite. The coordinates of the test pit were changed to fit later measurements so there would be consistency within the excavation.

Future work at the Ceren site will undoubtedly remove the datums that have been established; in fact, the datum at N0,W50 has already been destroyed by heavy equipment. The nails placed in structures may be removed as consolidation and conservation of the structures proceeds. In future seasons, the grid will have to be re-established, in order to keep horizontal and vertical control consistent from year to year. To facilitate the grid re-establishment, marks have been filed into the two telephone poles on the site, possibly the only permanent objects nearby. A mark was made on the southwestern corner of the eastern telephone pole at an elevation of 101.48 meters. A similar cut was made on the southeastern corner of the western telephone pole at 99.873 meters elevation. These telephone poles have been carefully mapped in from the main site datum. Also, horizontal azimuths have been recorded for distant points, such as the radio towers on Boqueron and the tallest grain tower at IRA. Finding the N0,W0 datum in future seasons should not present any problem.

Chapter 3. STRATIGRAPHY OF VOLCANIC DEPOSITS AT CEREN

C. Dan Miller, USGS Cascades Volcano Observatory

Introduction

During July, 1989, two weeks were spent at the Cerén site studying the eruptive products of the A.D. 600 eruption of Laguna Caldera Volcano which buried Classic Period structures to a depth of about 5 meters. The Cerén site is located near the village of Joya de Cerén, El Salvador, and is described by Sheets (1983) and Chapter 1 of this report.

The purpose of this paper is to describe the character and stratigraphy of pyroclastic deposits that destroyed and buried the structures at the Cerén site, and to interpret the nature of the eruptions. This project interfaced with concurrent archeological investigations at Cerén in order to help place structures and household belongings in a geological context. Measured sections were described at each of the three main structures, Structures 1, 2, and 3, (Fig. 1) to determine the sequence of eruptive events and to allow comparison of the sequences of deposits at each of the structures. At each of the three excavation blocks, individual stratigraphic units were measured and described, and representative samples were collected to determine their origins, depositional mechanisms, and to identify destructive and hazardous events.

A second objective of this investigation was to determine the effects of each eruptive phase of the Laguna Caldera eruption on the structures at Cerén and to determine, where possible, the timing of destructive events and their effects upon the cultural materials and objects within the structures.

Character of the Laguna Caldera eruption

As has been noted by Hoblitt (1983), the Laguna Caldera eruption was dominantly phreatomagmatic in character. The eruption occurred when basaltic magma reached the surface about 1.5 km north of the El Ceren site, along a fissure that extends in a northwest direction from San Salvador Volcano (Zier, 1983). The fissure seems to have been the locus of several basaltic eruptions along a line of vents between Laguna Caldera Volcano and El Boqueron Volcano on the north flank of San Salvador Volcano.

Excavations at the three structures at Cerén expose a consistent series of pyroclastic deposits totalling slightly more than five meters in thickness. Near the surface of the section, and overlying the Laguna Caldera deposits, Hart (1983) described tephra deposits about 1 cm thick from an eruption of El Boqueron that, according to Payson Sheets (cited in Hart, 1983), occurred between about A.D. 800 and 1000. Overlying the El Boqueron tephra is about 10 cm of tephra from an eruption in A.D. 1658 of nearby El Playon Volcano (Hart, 1983).

Investigations during this study were restricted to the Laguna Caldera pyroclastic deposits in the immediate vicinity of the Cerén excavations. Furthermore, the lowermost three meters of the Laguna Caldera sequence were studied in the greatest detail because they were most important layers in terms of their effects on the structures buried at Cerén. No effort was made during this investigation to confirm that the Laguna Caldera Volcano is the source of the deposits at the Cerén Site or to isopach the deposits; preliminary results of such studies have been described by Hart (1983). Similarly, no efforts were made to isopach or trace the two younger tephra deposits to their sources.

Pyroclastic deposits from the Laguna Caldera eruption consist of a series of pyroclastic-fall and pyroclastic-surge beds deposited during fluctuating eruptive activity. The eruptions were phreatomagmatic in nature and appear to have resulted from the interaction of basaltic magma with the water table at shallow

depths in the crust. Fisher and Schmincke, (1984), describe these types of pyroclastic processes and summarize the character of the resulting deposits. By comparison with historical eruptions similar to the Laguna Caldera eruption, the deposits at El Cerén probably accumulated during eruptive activity that lasted for days to weeks.

Individual beds and groups of beds are here described as "units"; they are numbered and described from the bottom of the section which sits on the Tierra Blanca Joven tephra, to the top. A composite stratigraphic section that is representative of exposures in pit walls at all three structures is shown in Figure 2. As described in Figure 2, the units are characteristic of the stratigraphy outside of structures. As will be discussed below, the stratigraphy inside, and immediately adjacent to structures, is often disturbed and variable. Units 1 through 15 (Fig. 2) are briefly described below along with their inferred mechanisms of deposition.

Unit 1.

Unit 1 consists primarily of a series of pyroclastic-surge beds. This unit consists of a series of ash and fine lapilli beds that vary laterally both in thickness and grainsize, especially in the vicinity of occupation structures at Cerén. Unit 1 varies from about 19 to 32 cm in thickness and consists of alternating laminated ash beds and relatively well-sorted lapilli-fall beds (Hoblitt, 1983). Juvenile basaltic lapilli and occasional (ballistic) blocks can be found in this unit beginning about 2 cm from the base; large clasts are breadcrusted, indicating their interaction with water.

Unit 2.

Unit 2 is a block and lapilli fall deposit. This unit varies in thickness from about 5 to about 15 cm and was described by Hoblitt (1983) as the "coarse airfall tephra bed". Unit 2 is a friable, open-work, relatively poorly sorted block and lapilli deposit. It consists dominantly of juvenile clasts, the largest of which were deposited at temperatures that exceeded 575 deg. C (Hoblitt, 1983). Although it is dominantly of airfall origin, Unit 2 also contains numerous large bombs which reached the Cerén site on ballistic trajectories. The largest ballistic bomb which has been found within the Cerén excavations measures about 66 x 40 x 40 cm! The floors of Structures 1, 2, and 3 are littered with juvenile ballistic bombs, apparently deposited during the eruptive event that produced Unit 2. Outside the structures there are numerous bomb sags within Units 1 and 2 generated by the impacts of ballistic blocks into wet pyroclastic deposits.

Unit 3.

Unit 3 consists of a series of dominantly pyroclastic-surge beds and varies in thickness from about 65 to 75 cm. Unit 3 consists mostly of brownish plane-parallel ash beds, many of which thicken and thin laterally. Some layers show crossbedding and form dunes. Many of the beds of Unit 3 are indurated and contain abundant accretionary lapilli suggesting that they were emplaced wet. Clasts in the coarser lenses often are subrounded suggesting that they were transported by turbulent flow. Unit 3 contains several thin, well-sorted lapilli beds that probably were deposited dominantly by airfall mechanisms. There are also bomb sags within Unit 3 resulting from the impacts of ballistic blocks.

Unit 4.

Unit 4 is a lapilli-fall deposit that form ss a massive layer about 20 cm thick that blankets the area and has a fairly constant thickness. Near the base, Unit 4 is relatively poorly sorted and consists of slightly indurated lapilli with a

sparse coarse ash matrix. The upper half of Unit 4 is composed of friable, open-work lapilli, many of which are slightly rounded. Unit 4 is composed of about 95% juvenile basalt clasts, and associated charcoal in Structures 1 and 2 indicate that it was hot when emplaced. Overall, Unit 4 has the characteristics suggesting that it is a near-vent airfall deposit.

Unit 5.

Unit 5 is a pyroclastic-flow and (or) pyroclastic-surge deposit. Unit 5 is a poorly sorted, matrix-rich deposit that varies in thickness from about 20 to as much as 60 cm. It is composed of juvenile lapilli in an abundant ash matrix. Unit 5 commonly appears to be massive, but in many localities shows planar and cross bedding; it thickens in depressions and up against structures. Abundant remnants of charred thatch and roofing poles within Unit 5 indicate that it was hot when emplaced. Units 4 and 5 appear to be related; the vertical eruption column that produced the Unit 4 tephra fall may have collapsed producing the pyroclastic flows and surges represented by Unit 5.

Unit 6.

Unit 6 is a crossbedded pyroclastic-surge deposit that forms prominent dunes and varies in thickness over short distances from about 10 to about 30 cm. Unit 6 is a light brown in color, has a relatively low content of juvenile clasts compared to Units 4 and 5, and is composed of scattered lenses of lapilli interbedded with relatively well-sorted ash beds. Some ash beds in Unit 6 are indurated and have abundant accretionary lapilli. Lapilli in Unit 6 are mostly subrounded due to transport in a turbulent flow.

Unit 7.

Unit 7 is a lapilli-fall deposit. This unit forms a fairly consistent deposit over the El Ceren area that averages about 25 cm in thickness. similar to Unit 4, Unit 6 is massive and consists primarily of lapilli; in the lower half, there is some coarse ash matrix, while in the upper half, clasts are in contact with each other. Unit 7 is composed of about 90-95% juvenile material. Large scoria clasts in this layer are breadcrusted indicating interaction with water during the eruption.

Unit 8.

Unit 8 consists of a series of phreatomagmatic surge beds. This unit consists of several brownish poorly sorted, indurated, and laminated ash beds separated by thin beds composed of small subrounded lapilli. Unit 8 varies in thickness from about 18 to 20 cm. Unit 8 has a smaller percentage of juvenile clasts than Unit 7, and fine-grained layers contain accretionary lapilli; both characteristics suggest that Unit 8 was deposited by base surge mechanisms.

Unit 9.

Unit 9 is a block- and lapilli-fall deposit. Unit 9 is a massive bed that is 45 to 50 cm in thickness, and that blankets the area with tephra fairly constant in thickness. Like Units 4 and 7, the lower half of this unit has some coarse ash in addition to blocks and lapilli, and is slightly indurated. The upper half is clast supported, friable, and better sorted that the lower half. Unit 9 is composed of approximately 95% juvenile clasts, many of which are breadcrusted. Characteristics of Unit 9 suggest that fallout combined with accumulation of ballistic debris was the dominant depositional mechanism.

Unit 10.

Unit 10 is a series of phreatomagmatic base surge beds. The unit is brown in color and consists of a series of poorly sorted "muddy" ash and lapilli beds that vary in total thickness from about 30 to 38 cm. This unit has a lower percentage of juvenile clasts than Unit 9, but there is a concentration of juvenile breadcrusted bombs 5 to 10 cm in diameter about one third of the way up from the lower contact. A zone of large and prominent accretionary lapilli is concentrated at the top of Unit 10.

Unit 11.

Unit 11 is a series of lapilli surge beds. The unit consists of a series of faintly laminated, friable layers composed of subrounded lapilli. Unit 11 "pinches and swells" slightly in thickness, which varies from about 35 to 40 cm. From a distance, sub-horizontal "lines" of similar-sized clasts can be seen in Unit 11. Unit 11 is composed dominantly of juvenile lapilli. Although Unit 11 has some characteristics of airfall deposition, its overall bedded character suggests some kind of phreatomagmatic surge mechanism of deposition.

Unit 12.

Unit 12 consists of a series of "sandy" base surge beds. Unit 12 averages about 15 cm in thickness and is composed of a series of planar, poorly sorted but friable, ash and lapilli beds. These beds are brown in color and are composed of a smaller proportion of juvenile clasts than Unit 11.

Unit 13.

Unit 13 is a lapilli-fall deposit. Unit 13 forms a deposit that is about 15 cm thick that is consistent in thickness at the El Ceren Site. It consists of poorly sorted, but friable lapilli that are dominantly juvenile in composition. This unit is similar to Units 4, 7, and 9 in its overall characteristics.

Unit 14.

Unit 14 is a composite unit consisting of numerous phreatomagmatic fall and surge deposits. Part of the unit forms prominent dune forms and thus the unit varies in thickness; its average thickness is about 1.2 meters. The lower 25 to 30 cm of this sequence consists of a series of poorly sorted, juvenile-rich lapilli and ash beds. The beds show planar- and cross-bedding. The next 25 to 35 cm of Unit 14 consists of thin, laminated planar and cross-bedded sand-sized ash beds, that form dunes. Above the dunes, is a series of lapilli-fall beds which are oxidized to a bright reddish-brown color, presumably due to soil-forming processes, and perhaps partly due to movement of ground water. The upper 45 cm of this unit is colluvium (reworked, either by man or by surface processes), and has an organic-rich soil developed on it. Unit 14 is thought to represent the final eruptions of the Laguna Caldera Volcano, and the presence of colluvium and an organic soil indicate that some time passed before deposition of the overlying units.

Unit 15.

Unit 15 is a composite unit consisting of all deposits that overlie the Laguna Caldera eruptive sequence. The composite unit at El Ceren has a total thickness of about 60 to 65 cm. Immediately above the soil on the Laguna Caldera sequence is a scoriaceous lapilli-fall deposit that is 10 to 12 cm thick. This may be the tephra deposit from the 17th century eruption of El Playon volcano described by Hart (1983). Above the lapilli-fall deposit is an organic-rich colluvium about 50 cm thick, which forms the present ground surface. I did not recognize the thin

tephra layer from the eruption of El Boqueron described by Hart (1983), or any tephra deposits from other sources, in Unit 15. There is no evidence in the sequence of eruptive units from Unit 1 to Unit 14 for a break in time. There are no noticeable soils, and I did not see any evidence of erosion or unconformities within the sequence that was not due to eruptive processes.

Relations between Laguna Caldera deposits and structures-artifacts at Cerén

Structures at Cerén were affected by the Laguna Caldera eruptive sequence both by burial and by physical destruction. Tephra-fall deposits were emplaced at the site primarily as ash and coarser particles fell vertically or nearly vertically from the eruption column. Because the site is only about 1.4 km from the vent, the airfall deposits also contain ballistic blocks and lapilli which help to account for the poorly sorted nature of many of the lapilli- and ash-fall deposits. Tephra-fall deposits affected the site primarily by burying it, although accumulations of tephra 20 cm or more thick could have caused the collapse of roofs. Because of their large sizes (Many are several decimeters in maximum dimension), ballistic fragments were very destructive, falling through roofs and walls, and breaking ceramic vessels and damaging the adobe floors. In addition, many of the tephra-fall and ballistic clasts, especially the larger ones, were hot when they fell at Cerén, and caused fires in roofing thatch and wooden structures that supported roofs and walls.

Pyroclastic surge deposits were deposited at the Cerén site by rapidly moving clouds of ash and coarser clasts, "ash hurricanes", which entered the Cerén village at very high speeds (speeds from 50 to 200 kilometers per hour have been reported in the literature) and caused partial destruction of structures. Such surge events caused the roofs of structures to be blown off and the walls of weaker structures to be blown down. Holes may have been knocked in walls by rapidly moving debris in such flows. Some surge units accumulated to great thicknesses on the sides of structures facing the Laguna Caldera vent allowing some later surges to pass over parts of structures without seriously damaging them. Many surge deposits were wet and apparently were emplaced at temperatures of about 100 deg. C. and thus did not burn organic materials that they came in contact with.

Houses 1 and 2 were primarily affected by Laguna Caldera eruptive Units 1 through 6 (Figure 2); later eruptive units simply buried what was left of the structures. House 3, because of its high adobe walls and sturdy construction, was affected by eruptive Units 1 through 11; later eruptive deposits buried the structure. The stratigraphic relationships between eruptive units and structures are briefly discussed below for Structures 1, 2, and 3.

Structure 1

Structures 1 and 1a, (Fig. 1) were completely excavated by the time that I arrived at El Ceren. Thus, I cannot comment on the volcanic stratigraphy as it relates to these structures. See Hart (1983) and Hoblitt (1983) for a discussion of these relationships. Structure 1b was nearly completely excavated when I arrived, but two ceramic vessels in the southeast corner of Structure 1b were excavated during my presence and record some interesting details of the earliest effects of the Laguna Caldera eruptions.

When the eruptions began a large pot with a smaller one on top as a "stopper", was sitting on some support stones near the south wall of Structure 1b. An early (surge?) event (Unit 1) of the eruption knocked the large vessel over (in the direction that appears to be directly away from Laguna Caldera Volcano), knocking the "Stopper" pot off the mouth of the underlying pot. The tilted large vessel subsequently was filled to a depth of about 20 cm with

stratified surge beds. At some later time (possibly during emplacement of Unit 2?) the large pot was broken or collapsed under the weight of the overlying units.

The absence of deformation or slumping of the laminated layers in the pot suggests that the pot did not contain a large quantity of organic food stuffs when partially filled with ash. The lowest strata in the pot contain small juvenile scoria clasts which were hot when emplaced, as evidenced by associated small charred bits of organic matter. The deposits in the pot are laminated and sometimes crossbedded, and contain accretionary lapilli. These characteristics, the fact that the pot was tipped over by a blast, and the fact that the ash had to enter through the mouth of the pot which was tipped on its side and facing away from the source of the eruption, indicate that these pot-filling deposits were emplaced by pyroclastic surges. Comparison of the sequence inside the pot with the stratigraphic sequence exposed outside Structure 1b suggests that the sequence inside the pot is correlative with Unit 1 (Figure 2) of the Laguna Caldera sequence.

Structure 2

Most of the inside of Structure 2a (Fig. 2) was excavated during my presence at El Ceren, and I was able to investigate the relationships between the roof, walls, artifacts and ceramics, and the eruptive sequence. The stratigraphy inside Structure 2a is different from that outside primarily because Units 1 and 2 are present in only limited quantities, and because Units 3, 4, and 5 are sometimes thicker than normal because they "fill in" the topography of the structure. In addition, there is an enigmatic extra unit, the "buff" Unit, which is not present around the outside of Structure 2a.

The stratigraphy on the adobe floor of Structure 2a begins with 0 to 3 cm of well-sorted, laminated fine ash, which presumably is correlative with Unit 1. This layer is overlain by the "buff" Unit, which varies in thickness from 0 to about 30 cm, and apparently is not an eruptive unit associated with the Laguna Caldera eruption. The buff Unit seems to be a mixture of some older, silicic ash (from the Ilopango eruption?), mixed with grass. Small vesicles in the buff Unit suggest that it was wet when mixed with fresh grass, which is preserved in the form of very abundant grass-blade casts. The buff Unit is concentrated in the middle of the floor of Structure 2a and on the bench along the east wall, where it forms mounds. The purpose of the buff Unit, its pre- eruption location within Structure 2a, and its mechanism of transport to its present position are all unknown at present.

Immediately overlying the buff Unit is an uneven layer of charred and uncharred roof thatch, charcoal fragments of roof beams and poles, and patches of dark, juvenile-rich ash with occasional scoria lapilli and blocks. This dark ash and lapilli debris resembles Unit 2, but is much thinner, finer grained, and less continuous.

Lying on top of either the dark ash layer, the carbonized roofing materials, or the buff Unit, is a thick sequence of Unit 3 pyroclastic surge deposits. Unit 3 varies in thickness from 30 to about 80 cm and fills a major part of the interior of Structure 2a. Some beds within Unit 3 thicken dramatically in the middle of the house, and accretionary lapilli are abundant. According to Brian McKee (oral communic., 1989), part of the west wall of Structure 2a appears to have been blown over by Unit 3 surge beds.

Units 4 and 5 overlie Unit 3 inside Structure 2a and also thicken in its interior. Both of these units were hot as evidenced by the frequent occurrence of charcoal poles, support beams, and sticks from the bajareque walls within these units.

Based on the presence of Units 1 through 5 under the fallen east wall of Structure 2a, that wall, and presumably the south wall, were blown down late during the emplacement of Unit 5 or during the early stages of emplacement of Unit 6. Collapse of the walls allowed the slumping of Units 3 through 5 where they were adjacent to the east wall. Unit 6 seems to have been erosional, at least at some time during its passage, resulting in crosscutting relationships with underlying units.

In summary, stratigraphic relationships at Structure 2a indicate that the house may have remained relatively intact during the emplacement of Units 1 and 2, and except for large Unit 2 ballistic bombs, only minor amounts of Units 1 and 2 were deposited inside the structure. Sometime after deposition of Unit 1 and coeval with deposition of Unit 2, the "buff" Unit was emplaced by unknown means and from an unknown source in the interior of the structure. The remaining roof materials then collapsed and were burned by emplacement of hot, Unit 2 bombs and debris and/or by the earliest deposits associated with Unit 3. Unit 3 was banked up against the north and west walls in very thick deposits which "armored" those walls and protected them from more intense and destructive surges yet to come. Part of the west wall was blown over by Unit 3. Finally, late in the emplacement of Unit 5, the east and south walls were blown down before most of Unit 6 was deposited. Later units in the eruption simply buried Structure 2 with additional volcanic debris that totals about 3.2 meters above the highest remaining part of Structure 2a.

Structure 3

A significant part of Structure 3 (Fig. 3) was excavated during my presence at Cerén and I was able to compare the stratigraphy inside the structure with that outside, and determine when certain events associated with damage to the structure occurred relative to eruptive events.

Outside of Structure 3

The stratigraphy of Laguna Caldera deposits outside of Structure 3 is similar to the generalized section shown in Figure 2. On the west side of Structure 3 adjacent to the wall, Units 1 through 3 are thicker than in the general stratigraphic section. These flowage deposits apparently "piled up" against the west wall of the structure and thickened. This is demonstrated by individual beds in Units 1 and 3 which thicken and coarsen rapidly as the wall is approached. Near the base of Unit 1, blocks of the cornice from the wall are sitting on 2 to 4 cm of the earliest deposits of Unit 1. Near the top of Unit 1, unburned roof thatch and the empty cast of a roof-support pole are preserved, indicating that at least the upper part of Unit 1 was not hot enough to burn organic matter, but the action was violent enough to collapse part of the roof and its supports. This stratigraphy indicates that part of the cornice was dislodged during the early stages of the deposition of Unit 1, either by the effects of pyroclastic surge or possibly due to ground motions associated with possible seismic activity associated with the eruption.

On the east side of Structure 3, a broken ceramic vessel is preserved in the lower units of stratigraphic Unit 1. The pot may have been sitting on the "porch" near the southern part of the house when it was disrupted by the eruption. The pot was broken into sherds which were scattered in a down-blast direction off of the porch. One large sherd came to rest concave side down and preserved about 1 to 2 cm of scattered juvenile lapilli underneath it, indicating that the disruptive event occurred early during the eruption of Unit 1.

Inside of Structure 3

Deposits preserved in the doorway between the east and west rooms of Structure 3 illustrate the sequence of events inside the structure. Stratigraphic

Units 1 through 5 are present in the doorway. Aside from being slightly thinner than the section outside of Structure 3, the eruptive sequence seems to be the same. Unit 1 is about 20 cm thick and charred roof fall material is preserved near the upper third of the unit. In the middle of the west room, there is a thick and very irregular accumulation of the "buff" Unit over thin and discontinuous layers of Units 1 and 2. The buff Unit is as thick as 30 cm and seems to form the irregular topography upon which the roof-fall thatch is sitting. The "buff" Unit here is similar to the same unit seen in Structure 2a; here it is sometimes massive, sometimes brecciated and occurring in pods, and in places, it contains lenses of juvenile scoria.

Above the roof thatch are thick accumulations of Unit 3, which is very irregular in thickness within Structure 3. Units 4 through 10 filled the rooms of Structure 3 without knocking down the walls. Thick accumulations of Units 1 and 3 against the walls of the structure facing the vent seem to have protected, or "armored" the walls from destruction by later surge events. The last part of Structure 3 to be covered by the eruption was the southeast corner which was finally covered by Unit 11. Later eruptions buried the house with about 2 meters of additional pyroclastic deposits.

In the middle of the bench near the south wall of the east room of Structure 3 there was a large ceramic vessel. The vessel collapsed after having been partially filled by tephra. The pattern of breakage suggests that force from the direction of the Laguna Caldera vent caused the destruction. The pot is surrounded by about 6 cm of Units 1 and 2 and is buried by thick deposits of Unit 3. Units 1 and 2 are anomalously thin and fine-grained at this location suggesting that some roof protection may have still been available at that time. Under a layer of large sherds inside the pot, there was about 8 to 10 cm of mixed juvenile lapilli and dark ash. These appear to represent incomplete deposits of Units 1 and 2, and suggest that the pot was broken late during Unit 2, perhaps by one of the large juvenile ballistic blocks associated with that event, although no such block was found inside remains of the pot. The sherds in the pot were buried by Unit 3. There was no sign of roofing materials near the pot, suggesting that they may have been blown off toward the south during emplacement of Unit 3.

Conclusions

The eruptions that destroyed and buried structures at the Cerén site appear to have been phreatomagmatic eruptions from the nearby Laguna Caldera Volcano. The eruption began with eruptions of frothy juvenile basaltic scoria that reached El Cerén initially as thin ash-fall events. Subsequent events very early in the eruption produced pyroclastic surges which entered the area as hot, turbulent clouds of ash and lapilli. Although these early (Unit 1) surges apparently did not destroy the walls of Structures 2a and 3, they did have enough force to tip over ceramic vessels and knock off parts of the cornices of structures like Structure 3. Rapid fluctuations between pyroclastic surge and fall deposited about 20 cm of ash and lapilli over the region; deposits near structures were thicker, deposits inside most structures were thinner and more fine grained. Late during emplacement of Unit 1, the roof collapsed on at least part of Structure 3 and was preserved both inside and outside of the structure.

Eruptions at Laguna Caldera Volcano intensified during deposition of Unit 2, resulting in the formation of a 5- to 15 cm thick blanket of hot lapilli and blocks over the region. Although at least some roofing protection apparently remained on Structures 2a and 3, limiting deposition of Unit 2 inside, ballistic bombs, some as large as 60 cm in maximum dimension came crashing through the roofs and possibly some walls in all three structures, causing considerable damage.

Unit 3 heralded the beginning of more intense pyroclastic surge activity. The eruptions contained less juvenile material, were wetter, and high-speed surge clouds deposited muddy base- surge deposits which stuck to all surfaces and structures in the area and accumulated in thick wedges on the walls of structures that face the volcano. Early during this eruptive phase, accumulations of thick, muddy debris on the roof of Structure 2a caused its collapse to the floor. Somehow during deposition of Unit 2, or during deposition of the early part of Unit 3, the "buff" Unit came to rest in piles on the floors of Structures 2a and 3, where it is overlain in most places by roofing thatch. Later Unit 3 surge beds filled in depressions within Structures 2a and 3 forming thick "ponded", accretionary-lapilli-rich layers inside the structures.

Units 4 and 5 were deposited by strong vertically directed phreatomagmatic eruptions. Coarse, hot lapilli and blocks fell from the eruption column as winds carried the column over the site. At some point, the column collapsed and a pyroclastic surge or flow swept over the site, forming thick massive deposits in the low areas within and around the structures. Carbonized roof support poles and wood associated with bajareque walls is found within Units 4 and 5 at Structure 2a. Late during these pyroclastic surges, the south and east walls of Structure 2a were blown down; they rested on the thick sequence of deposits of Units 1 through 5.

The next phase of the eruption was a series of phreatomagmatic surges, which swept over the site leaving dune forms. These juvenile-poor Unit 6 surge deposits buried most of the remaining remnants of Structures 1 and 2a. Because of its high walls and thick platform, Structure 3 remained standing above Unit 6 and was not completely buried until later.

Following the eruption of Unit 6 the volcano alternated between vertically and laterally directed explosions, and deposited a series of alternating pyroclastic surge and fall deposits over the region. Deposition of Units 7 through 11 buried the last remnants of Structure 3.

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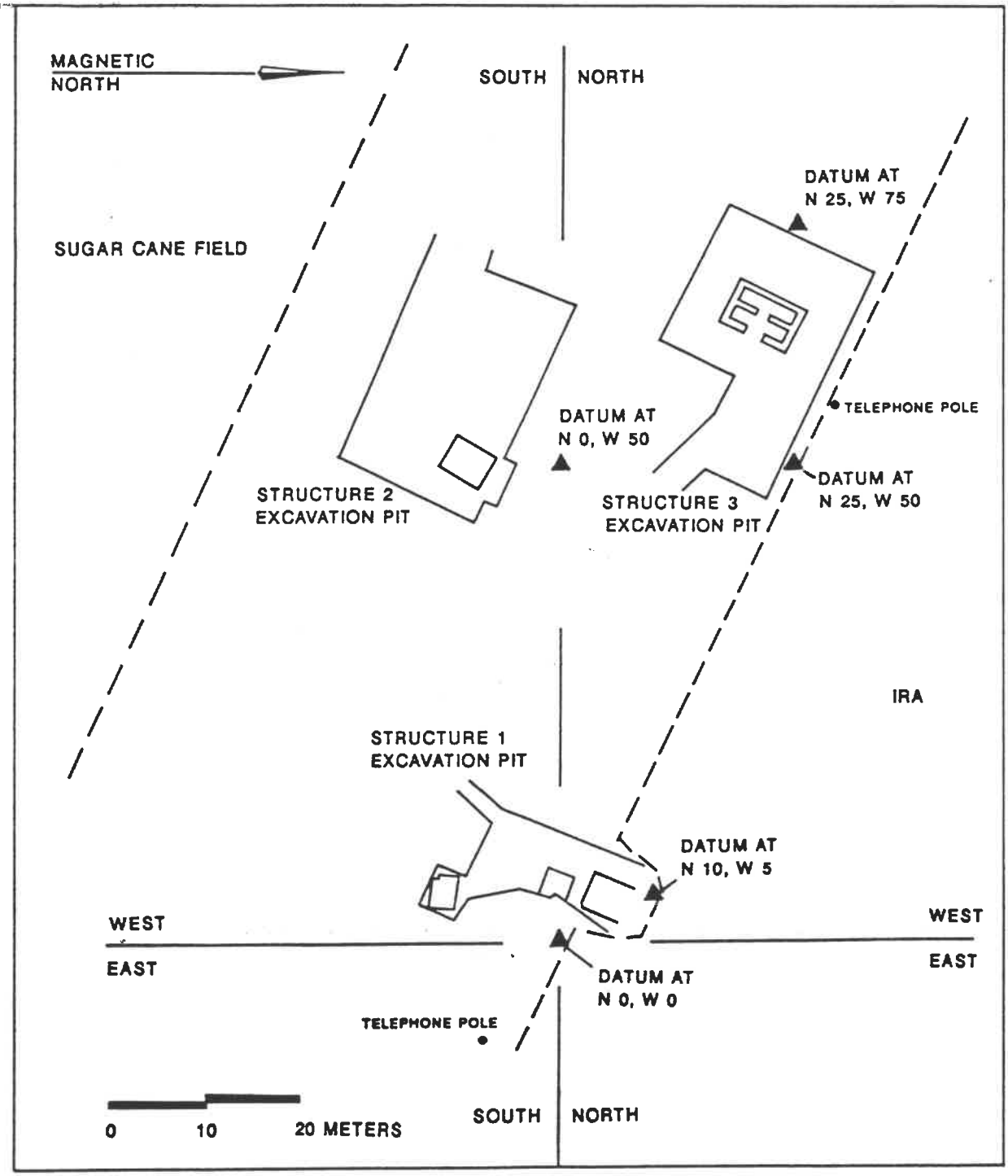

Figure 1. Map showing locations of Structures 1, 2, and 3, and the horizontal control grid at the El Ceren site. (Modified after Tucker, Ch. 2, this report.)

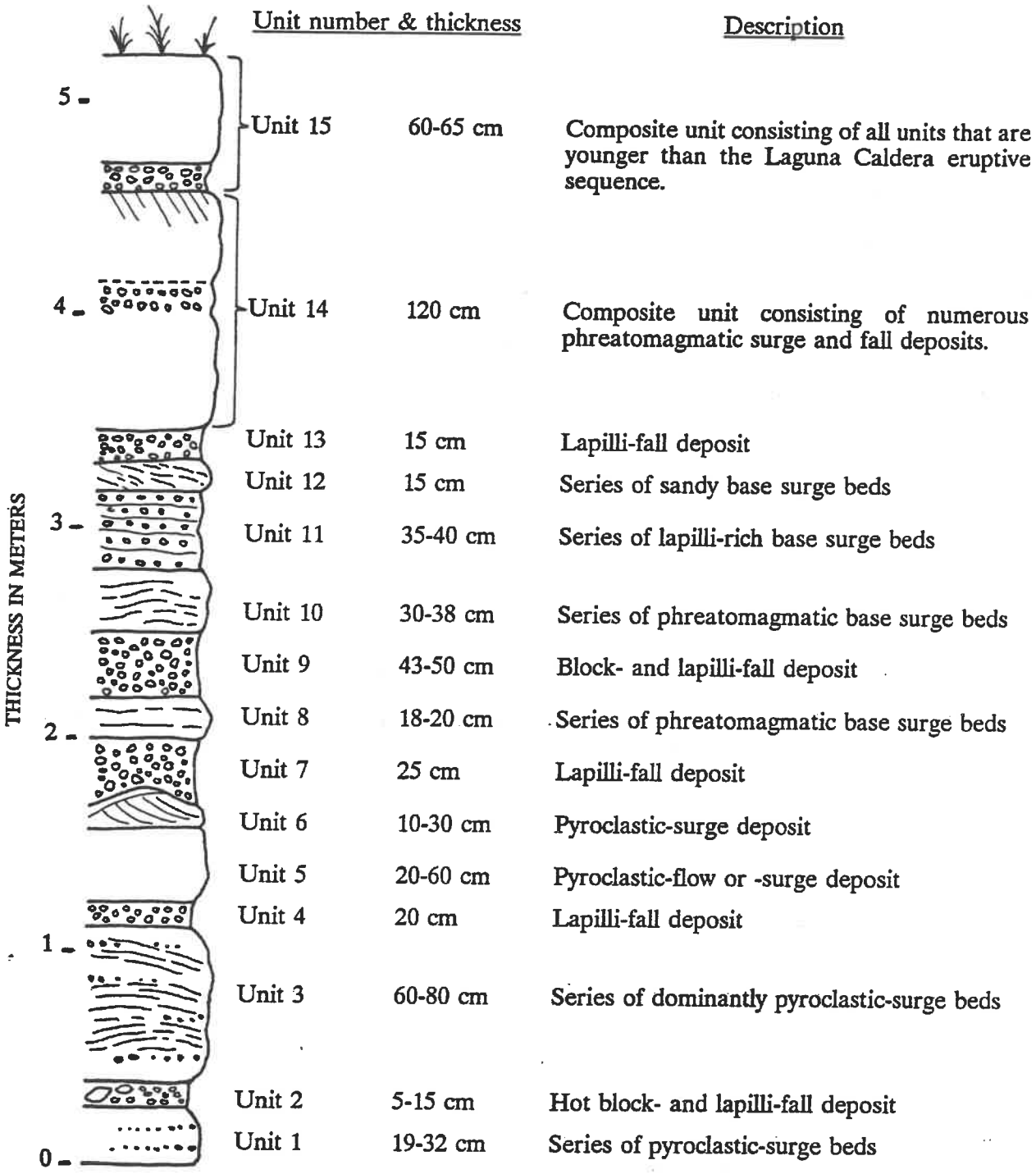

Figure 2. Generalized stratigraphic section of pyroclastic deposits at the El Ceren Site.

Chapter 4. 1989 Geophysical Research at Ceren

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During 1979 and 1980, several geophysical instruments were used in the search for covered houses: radar, seismic and electrical resistivity. Of these, radar and resistivity proved to be the most successful. Because of its simplicity and ease of use, resistivity was chosen to search for more tephra-covered structures in the 1989 field season. A thorough description of the theory and use of resistivity may be found in Loker 1983. The data recorded in the field was entered into a computer equipped with the Surfer software program, a program capable of producing topographic contour maps and three dimensional net-plots. This greatly facilitated data interpretation. The x and the y axes of the original 100 by 100 meter grid were re-oriented to correspond to the default position of 0,0 in the southwest corner.

The resistivity equipment, the ABEM Terrameter SAS 300, which was used in 1980, was again employed in 1989. With the same Wenner electrode arrangement as in 1980, i.e. 5 meters between electrodes, we tested Anomaly A, or Structure 2, in a 20 by 20 meter square grid over the anomaly. This covered coordinates 50-70,70-90 with anomaly A located at 65,75. Measurements were taken with the electrodes oriented along the x axis, then again oriented along the y axis. For subsequent measurements the electrode spacing was increased to 10 meters, and both orientations were again measured. This spacing has the advantage of reaching its maximum sensitivity at a depth of approximately 5m and is still sensitive at greater depth.

East-west lines were measured in the area not covered by the original 100 meter grid in the north half of lot 189, (west of the grid and some to the north) (Figure 1). Obstacles include Salvador Quintanilla's bodega, a papaya grove, and the dirt road to Joya de Cerén. Resistivity as well as selfpotential readings were recorded, but interpretation of the selfpotential readings await further study before conclusions can be made. The resistivity data are shown in graphic form in figure 2. For convenience, topographic lines are extrapolated for those places on the grid where we could not get measurements, e.g. where the bodega stands and in its vicinity.

All resistivity data have been converted to Ohm Meters using the formula (resistivity reading (ohms) * 2 pi * electorde spacing) = Ohm Meters. This allows data taken with different electrode spacings to be comparable. However, other factors serve to make exact correlation between the 1980 and 1989 surveys difficult. In 1980, data were recorded by the position of the western-most electrode, thus placing the center of the field of measurement 7.5 meters to the east (Loker 1980:146). This offsets the 1980 data 2.5 meters from the 1989 data where the surveys overlap. Also, correlation is further hampered by the differences of season and by the nine year interim between surveys. Ground cover and soil moisture could be significantly different. Exact correlation of the two sets of data must await further study.

Three anomalies in addition to those found in 1979 and 1980 were identified in the remainder of Lot 189, were then tested with a core drill rig. These anomalies appeared around 45,100; -30,110; and -25,70. Complete descriptions of the drill cores and results may be found in McKee, Chapter 5, this volume. The anomaly around 45,100 was the only one to be found positive for cultural material. It has a strong M shape in profile (Figure 3), and seems to be associated with or a continuation to the north of anomaly B found nine years ago. The anomaly at around -30,110 is just to the north of the bodega and also has a strong M shape, but drill cores came up negative for cultural material. It is unknown what effect the bodega structure itself may have had on the resistivity

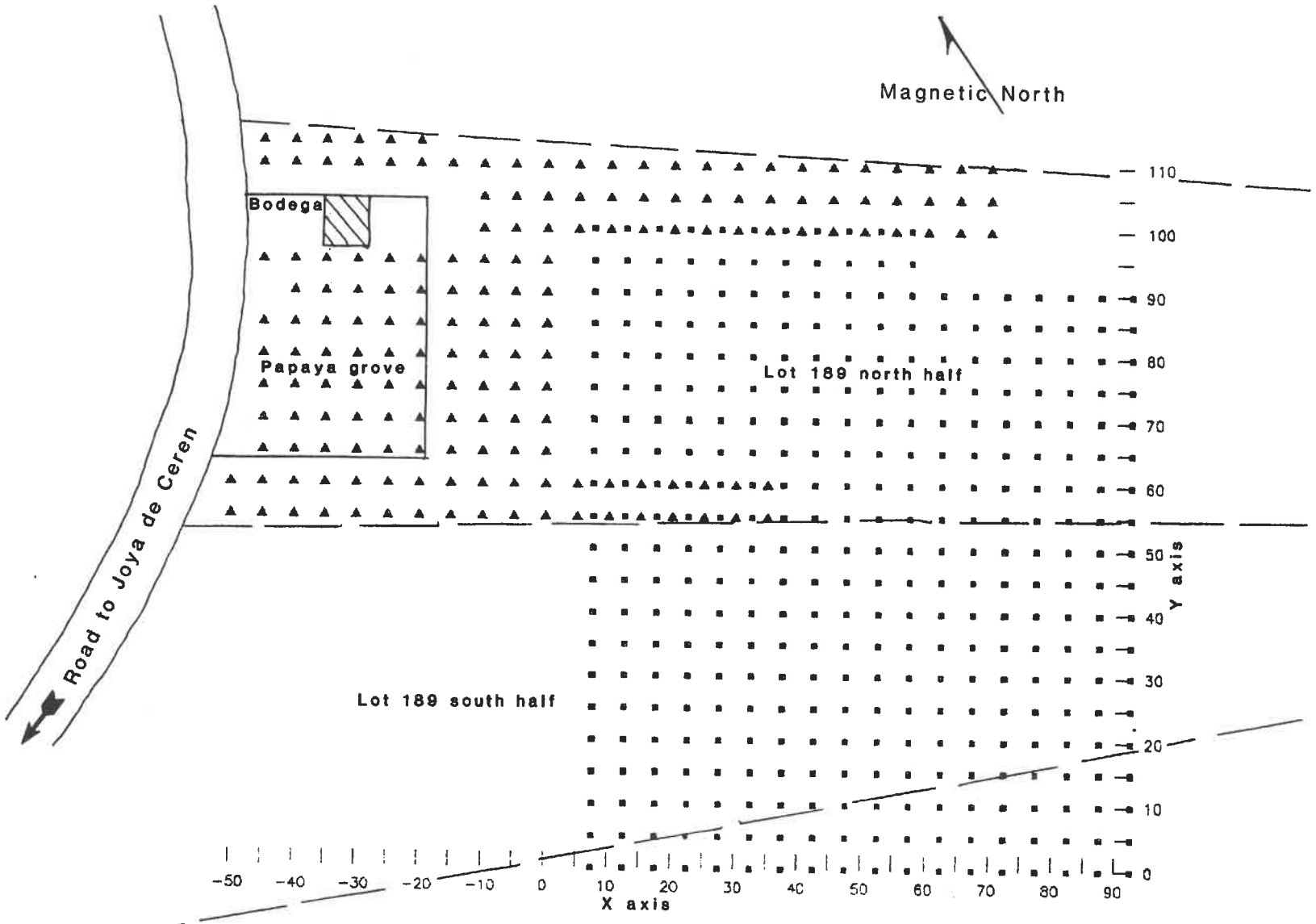

FIGURE 1 Map of Lot 189 showing placement of resistivity grid. Data taken in 1980 are represented by (▪) and by (▲) for 1989. Resistivity grid in meters.

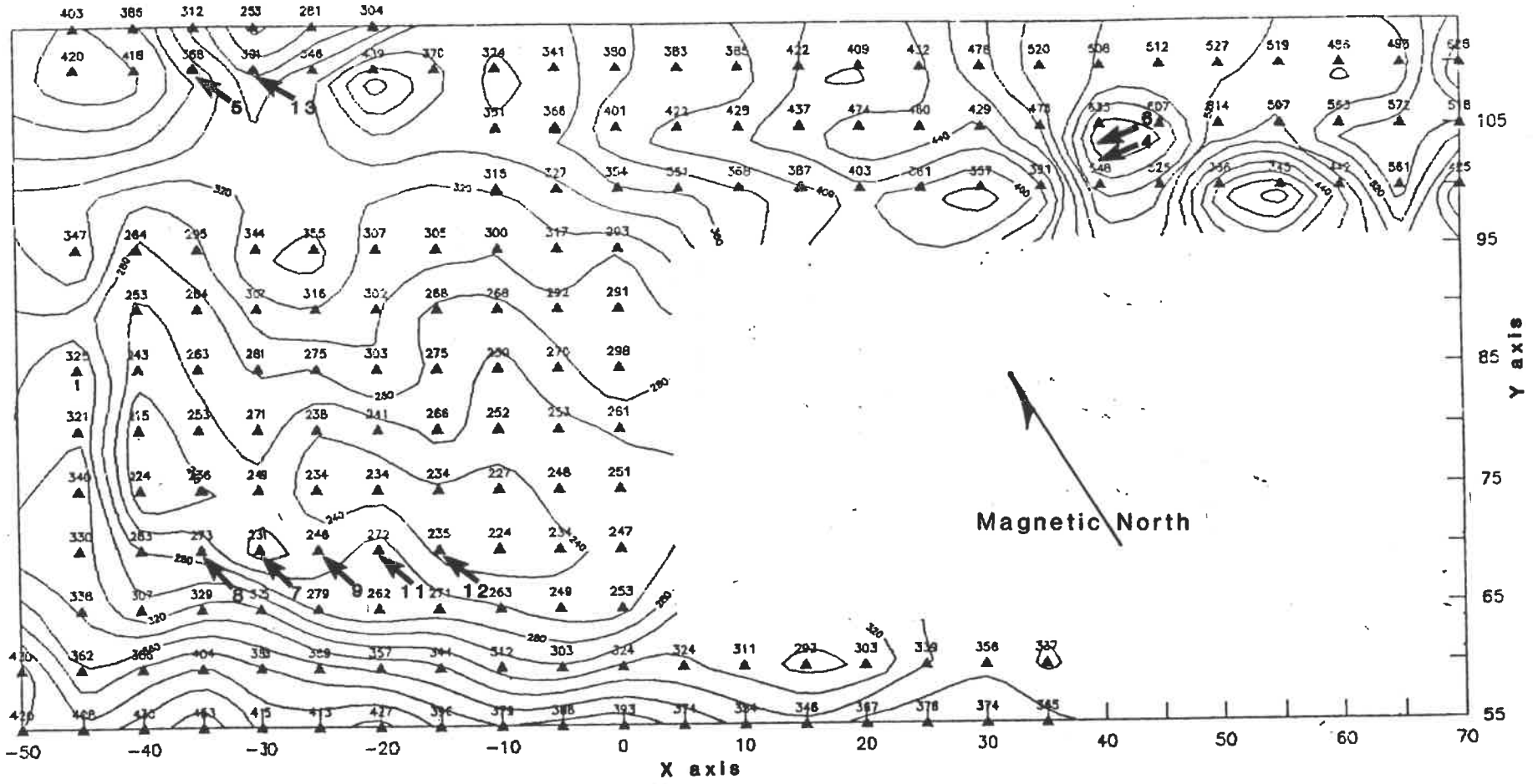

FIGURE 2 Topographic map of 1989 resistivity data taken in the north half of Lot 189. Arrows indicate core test locations. Cores 4 and 6 yielded cultural evidence. Resistivity grid in meters. Contour interval is 20 ohm meters.

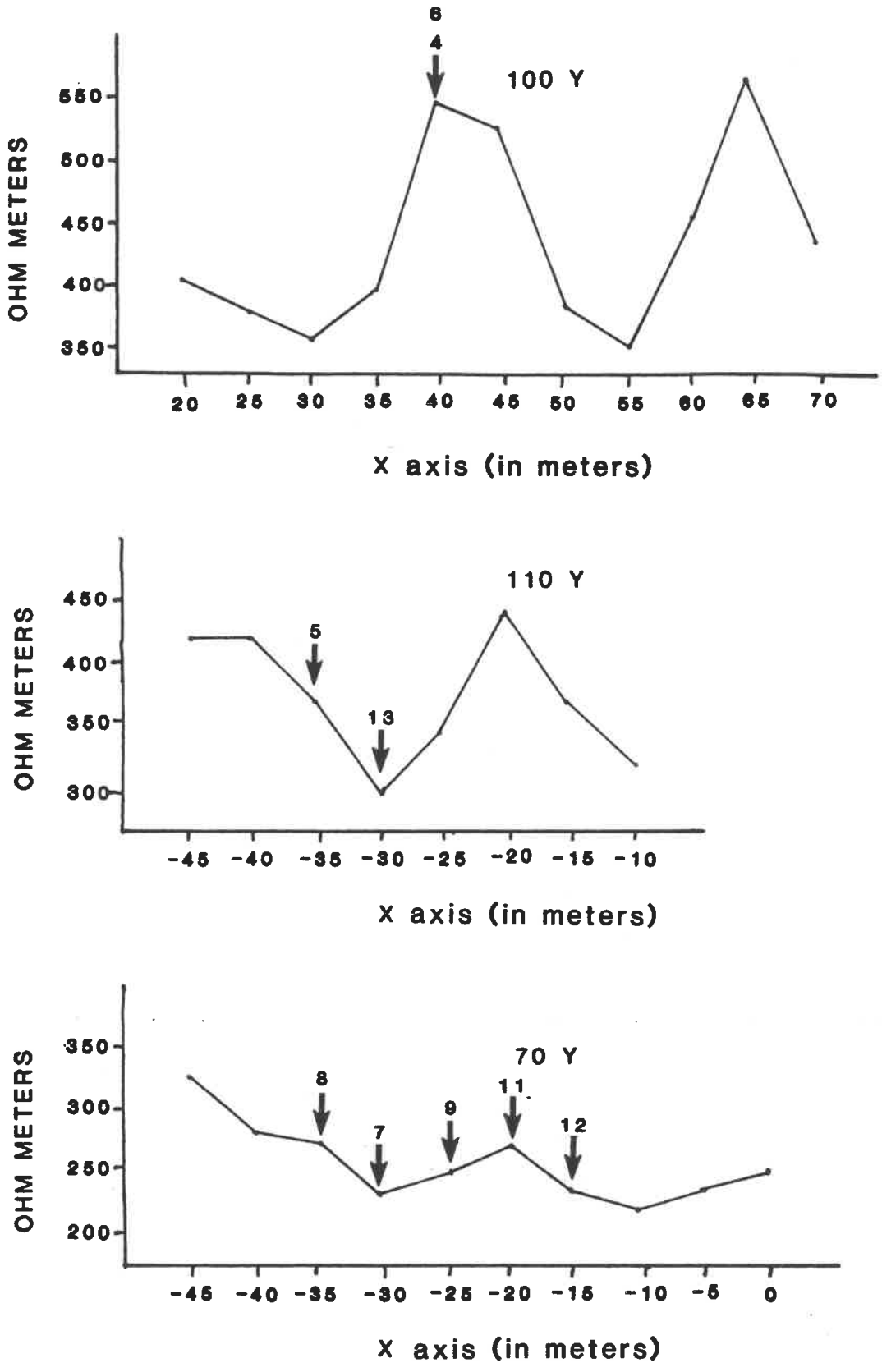

FIGURE 3 Data profiles of those anomalies tested with core drilling. Arrows indicate core test locations.

in this area. The anomaly at -25,70 was located within the papaya grove, had the shape of a shallow W in profile, and also tested negative. The whole papaya grove had very low resistivity; ground water retained by the root systems may have prevented us from detecting anomalies deep enough to find prehistoric structures.

Resistivity measurements were also made in a corn field (Lot 185) located to the west of the Joya de Ceren cemetery (Figure 4). There the topography is not flat, necessitating resistivity profiles to go up and down hills. In general the resistance values are highest at the crest of the hill and lowest in drainage areas. This may be a direct reflection of the soil moisture content. The one exception to this is what appears to be an area of very high resistivity in the northeastern corner of the field (Figure 5). Topographically, we would have expected low resistivity values in this area. We also observed th topsoil to be quite damp compared to higher-lying ground. These considerations contributed considerably to our surprise in finding a large resistivity anomaly in this location. This was the only point that was tested with the drill rig. The core here came up negative for cultural material, but contact with Ilopango ash was much closer to the surface than in the other cores. It is posible that resistivity in this area is reflecting a rise in the ancient ground surface not mirrored by the present ground surface. It is also possibly that this may represent a cultural feature that continues beyond the limits of this survey, into the field to the north.

A strong M-shaped anomaly was detected in the southwestern corner of the corn field (Figure 5), at the top of the high ridge. This is strongly suspected to be a cultural feature, though we were unable to test it with the drill rig due to the lack of access through the corn. This anomaly may also continue beyond the limits of the survey. It is hoped that subsequent field seasons will provide the opportunity to fully test this area.

Further examination of the 1989 data, as well as detailed correlations between the 1980 data and the actual locations of recently excavated structures, may provide the key to improved interpretation of resistivity in the field. If it can be determined exactly what causes a cultural anomaly, more anomolies may be detected in the existing data. These anomalies would need to be tested, as well as the untested location of anomaly D of 1980, and the ridge-top anomaly in Lot 185. Also, since the 1980 and 1989 field seasons have only begun to explore the area covered by the Laguna Caldera Volcano, future seasons should expand considerably the area covered by resistivity mapping. Geophysical research within the Proyecto Arqueologico Joya de Ceren should continue for many years to come.

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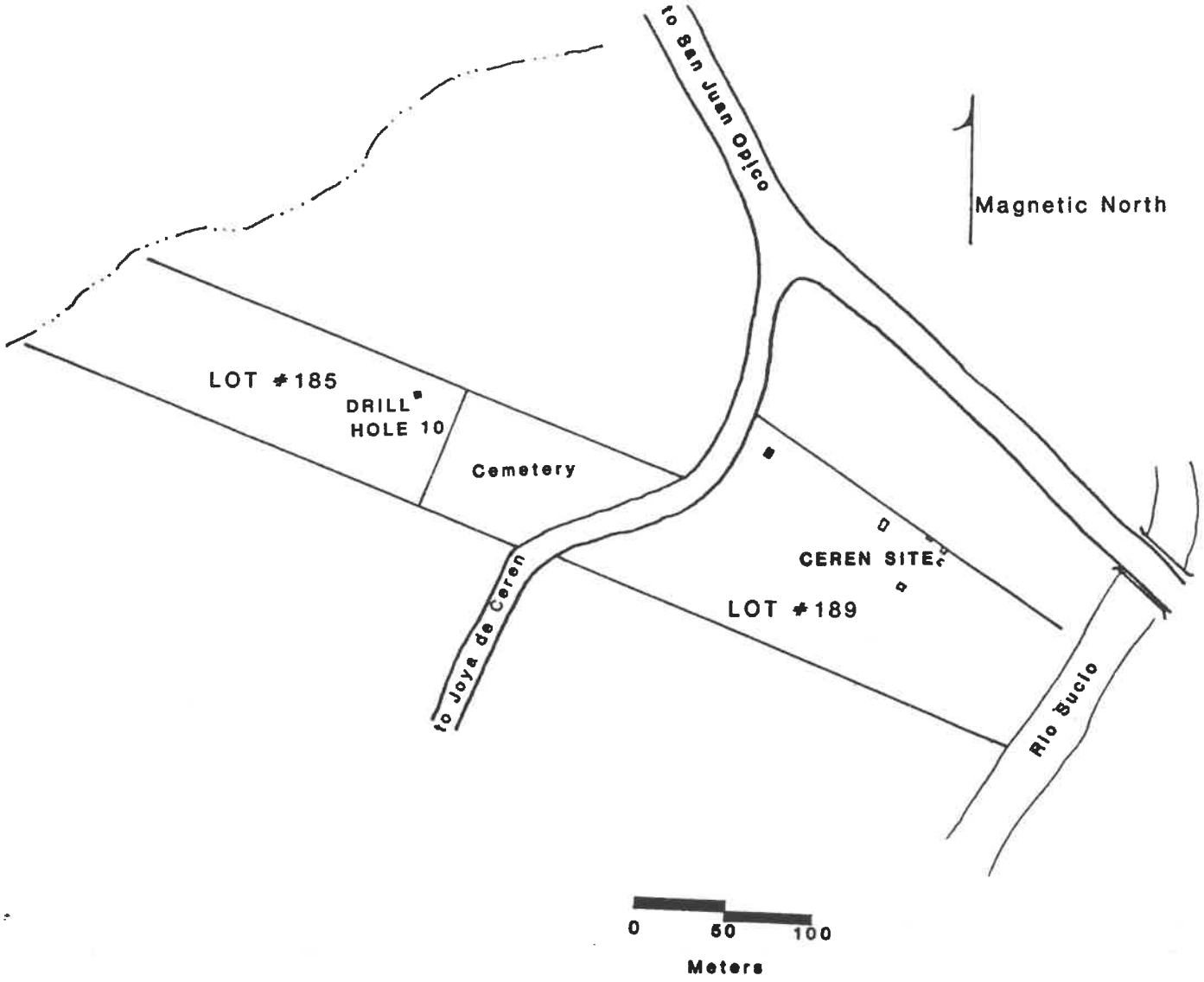

FIGURE 4 Map showing locations of Lots 185 and 189.

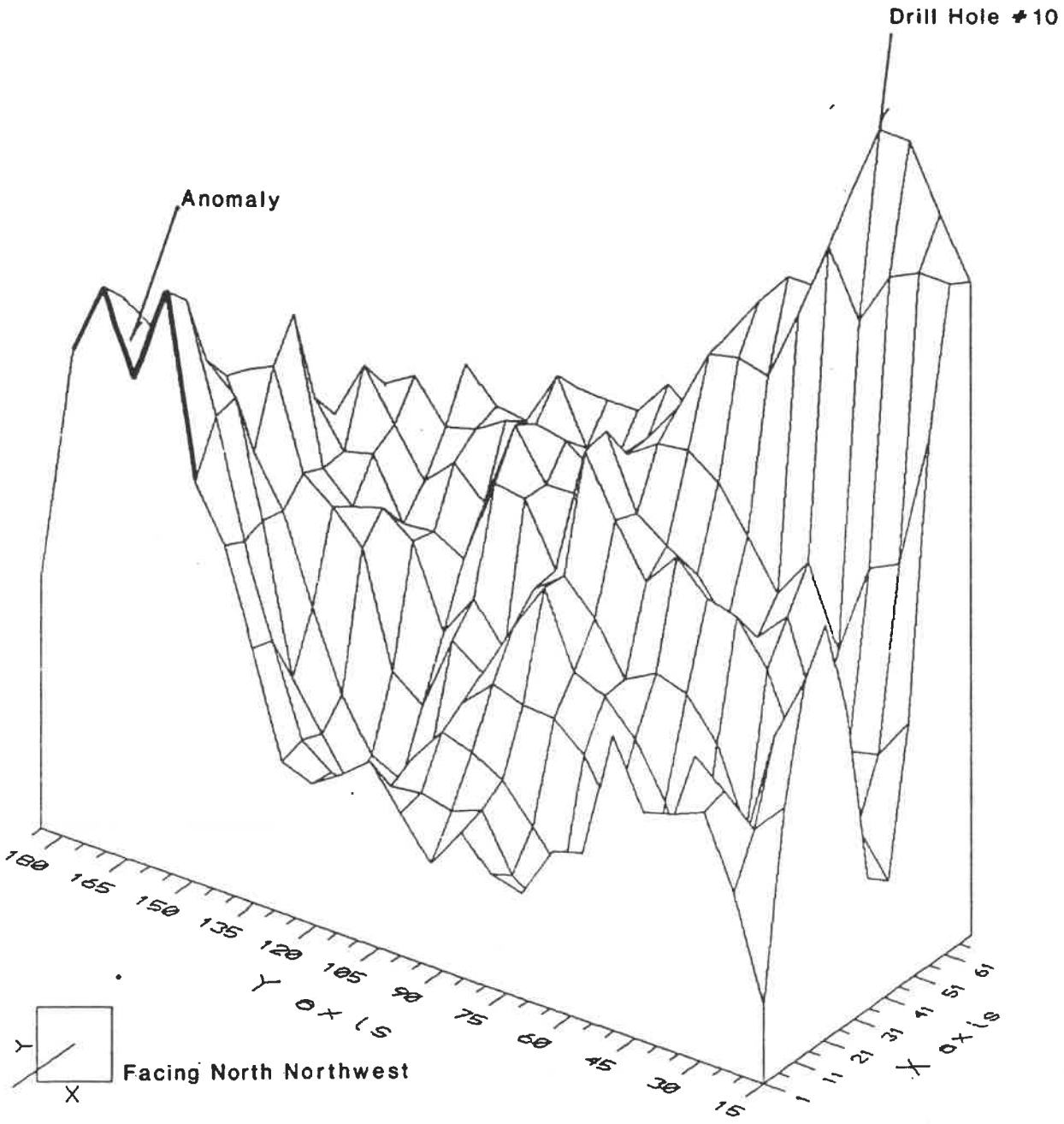

FIGURE 5 Three dimensional plot of resistivity data from Lot 185. Core test 10 was the only test made in this lot. It was negative for culteral material.

Chapter 5. CORE DRILLING PROGRAM

Brian R. McKee, University of Colorado

Introduction

The core drilling program of the Cerén Project, which was conducted between 7 and 29 June, 1989, had two basic purposes. The first was to determine whether or not anomalies detected in the resistivity survey conducted in early June, 1989 (Spetzler and Tucker, this volume) resulted from cultural activities, notably the construction of prehistoric buildings, and the second was to search for the possible natural causes of non-cultural anomalies.

Methods

The studies relied on the volcanically derived stratigraphy of the Cerén site. The following summary of the volcanic history of the region borrows heavily from Hart and Steen-McIntyre (1983). The natural stratigraphy of the site includes deposits and incipient soils derived from four prehistoric and historic volcanic eruptions located stratigraphically above a far older paleosol. This paleosol was probably formed on deposits from an eruption of Coatepeque Volcano, dating to between 10,000 and 40,000 years ago (Howel Williams, personal communication to Sheets).

The eruption of Ilopango Volcano in A.D. 260 $\pm$ 114 (Sheets 1983) blanketed large portions of El Salvador, including the Zapotitan Valley, in which the Cerén site is located, with airfall and pyroclastic flow deposits. All Ilopango deposits at the Cerén site are of airfall ash. Deposits in the site range from a few centimeters to 1.5 meters. These deposits are known as the *Tierra Blanca Joven* (TBJ) because of their white color and relatively young age. A shallow, incipient paleosol was formed on top of the Ilopango tephra.

This soil was buried in A.D. 590 $\pm$ 90 by the eruption of Laguna Caldera Volcano, located approximately 1.4 km northwest of the Cerén site. This eruption deposited approximately 5 meters of tephra deposits over the Cerén site (Miller, this volume), in a series of airfall and pyroclastic flow deposits.

The final two eruptive events to affect the Cerén site were the A.D. 1000 El Boqueron eruption of San Salvador Volcano, and the 1658 eruption of Playon. Both left distinctive tephra deposits. The modern soil at the Cerén site has formed on the Playon tephra.

In locations of prehistoric construction activity, the stratigraphic sequence before the Laguna Caldera eruption was disturbed. Prehistoric houses at the Cerén site were constructed of adobe made from a mixture of sand, organic matter and the clay-rich pre-Ilopango soil. These structures were constructed during the Classic Period, and were built on top of the Ilopango ash. Therefore, in locations of construction, we expect to find deposits beginning with the pre-Ilopango soil, followed by TBJ, followed by adobe made from the earlier clay rich soil. This sequence would then be buried by the succeeding eruptions of Laguna Caldera, Boqueron, and Playon. Based upon narrow core samples, it was impossible to distinguish the pre-Ilopango soil from the adobe made of this soil. Our field methodology for confirming geophysical anomalies as prehistoric structures consisted of determining whether or not this apparent stratigraphic inversion was present.

The equipment and crew were provided by the Centro de Investigaciones Geotécnicas of El Salvador. The studies utilized a percussion driven Acker drill rig, with a 5 cm outside diameter, hollow core, split pipe sampling tube. The techniques utilized were similar to those described by Loker (1983).

The cores were taken by driving the sampling tube on the end of a length of solid pipe into the ground, through the use of repeated impacts with a weight. As the pipe was driven into the ground, the underlying sediments were forced

into the sampling tube. At the bottom of each sampling interval, usually either 50 or 100 cm, the pipe and tube were removed from the ground, the sampling tube opened, and the core extracted. The sampling tube was approximately 50 cm in length. The drilling operation tended to compact the deposits, particularly the coarser, looser sediments. It was not possible to quantify the relative degree of compaction for each stratigraphic level, so the compaction was assumed to be constant for each sampling interval, and was corrected for accordingly. In some of the deeper holes, we had problems with the fall of stratigraphically higher sediments into the hole, which caused sediment mixing. This problem was alleviated through the use of casing. A larger diameter pipe was driven into the ground around the sampling pipe. The interior of the casing pipe was then carefully cleaned with water. This operation largely eliminated the problem of the mixing of sediments.

Brief descriptions of the drill holes follow. Detailed measurements of the thicknesses of the various tephra layers are given in Table 1. The locations of the drill holes are based on the grid used in the resistivity survey (Spetzler and Tucker, this volume). The X and Y axes were set up parallel to the property boundaries. All holes except Drill Hole 10 are located on the grid within Salvador Quintanilla's property (Lot 189). Drill Hole 10 is located in the milpa to the west of the Joya de Ceren cemetery (Lot 185).

Results

Descriptions of Drill Holes

Drill Holes 4 (45, 102) and 6 (45, 103)

These cores were drilled in Lot 189, at the location of a large anomaly that was visible in the resistivity data from both 1980 and 1989. The holes were located slightly to the east of a sharp peak that appeared in the data. Drill hole six was approximately one meter north of Drill hole 4. Core 6 was taken because the results of Core 4 were somewhat unclear due to stratigraphic mixing in the hole. Drill Hole 6 was cased to alleviate this problem, and the results were easier to interpret. In both cases, a thick deposit of clay, later confirmed to be the floor of a prehistoric structure (House 3, see Gerstle, this volume) was found above the TBJ deposits. The total depth of deposits found above the clay floor was 5.20 meters for Hole 4, and 5.30 meters for Hole 5. The thickness of the clay deposits for Hole 4 was 25 cm, and that for Hole 6 was considerably greater, approximately 95 cm. Some of this difference may be explained by errors in sampling, but it likely reflects differences in construction of the floor or platform.

Drill Hole 10 (70,25 in Milpa above Cemetery)

This was the only core that was drilled in the milpa located above the Joya de Ceren Cemetery (Lot 185). The hole was placed in the location of a sharp peak in the resistivity data. Topographically, it was situated at a point of inflection in slope between the steep slope above, to the west, and a shallower slope below, to the east. No cultural features or unusual geologic features were found in this profile to account for the anomaly in the resistivity data, but more drill holes in surrounding areas may help to determine its cause. The depth of volcanic tephra (including Playon, Boqueron, and Laguna Caldera) above Tierra Blanca Joven (TBJ) deposits from the third Century AD eruption of Ilopango Volcano was considerably less than that of other areas cored, a total of approximately four meters. The TBJ tephra was also thin, only approximately ten centimeters.

Table 1: Information on Drill Holes From 1989 Season.
Res. = resistivity in ohm meters. Depth information is in cm.
TBJ signifies Tierra Blanca Joven tephra from the Third Century AD eruption of Ilopango, and L.C. signifies tephra deposits from Laguna Caldera Volcano.

Drill #	Loc.	Res.	Cult. Feat.?	A Hor Thick	Dept to L.C. top	L.C. Thick	Depth to TBJ	TBJ Thick
4	45,102	526	Yes	70	100	445	545	>5
6	45,103	526	Yes	40	60	570	630	>20
10	70,25 (milpa)	390	no	45	73	332	405	10
5	-35,110	368	no	55	188	512	700	>100
13	-30,110	302	no	40	130	580	710	35
8	-35,70	274	no	130	220	490	710	>40
7	-30,70	232	no	143	220	485	705	45
9	-25,70	246	No	167	220	485	705	45
11	-20,70	273	No	170	210	515	725	35
12	-15,70	236	No	100	210	465	675	>25

Drill Holes 5 (-35, 110), and 13 (-30, 110)

These holes were positioned to determine the nature of an anomaly located to the north of Salvador Quintanilla's house. They were located in the "valley" of a large M-shaped anomaly that was located at the northern edge of the resistivity survey. Hole 13 was located five meters to the east of hole 5. We originally planned to drill a series of holes similar to those on the south side of the house, but time restrictions on the Centro de Estudios Geotecnico's drill rig rendered this impossible. Both holes were cased at a depth of 5.50 meters, in order to prevent mixing of tephra from higher levels.

The stratigraphy in both holes followed the natural sequence of Laguna Caldera tephra above Ilopango tephra above the clay-rich pre-Ilopango soil, and thus, neither hole indicated that prehistoric construction activity occcurred. It was impossible to tell whether there were natural topographic changes that resulted in the anomaly, due to the small number of holes across the anomaly. and there were no clear natural causes of the anomaly either. Tierra Blanca Joven was found above the clay-rich pre-Ilopango soill in both holes at a depth of approximately 7 meters.

Drill Holes 7, 8, 9, 11, and 12

These holes were drilled to explore the nature of a large anomaly located to the south of Salvador Quintanilla's house, along the X=70 meters line of the resistivity survey grid. The five holes were placed at five meter spacing in order to get a comprehensive view of this anomaly. The five holes that were drilled will be discussed individually, and then there will be a brief summary of the nature of the entire anomaly.

Drill Hole 8 (-35,70)

This was the most northerly of the five holes in the line. The A horizon was approximately 1.3 meters thick at this location, and the uppermost portion of Ilopango ash was encountered at 7.1 m depth. No evidence of prehistoric construction was found at this location. The hole was terminated at a depth of 7.50 m, at which point TBJ was still present.

Drill Hole 7 (-30,70)

This core was similar to Drill Hole 8 in most respects, although the total thickness of Laguna Caldera ash was somewhat greater. The A horizon was about 1.45 m thick, and Ilopango ash was encountered at a depth of 7.75 m. The pre-Ilopango clay-rich soil was reached at a depth of 8.0 m. No evidence of cultural activity was found. This was the deepest core taken, and was terminated at a depth of 9.0 meters.

Drill Hole 9 (-25,70)

This core was nearly identical to Drill Hole 8. The A horizon was 1.65 m in thickness, and TBJ was reached at a depth of 7.1 meters. The pre-Ilopango soil was reached at a depth of 7.50 meters, and the hole was terminated at 8.0 meters depth. No evidence of cultural features was found.

Drill Hole 11 (-20,70)

This hole was also drilled to a depth of 8.0 meters. The depth of the A horizon was 1.7 m, and TBJ was reached at a depth of 7.25 meters. The pre-Ilopango soil was encountered at a depth of 7.60. No evidence of cultural activity was found.

Drill Hole 12 (-15,70)

This was the southernmost hole drilled to explore this anomaly. The A horizon extended down to 1.0 m, and TBJ was encountered at a depth of 6.75 m, the shallowest depth of any of the holes drilled in this line. The hole was terminated at a depth of 7.0 meters.

We did not find strong correlations between the resistance measurements in these five holes, and the thickness of the A horizon, the depth to Laguna Caldera tephra, the thickness of Laguna Caldera tephra, or the depth to the top of the TBJ tephra. Based on the results of these five drill holes, we were unable to determine the cause of the anomaly in this area.

Discussion, Summary, and Conclusions

The core drilling operations at Cerén were useful in determining the presence or absence of prehistoric construction at specific localities determined through geophysical survey. Two cores, Holes 4 and 6, served to confirm the presence of House 3, a large adobe structure which caused an anomaly noted in the resistivity data. The eight other holes that were drilled this season failed to encounter cultural features. The peak in the resistivity data at the location of House 3 was the highest that was sampled through coring. The other anomalies that were explored were less pronounced, and had lower overall values. We have learned that future coring operations should concentrate on areas with overall high resistivity values, and with marked differences from surrounding areas.

Excavation results from Households 1, 2, and 3, and drilling results from 1978 indicate that several structures are often built together, and that the area covered by these structures is large, extending over at least 10 to 15 meters in several directions. This indicates that the size of cultural anomalies may be considerably larger than the size of a single structure.

The core drilling operations were not sucessful in determining the cause of non-cultural anomalies at the Ceren site. We did not find a high correlation between resistivity values and the thickness of the A horizon, the depth to the top of the Laguna Caldera tephra, the thickness of the Laguna Caldera tephra, the depth to the top of the TBJ tephra, or the thickness of the TBJ tephra.

In summary, the core drilling operations at the Ceren site in 1989 were sucessful in confirming the location of an additional structure from those found in 1978, but were unsucessful in determining the causes of noncultural anomalies in resistivity data. Further studies in the future will likely continue the success in confirming houses, and a number of holes should be drilled in areas of non-cultural anomalies, in order to explore possible causes.

Acknowledgements

This research was aided greatly by the assistance of the Centro de Estudios Geotecnicos of San Salvador. They provided the equipment and crew used during these studies. The crew included Rafael Roberto Robles Umongor, Felipe Alvarenga, Thomas Antonio Cruz, Ramon Poso Muños, and Ricardo Pinemtel. Their hard work and assistance in interpretation of the cores is gratefully acknowledged. These studies also relied heavily on resistivity survey conducted by the Proyecto Protoclasico in 1979, and by the Cerén project in 1989. Finally, I would like to thank Payson Sheets for the opportunity of working on this project.

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Chapter 6. CASTING ORGANIC MATERIALS.

Sean Murphy, Armed Forces Institute of Pathology

Portions of a prehistoric cornfield (milpa) were uncovered during 1978 excavations at the Cerén Site, located near the village Joyà de Cerén, 22 km northwest of San Salvador, El Salvador. During excavation of the cornfield a number of well preserved voids marking the location of plants utilized by the prehistoric inhabitants of the site were discovered. These casts formed when the site was covered by tephra from an eruption of the nearby Laguna Caldera Volcano. The extraordinary detail of the plant molds led to speculation that they could be casted and used as a unique source of information about the types of plants grown, the age of the plants at the time of the eruption (which would help in identifying the season of the eruption), and planting strategy.

In June of 1989, under the direction of Dr. Payson Sheets, the original test pit (Test Pit 2) was reopened. The cultivation rows were excavated and markers identifying the original plant molds located. In the hope of finding additional casts the test pit was expanded (Figure 1) and new casts were identified and mapped (Table 1).

Dental stone (U-S-746D type 1) was chosen as the casting material. It has a set time of eight to twelve minutes, a compression strength of 5000 pounds per square inch (after one hour of set time), and an expansion of .10% maximum. Dental stone comes as a white odorless fine-grained powder which is very sensitive to humidity and must be stored in a dry area at all times. The quick set time, strengh, and minimum distortion combined with its ability to cast very fine detail made this material highly suitable for use in this unique archaeological setting.

The dental stone was mixed using an estimated 100 grams of powder to 24 milliliters of water. At various times a thinner solution (35 + milliliters of water) was used in an attempt to allow for increased penetration of the mold (a proceedure which was not successful as will be explained below). When mixing, the casting material was hand sifted into the water. The degree of saturation can be visually gauged by how quickly the material disperses in water. Once the dissolving has ceased and the powder begins to collect on the surface, the solution has reached saturation. It is important to sift the material slowly and evenly over the water surface, allowing for the even mixture of the powder. When saturation has been reached the solution is slowly hand mixed, to ensure uniform admixture and minimize bubble formation. The solution should ultimately attain the consistency of dairy cream. Due to the relatively rapid set time, the solution should be prepared just prior to use. A large gauge two ounce (60 cc) syringe was used to inject the dental stone solution into the molds. This device allows for specific placement of the casting material, further elimination of air bubbles, and a method of recording the amount of solution used. The syringe should be cleaned with water immediately after use to prevent the accumulation of hardened dental stone.

A 2 1/2 by 1 3/4 meter section was excavated immediately to the east of the original test pit and thirteen possible plant molds were identified and casted. The orientation of these molds seemed to correspond with the general direction of the rows excavated in the 1978 season. A small test excavation to the south (labeled P1 on Figure 1) was also opened and three plant molds were detected and casted.

Excavation of the casts revealed several interesting points. First, a layer of coarse volcanic ash about 180 mm above the tierra blanca (64 mm thick and 120 mm below the casting surface) tended to absorb a great deal of the dental stone and prevented further penetration of the casting material. This meant that

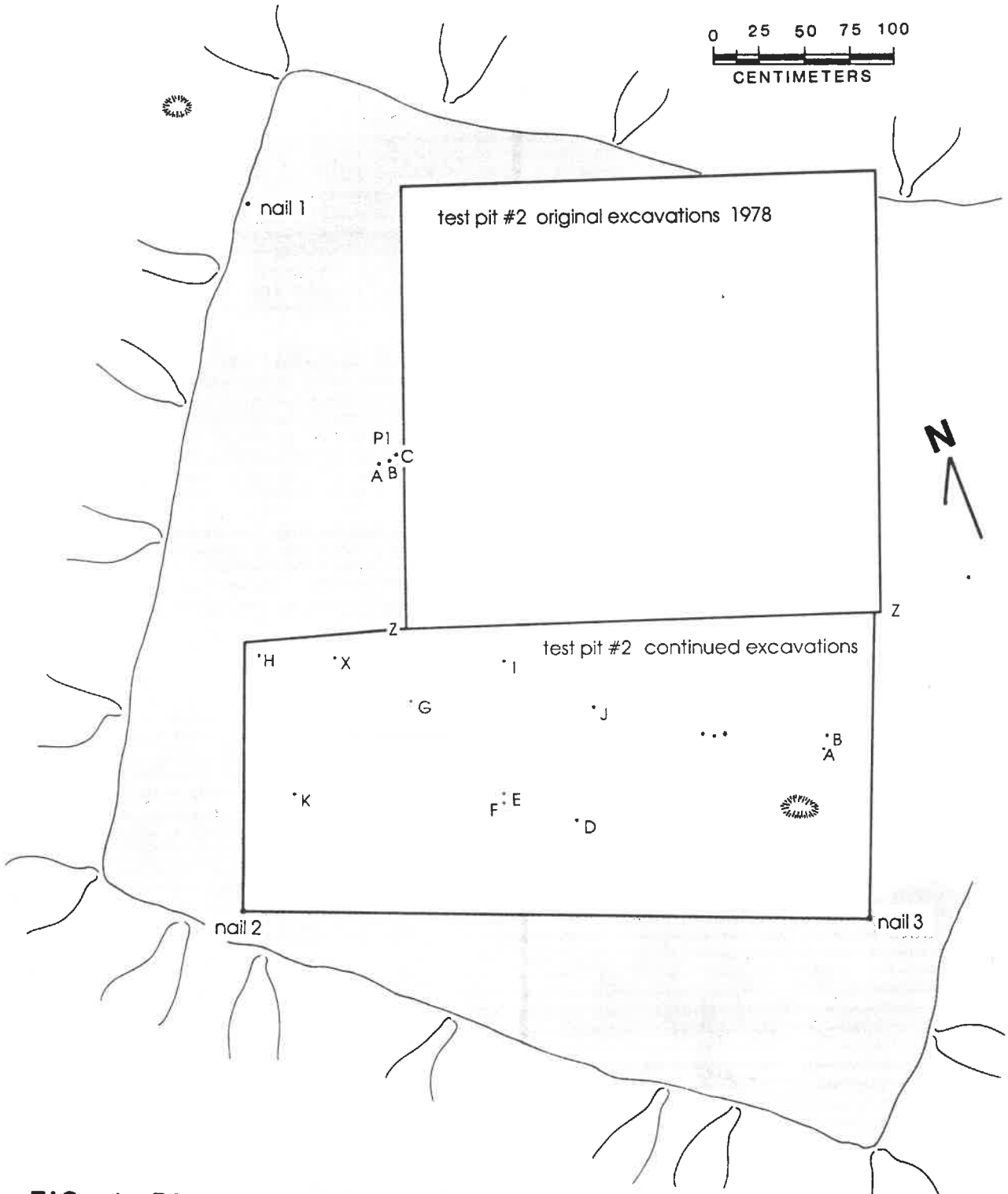

FIG. 1. PLAN OF PREHISTORIC MILPA EXCAVATIONS. TEST PIT 2 WAS EXCAVATED IN 1978. EXTENSION WAS EXCAVATED IN 1989. LETTERS INDICATE CORN PLANTS CAST WITH DENTAL PLASTER

Table 1. Diameter and elevation of excavated plant molds from the 1988 Cerén Site.

Cast	Diameter	Elevation
A	7.62 mm	32 cm
B	11.91 mm	35 cm
C	9.40 mm	32 cm
D	10.04 mm	34 cm
E	12.12 mm	35 cm
F	11.82 mm	35 cm
G	10.75 mm	46 cm
H	6.44 mm	53 cm
I	9.58 mm	40 cm
J	9.91 mm	41 cm
K	13.45 mm	43 cm
X	Not Measured	45 cm

only the tops of the molds were receiving adequate casting material. This was a particular problem when utilizing a thinner casting solution. Several attempts were made to solve the problem by varying the viscosity of the solution, but none proved sucessful. To rectify the problem it was decided to isolate each plant mold as a pedestal and then separate these columns at the coarse layer. This separation would allow for the casting of the lower portion of the mold and easy excavation of the cast. This was done with some success, although in general the molds below the coarse layer did not cast as well as those above.

When the pedestaled areas were split it was noted that plant molds occurred in clusters of four plants (one group had three). This clustering is supported by ethnographic observations of traditional planting methods in which several plants were grown together. In most cases the molds were oriented vertically and did not appear to bend in any direction (no evidence of modification of plants by volcanic eruption). The absorptive properties of the coarse layer was useful in several circumstances in creating a base and preserving the spatial relationship of the plants (this was successfully done in three instances). In most cases the plant cluster formed a rough square with a plant at each corner, although this pattern varied greatly and no specific intentional design was noted.

In the excavation and cleaning of the casts it was observed that in many instances the imprint of the plant was not reproduced. Investigation revealed that rain water had seeped into the molds during the nightly rainstorms and covered the impressions with mud rendering the casts almost unusable. The majority of the plant molds had been uncovered on a Friday and not cast until the following Monday. Over the weekend it had rained on several occasions and even though the area had been covered with plastic to prevent water damage, some had seeped in. It is highly recommended that in the future molds be cast as soon after discovery as possible.

In spite of this problem, several casts were produced with good plant impressions. The molds were generally of the same diameter (Table 1) which seemed to indicate that all of the plants were at the same level of development. Field analysis of the casts and uncasted plant molds indicated that the plants were probably maize, but a specific variety can not be determined until a botanical analysis of the material is completed.

Chapter 7. HOUSEHOLD 1 AREA EXCAVATIONS

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University of Colorado

Introduction

During the 1978 Zapotitan Valley project, Structure 1 at Cerén was partially excavated, as was a nearby platform (Structure 1A) that had been roofed, and several unroofed areas with artifact distributions suggesting various activity areas. Part of the northern section of Structure 1 of unknown dimensions had been removed by bulldozers for the building of grain silos in 1976, and the incomplete nature of this residence had been recognized even before the 1978 work. Property boundary lines prevented the full excavation of what remained of Structure 1, so the cut bank was steepened as much as possible, and some tunneling was done. Two test pits to the south of Structure 1 revealed cultivated milpa fields with evidence of planting rows and plant casts. Enough information was recovered in 1978 to suggest that the Ceren site was a complex and well preserved village or aldea. (See Zier 1983 for a complete description of the 1978 Ceren excavations.)

As part of the initial work during the 1989 field season, mechanized equipment removed approximately five meters of overburden to the west and south of Structure 1. Less overburden was removed from where the structure was known to be standing. Heavy equipment also expanded the area of the milpa zone including the backfilled 2.5 x 2.5 meter Test Pit 2 from 1978.

It was feared that human and environmental forces during the intervening 11 years would have destroyed -- or disturbed significantly -- much of the unexcavated Structure 1. Because of these acknowledged and expected problems with the data that could be derived from this residential unit, a limited excavation operation was planned. However, as work progressed, it was found that very little disturbance had occurred since 1978 and that a significant part of the area remained intact. Ironically, the only significant damage was caused by the cut bank left above the structure. During 1981 or 1982, the tephra slumped down, destroying most of what had been previously excavated. With the realization that undisturbed sections were present, excavation areas were expanded as much as possible without having to reemploy heavy equipment to remove more of the overburden. This procedure has still left us with some unexcavated portions of the Household 1 area, and the section removed by the 1976 bulldozer can never be reclaimed, of course. Nevertheless, probably a majority of the living and working space occupied by the residential unit as it existed at the time of the eruption is still in situ.

Figure 1 shows the location of the Household 1 area including the milpa excavation unit which is assumed to be associated with Household 1. It should be noted that the designation of the platform located west of Structure 1 and exposed during the 1978 excavations has been changed from Structure 2 to Structure 1A to indicate its association with Household 1 and to avoid confusion with the 1989 Structure 2 complex.

The following sections of this chapter will describe briefly the excavation procedures, the construction of the structures, the areas in which field work was done, and the probable functions of the different areas based on artifact assemblages.

Excavation Procedures

Once the overburden had been mechanically removed to within approximately 50 cm from the recorded top of the standing columns in Structure

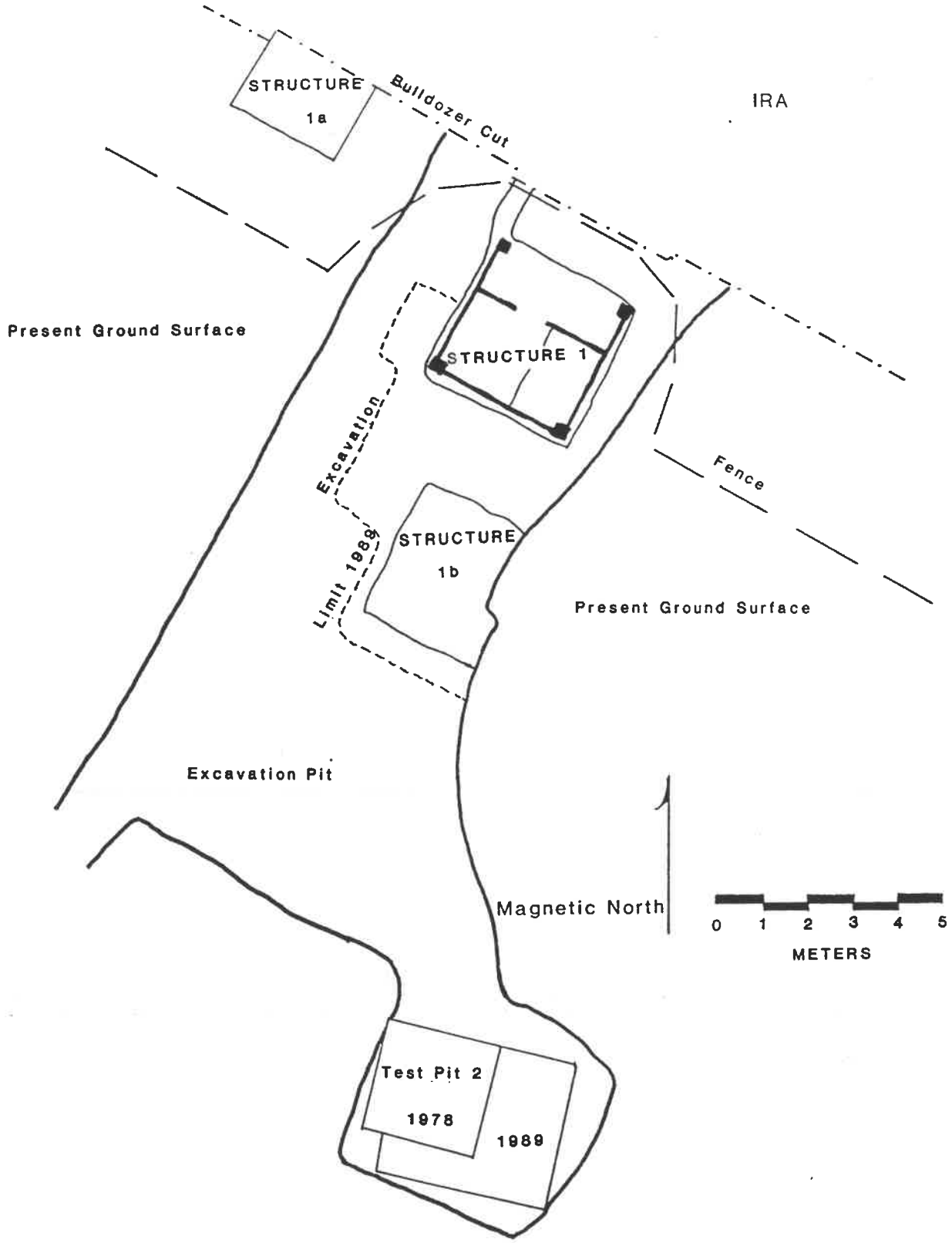

FIGURE 1 Map showing structure and milpa areas excavated during both the 1978 and 1989 seasons. Note the new designation of structure 1a.

1, the volcanic layers were removed manually, using picks, shovels, trowels and dental picks. Working from the north and the west, the western wall and the remains of the two northern columns were relocated. Clearing continued through the previouly excavated Area 1 and into Areas 3 and 4 (Figs. 2, 3).

The general strategy was to clear away eruption strata until reaching evidence of roof fall or an architectural feature. In either case the lateral extent was determined and mapped in. Roof fall was then removed and excavation was continued to the use surface--floor, raised platform, or ground surface. Artifacts encountered in tephra layers, roof fall, or surface contact were mapped in place before being removed.

In this manner the following areas were excavated (Figures 4, 5, 6):

1. Area 3, Structure 1, interior floor

2. Area 4, Structure 1, raised floor or bench

3. Area 6, between Structures 1 and 1B

4. Area 7, east of Structure 1 (abutting onto Area 5 which had been excavated in 1978)

5. Area 8, west of Structure 1B

6. Structure 1B (Area 10)

7. Area 9, south of Structure 1B

8. A 1 x 2 m test pit west of Structure 1, placed so that one meter of the long side was adjacent to the structure and the second meter adjoined Area 6 south of the structure.

Note: Areas 6-9 have been defined spatially according to their proximity to known architecture. The designations have not been established from a functional interpretation of artifact distribution. They are working units, utilized to facilitate the description of the excavations and to organize the catalog of recovered materials.

Layout, Construction, Architecture

Structure 1 (Areas 3 and 4; Test pit adjacent to Structure 1)

Zier (1983:124-129) has described the existing northern part of Structure 1 with the northern square adobe columns and bajareque walls forming both the eastern and western limits of the house and the inner "wing walls." Following excavations during this field season the overall existing dimensions of this structure are 4.45 meters from the bulldozer cut to the southern limits of the platform. The platform is 3.71 meters wide running roughly east-west. From the inner wing wall to where the back (southern) wall stood, measures 1.90 meters. This interior room is 3.22 meters wide. The raised bench (Area 4) occupies 1.90 by 1.24 meters and is elevated 40 cms from the house floor. The bench was finished with a cornice made of compacted clay which was found detached from the bench and resting in tephra. It protrudes out from the bench surface for 5 cm and extends 11 cm down from the top of the bench. This cornice appears to have been finished from underneath by 4 cm square columns of adobe placed at

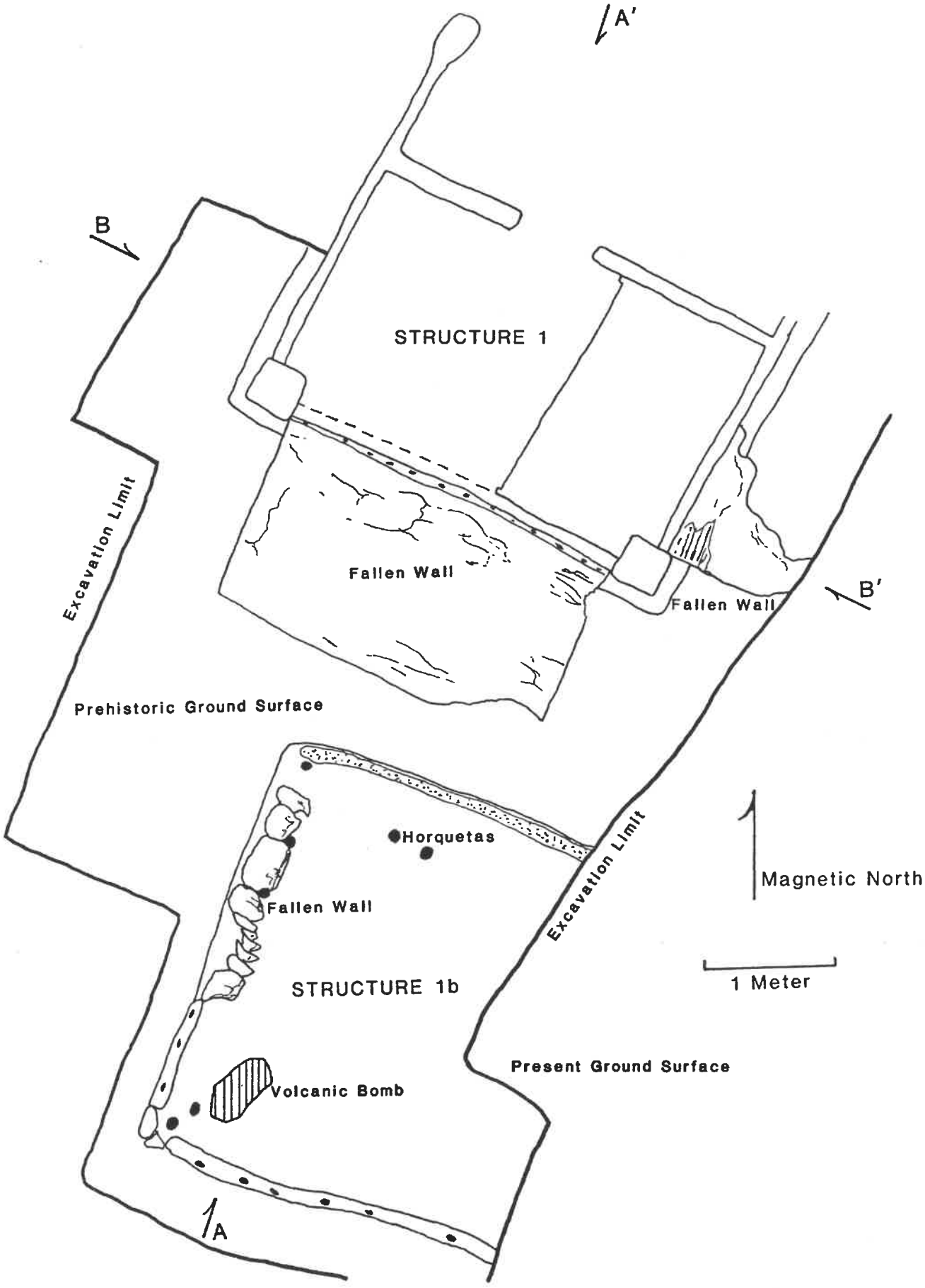

FIGURE 2 Plan map of 1989 excavations showing architecture in situ. Locations of section drawings (Figure 3) are indicated.

KEY TO PLAN VIEWS

HOUSEHOLD 1 JOYA DE CEREN

 DEPRESSION

 POSTHOLE

 ROCK

Bn BONE

C CLAY

D PERFORATED STONE DISK

F FIGURINE

Fl ANDESITE FLAKE

H HEMATITE

L LAJA

M MINIATURE POT

Mn MANO

Mt METATE

Ob OBSIDIAN

P POT (b — WITH BEANS)

Rf found in ROOF FALL

S SPINDLE WHORL

Sh SHERD(S)

W WORKED WOOD

Note: Field Secimen and Pot numbers are referenced in the text.

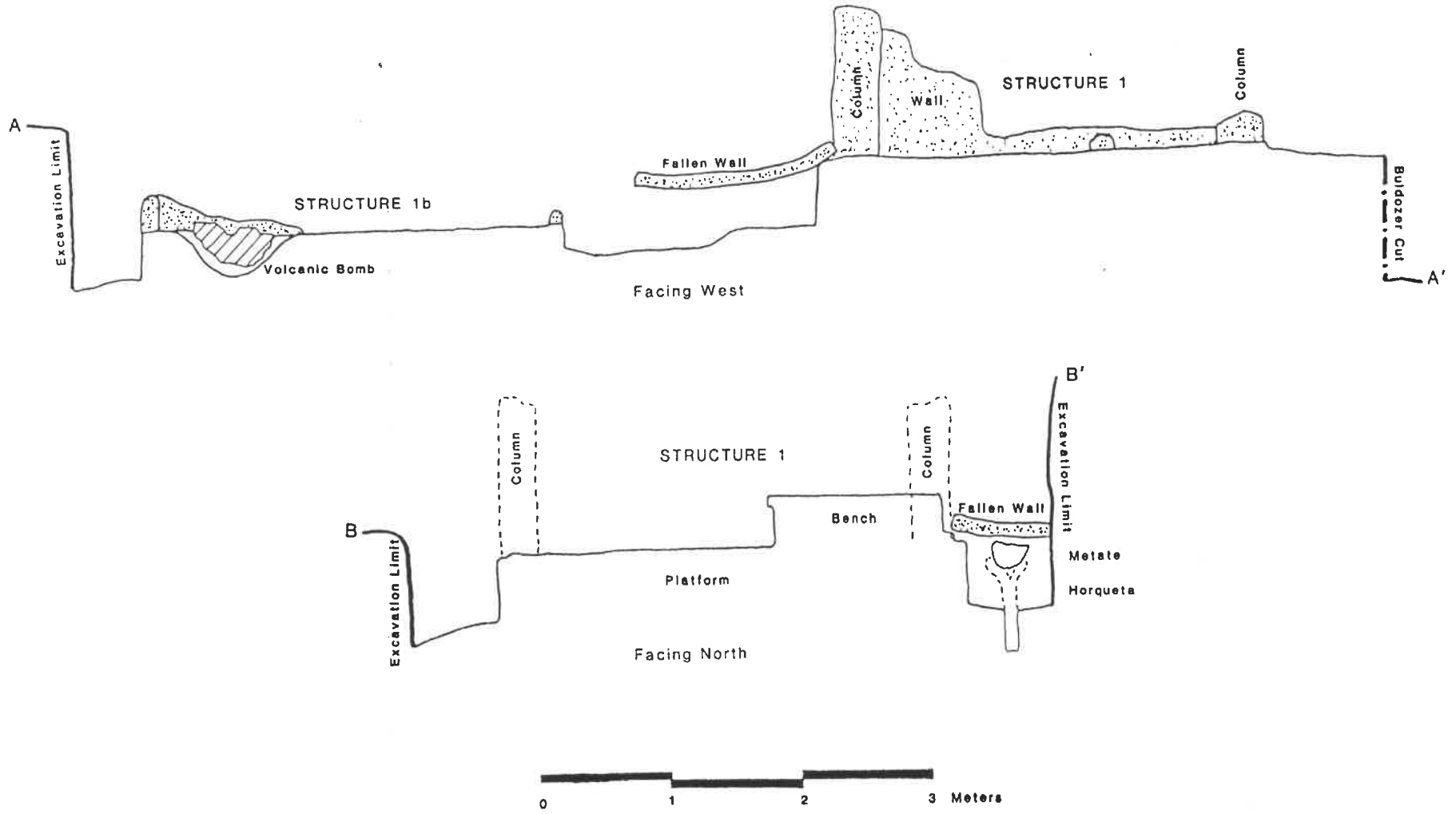

FIGURE 3 Section drawings. Locations of sections may be found in Figure 2.

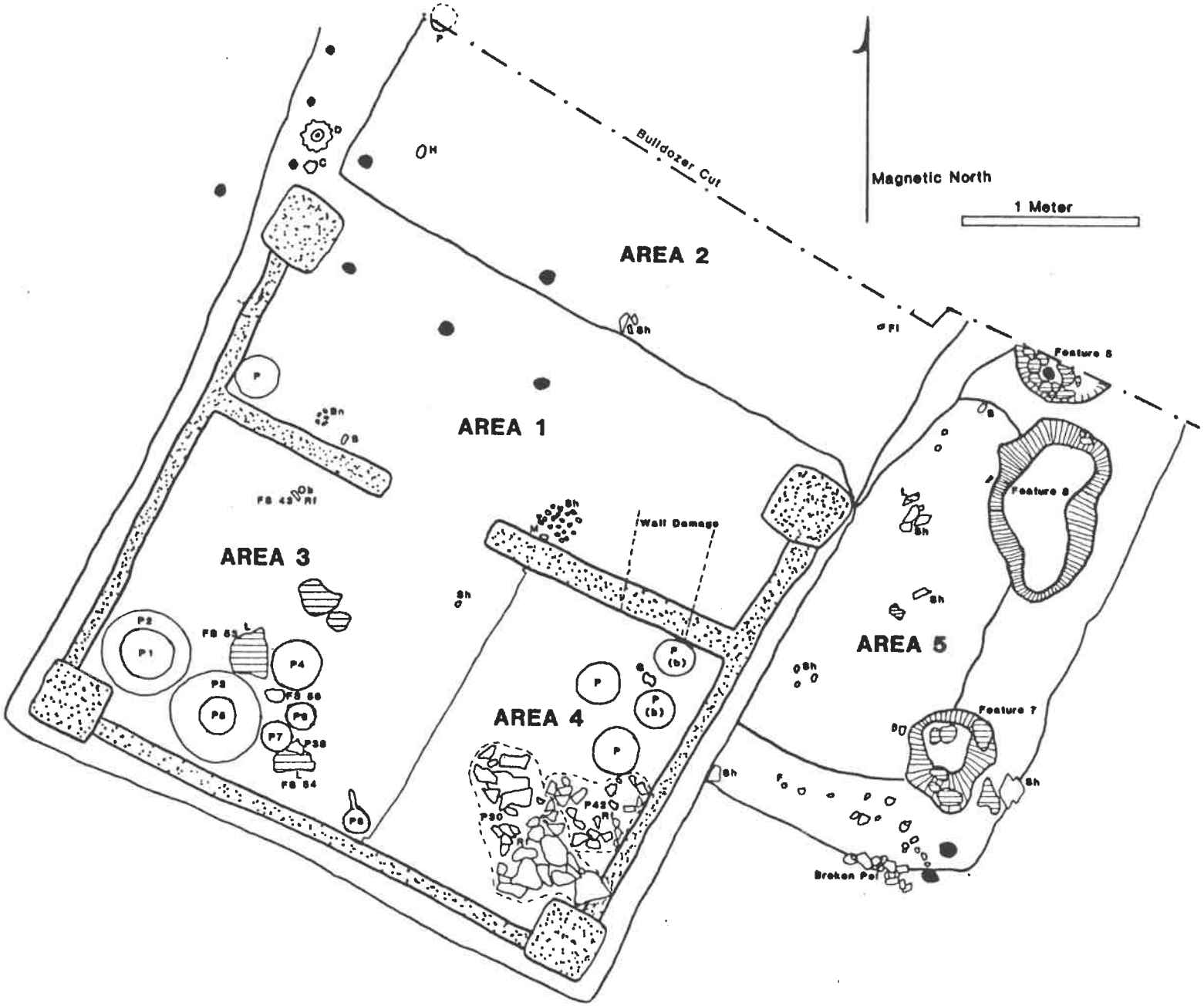

FIGURE 4 Structure 1 with area designations and artifacts in situ.

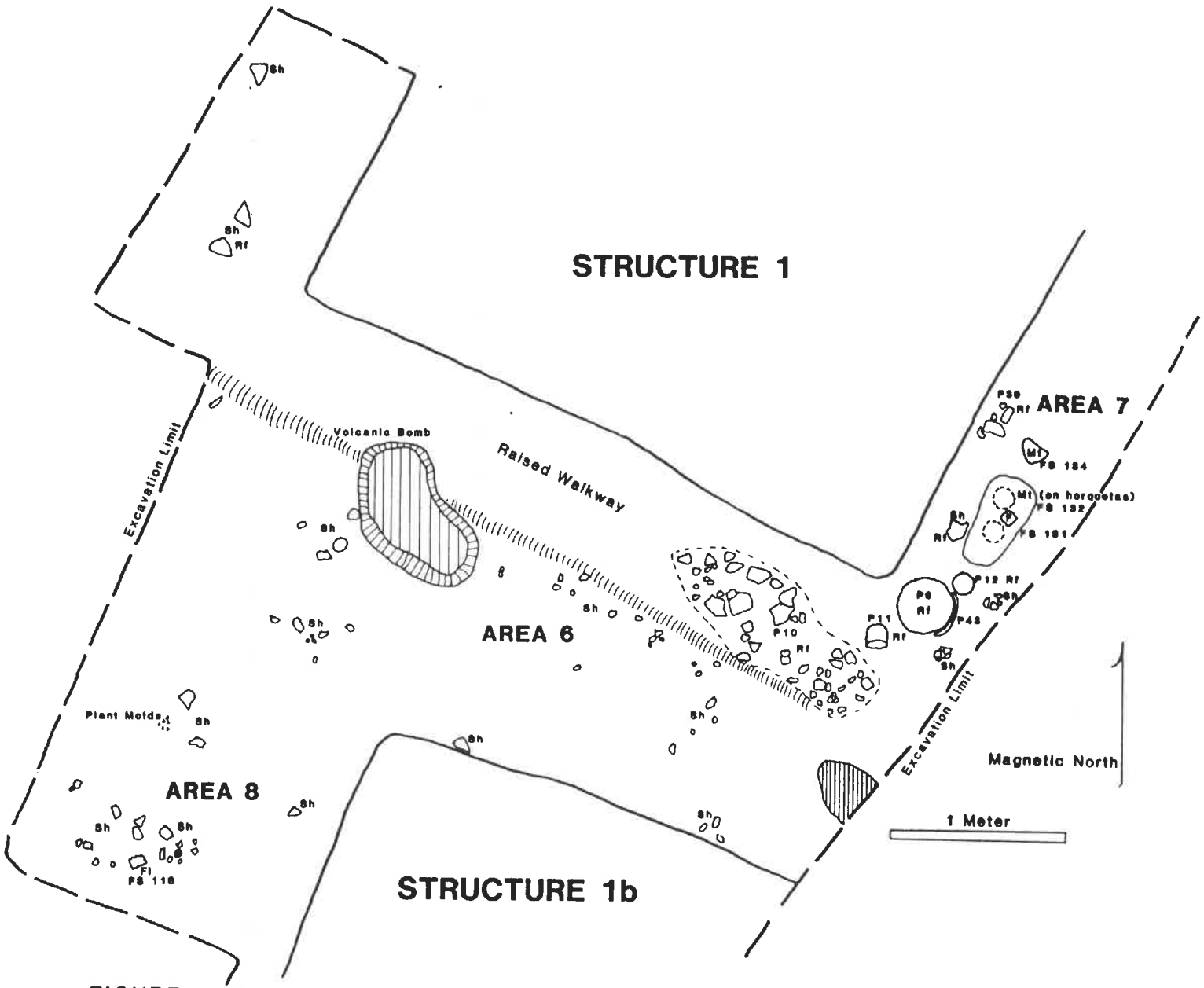

FIGURE 5 Excavated prehistoric ground surface between structures 1 and 1b with area designations. Fallen walls not depicted.

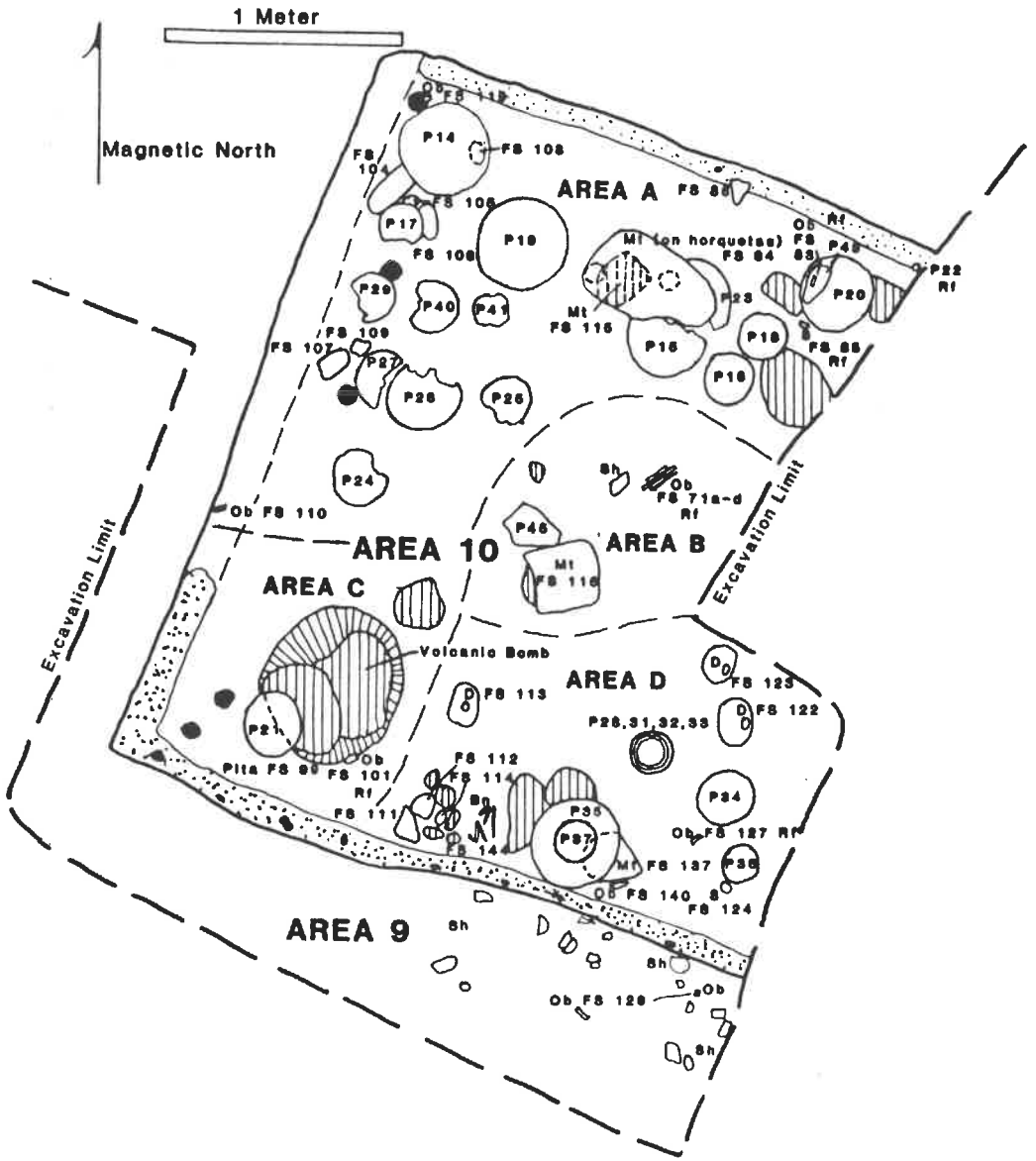

FIGURE 6 Structure 1b with area designations and artifacts in situ.

either corner where the bench meets a wall. It is unknown whether these represent actual supports or simple decoration.

The southern bajareque wall was found collapsed outward from the house with the original inner surface facing upward (Fig. 2). The maximum height of the fallen wall was 1.55 meters. The break point near floor level showed casts from the vertical poles that had been used in the wall construction: diameter of approximately 3 cm, spaced approximately 12 to 14 cm apart. The wall thickness was 14 to 16 cm. The southwest adobe column was found in situ, measuring 36 by 37 cm and standing to a height of 1.21 meters above the floor level. The lower part of the southeast column also was in place (36 by 35 cm; 1.03 meters high). The upper part, however, had fallen to the southeast, 40 cm from the standing portion. While the techniques used to construct these columns remain unknown, the southeast column twisted counterclockwise as it was built, causing the standing top to be about 5 to 10 degrees off from square with the structure.

Part of the fallen eastern wall had been located during the 1978 excavation (Zier 1983:128); more was located this season extending to the limit of the cleared area. It was 14 to 16 cm thick with vertical poles of 3 cm diameter spaced about 12 to 14 cm apart. Part of this wall was consolidated and collected for future analysis of construction techniques.

The 1 x 2 m test pit placed adjacent to the western wall of Structure 1 and excavated to the original ground surface uncovered the base of the southwest corner of the structure platform and the surface upon which the structure had been constructed. This platform was 66 cm high from the ground surface at this point and extended beyond the walls of the structure by an average of 12 cm.

Area 6 (between Structures 1 and 1B)

This outside area between the two structures seems to have been covered by thatch roofing extending from the roof supports of Structure 1. Evidence for this consists of carbonized wood and oxidized thatch on both sides of the fallen southern wall. A large volcanic bomb had impacted the center of Area 6 probably causing the destruction of the roofing over this exterior area (Miller, this volume). Burned thatch was noted both above and below this bomb.

Abutting and running the length of the south wall of Structure 1 was an area approximately 85 cm wide and raised about 15 cm above the ground surface of the remainder of the outdoor area (Fig. 5). This raised area probably aided drainage around Structure 1. It was completely devoid of cultural material in contrast with the lower surface where an occasional sherd was found embedded into the ground. The lack of cultural debris may indicate that it served as a walkway between Structure 1 and Structure 1B.

Area 7 (East of Structure 1)

This exterior area has been minimally excavated due to a high tephra balk. North of it is Area 5 which has been described from the 1978 work. It was distinguished by complex floor characteristics, three floor features, and artifacts found scattered throughout the area. Its use seemed variable -- for storage, possibly for sleeping or other activities (Zier 1983:131,139). It is possible that Areas 5 and 7 are functionally related. In Area 7 horqueta holes were located in the ground surface with a metate in place above them (Fig. 3, bottom). Area 5 contained clear evidence that it had been covered by a thatched roof. It seems likely that this roofed area continued over Area 7 to join with the roof over Area 6. Further excavation to the east in subsequent seasons may reveal the post holes for supporting this roof.

Structure 1B (Area 10)

This structure consists of a platform 20-30 cm above the ground surface. Its northern limit is 1.87 m south of Structure 1. The north-south extent of Structure 1B is 3.2 m; the known east-west extension is 2.8 m. Once again, a high tephra balk prevented further exposure, so the eastern border of this platform has yet to be determined. It appears that at its northern end, this structure had only a low wall made of poorly consolidated adobe. Remains only to a height of 8 cm have been found there. It contained no post holes and was only about 10 cm wide. Remains of the southern wall are slightly higher (36 cm) and a row of regularly placed holes (4 cm dia; @ 30 cm apart) suggest a bajareque construction similar to that in Structure 1. Thickness of this wall is 14-16 cm. The height of this wall also is low: no collapsed sections equivalent to those of Structure 1 have been located.

Placed inside the west wall are a series of post holes. The diameters are fairly regular (7 to 9 cm) but the depths vary considerably. The deepest are found at the north and south corners (59 cm, north; 58 cm, south), suggesting that these bore more weight than the others. The spacing and depths are shown on Figure 6. It seems probable that vertical posts placed in these holes supported a horizontal pole from which roof beams were stretched. Impressions of two poles (5 cm dia) oriented perpendicular to the west wall were found underneath a large volcanic bomb that landed in the southwest part of Structure 1B (Fig. 6). The force of the bomb pressed the poles into the adobe. Another mold of a pole oriented in the same direction was found at the southeastern extent of the Structure 1B excavations 36 cm above the floor surface. Still unknown is the overall size of this structure, the pattern of post holes on the eastern side, and the location of the entry into it. From the general layout of the household area as now known, the northeastern part of the structure would seem the most likely place to find a doorway.

Areas 8 and 9

These designations were assigned to the exterior areas to the west (Area 8) and to the south (Area 9) of Structure 1B that were exposed during this season's work (Fig. 1). Each area was cleared to the TBJ ground surface and showed no particular architectural features, only a general sloping down to the southwest.

Description by Area

Area 3, Structure 1. (Fig. 4)

This inner part of Structure 1 was excavated to a minor extent in 1978. It was the first part of Structure 1 to be cleared to floor level this field season. Considerable roof fall in the form of both carbonized and oxidized wood ash [1] was found throughout the area. An obsidian blade (295-1-43) was recovered mixed with the roof fall above the floor level (60 cm from the west wall, 20 cm from the inner wall defining Area 3).

The floor itself was clear of artifacts in the northern half of the area. In the southern part, a group of artifacts were found in floor contact. A large storage jar, 60 cm high, was sitting upright near the southwest adobe column (Pot 2)[2] with a smaller globular jar (Pot 1) on top of it. Roof fall was noted around the handle of Pot 2 as well as closer to the floor level around Pot 3, another large storage jar of the same shape and decoration.

It is probable that Pot 3 also had been covered by a smaller vessel since Pot 5 was found inside of Pot 3. Pot 5, a globular small jar, was essentially complete except for its rim which was not recovered. This was the first of a

number of examples of previously damaged vessels still in use in the Household 1 area.

In addition to these storage-related vessels, three other complete pots were found in this part of Area 3: a polychrome tetrapod serving dish (Pot 6) and two small red-painted jars (Pots 5 and 7). One of the small jars (Pot 7) had been the receptacle for a variety of small items: three shaped cylinders of compressed hematite, a spindle whorl, a miniature metate whose surface showed traces of pigment having been ground on it, and fragments of mother-of-pearl-like shell. Also in this grouping were two flat stones (lajas) (295-1-53 and -54) that had been used as grinding stones and were placed close to but not supporting Pot 3, a tumbled river cobble used as a hammerstone (295-1-56), and an incomplete vessel (Pot 38) lying partially on top of one of the lajas. A small smashed ladle-handled censer (Pot 8) was separated from the closest other object (one of the lajas) by approximately 20 cm. It was on the floor surface, scattered from the edge of the raised platform at the southern wall in Area 3.

Area 4, Structure 1 (Fig. 4)

Approximately 1.5 m^2 of this area was explored in 1978 after having been exposed by a large hole in the interior wall. "Resting on the floor [now recognized as a bench] in a tight cluster are 4 large pots, 2 of which contain beans, and a grooved maul" (Zier 1983:131). Excavation of the rest of Area 4 disclosed a widespread scatter of sherds covering an area of approximately 1 sq meter north and west of the rear southeast house column.

Once the entire scatter was uncovered and mapped, artifacts were collected in units that attempted to reflect probable discrete vessels. It was noted that none of the pottery was in floor contact. Beneath the lowermost sherds were small bits of thatch (paja) and tephra particles, suggesting that the vessels had been stored in rafters which fell, smashing pots and contents, if any had been present, on the bench. Carbonized seeds were collected from the upper levels of the scatter; samples of soil that seemed to have been on the inside of vessels also were reserved. (The upper level of carbonized seeds were tentatively identified in the field as being from chile peppers. It is possible that chiles were hung from the roof supports to dry, as has been observed ethnographically.)

When the pottery was reconstructed in the laboratory, it was found that only two partial vessels and one non-matching sherd were represented. One of the partial pots (Pot 30) is the lower half of a very large storage vessel (maximum diameter 49 cm; existing maximum height 37 cm). This piece is too sizable to have been stored overhead in the roofing. The recovered half may have already been broken with sections of it being stored in the same area. A majority of the sherds were found with the interior facing up, suggesting a fall from above and then a lateral displacement. The second partial vessel (Pot 42) was a polychrome open convex wall bowl of which only the base and one rim sherd were recovered. The non-matching sherd found with the two partial vessels fits a small polychrome straight wall bowl (Pot 11), the rest of which was recovered in Area 6 outside of Structure 1. It seems probable that the pot had been broken before the eruption with both the broken piece and the practically whole pot being kept in the roof support storage area. When the roof collapsed, the main part of the pot was projected into the area behind Structure 1. The sherd fell downward, mixing with the polychrome bowl and the remains of the large storage vessel.

Area 6 (Fig. 5)

Artifacts recovered from this unwalled area fell into two categories:

1. Objects that had been stored in the roof area and fell with the roof material during the eruption activity (recovered above the floor surface, mixed with the thatch material and with tephra or ash below);

2. Artifacts that had been discarded before the eruption and were pressed into the ground surface.

Falling into the first category were five whole or partial vessels: two polychromes (Pot 11 and 12), two globular jars (Pots 9 and 10) and the lower part of a jar (Pot 43). The deposition pattern of these vessels suggests several possible pre-destruction situations. It is possible that Pot 9 was resting on the surface of Area 6 alongside the southeast corner of Structure 1. The small vessels (Pot 11, missing one rim piece, and Pot 12, already broken but serving as a pigment container) probably were wedged into roof supports along with Pot 43, the lower part of a previously broken jar. Pot 10 may either have been stored, in pieces, in the roof area or it may have been suspended by one of its handles from a roof beam. One oblong piece from its lower wall area was recovered from under Pot 9 (where Pot 43 also was found); the rest of Pot 10 was widely scattered in Area 6, more than 60 cm away from the other portion. It would appear that Pot 10 fell from a sufficient height and with sufficient force to shatter it into numerous pieces and to send one oblong piece (30 cm x 16 cm) a considerable distance. Following this stage of the eruption, subsequent violence--perhaps the impact of the volcanic bomb found about 3 m away--dislodged Pot 9 and tumbled it onto its side over the part of Pot 10 and Pot 43. (Pot 9 was found tipped to the southeast with one handle located higher than the rim; a piece of fallen adobe was between the pot and the wall of Structure 1.)

Another possibility is that Pot 9 with a broken handle had been stored inside of Pot 10 and that they fell together with Pot 10 hitting the hard tephra surface. Thus, Pot 10 shattered severely but acted as a buffer for Pot 9. Artifacts discarded before the eruption are widely scattered small sherds from both utilitarian and serving vessels. They seem to represent the occasional "trash" item that is not swept away if the area is not a high traffic one.

Area 7 (Fig. 5)

As mentioned, this area seems architecturally and functionally related to Area 5. Very little was exposed this year. Pottery is known to be present immediately east of the existing balk. The most significant find in this area is a large metate (295-1-132) that was resting on the horquetas (two forked wooden branches placed to support the end of the grinding stone) at the time of the eruption. It seems probable that this is an active work area which could yield important information about various aspects of the functioning of Household 1. A figurine head (295-1-131) found on top of the metate may have been kept above in the roof supports. (In 1978 a figurine head was found on the raised floor strip in Area 5, approximately one meter directly north of the current find [Zier 1983:131].) The upper part of a recurved polychrome bowl (Pot 39) was found above ground surface at the edge of the excavated area. A metate fragment (295-1-134) and miscellaneous sherds were recovered from the ground surface.

Structure 1B (Area 10) (Fig. 6)

This part of the Household 1 area is the most complex in terms of the location of artifacts and, for certain areas, the reconstruction of the deposition sequence. The finds from this structure will be described by four general areas in order to highlight what seems to be differential use of space with the structure:

-- Area A: the northern part of the structure, extending further to the south in the western third than in the center or eastern parts due to displacement of pottery in that zone.

-- Area B: the center part of the excavated area

-- Area C: the southwestern part

-- Area D: the southeastern part to the excavation limits.

Area A. A wide variety of artifacts -- pottery and other ceramic objects, groundstone, chipped stone -- were found in a context that suggested storage for occasional use or in anticipation of reuse. Table 1 lists all the material from this area; Figure 6 shows artifact locations. The western part of this area housed 10 pottery vessels (partial or complete) along with two whole manos, one partial mano, five hammerstones, and a collection of pottery sherds. All of these objects were found extremely intermixed: some on the floor, others interleaved with tephra and roof fall. This seems to indicate that objects had been stacked together rather than carefully arranged. In addition to the artifacts already mentioned, an obsidian scraper (295-1-119) was found, resting at the edge of the post hole in the northwest corner. It probably had been tucked into a safe place where it would not accidentally cut a family member.

A number of interesting aspects of the pottery from this area should be mentioned:

-- The majority of the vessels were incomplete (at least 6 of the 10);

-- half of the vessels were thin walled painted types rather than utilitarian pieces;

-- two of the thin-walled vessels are globular jars (Pots 25 and 26) of a ceramic type recovered for the first time in the Zapotitan Basin during the 1989 field season and represented by the unique specimen in this structure (See Beaudry, Chapter 10);

-- a hole in Pot 26 had been repaired with a ceramic plug made from a pot of a different paste, the first known instance of this method of repair.

Given these circumstances, a collection of pottery sherds found in this context takes on some significance. These sherds, mixed with pieces from reconstructable partial and whole vessels, included some small rim sherds and ordinary angular body sherds. However, others appear to have been rounded to approximate a discoid shape -- three are completely rounded; four are rounded except for one side which has not been shaped. None have ground edges. Reworked sherd disks are frequently recovered in Mesoamerican archaeology and probably were used for a number of functions. During 1978, a total of 21 were collected including eight from the Cambio site and three from Ceren (Black

TABLE 1. LIST OF ARTIFACTS IN AREA A, STRUCTURE 1B. G:M MEANS GUAZPA SCRAPTED SLIP TYPE: MILTITALAN VARIETY.

FS #	ARTIFACT	POT#	CONTACT
59	SOIL FROM CENTER METATE, FS-84		METATE
72	PART.COPADOR MELON STRIPE BOWL	POT 40	FL
74	G:M GLOBULAR JAR	POT 14	FL
75	G:M OPEN BOWL	POT 15	PAJA
76	G:M SMALL GLOBULAR JAR	POT 16	PAJA
77	G:M SMALL GLOBULAR JAR	POT 17	RF
78	HAMMERSTONE, IN POT 14		IN POT 14
79	G:M BOWL	POT 18	FL
80	HAMMERSTONE OUTSIDE POT 14		FL
81	G:M OPEN BASIN	POT 19	ASH UNDER
82	G:M SMALL JAR	POT 20	
83	OB. BLADE MIXED W/ POT 20		
84	METATE		
85	MALACATE, TOP OF POT 20		PAJA
86	HAMMERSTONE, ON TOP OF WOOD		
87	G:M SLOBULAR JAR (PART IN AREA C)	POT 21	ON ROCKS
88	MINIATURE	POT 22	RF
89	G:M OPEN BASIN	POT 23	FL
90	CASHAL:CALDERA GOLB. JAR	POT 24	FL
91	HUATALES BICHROME	POT 25	FL
93	ZULUNICHE PAINTED JAR	POT 26	FL
94	PAT. GUAL. SPIRAL BOWL	POT 27	TOP OF 14
96	UNCLASS. CREAM SLIP LOWER JAR	POT 29	FL
98	BASE/WALL COPADOR RECURV. BOWL	POT 41	FL
103	SHERDS, VARIOUS VESSELS		FL
104	MANO (FITS W/ METATE FE 84)		FL
105	HAMMERSTONE		FL
106	HAMMERSTONE		FL
107	MANO		FL
108	HAMMERSTONE		FL
109	MANO FRAG.		FL
115	PARTIAL METATE		FL
117	SHERDS NEAR HORQUETS		
119	OBS. SCRPR IN POSTHOLE		
148	CONTENTS POT 18		ASH UNDER
157	G:M SHERD MIXED WITH POT 21		
159	HANDLE WITH POT 23	POT 23	FL
160	G:M JAR FRAG, MIXED #20	POT 13	
161	G:M PARTIAL JAR	POT 44	RF

TABLE 2: LIST OF ARTIFACTS IN AREA B, STRUCTURE 1B.

FS #	Artifact	Pot #	Contact
71a-d	OBSIDIAN BLADES		RF
92	G:M JAR	45	F1
116	PARTIAL METATE		F1

TABLE 3: LIST OF ARTIFACTS IN AREA C, STRUCTURE 1B.

FS #	Artifact	Pot #	Contact
87	G:M JAR	21	MIXED W/ BOMB
99	PITA (STRING)		WITH BOMB
101	OBSIDIAN SCRAPER		WITH BOMB

TABLE 4: LIST OF ARTIFACTS IN AREA D, STRUCTURE 1B.
G:M MEANS GUAZAPA SCRAPED SLIP TYPE: MILTITLAN VARIETY.

FS #	ARTIFACT	POT #	CONTACT
95	MOCAL MODL. APPLIQUE BOWL	POT 28	FL
111	HAMMERSTONE		FL
112	UNALTERED STONE POT SUPPORT		FL
113	PERFORATED STONE DISK		FL
114	WORKED PUMICE		FL
120	G:M JAR	POT 36	
121	WOOD WITH USE CUT		RF
122	PERFORATED STONE DISK		RF
123	PERFORATED STONE DISK		RF
124	SPINDLE WHORL WITH HEMATITE		
125	LARGE G:M JAR	POT 35	FL
127	OBSIDIAN BLADE		
128	PART. COPADOR MELON STRIPE BOWL	POT 34	
137	BROKEN METATE, SUPPORT POT 35		FL
140	OBS. MACROBLADE BTWN FS137-WALL		FL
141	SHERDS UNDER FS 137		FL
142	PIGMENT MIXED W/ SHERDS		
144	REMAINS OF DUCK		FL
146	CONTENTS BOTTOM POT 28	POT 28	
149	CONTENTS POT 35 DBTFL	POT 35	
150	SOIL SAMPLE, POT 28, NOT BOTTOM	POT 28	
151	SMALL G:M JAR	POT 31	
152	CASHAL CREAM: CALDERA BOWL	POT 32	
153	G:M JAR	POT 33	
154	MISC. SHERDS WITH POT 36	POT 36	
155	MISC. SHERDS, POTS 28,31,32,33		
156	MISC. SHERDS, POT 34	POT 34	

1983:193). During this season, one reworked biconically drilled disk made from a Guazapa Scraped Slip jar was recovered at Structure 2 in a general trash context (Cat. 295-2-140). Thus, it would not be unlikely for there to have been an area where broken pieces of pottery were kept to be eventually refashioned into disks or plugs to repair slightly damaged pots.

One of the manos (295-1-104) mixed in with the pottery and the other groundstone in the western part of Area 1 fit with the metate found about 1 meter to the east (295-1-84). This metate had been maintained in a "working position" on top of its horquetas. Ethnographically, a metate with its mano are kept together or in very close proximity while in active use. The relative location of these two objects suggests that they were not the primary grinding stones of this household. Rather, they probably were a "reserve" set: the metate kept ready, the mano close enough to retrieve for use as necessary.

The interpretation of the central part of Area A as having a relatively active work/storage area in terms of the objects kept there gains support from the pottery found in association with the metate: two complete utilitarian vessels (Pots 15 and 16) and two partial vessels (Pots 23 and 44), all classified as the dominant Guazapa Scraped Slip type: Miltitlan variety. Two painted sherds and a detached large handle near the metate were likely being conserved for reuse. A hammerstone (295-1-86) was found in roof-fall nearby, and a partial metate (295-1-115) was located on the floor under the metate (295-1-84) on horquetas.

The eastern part of this area contains two more partial vessels (Pots 13 and 21) and two complete vessels (Pots 18 and 20). The details of the recovery situation makes it somewhat difficult to determine pre-destruction circumstances. Sherds from one of the partial vessels (Pot 21) fit with sherds found smashed under a volcanic bomb in Area C, to be discussed below. The parts of Pot 21 in Area A are larger and less fire-blackened than those in Area C. If Pot 21 had been whole prior to the eruption event then probably it had been located in Area C and took a direct hit from the bomb with part of it flying to the northeast and landing in Area A. However, the vessel section in Area A appeared to be in floor contact with roof fall on top. No base sherd that were recognized have been recovered but three large rocks located around the sherds could have acted as a support for a rounded base. Interpretation is hindered by the fact that this material is very close to the balk and more of this vessel could still be unexcavated.

Vessel 20 seems to have been smashed where it was located on the floor near the north wall. Several small objects found on top of the vessel fragments mixed with roof fall probably were stored in rafters (an obsidian blade (295-1-83); a spindle whorl (295-1-85)). The lower part of a jar (Pot 13) found with Pot 20 sherds seems to have been in the roof area storage was a miniature pot (Pot 22) mixed with roof fall east of the Pot 20 grouping.

Area B (See Table 2 and Figure 6). The part of the Structure 1B midway between the north and south walls seems to have been practically devoid of artifacts. A single sherd and four obsidian blades (295-1-71a-d) were found in roof fall. A partial trough metate (295-1-116) was overturned above a stone on the floor of this central area with the lower part of a jar (Pot 45) nearby. The partial metate could well have served as a seat for occasional work in the structure (as it did for several days during the 1989 field season) or have been kept to support a pot.

Area C (See Table 3 and Figure 6). Similar to Area B, the southwest part of Structure 1B was not a depository for many objects. As already mentioned, this part of the structure sustained a direct hit from a

volcanic bomb of considerable magnitude, smashing a partial or complete vessel (Pot 21, 295-1-87) that had been located somewhere in this area. A handle from the pot was recovered so the vessel could have been suspended above the floor or sitting on the floor surface. An obsidian scraper (295-1-101) mixed with the bomb debris probably had been kept in the roof supports in line with the observed pattern in other parts of the Household 1 structures. Pieces of string (pita) (295-1-99) were found mixed with the bomb debris. The existing pieces look quite fragile to have been the material used for lashing together roof supports; their precise function cannot be stated at this time.

Area D. This part of Structure 1B contains a density of artifacts similar to that in Area A of this building and possibly functioned in a similar storage capacity. Table 4 lists the objects and material removed from this area; Figure 6 shows their location. It is interesting to note that the only faunal specimen recovered in the Household 1 area during the 1989 field season was found in this part of the structure: a domesticated duck (295-1-144) whose remains were located near the south wall close to a large storage vessel (Pot 35) which was in floor contact. Although the skeleton seemed articulated, part of it was missing. Thus, it cannot be determined whether the duck was alive or dead at the time of the eruption.

Several interesting remains were collected from this area:

-- A piece of carbonized wood with a diagonal cut indicating use modification (295-1-121). This specimen was located close to the eastern balk, 22 cm above floor level and was mixed with an obsidian blade (295-1-127), a pigment-covered spindle whorl (295-1-124) and sherds. Just to the south was the mold of a pole that probably had been part of the roof construction. Whether the cut wood relates to roofing or was modified for some other use is unknown.

-- In the same immediate area was a minor amount of powdered red pigment (probably hematite) mixed with mica and soil. None of the nearby sherds showed evidence of having held powdered pigment but the spindle whorl was covered with pigment, suggesting that the powdered substance and the whorl had been together in some type of container, perhaps organic. It is possible that the container will be located in the still-unexcavated area to the east.

Pottery in this area seems to represent a similar storage-with-stacking arrangement as described for Area A. Pot 28, a pedestal base effigy handle incensario was well implanted on the floor. Pushed into its interior were parts of three small pots (Pot 31, 32, and 33) that could have sat, one inside the other on the top of the incensario. A small volcanic bomb had displaced parts of these vessels approximately 40 cms to the southeast. Another vessel in floor contact was a large storage jar (Pot 35) situated at the southern edge of the structure. It was supported by a broken metate (295-1-137), a laja, a large piece of adobe, and an unaltered stone. A piece of worked pumice (295-1-114) was nearby and an obsidian macroblade (295-1-140) had been kept out of the way between the broken metate and the southern wall. Pot 35 had had its rim displaced by the eruptive force. The rim was found outside the structure in the tephra fall (Area 9). Also in that area, south of Structure 1, was an overturned small jar (Pot 37) that had been sitting on top of Pot 35 as a lid. Pot 37 was intact with several small areas of damage from small hard objects having hit it from the exterior.

Two partial vessels (Pot 34, a painted serving bowl; Pot 36, an utilitarian jar) were completely mixed from the effects of the small volcanic bomb mentioned

above. Little can be stated about their condition or precise location before the eruption.

Three perforated stone disks were found in the area. One (295-1-113) was on the floor near the large lava bomb in Area C. The other two (295-1-122, and -123) were only a few centimeters apart near the angled eastern balk. Both of the last-mentioned objects were oriented northeast-southwest with the perforated hole angled to the east. There was no evidence of there having been a stick in the hole at the time of the eruption since the holes were filled with tephra. The disks were not in floor contact but rested 2-4 cm above the floor surface.

Area 8 (Fig. 5)

This exterior area yielded a few scattered sherds and one obsidian blade fragment embedded into the ground surface. Another obsidian blade (295-1-110), found under collapsed wall of the Structure 1B platform, had probably been stored along the roofline of Structure 1B. Six small-diameter holes from burnt-out plant remains were clustered together about 1.2 m west of the west wall of Structure 1B and 40 cm south of that structure's north wall. They were first encountered 19 cm above ground surface. Molds were cast for possible identification.

Area 9 (Fig. 6)

A scatter of sherds and two obsidian blades (295-1-129) were removed from the ground surface of this exterior area. As mentioned above, Pot 37 was found overturned 57 cm above ground surface in this area. From its location and position it had been sitting on top of Pot 35, the large storage jar inside Structure 1B. Pot 35 was pushed to the side by the volcanic activity (See Miller, Chapter 3) and Pot 37 dislodged from the top of it.

Summary

The 1989 field work at the Household 1 area of the Ceren site expanded knowledge of this part of the settlement and altered some of the functional interpretations drawn from the 1978 excavations. For instance, Area 4 was not a pantry as proposed from the earlier limited testing (Zier 1983:139). Rather, the raised platform probably was used as a combination bed/sitting area similar to those known from other Mesoamerican sites and from Structure 3 at Ceren. The use of a cornice on this architectural feature indicates care in its finishing appropriate to an important household component. The presence of pots containing foodstuffs on its front (north) surface (Zier 1983:131, 139) could indicate a temporary use of the convenient raised area when not employed for its primary function. The overhead area near the back wall was a well-used out-of-the-way storage place.

Area 5 and the adjoining Area 7 with a variety of artifacts and possible burned floor mat seems to be an active area of daytime use rather than essentially an area for storage or sleeping. The mat, as Zier suggested (1983:139), probably was used to make the hard clay floor more comfortable for sitting or kneeling while working.

Area 6, a roofed exterior area, would have served as a passageway for access to the various structures and activity areas of the household.

Structure 1B, as excavated to date, was a combination storeroom for household equipment and working space for intermittent activities. The quantity of pottery and ground stone implements being maintained in Structure 1B was substantial but not out of keeping with ethnographic data. For example, ceramic censuses have recorded a wide range in the number of pots per household. Rice summarizes some of these censuses (1987:294-297) and reports that "the average

number of pots in the households in these communities varies between nine and fity seven" (ibid:294). The number of pots in a given household relates to size nad composition of the household, its socio-economic status, and possibly other variables as well. When more complete inventories for other Cerén households are available, interesting comparisons can be made to assess these houshold characteristics. The presence of partial vassels in Structure 1B as well as elsewhere in the household area is reminiscent of the reuse of damaged pots and sherds that has been documented from ethnographic studiesin a number of geographic areas. Rice (1987: Table 9.3, 294) also summarizes these data.

These inferred functions will be refined when further work permits additional exposure of the Household 1 area. Several additional points should be made in regard to work in this part of the Ceren site. First of all, it may be that the portion of Structure 1 destroyed by the bulldozer was minimal. Complete excavation of Structure 2A (see McKee, Chapter 8) has uncovered columns, wing walls, a bench, and a front area similar to Structure 1. This may indicate that Structure 1 is fairly complete. The bulldozer may have only clipped the front part of the house platform. Thus, by analogy with nearby structures, we may be able to estimate quite accurately what is missing from the Household 1 remains. Informants may have been mistaken as to how much of Structure 1 was destroyed or there may have been an entirely different structure connecting to the north or located immediately adjacent in that direction.

From the data at hand, continuation of work to the east of the currently excavated zone is considered extremely important. Area 7 and Structure 1B are known to continue further east. The possibility exists that additional structures are located in that direction, accessed by the walkway in Area 6. Excavation to the east also would provide an opportunity to obtain more information about the destruction pattern for this part of the settlement following Miller's very detailed sequence developed this year (Chapter 3).

We also do not know anything about the history of the Household 1 structures prior to the point of destruction. To what extent was Structure 1 remodeled or altered? Is there earlier construction under the presently visible remains? Are there subsurface caches or burials? All of these questions need to be answered to understand the operation of the residential unit over time.

We also do not know the exact relationship between Household 1 and the milpa to the south. How close to the Household 1 complex does the milpa start? Is it directly related to Household 1 or is it more communal in nature?

Patterns of life in the Household 1 area of Ceren have begun to emerge from the 1989 season. Additional work will help to amplify our knowledge of this residential unit and its place within the community organization.

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Endnotes for Chapter 7

1. Descriptions of chipped stone artifacts can be found in Chapter 11; ground stone in Chapter 12.

2. During excavation and laboratory processing pottery containers -- whole vessels, partial vessels, or sizable sherds -- recovered from cntexts that indicated active use or storage were designated as "pots" and given sequential numbers. This procedure was followed in order to develop an inventory of the number of different vessels being maintained by Household 1. Because of the pattern of destruction. many vessels were jumbled together when exposed. Field specimen numbers were assigned according to the apparent scatter pattern and pot numbers provisionally assigned at the time of excavation. Once the material was removed and washed, the project ceramicist (Beaudry) reconstrcuted sherd by sherd as much of each vessel as had been recovered. In many cases it was found that more than one vessel had been collected as a single pot during hte excavation process. Consequently, at that point pot numbers and field specimen numbers were reconciled so that each field speciment number represents a discrete ceramic container. Throughout this chapter the ceramics will be referred to by pot number while the other artifacts will be referenced by their catalog (field specimen or FS) number.

Chapter 8: EXCAVATIONS AT STRUCTURE COMPLEX 2

Brian R. McKee, University of Colorado

Introduction

Excavations were conducted at Structure Complex 2 at the Cerén site in June and July of 1989. Project goals were to determine the nature of daily household life and subsistence in rural Classic Period households, as well as determine the nature of the impact and response of the people to the eruption of Laguna Caldera Volcano in AD 590 ± 90. The majority of the time and effort of the Structure 2 excvations went into the excavation of Structure 2A, a Classic Period structure of primarily bajareque (pole and mud) construction. During the final week of excavation, portions of a second structure, Structure 2B was uncovered to the southwest of Structure 2A. Only a small area of the SE portion of this structure was excavated, due to time constraints.

Workers in the excavations included employees of the Patrimonio Cultural of El Salvador and local workers hired by the project, as well as the Cerén Project crew. Approximately half of the workers had previous excavation experience at other archaeological sites in El Salvador. Experienced and inexperienced workers were teamed together with the result of high quality excavations and data recording.

Excavation Methods

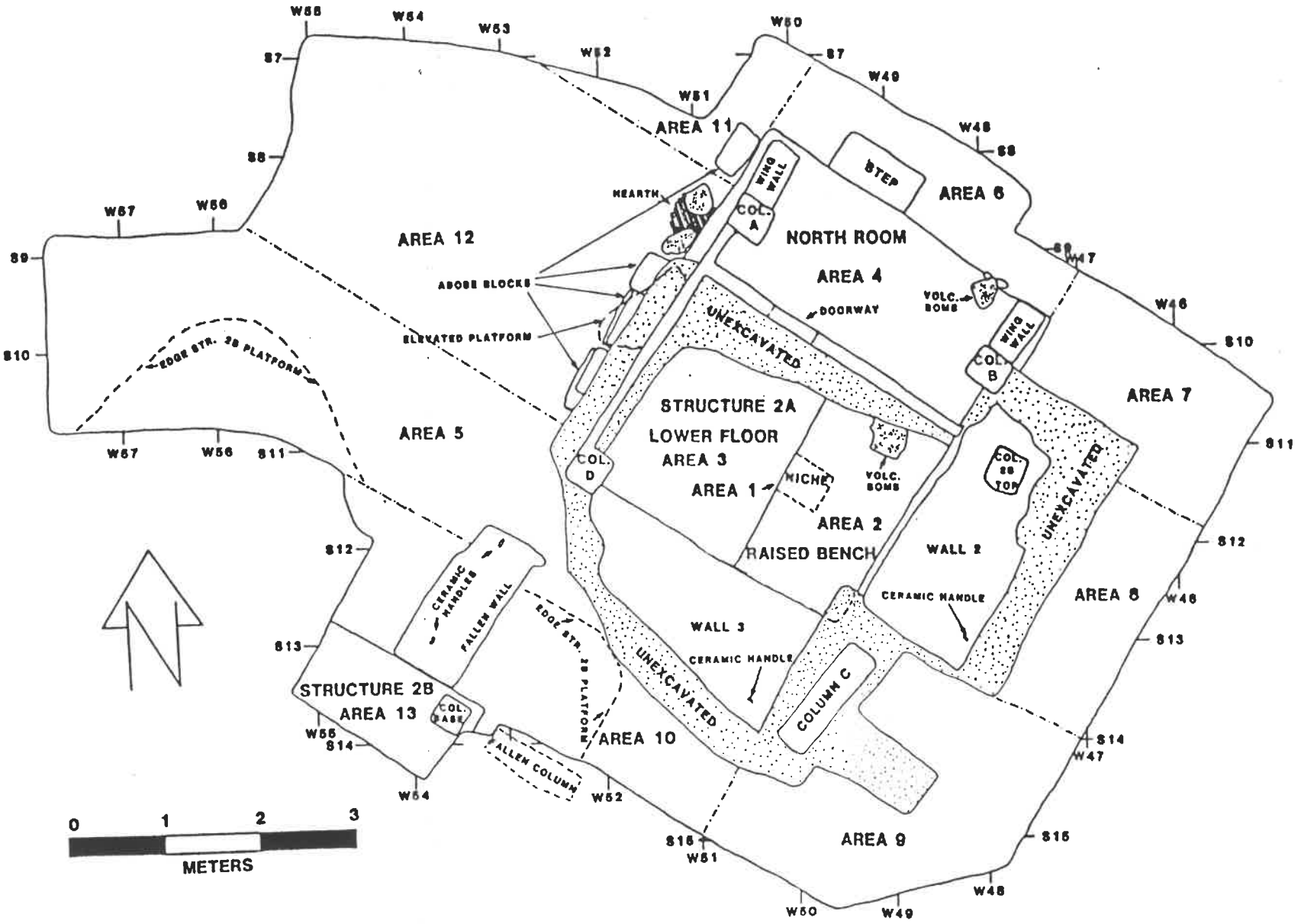
Evidence of prehistoric construction at Structural Complex 2 was first discovered in 1979, during the resistivity survey and core drilling program of the Proyecto Protoclasico (Loker 1983). During these studies, a large anomaly was observed in both the resistivity and ground penetrating radar data. Subsequent sampling with a soil drill confirmed the hypothesis that the anomaly was due to a cultural feature, by showing the inverted stratigraphy characteristic of these features (for details, see Loker 1983, and McKee Ch. 5 this volume).

The resistivity anomaly and the drill hole sampled in 1979 were relocated in May of 1989, and an area extending approximately 15 meters (N-S) by 21 meters (E-W), roughly centered on the location of the drill hole, was marked as the limit of the 1989 excavations at Structural Complex 2. The area was chosen based on the location and approximate size of the anomaly in the resistivity data. This area was then excavated to a depth of approximately 3.5 to 4 meters through the use of a large backhoe, provided by the Proconsa construction firm of San Salvador. The depth of the mechanical excavations was based on the stratigraphy viewed in the core sample extracted in 1979. Excavating to this level was believed to allow a sufficient thickness of volcanic tephra so that the standing portions of the structures would not be damaged.

At the termination of the mechanical excavations, no evidence of prehistoric structures was visible. We decided to continue the excavations by hand in a limited area, in order to determine the depth at which the structures were actually located. We centered a 2 x 2 meter excavation pit over the approximate location of the drill hole from 1979. The excavation pit extended from 9 to 11 meters south and from 56 to 58 meters west on the 1989 excavation grid. The pit was excavated with shovels and acedones (large hoes) to the bottom of the Laguna Caldera ash, which was encountered approximately 3 meters below the base of the mechanical excavations.

We found a rough, unfinished clay floor which sloped down to the north and west at the base of this excavation unit. The floor was clearly not a finished surface, but it was constructed. In natural circumstances, the Tierra Blanca Joven deposits from Ilopango Volcano would have been found at the base

FIGURE 1. PLAN OF HOUSEHOLD 2 COMPLEX



of the Laguna Caldera ash. This surface was interpreted to be the floor of a platform outside of a structure, due to its slope and poorly finished condition. The surface began to level off in the extreme southern portions of the pit. The floor was littered with a diffuse scatter of ceramic sherds.. Other indications of prehistoric cultural activity included carbonized roofing material in the southern portion of the unit, the tooth of an unidentified canine in the SW corner of the unit, approximately 20 cm above the floor, and several hollow voids in the floor. Two of these were cast with dental plaster (Murphy, this volume), and yielded the remains of a freshwater snail (jute), and a round seed approximately 1.5 cm in diameter.

Because of the depth at which this floor was encountered, and the time that would be consumed in excavating to the floor with hand tools, we decided to continue excavations with the power equipment. The Proconsa backhoe continued the excavations begun earlier under close monitor by the archaeologists. The area believed to be the most likely location of a structure was located to the S and E of the initial 2 X 2 m. excavation unit, based upon the slope of the floor and the presence of roofing thatch in the southern portion of the pit, as well as the dip of the volcanic strata above the floor.

The first evidence of cultural activity found by the backhoe was in the extreme SE corner of the unit. Here, we encountered a scraped slip ceramic vessel and some fragments of adobe from construction. The backhoe excavations were halted in this area, but were extended to the west to determine the extent of the structure. Approximately 7-8 meters to the west, the backhoe exposed the top of an E-W running bajareque wall, and a N-S running massive adobe wall or fallen column, probably the latter. Thses were likely a portion of the building later designated Structure 2B. Excavations were then extended to the north of the first structure encountered to determine its northern limits, and a third structure was encountered. This structure was located approximately 7-8 meters north of the first structure. The first items of this structure to be found was an E-W running bajareque wall and some scattered small pieces of adobe, apparently from walls impacted by the volcanic eruption.

Excavations during the 1989 field season were concentrated on the northeastern structure, which was designated Structure 2A. This structure was chosen because the its remains were located topographically higher than those of the other structures encountered in the pit, and because we believed that the entire structure was located within the area excavated by the backhoe. There is a possibility that other structures encountered extend outside of this pit.

The excavations were continued by hand, using shovels and acedones in areas with a low probability of encountering artifacts or other cultural remains, and trowels, brushes, and dental picks in areas of greater sensitivity.

Architecture

Structure 2A

The architecture of Structure 2A is in many ways similar to that of Structure 1 (Zier 1983, Beaudry and Tucker, this volume), although preservation is more complete in the case of Structure 2A. The long axis of the structure is oriented at 30 degrees east of magnetic north, as is the case for all other structures excavated at the Cerén site. When cardinal directions are used in the text, they are given relative to the long axis of the structure, which is considered N-S. Columns were set in each of the corners of the structure, and connected by bajareque (pole-and-mud) walls on the east, west, and south. The north wall connected the east and west walls at a location to the south of the northeast and northwest columns. Two more massive, probably puddled adobe

FIGURE 2. CROSS-SECTION OF HOUSEHOLD 2 COMPLEX FACING NORTHWEST

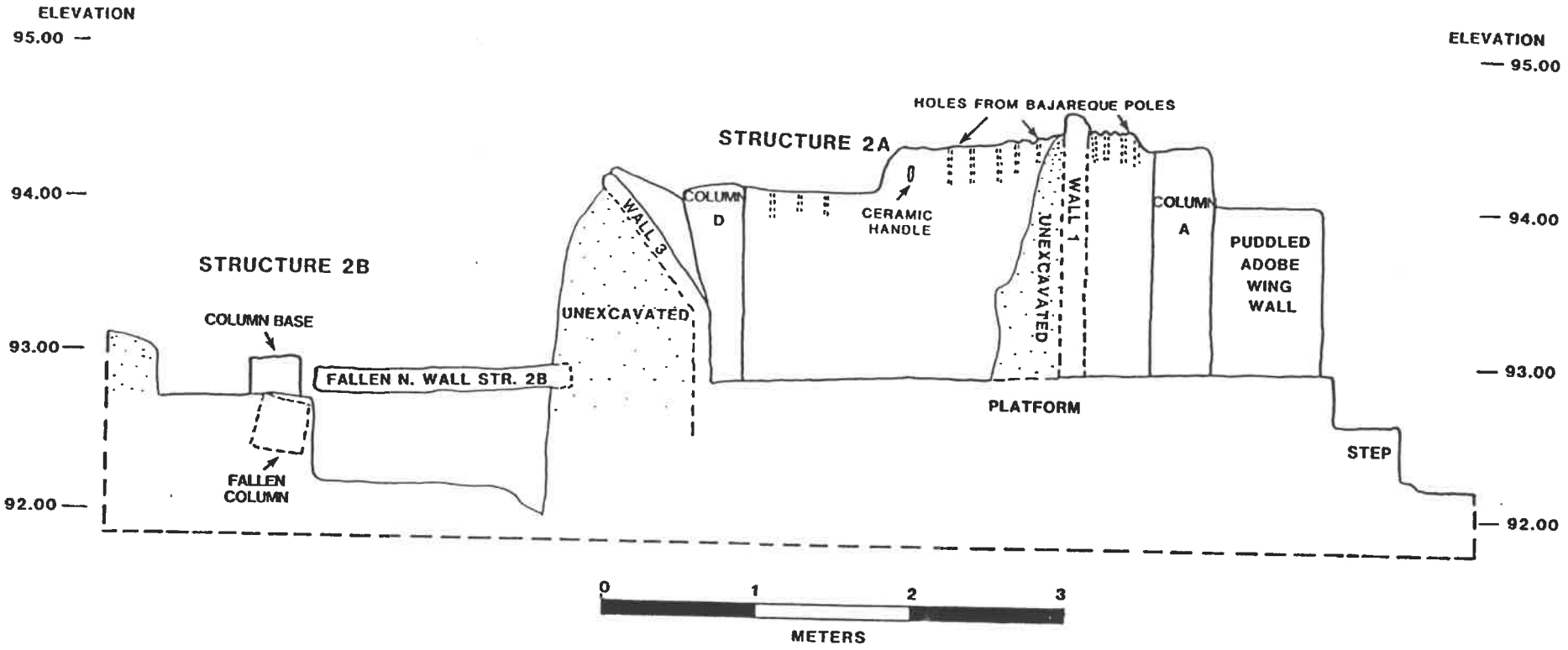
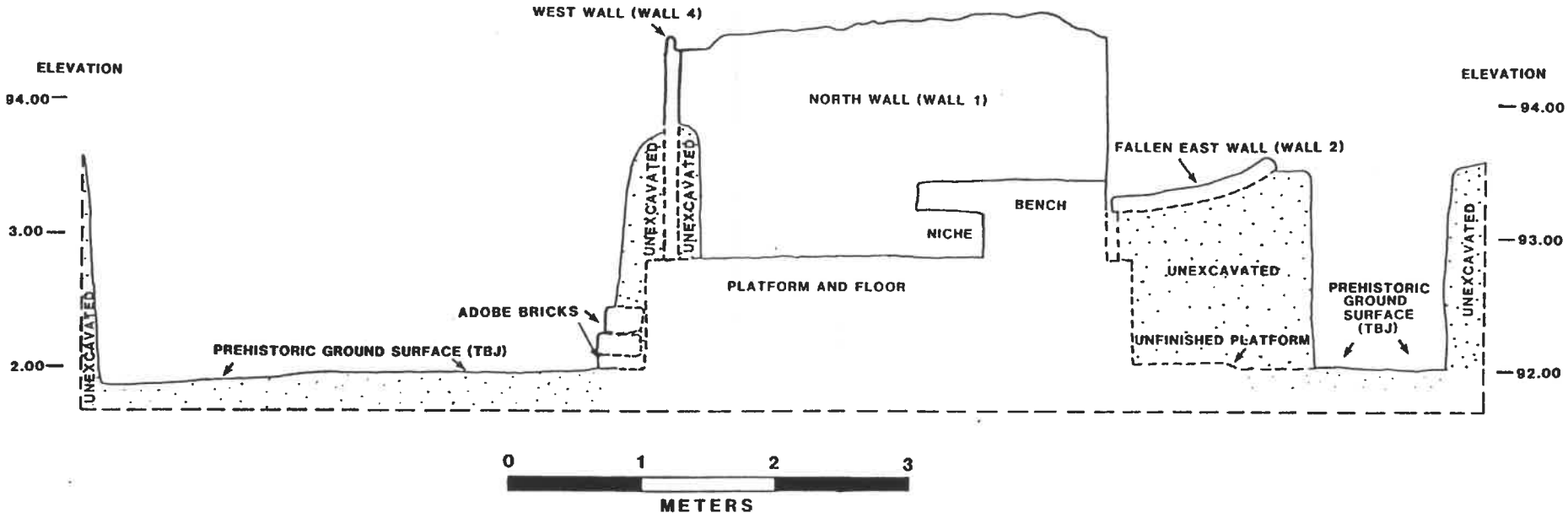


FIGURE 3. CROSS-SECTION STRUCTURE 2A FACING NORTHEAST



wing walls extended to the northeast from the NE and NW columns. To facilitate discussion of the architecture of Structure 2A, names have been assigned to the various walls and columns. The NW column was designated Column A, the NE Column B, the SE Column C, and the SW Column D. The northern interior wall was designated Wall 1. The eastern wall, which connects columns B and C is Wall 2, the southern wall between columns C and D is Wall 3, and the western wall between Columns D and A is Wall 4.

Substructure

The lowermost construction consists of a thin layer of unfinished clay resting on top of the TBJ soil. This layer varies between two and seven centimeters in thickness, and is only visible on the northern, western, and northeastern sides of the structure. To the north of the structure, it extends approximately 55 cm, and it extends between 20 and 50 centimeters to the west. This layer was also visible outside the NE corner of the structure, where it extends approximately 40 cm. Nothing is known of this platform in other areas outside of the structure, due to lack of excavation.

A finished platform of puddled adobe rests on top of the lowermost clay layer. This platform is only exposed outside of walls 1 and 4, and in the northern portion of Wall 2. The platform varies between 72 and 74 cm in thickness on the northern side of the structure, with a very gentle slope to the west. The length of the platform along Wall 1 is 3.42 meters. Both corners of the platform were exposed on the northern side, and both were square, indicating a flat, rectangular platform. The platform was also exposed for a length of approximately 1.70 meters along Wall 4. Along this wall, the platform varied between 72 and 80 cm in thickness, and sloped gently to the south. Because the southern portion of this wall was not excavated, we were unable to measure the exact length of the platform, but assuming symmetry in the NW and SW corners, the platform is approximately 4.33 meters in length. The platform was not exposed along the south or east walls. The upper surface of the platform has been subjected to heat, as indicated by oxidation. It is likely that it was fired prehistorically, as the oxidation is present in areas buried by cool tephra units as well as by those that fell hot.

Columns

Structure 2A contained four massive columns of puddled adobe. All four had dimensions of 42 cm by 36 cm, and were rectangular in cross section. It seems likely that a mold was used for the construction of these columns, and that the same one was used for all four, given the regularity of dimensions. Column A, the northwest column was 1.40 m in height. It had a piece of laja, or exfoliated andesite, resting on its top. Impressions of wood were also found on the top of this column, indicating that it likely served the function of structural support. Column B, to the NE, measured 1.25 m in height, but the top was knocked off by the force if the Laguna Caldera eruption. Column C, on the SE side of the structure, was knocked off of the house at its base, and measured 1.3 m in height. Column 4, to the SW, measured 1.3 m in height.

Walls

Wall 1, the northern wall of the structure contained the entrance. It was inset from the northern edge of the puddled clay platform by 1.55 m, and thus is believed to have been an interior wall. The wall is of bajareque construction, and is extremely well preserved. Most of the southern side of the wall was left unexcavated in order to preserve the adobe, and large portions of the northern side are still covered with tephra as well, but enough was excavated to

understand some details of the construction. Due to the remaining tephra, it was impossible to determine if handles or other unusual features were associated with the interior of the doorway and other portions of the wall. The total length of the wall between Walls 2 and 4 is 3.12 meters, and the average thickness was approximately 8 cm.

There are several outstanding features of Wall 1 that are not present on the other walls of this structure. The first is the presence of a doorway. The doorway averages about 55 cm in width, and is 153 cm high. The western edge of the doorway begins 70 cm west of the juncture of Walls 1 and 4, and the eastern edge is 180 cm west of the juncture of Walls 1 and 2. Pilasters, partial columns extending out beyond the rest of the wall, are present on either side of the doorway. The top 20 cm of the wall consists of a cornice, which begins at the height of the top of the doorway. The total height of the wall is thus approximately 175 cm above the floor level. The pilasters and cornice extend out 7 cm from the rest of the wall, giving a total wall thickness of 15 cm in areas with cornices or pilasters.

Three different construction techniques were used for Wall 2, the eastern wall of the structure. The northernmost portion of the wall, which will be called a wing wall, was of massive adobe construction, and was 56 cm long, and 30 cm thick. This portion of wall had a height of 1.12 meters above the level of the floor in the northern room of the structure. The wall was probably constructed as puddled adobe. Three holes, approximately 1.5 to 2 cm in diameter were found running vertically into the top of the wall to a depth of at least 5 cm. They were inset approximately 5 cm from the outside of the wall. It appears likely that these holes contained poles to support some type of superstructure.

Column B was located immediately to the south of the massive adobe portion of the wall. This column was oriented with the long axis of 42 cm oriented NW-SE. The shorter 36 cm axis was oriented NE to SW, and its outside formed a portion of the wall. The top 20 cm of the column was knocked over by the Laguna Caldera eruption.

The portion of the wall to the south of Column B was of bajareque construction, and fell to the east due to the force of the Laguna Caldera eruption. The wall was lying in an approximately horizontal position when it was excavated. We were unable to remove the fallen portion of the wall, or to excavate underneath it, and therefore only the interior surface was studied. This portion of the wall was 2.55 meters long, and .80 to 1.20 m in height. The portion of the wall to the north was more poorly preserved than the portions further south, and it was possible to see portions of the bajareque framework in areas where the adobe had fallen away. There was at least one layer of vertical and one layer of horizontal poles forming the framework. The top twenty centimeters of column B, which was knocked off by the impact of the Laguna Caldera eruption, was lying upside down on top of this fallen portion of Wall 2. One handle from a ceramic vessel was also found in contact with the northern portion of Wall 2, but no indications that it was attatched to the wall were found. A second handle was embedded in the southeastern portion of the wall. Impressions on the top of central portion of the wall indicated that a number of horizontal poles approximately 1.5 to 3 cm in diameter had been placed perpendicular to the wall during construction. Similar impressions on Wall 4 indicate that an interior ceiling or elevated storage bench, locally called a "tabanco", may have been located beneath the roof.

Column C made up the southernmost portion of Wall 2. This column fell from its base to the SE. It was 1.30 m long, and the shorter axis of 36 cm was lying facing up.

Wall 3, the south wall, was the simplest of the walls of Structure 2A. This wall was partially knocked down by the force of the Laguna Caldera eruption, but the lower 55 cm of the wall were still standing. Upper portions of the wall "peeled" away from the southern side of the building, with the SW corner of the wall still in a nearly vertical position, and the SE corner lying nearly horizontal. Instead of a sharp break, as happened with Wall 2, Wall 3 bent and deformed plastically as a response to the force of the eruption. Only the interior surface of this wall was excavated, and the exterior remains unknown. No doors, windows, or niches were present in this wall. The only unusual feature that was present was a ceramic vessel handle, approximately 10 cm long that was embedded in the SE portion of the interior of the wall. It was located 45 cm from the east edge of the wall, and 25 cm below the top of the wall. This handle was unusual in that its long axis was oriented horizontally. All other handles that have been found embedded in walls on the site have had their long axis vertical. The handle was not associated with a doorway or other unusual feature. The SW edge of Wall 3 was connected with column 4, and an adobe "lip" on Column 3 indicate that this wall was originally connected with that Column as well.

Wall 4, the western wall of the structure, was similar in many ways to Wall 2, although much better preserved. The northern portion of the outside of this wall was completely excavated to its base, but the southern portion was left covered with tephra for conservation purposes. Only the higher portions of the inside of the wall were excavated clear of tephra. Like Wall 2, Wall 4 had four components: a massive adobe northern portion, Column 1, a bajareque central portion, and Column 4 to the south.

The massive adobe wing wall was nearly identical to its counterpart on the eastern wall. It was 65 cm long and 35 cm thick. It reached a height of 1.05-1.10 m above the floor of the northern room, and 1.90 m above the pre-Laguna Caldera ground surface outside of the structure. Three holes were found along the top of the wall, arranged in a fashion similar to those found in the northern portion of Wall 2.

Column A formed the next portion of Wall 4. The long (42 cm) axis of the column was oriented from NW-SE, perpendicular to the wall, and the shorter (36 cm) axis was oriented along the wall. The top of the column is 2.25 m above the outside ground surface, and 1.65 m above the floor inside of the house. A roughly triangular piece of laja (exfoliated andesite), approximately 20 cm x 15 cm, rests on top of the column, which is also marked by wood impressions, indicating that the column likely served as some sort of structural support.

A portion of bajareque wall was located immediately to the south of Column A. This section of wall is 2.55 m long and is extremely well preserved. The vertical reinforcing poles have rotted away, but the holes where they were located remain. These holes range between 2 and 5 cm in diameter, and are spaced at intervals ranging between 8 and 15 cm. The spacing is not extremely regular, although most are spaced between 10 and 12 cm. The northern portion of the bajareque wall is better preserved than the southern portion, the uppermost portion of which has fallen. In areas where the wall is still standing, the height of the bajareque wall is slightly higher than that of Column A, approximately 2.35 m above the outside gound surface, and 1.75 m above the platform level.

Horizontal pole impressions are visible at the top of the northern portion of this wall, as they were in Wall 2. Their close spacing and the diameter of the impressions (2-5 cm) indicates that they likely supported an interior ceiling or shelf. Another interesting feature of the wall is that the external half extended up approximately 6 cm higher than the internal side. A narrow "shelf", approximately 6 cm in width was present on the inside. A vertically oriented

FIGURE 4. PROFILE WEST WALL (WALL #4) STRUCTURE 2A (FACING EAST)

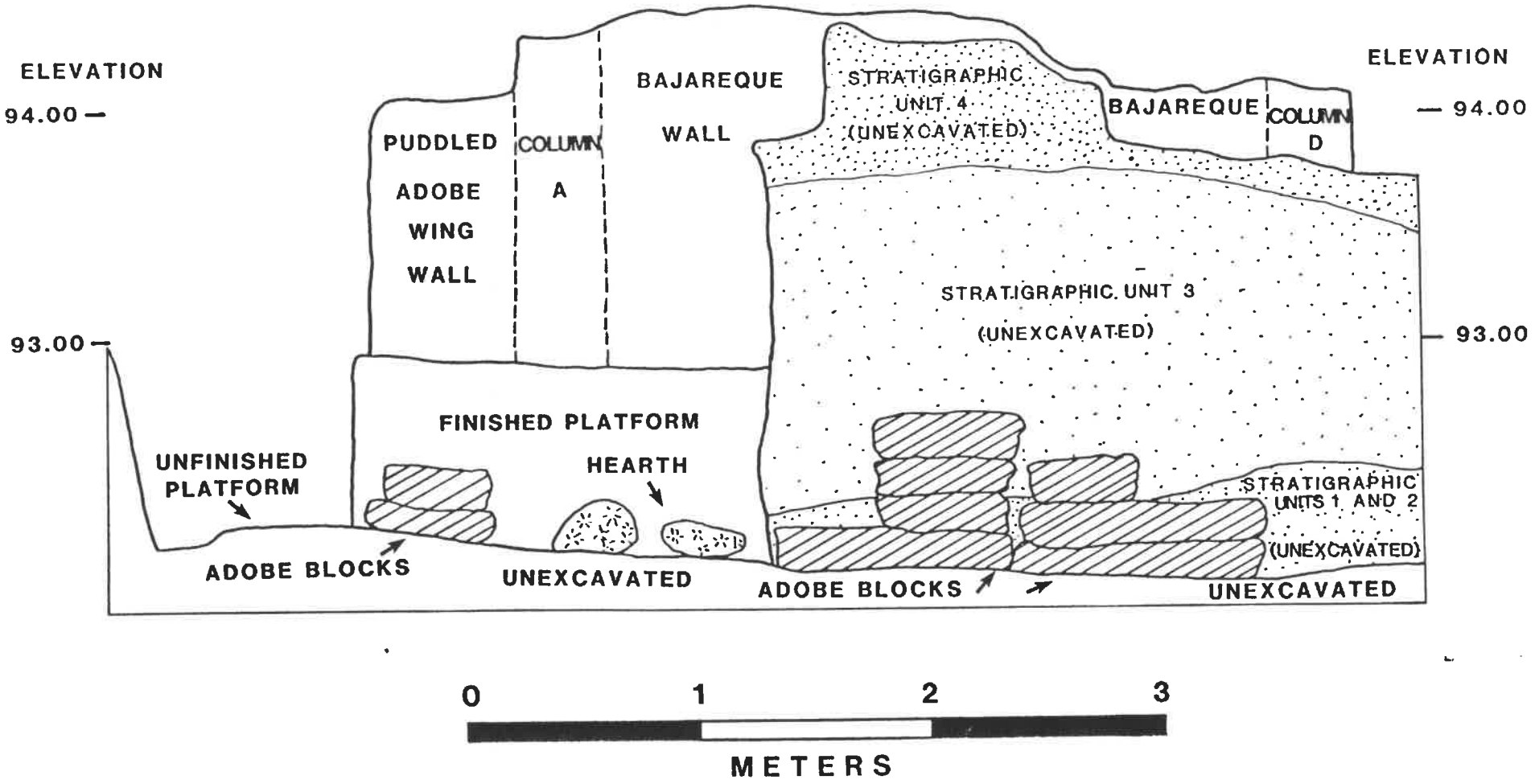
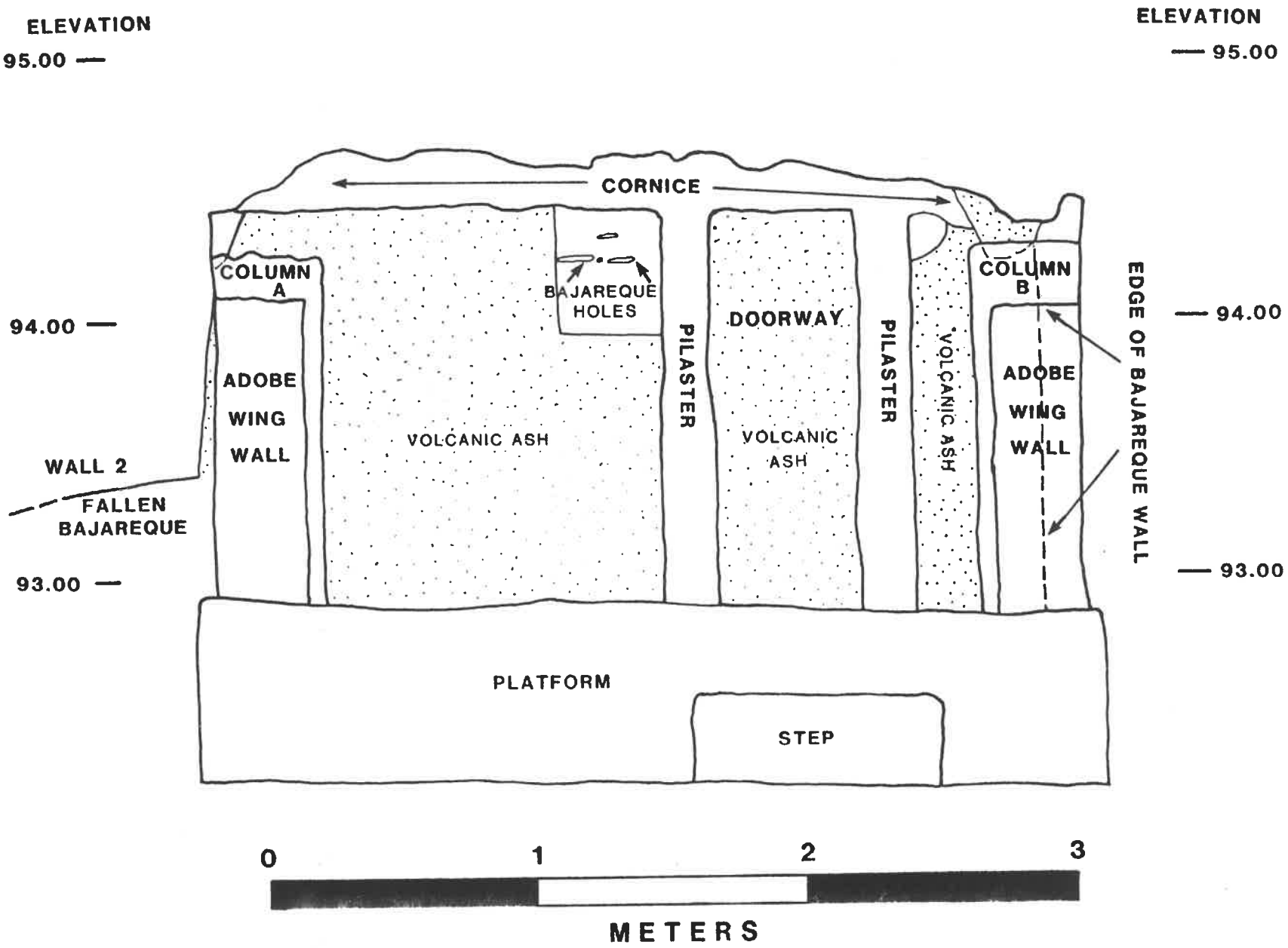


FIGURE 5. PROFILE NORTH WALL (WALL 1) STRUCTURE 2A



ceramic handle was the only other unusual item exposed on the interior of Wall four. It was located approximately 8 cm below the top of the wall, and 110 cm north of the north end of column four. The handle was 12 cm long, and 5 cm wide at the top and 3 cm wide at the bottom. No doorways or windows were visible in the area surrounding this handle, but nearly the entire area is still covered with tephra.

Column D anchored the sourthernmost portion of Wall 4. This column had the same dimensions (36 x 42 cm) as the other columns used for Structure 2A, but its orientation was rotated by 90 degrees. That is, the long axis was orienteed along wall 4, and the short side was perpendicular. The top of the column, which was intact, is 2.10 m above the prehistoric ground surface outside of the structure, and approximately 1.65 m above the floor of the structure.

The total length of Wall 4 is 4.10 m. The outside surface of the wall is finished so that the joints between the adobe walls, columns, and bajareque walls discussed above are not visible. This was likely accomplished through the application of a wet clay plaster (without lime) after the construction of the individual parts, but this is uncertain.

It appears that all of the walls were fastened together in a similar fashion. None of the exposed edges of walls indicate that the bajareque reinforcing poles extended from one wall into another, or into columns. In areas where the edges of columns where walls weere attached are exposed, these invariably have a protruding "lip" of clay, where the final plaster to join the wall and the column was applied.

Rooms

Two rooms were present in Structure 2A. The northern room was located north of Wall 1, and was walled on three sides, but open to the north. Five postholes located to the north of the base of the platform, as well as a large quantity of thatch found on the floor indicate that this room was roofed. The room has a maximum dimension of 3.10 m east to west, and 1.60 m north to south. The area of this room is 4.96 sq meters.

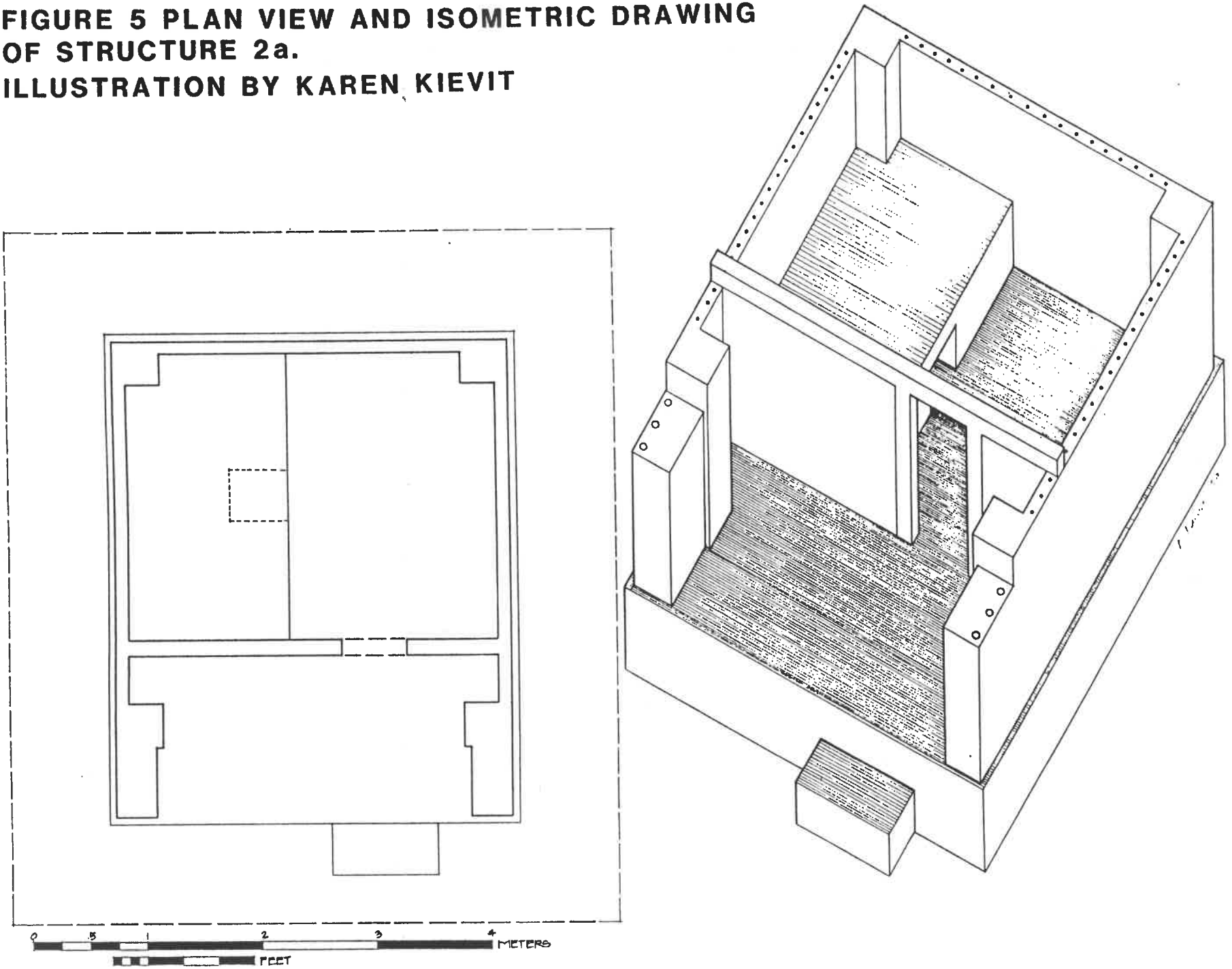
The second room was enclosed on all four sides, and was roofed. There were two different levels to this room, a lower floor area to the west, and a raised "bench" area to the east. The bench was 55 cm higher than the lower floor area. The lower area extends 1.75 m E-W, and 2.20 m N-S, and the bench has dimensions of 1.42m E-W and 2.20 m N-S. Thus the dimensions of the entire south room are 3.17 x 2.20 m, giving an area for the room of 6.97 sq. m. The total floor area of Structure 2A is 11.93 sq. meters.

A large niche was constructed within the bench. This niche was nearly square, with dimensions of 48 cm E-W and 49 cm N to S. The niche was 36 cm in height. The spalling off of a layer of clay approximately 1 cm in thickness over most of the interior surface of the niche indicates that this clay was applied as a plaster during the final construction of the niche.

Floors

The floors of Structure 2A all appear to be of puddled and fired adobe. The floor inside of both rooms are at the same level as the finished adobe platform, indicating that the top of the platform also served as the interior floor of the structure. The only area within the house without a floor at this level is the raised area or bench inside the southern room. This bench is 55 cm higher than in the rest of the structure.

FIGURE 5 PLAN VIEW AND ISOMETRIC DRAWING OF STRUCTURE 2a.
ILLUSTRATION BY KAREN KIEVIT



Roofing

Our evidence for the roofing of the structure is less complete than that for the walls and the floor. Large roofing timbers up to 10 cm in diameter were found within the southern room on both the bench and the lower portion of the floor. Large timbers were also found outside of the house to the east, west, and south, and the largest were over 10 cm in diameter, and 4 m in length. Smaller pieces of wood associated with roof construction were found throughout the interior of the structure and on all sides of the exterior. Grass and/or palm thatch from the roof was also found throughout the interior of the structure, and on the exterior in most areas within one meter of the walls of the structure.

Five post holes located immediately to the north of the edge of the prepared platform and much thatch on the floor indicate that the northern room of the structure was roofed as well.

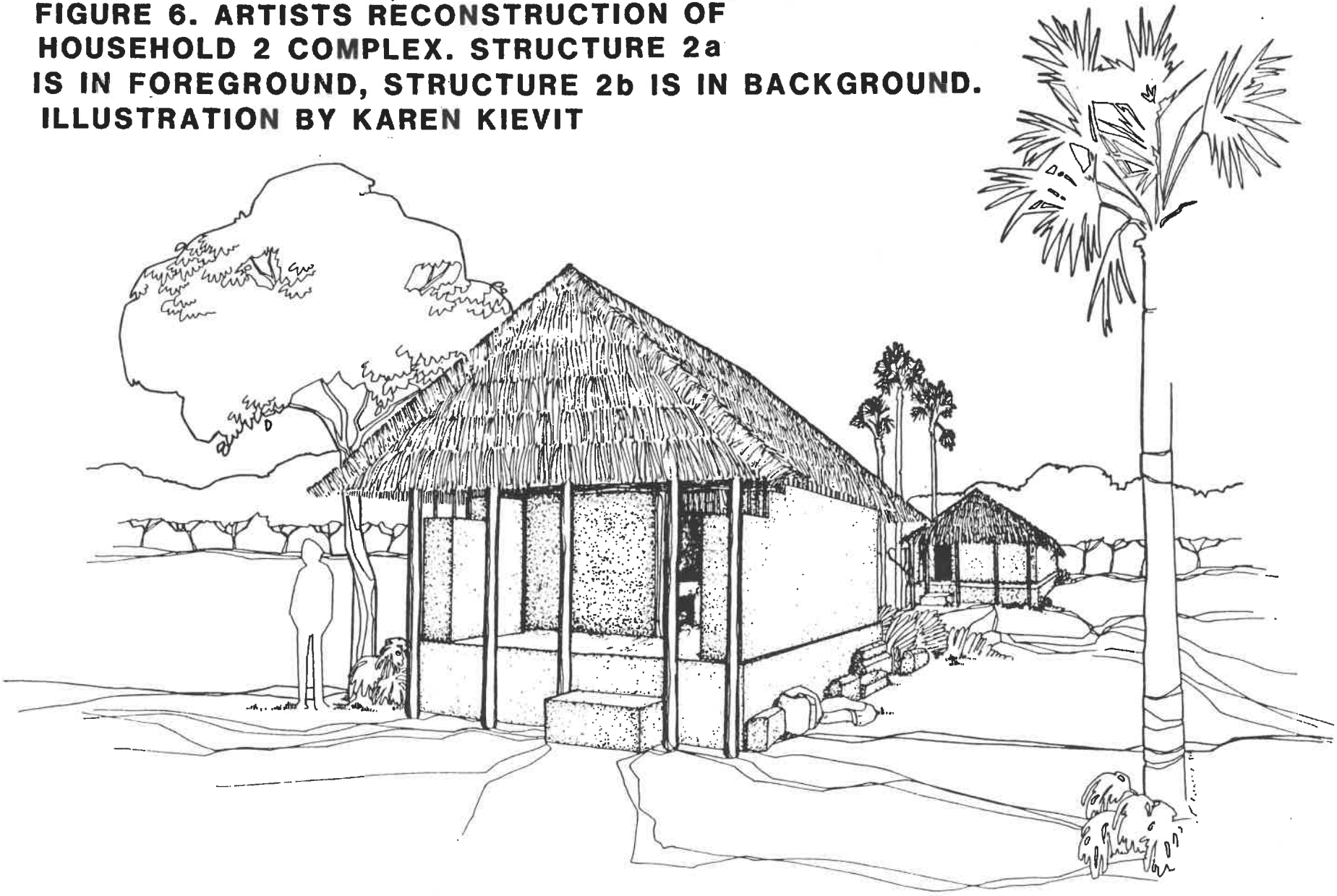
Analyses have not yet been conducted to allow for an accurate reconstruction of the roof, but portions of roof-fall from two areas outside of the structure give some insight regarding the techniques used. Outside of the south wall of the structure, several pieces of wood and bamboo-like "barra castilla" were found lying perpendicular to the wall. Several pieces of wood, which had apparantly been split were lying on top of the poles, parallel to the wall. The area of preserved roofing extended about 60-70 cm along the wall, and out about 20 cm perpendicular to the wall.

The other area where details of roof construction were preserved was along Wall 4, near the NW corner of the structure. Here, roofing was preserved over an area extending 135 cm N-S and 42 cm E-W, perpendicular to the wall. Two layers of perpendicular poles were present. The poles were all approximately 2-3 cm in diameter. The lower layer was perpendicular to Wall 4, and the upper layer parallel to the wall. Poles in both layers were spaced at distances of 5-10 cm. The thatch in this area was located beneath the poles. Two alternative hypotheses may account for this apparent inversion. The first is that the thatch may have burned and fallen through before later blasts caused the fall of the poles, and the second is that the entire portion of roofing may have flipped as it fell to the ground. The former hypothesis is supported by the fact that the thatch and the pole structure are separated by approximately 10 cm of tephra.

Based on the evidence that we have of construction, and comparison with historic Maya houses reported by Wauchope (1940), we believe that the roof was supported by a hierarchical substructure of poles. At least one layer of large poles, approximately 10 cm in diameter formed the main roofing members, and at least two layers of smaller poles, approximately 2-3 cm in diameter rested on these supports. These poles in turn were covered with thatch.

One other constructed feature at Structure 2A is worthy of special note. This was a raised, adobe-covered platform located immediately adjacent to and outside of the west wall. The feature extended for approximately one meter along the wall to the south of the intersections of Walls 1 and 3. Its maximum width perpendicular to the wall was 45 cm. The feature consisted of a 7-8 cm thick layer of adobe resting on thatch, which in turn was resting on poles approximately 2 cm in diameter. The adobe contained thatch impressions, which show that it was in contact with the thatch before it dried. The feature was located adjacent to the portion of Wall 4 with the pole impressions, indicating that it may have been related to the shelf or interior ceiling which left those impressions. This feature was located fairly high stratigraphically, indicating that it probably fell relatively late during the course of the eruption.

FIGURE 6. ARTISTS RECONSTRUCTION OF HOUSEHOLD 2 COMPLEX. STRUCTURE 2a IS IN FOREGROUND, STRUCTURE 2b IS IN BACKGROUND. ILLUSTRATION BY KAREN KIEVIT



Structure 2B

Structure 2B was discovered in the final week of excavations, and only a small part of the Northeastern portion of the structure was excavated, due to time constraints. The purpose of these excavations was to obtain preliminary indications of the nature of the structure, and to formulate plans for possible future excavations.

Structure 2B rests on a constructed platform of clay. The lowest level is unfinished, and was apparently placed to raise the structure above the TBJ soil in the area, probably for drainage purposes. Portions of this lower platform were noted in the 2x2 meter test pit excavated at the location of the drill hole from 1979, and in the area excavated to the south of Structure 2A. This surface slopes away from the structure on the north and east sides. A finished platform of puddled adobe was constructed above this unfinished surface. The contact of this platform with the lower surface was not exposed anywhere, but its height is approximately 50 cm. The NE corner of the platform was exposed, and its 90 degree angle indicates that the platform likely has a rectangular shape. The form of the southeastern and northeastern portions of the platform indicate that walls were present on both of these sides.

A column was present in the NE portion of the platform. The majority of the column has fallen to the SE, but the lowest 20 - 25 cm are still standing. The edges of the column are inset 12 cm from the eastern edge of the platform and 10 cm from the northern edge. The column measures approximately 32 x 32 cm.

A portion of the northern wall of Structure 2B was also exposed during the excavations. The wall fell to the northeast during the Laguna Caldera eruption. This is unusual, as it is the only wall that fell towards, rather than away from the source of the eruption. All other fallen walls excavated on the site fell to the south or the east. The wall measured approximately 70 cm wide (E-W) by 165 cm tall (N-S). The construction was of bajareque, and the total thickness of the wall is unknown, due to time constraints on excavations, but appears to be approximately the same as for the walls in Structure 2A, about 10-15 cm. The northwestern edge of the wall is finished, indicating that a doorway was probably located to the north of the fallen wall. This hypothesis is further supported by the presence of two ceramic handles embedded in the interior adobe surface of the wall, inset approximately 30 cm from the doorway, at heights of 30 and 155 cm above the base of the wall. Similar ceramic handles were noted near doorways in Structure 3 (see Gerstle this volume). The eastern edge of this wall was also interesting. The edge was not finished, except at the top, where there was a curious protruding lip of adobe, positioned as though to connect with the eastern wall of the structure.

Artifacts, Features, and Organic Remains

The number of artifacts and other specimens encountered at the Structure 2 complex was considerably lower than at the Structure 1 complex, but higher than at Structure 3. This is likely because a larger portion of the Structure 1 complex, including a probable bodega, has been excavated. Remains that were studied include ceramic, chipped stone, ground stone and miscellaneous artifacts, as well as a variety of organic remains. Detailed descriptions of each category are presented elsewhere (Beaudry, Beaubien, and Gerstle and Sheets chapters, this volume), and so descriptions will be kept brief, and concentrate on some preliminary associations of artifacts within different areas.

For the purpose of describing the spatial distribution of cultural materials, the structures were divided into a number of areas. These are not activity areas, and should not be treated as such, but can allow some preliminary

analyses of the use of space. Future studies in the laboratory will attempt to define statistically valid activity areas on the basis of the locations and associations of artifacts and features. Some of the areas are based on divisions between inside and outside of the house, and some on internal structural divisions of the house. Others are arbitrary, based on convenient breaks in the excavations or units of a manageable size and were defined to aid in the description of the house. The location of artifacts within and surrounding the structure will be discussed with reference to these areas. Twelve areas were defined for the excavations, four within Structure 2A, seven others in the areas surrounding this structure, and one within and immediately surrounding Structure 2B.

Area 1 consisted of the niche inside of Structure 2A. Area 2 included the raised portion of the floor or bench in the southern portion of the structure. Area 3 consisted of the lower floor area in the southern portion of the structure. Area 4 included the entire northern room of the structure.

Area 5 consisted of the area to the southwest of Structure 2A, but to the north of the fallen wall of Structure 2B. Area 6 included the area to the north of Structure 2A, and was defined on the E and W by the outside extension of the outside of the walls of Strucure 2A. Area 7 was located to the NE of Structure 2A, and extended from the eastern edge of Area 6 to the eastern edge of the excavations. Its southern boundary was marked by the northen edge of the fallen eastern wall of Structure 2A. Area 8 included the area above the fallen eastern wall and extended eastward to the edge of the excavations. Area 9 extended south from Area 8 to the southernmost extent of the excavations. Area 10 included all excavations immediately to the south of Structure 2A. Area 11 extended from the western edge of Area 6 to the western limit of excavations, and was limited to the south by a western extension of the northern edge of the NW column of structure 2A. Area 12 included the area between Areas 5 and 11, outside of the western wall of structure 2A. Area 13 included areas within Structure 2B, its fallen north wall, and areas immediately adjacent to the north.

Area 1 (Niche)

Ceramics

The niche contained three complete polychrome vessels. Detailed descriptions of each of these vessels are provided in Beaudry (this volume). The first, FS 46, is a Gualpopa Polychrome open bowl with a direct rim and slightly flattened bottom. This vessel has a maximum rim diameter of 22 cm and a height of 8 cm. The vessel was placed upright in the NE portion of the niche.

The second polychrome vessel found in the niche (FS 47) is a Copador shallow tripod bowl. According to Beaudry (this volume), this is a form varient not previously reported for Copador Polychrome vessels. The rim diameter is 26 cm, and the height is 9 cm. The supports are 3 cm tall. This pot was placed upright in the south central portion of the niche, and was covered by the inverted bowl three.

Vessel 3 from the niche (FS 48) is a Copador Polychrome bowl with melon stripe decoration. It is a direct rim, rounded base, open bowl. The rim diameter is 22 cm, and the height is 9.7 cm. This bowl was placed upside down over FS 47 as a sort of lid. Food residue was left inside this bowl, and the marks where someone's fingers had passed while removing food were preserved.

No other sherds or portions of ceramic vessels were present within the niche.

Other Artifacts

Two other artifacts were found within the niche. The first was a portion of shell, likely from a marine bivalve. Identification by the Museo de Historia

Natural is in progress. The shell measured approximately 9 cm x 11 cm, by 2 cm deep. The central portion of the shell was missing, and the portion of the shell adjacent to the missing portion has experienced a high degree of chemical weathering. It is uncertain if this portion of the shell was removed prehistorically, and the margins then weathered, or if the entire missing portion weathered away. Sheets (personal communication, 1989) believes that the former is more likely.

The final item inside the niche was the "Ceren Codex." This was originally discovered as a series of small "flecks" of a paint-like substance. Cleaning revealed that the flecks were more or less continuous, that there were several layers, and that they formed a 10 x 15 cm rectangular shape. The artifact was removed by sliding a sheet of metal along the floor of the niche, and by lifting this sheet and the overlying sediments, including the folio out and wrapping them in foil and in plastic. The Smithsonian Institution was notified immediately, and a conservator was sent down within a few days. According to the Smithsonian Institution, the white sizing material is kaolinite clay, red pigments are of cinnabar, and yellow and green pigments are composed of limonite. For more details on the folio, see Beaubien (Chapter 13, this volume).

Area 2 (Bench)

Ceramics

Remains of portions of three ceramic vessels were found on the surface of the bench. FS 43 was a sherd consisting of the lower 1/4 of a globular scraped slip jar with a maximum diameter of 24 cm, and a height of 16 cm. The sherd was resting on the W. edge of the bench, in contact with the surface. It probably fell from the ceiling or rafters and broke during the very early phases of the Laguna Caldera eruption.

FS 55 is a body sherd from the wall of a scraped slip jar and measures 9 x 12 cm. The sherd was broken into small sherds that were scattered over the surface of the bench. Like FS 43, this sherd likely fell from somewhere in the rafters during the early phases of the Laguna Caldera eruption.

Two small sherds (FS 44 and 66) were found on the bench and were part of a small incensario. Other portions of the same vessel were found in Area 3, on the lower portion of the floor. It appears as though the vessel was broken by the fall of volcanic bombs or roofing material, and some pieces remained on the bench while others fell to the floor below. The vessel was apparently a tripod, although only two legs have been found, with a smoothed, unslipped upper portion. Beaudry (this volume) believes that it is related to the Chichontepec Unslipped type reported at Chalchuapa by Sharer (1978:3:43).

Features

No cultural features were found in Area 2, but three large volcanic bombs that were present can aid in understanding the eruption (Miller, this volume). The largest measured 40 x 30 x 30 cm, and apparently crashed into the house through the north wall. The other two were smaller, with diameters of 20 and 30 cm. These apparently came in through the roof, based upon thatch adhering to their lower surfaces.

Organic Remains

A number of samples of organic remains were taken for study at the Museum of Natural History. Among these included samples of burned wood presumed to be portions of roofing timbers (FS 76, 63, 56). Two samples of braided fiber believed to be string were collected as well (FS 59, 62). A fragment of a bone tool was also collected (FS 60). This is a spatulate tool made from a longbone of a large mammal. It was broken in four pieces and has been

burned. The complete piece measures 17 cm long and 1.5 cm wide. The rounded end of the piece has been heavily polished, but its function is unknown. A small piece of wood that looked as though it was shaped into a disk (FS 70) was also collected (see Sheets, Ch 12 this volume). A sample of carbonized roofing thatch (FS 40) was collected for submission to the University of Texas Radiocarbon Laboratory.

Groundstone

A small hammerstone (FS 57) was found resting on the bench. This was a river cobble of non-vesicular basalt, and showed a low degree of battering on one margin.

Area 3 (Floor S. Room)

Ceramics

Three small sherds were foundthat were parts of the small incensario descibed above. In addition, three other sherds were found, one of which was identified as Guazapa Scraped Slip. The others were undiagnostic body sherds.

Organic Samples

A sample of roofing thatch was collected and designated FS 38.

Features

One very curious feature was present in the lower portion of the south room. This was a mixture of the Tierra Blanca tephra from the Third Century AD eruption of Ilopango Volcano, water, and grass. This was present in the western portion of the room, and is described in detail by Miller (this volume), where it is called the "buff unit". The feature was approximately 1.8m in length (N-S), and 80 cm in width (E-W). There was a very thin (1-2 cm) layer of Laguna Caldera ash underneath this mixture, indicating that it fell relatively early in the eruptive sequence. This is one of the most enigmatic features of the site discovered so far, and we have not yet found an explanation of how or why this mixture was suspended above this portion of the floor.

Area 4 (Floor N. Room)

Ceramics

A number of sherds found in the roof fall in this area fit together to form one vessel. The type: variety designation it was assigned to was Cashal Cream Slipped: Caldera Red Painted variety. The maximum diameter of the vessel is 18 cm, and the walls are .7 cm thick.

Chipped Stone

Area 4 contained the largest number of chipped stone artifacts of any of the designated units. FS 53 was a complete obsidian prismatic blade found in fallen roofing thatch. Almost all of undamaged blades found on the project were stored in the roofing. This served to protect the extremely sharp and delicate edges, as well as likely protecting any children who would have otherwise come into contact with the blades. FS 53 was in nearly unused condition, with very light use wear and only a small amount of organic residue.

FS 54 was the proximal fragment of another obsidian prismatic blade. This blade was larger, and had a larger platform that FS 53. It showed moderate use-wear and some organic residue, and was also located in roof-fall.

FS 58 was a large stemmed percussion macroblade at least 15 cm long. It experienced lateral retouch on the proximal end and light use wear.

FS 67 was a small roughly made side scraper what was found on the top of Column D. No use wear or organic residue was visible.

Organic Remains

One curious feature was found near the northern edge of this room. This was a series of 31 holes, approximately 1-1.5 cm in diameter, closely spaced in a U shape. The holes were apparently hollow cavities left when organic matter decayed away. The holes were cast with dental plaster. String was found connecting two of the holes together. These may represent matting of some sort used as a divider or doorway.

Area 5 (SW of Str. 2A, including 2x2)

Ceramics

34 body sherds were found trampled into the clay floor of the 2 x 2 meter excavation unit. All were apparently trash that had been discarded before the Laguna Caldera eruption. The majority were scraped slip.

Organic Remains

A tooth of a carnivore, possibly a coyote or more probably a domesticated dog was found in the 2 x 2 m test unit approximately 20 cm above the floor. Two voids in the floor of the 2x2 were cast with dental plaster. One proved to be a round seed of unidentified species, and the other to be a freshwater snail, identified as a jute, an edible species common in clean water in the area.

Groundstone

Two biconically perforated doughnut stones were found in Area 5. FS 34 was a small decorated doughnut stone made from a non-vesicular basalt. It exhibited little use-wear. It was found relatively high stratigraphically, within the hot airfall Unit 4 deposits. It was likely stored on the wall, in the rafters outside the house, or possibly on the exterior bench located in Area 12, and fell during the Unit 4 phase of the Laguna Caldera eruption.

FS 74 was another doughnut stone found in Area 5. This stone was considerably larger than FS-34, and was found in Stratigraphic Unit 3. Organic remains were found inside of the hole, and a hollow space, where organic remains had largely rotted away and partially carbonized was found extending to the S from the perforation in the stone. Some use wear was present, and this item has been interpreted by Sheets (this volume) as a perforated mortar with a hardwood pestle. The location of this artifact in the Unit 3 tephra indicates that it fell somewhat earlier than FS 34, but the proximity of their locations indicates that they may have been stored together, likely on the top of the wall. A third doughnut stone, FS 86 was located approximately 50 cm to the North in Area 12. This artifact might also be closely associated with FS 34 and 74.

Area 6 (N. of Str 2A)

Ceramics

Two ceramic sherds were found in Area 6. One was a scraped slip body sherd with a red slipped interior from an open bowl, and the other was a thick walled scraped slip body sherd

Area 7 (NE of Structure 2A)

Ceramics

Eighteen ceramic sherds were found in area 7. They included examples of Guazapa Scraped Slip, Cashal cream: Caldera red painted variety, and Gualpopa Polychrome.

Chipped Stone

A small distal fragment of an obsidian prismatic blade (FS 69) was found in loose tephra in Area 7. Its original location is uncertain, but it was clearly from within Area 7. It displayed light to moderate use-wear and some organic residue.

Another portion of an obsidian blade (FS-138) was also found within Area 7. This is the proximal end of a prismatic blade with a small platform and extensive use wear. This fragment was discarded before the Laguna Caldera eruption.

Area 8 (E of Str 2A)

Ceramics

32 sherds of Guazapa Scraped Slip, Cashal cream: Caldera red painted variety, and Gualpopa polychrome were found in Area 8. A portion of a perforated spindle whorl (FS 140), made by abrading a ceramic sherd into a round form was also found (Beaudry, this volume).

Chipped Stone

A small medial fragment of a macroblade (FS 139) was found on the TBJ surface outside of the house in Area 8. The original blade was probably fairly long, at least 12 cm. This specimen had experienced relatively heavy use-wear and had apparently been discarded prior to the eruption.

Groundstone

A single piece of Laja (FS 144) was found resting on the prehistoric soil in this location. This was a relatively small piece of laja with an edge shaped by flaking and one face that had experienced some grinding.

Area 9 (SE of Str 2A)

Ceramics

Sherds from a single vessel were recovered from Area 9. This was identified as a Cashal cream slip: Caldera red painted variety jar. The neck and upper shoulder wall were present.

Area 10 (S of Str. 2A)

Ceramics

Sherds from a Copador polychrome vessel associated with other sherds collected from area 13 were found in Area 10. Twelve other sherds of Guazapa Scraped Slip and Copador and another unknown polychrome were also found within Area 10.

Organic Remains

Several pieces of wood and barra castilla from portions of the fallen roof were collected from the southern wall area. These included FS 37 and 41.

A bone tool, designated FS 90 was also collected from this area. This was a minimally worked bone splinter. Two fragments of large mammal bone were present. The complete piece was approximately 8 cm long and 1 cm wide. Use wear was minimal.

Area 11 (NW of Str 2A)

Ceramics

Twenty three sherds of Obraje Red Painted: variety Obraje, Guazapa scraped slip, and Gualpopa polychrome were found in Area 11, as well as a handle associated with FS 87, which was in Area 12 to the south.

Groundstone

Two pieces of andesite laja were found within Area 11. The first, FS 84, was a small thin laja minimally abraded on both faces. It rested on top of the TBJ soil. The second, FS 98, was slightly shaped by percussion blows around the margins, and showed some smoothing on one face.

Features

A possible midden area was found at the extreme western portion of Area 11. In this area, we found a number of sherds that had been discarded, as well as some scattered charcoal on an uneven surface of TBJ tephra.

Area 12 (W of Str 2A)

Ceramics

Approximately 85 sherds were collected in Area 12. the following types and varieties were represented: Guazapa Scraped Slip: Maltitlan, Sacazil Bichrome, Copador Polychrome, Gualpopa Polychrome, and Cashal Cream Slipped: Caldera red painted.

Chipped Stone

A small medial fragment of an obsidian prismatic blade was found in contact with the pre-Laguna Caldera soil. This fragment showed extremely heavy use-wear, and was likely discarded prior to the time of the eruption.

Groundstone

More groundstone was found in Area 12 than in any other area of the Structure 2 complex. FS 86, a medium sized doughnut stone, was located near the southern edge of Area 12, and may be associated with two similar artifacts found in Area 5. This stone was broken into two pieces separated by less than 20 cm. We therefore believe that it broke during the course of the eruption. It was made of vesicular lava, likely andesite, and has been interpreted by Sheets (this volume) as a probable perforated mortar. This stone was located at the base of stratigraphic Unit 3, and likely fell from the wall or the rafters in a fashion similar to that described for FS-34 and FS-74 above.

A whetstone (FS 39) was found about 1.5 m NE of FS 86. It was made from a very fine grained sandstone, and had multiple utilized surfaces. According to Sheets (this volume), it may have been used to sharpen ground and polished stone tools, or to grind and flatten ceramic legs. The stone was located relatively high up stratigraphically, near to the top of Wall 4, and was likely stored on the nearby raised adobe platform.

One possible hammerstone (FS 93) was found in this area. Laboratory analysis showed that it was not utilized.

Two pieces of laja (FS 96 and 97) were also recovered from Area 12. Neither exhibits any signs of usewear, and they are cultural only in the sense that they were transported to their location by the prehistoric inhabitants of the site.

Features

One hearth, the only one found thus far at the Ceren site, was located adjacent to the west wall. Two stones, approximately 30-35 cm in diameter were spaced 15 cm apart, and about 10 cm from the adobe wall. Diffuse charcoal staining was present between and around the rocks. The wall was only slightly oxidized, and no smoke staining was visible, indicating that this hearth had not been heavily utilized previous to the time of the eruption. The fill from the hearth was collected as FS 132, and sent to the natural history museum for analysis.

Another interesting feature of this area was a storage area for adobe bricks, which also extended into Area 11. Nine blocks were visible, all of which were approximately 15 to 20 cm thick. They were also mostly 50 to 60 cm wide, measured from east to west. There were two different lengths, however. The longer bricks measured approximately 95 cm, and the shorter ones 50 to 60 cm. Their location would allow them to be protected from the rain by the eaves of the house. The most curious note about these bricks is that no adobe brick construction has yet been discovered on the site. It would appear that these bricks were made for use in construction of a structure as yet undiscovered, and stored for protection against the rain.

Area 13 (Str 2b and assoc. areas)

Ceramics

A total of more than forty sherds were found in area 13, representing Tazula black: Undecorated variety, Copador Polychrome, Gualpopa polychrome, and Guazapa Scraped Slip. Two partial vessels were largely reconstructable, including a Gualpopa open bowl, and a jar with a ridge on the neck, which was red painted from the lip to the top of the ridge, and cream below. The rim diameter measured 16 cm. FS 107 consisted of a complete cream slip globular jar with a slightly outflaring neck with a medial ridge and a rounded base. No handles were present on the jar. It was sitting upright in direct contact with the floor of Structure 2B, just to the SW of the NE column. Organic remains were present inside of the pot, and were collected as FS 108.

Some small bones, likely from a rodent skeleton, were present on the floor between the pot and the column. These were collected as FS 117. In addition, the floor surface near the doorway was littered by a large number of flat seeds, which have been tentatively identified as Uhushte. These seeds are used as a starvation food in times when the maize harvest fails in modern El Salvador (Murcia personal communication, 1989), and can be ground to make tortillas. A hemispherical deposit of wood ash was also in contact with the floor surface. This deposit was apparently stored in a round bottomed organic vessel, which inverted and fell onto the floor in the early stages of the eruption. Its top was rounded, and the bottom was in direct contact with the floor, except in the areas where it was resting on the uhushte seeds.

Chipped Stone

Two obsidian prismatic blade fragments were found in Area 13. The first, FS 133, was a medial segment that had been heavily unifacially retouched. Moderate usewear was visible. This segment was located in roof fall material. The second blade, FS 134, was nearly complete, with only a small portion of the proximal end missing, and was from a large blade, likely 12 to 15 cm long. Only very light use wear was present on this blade, which was also found in roof fall deposits.

Groundstone

One piece of unmodified laja (FS-122) was found in Area 13. It is an artifact only in the sense that it was transported onto the site by people.

Other Artifacts

Two organic items that likely had been painted were collected from the floor of Structure 2B. A rounded item that had apparently been painted was collected as FS 137. Another, larger area with similar materials was found to the south. A number of loose chips of possible painted sizing were collected as FS 136, but time constraints prohibited excavation this season. There were apparently four layers of white sizing material with an outside covering of red paint present. The area was carefully covered and backfilled to await future excavations.

A series of holes resembling those found near the doorway to structure 2A were found near the doorway to Structure 2B. A total of eighteen holes, approximately 1 cm in diameter were found lying in two lines. There may have been a mat or other similar item used to cover the doorway. These holes were found on the final day of excavation, and were therefore filled with plaster and carefully backfilled to await excavation in another season.

General Collection

A number of ceramic sherds and one obsidian blade were found during the course of the excavation that could not be assigned a specific provenience. Fifteen sherds (FS 31) were collected, including Guazapa Scraped Slip: Miltitlan

variety, La Presa Red: La Presa variety, Sacazil Bichrome, Huascaha unslipped: Huascaha varity. FS 32 was an obsidian blade that was found in the backdirt removed by the power equipment. It was a small medial segment, and almost certainly came from deposits postdating the Laguna Caldera eruption.

Summary and Conclusions

Excavations conducted at Structure Complex 1 at the Cerén site suceeded in locating at least three, and possibly four structures, excavating the majority of one of these, and conducting limited excavations on another. Mechanical excavations using power equipment served to locate the structures, and later hand excavations uncovered the structures and allowed for more detailed analyses.

The majority of the excavations concentrated on Structure 2A, a two roomed structure constructed of a combination of puddled adobe and bajareque. Artifacts were relatively sparse in both rooms, leading to a preliminary interpretation as a sleeping and daytime activity structure. The one area where a high artifact density was encountered was in a niche located under the bench in the south room. The polychrome pots, bivalve shell, and possible codex indicate that this was an area of some importance. The value of these objects similarly indicates that the structure was probably not occupied by the lower class of the Cerén site.

As only a small portion of Structure 2B has been excavated, it is too early to make final conclusions regarding the nature of this structure. However, it is possible to make some preliminary interpretations. The density of ceramic and chipped stone artifacts is higher than for any comparable area in Structure 2A. There are also remains of possible food items present, both within a ceramic vessel, and scattered across the floor, as well as the skeleton of a small animal, possibly a rodent. These indicate the possibility that Structure 2B was used as a kitchen or bodega.

One of the most striking elements of the structures in Building Complex 2, and of the Cerén site in general, is that of structural specialization. If each household utilized only one structure, then one would expect to see remains of production, distribution, transmission and reproduction represented in the archaeology of that structure (Wilk and Rathje, 1982). The fact that indications of only some of these activites have been recognized at each structure indicates that each household likely utilized a number of structures, each one suited for a specific task.

Future research at Cerén should concentrate on the excavation of all of the associated structures of a single household group. The dynamics of the household can not be understood with only a portion of hte structures excavated. Structural Complex 2 is ideally suited for this sort of excavation, as at least three, and possibly four structures are present. Future seasons excavating at this complex should greatly aid in our understanding of the nature of the household in the Classic Period Southeast Periphery of Mesoamerica.

Acknowledgements

This research would have been impossible without the aid of many institutions and individuals. First, I would like to thank the staff of the Patrimonio Cultural of El Salvador, especially Arq. Maria Isaura Arauz de Rodriguez, Evelyn Guadelupe Sanchez, Ana Alicia de Rodriguez, Manuel Lopez, and Concepcion Clara de Guevara. Special thanks to Salvador Quintanilla, the land owner and guardian of the Cerén site. The Salvadorean field crew was superb, and without their aid, none of this work would have been possible. The members of the crew include Marco Tulio Chinchilla, Lazaro Amaya Lopez, Antonio Rivera

Espinoza, Salvador Ramirez Rojas, José Antonio Menjivar, José Mario Quintanilla Ramirez, Manuel Antonio Bueno Quintanilla, Oamin Elisandro Graados, Rodrigo Bautista Canton, Pedro Ramirez Galdamez, José Guadalupe Funez Canton, José Cesar Cordova Bonilla, Salvador Quintanilla Carabantes, José Humberto Portillo Padilla, Pedro Ismael Giron, and Elias de Jesus Rivera Espinoza. The integration and functioning of the best crew I have ever worked with was largely the result of the planning and work of Manuel Murcia. Special thanks to Manuel for everything. The Patronato Pro Patrimonio Cultural aided us greatly as well. I would like to single out Juan Carlos Choussy, Mario and Maria Eugenia Cristiani, and Neto and Carmen Maria Raubusch in particular. Ricardo Recinos has provided an exceptional amount of assistence. Without his aid, the research could not have gone as smoothly as it has. Maria de Los Angeles and the staff at the Casa Austria helped to give us a home away from home in San Salvador. Jose and Rene Cuenca of Proconsa aided us greatly through the use of their power equipment, and the backhoe operator, Buena Suerte, did a superb job of removing the volcanic ash overburden from the structures. Many special friends, especially Peter and Paulita Doty, and Oscar and Barbara Lopez have also helped to make our stay comfortable. If there is anyone else that I've neglected to include, I appologize for the oversight. I'd also like to thank the Proyecto Ceren crew. David Tucker, Andrea Gerstle, Marilyn Beaudry, Frank and Julie Saul, Theresa Bocklage, Hartmut Spetzler, Dan Miller, and Sean Murphy are among the finest people that I have ever had the opportunity to work with. Their aid and analyses are gratefully acknowledged. Finally, I would like to thank Payson Sheets for the opportunity to work on this project. The work and the weekends have been terrific.

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Chapter 9: EXCAVATION AT STRUCTURE 3, CEREN, 1989

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I. Introduction

Structure 3 is the western-most of the three structures excavated in the 1989 season. Following its discovery, Andrea Gerstle supervised excavations there until the end of the season. The size of the work crew varied from 4 to 8, and included several experienced excavators as well as some novices who were being trained. The quality of work was uniformly high.

Structure 3 was first discovered as a subsurface anomaly during the course of geophysical survey during the 1979 season. In that year, three different subsurface survey techniques were used: ground-penetrating radar, resistivity, and seismic refraction. The former two detected a subsurface anomaly, and the anomaly was confirmed with repeated resistivity survey in 1989 (see Chapters 4 and 5 for details).

The cultural character of the anomaly was determined by drilling. The first drill hole was done without casing, and although a clay layer was observed, it was impossible to determine its thickness or depth. The second drill hole, approximately 1.5 m away from the first, was done with casing, and a clear layer of clay approximately 25-95 cm thick was observed at a depth of 5.2-5.3 m below the modern ground surface. This clay layer, located at the intersection of Ilopango Tierra Blanca below and Laguna Caldera ash above, clearly suggested artificial construction in the area. (See Chapter 4.) The drill holes are shown on Figure 1.

Excavation in the 1989 season was initiated with a large backhoe and operator provided by Proconsa. A large area was excavated downward in a fairly even manner until some evidence of architecture was uncovered. The first sign of architecture was in the south sidewall of the trench, where the broken ends of three north-south oriented and apparently parallel walls appeared. They continued south into unexcavated area. The backhoe operator had inadvertently removed the top portion of the north end of these walls, but the intact north end of Wall 1 was discovered by hand clearing. These were labeled Walls 1, 2, and 3 from west to east (Fig. 1).

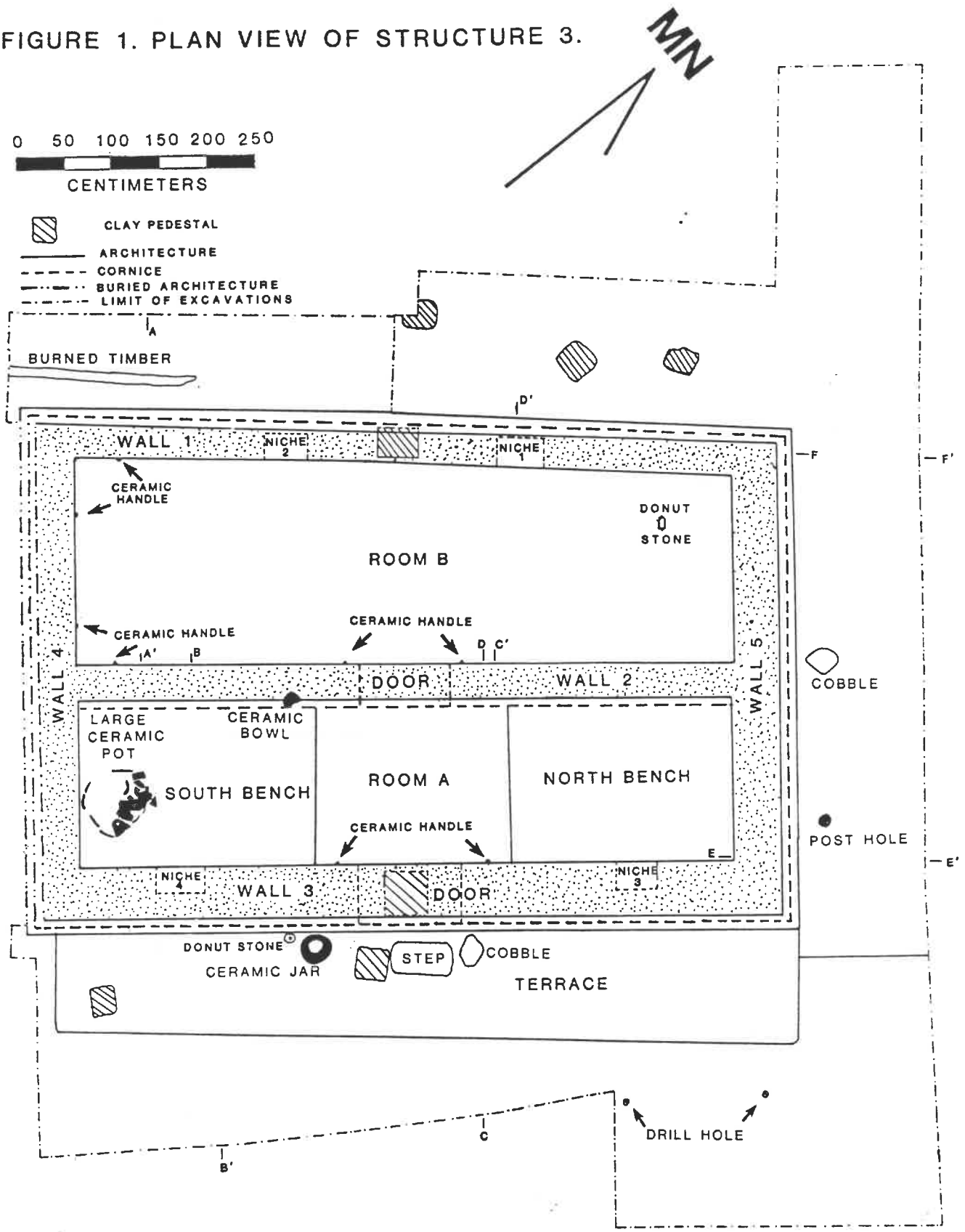
Following the discovery of these three walls, the backhoe operator was instructed to remove the tephra from outside of the outer walls (i.e., west of Wall 1 and east of Wall 3) to a depth of ca 1.5 m below the tops the walls. The west face of Wall 1 was cleared by hand to the SW corner of the building. The SE corner of the building was interpolated by assuming N-S and E-W symmetry for the building; the location of the corner was verified by hand clearing. Approximately 1 m of tephra was left on top of the building, to be excavated by hand once the dimensions of the building had been ascertained.

Once the building had been surrounded by backhoe trenches to a depth of ca 1.5 m below the tops of the walls, all excavation was conducted by hand using picks and shovels, and, to clear architecture and artifacts, trowels and other small tools.

II. Description of Architecture

Structure 3 is a single large edifice measuring approximately 8 m x 5 m, and with a maximum height approaching 3.5 m (Figures 1-7). It is the largest and best-preserved of the structures excavated thus far. To facilitate description of the structure, it will be considered in four parts: (A) the substructure, (B) the super-structure, (C) the terrace, (D) surrounding areas, and, (E) the roof.

FIGURE 1. PLAN VIEW OF STRUCTURE 3.



Observations on construction technology and the preservative and destructive effects of the volcanic explosion are included in the descriptions.

A. Substructure

The building substructure, an elevated rectangular platform, is in virtually perfect condition. All excavated substructure surfaces, including the west, north and east sides and the top surface forming the superstructure room floors, are faced with smoothed clay. Although rectangular in appearance, it is not equidimensional. The longer east and west sides both measure 8.20 m, but the shorter sides vary in length. The northern side is 5.20 m long and the southern side is 5.55 m long. The substructure orientation is on an azimuth of approximately 210 degrees. Henceforth, for simplicity, the terms north, east, south, and west will be used to denote the northeast, southeast, southwest, and northwest sides of the structure respectively.

The height of the substructure is variable. On the west side, substructure height is from 1.30-1.35 m. On the north side, it is from 1.17-1.23 m high. On the east side, it is within a few centimeters of 1.0 m high. The substructure surface is not horizontal but dips from north to south. The slope of the substructure surface is ca 4%.

The methods used to construct the substructure are unknown due to lack of structural testing. The top surface of the platform (the floor of the superstructure Room B) exhibits some fracturing and indications of hollow areas under the clay surface. This may be an indication of differential settling of the substructure fill; it is also suggestive of a chamber within the substructure such as a tomb. Such a feature could be anticipated based on Mesoamerican burial patterns in general and the 1978 discovery of a burial in a platform near Str 1 in Ceren.

B. Superstructure

The superstructure is a two-room building. Room A is entered through a main doorway centered in the east wall. Room B is reached from Room A through a doorway centered in a wall separating the two rooms. The rooms exhibit a variety of architectural features including benches, curtain-holders, and niches.

1. Walls

The two rooms of the superstructure are defined by five walls. Walls 1, 2, and 3 are oriented N-S and are approximately parallel. Wall 1 is the back (west) wall, Wall 2 the interior dividing wall, and Wall 3 the front (east) wall. Walls 4 and 5 form the south and north end walls respectively. With the exception of the top of Wall 5, which was destroyed during early backhoe excavation, these walls are preserved to their full original height. All of them rest directly on the substructure surface. The exterior walls (Walls 1, 3, 4 and 5) are inset 15-16 cm from the outer edge of the substructure, leaving a narrow ledge surrounding the entire building.

Wall heights and thicknesses are presented in Table 1. Walls 3 (east front), 4 (south end) and 5 (north end) walls, are the thickest, with minimum thicknesses of 50-55 cm. Wall 1 (west back) approaches these with a thickness of approximately 43 cm. The thinnest wall is Wall 2, the interior dividing wall, with a thickness of 38 cm.

Wall heights are also variable, although this may in part be due to the fragility of the top wall surfaces. In many cases, the fine tephra layer capping the walls was often more consolidated than the clay walls. Removing the ash was often impossible without destroying the top wall surfaces.

Wall 3, the east (front) is the highest and measures between 2.04 and 2.10 m high. The top surface of this wall has two levels: the outer 32-34 cm are approximately 8 cm higher than the inner 12-14 cm. The top of this wall has, in effect, a ledge as long as the wall itself.

The back west wall (Wall 1) is 1.96 m high. This matches the height of the lower interior ledge of the opposite Wall 3. No elevation differences were apparent on the top surface of this wall.

The south end wall (Wall 4) was measured only inside the structure; its top surface has not been exposed. Along this edge, it apparently varies in height between 1.82 and 1.90 m, with the lower part in the middle where the interior dividing Wall 2 abuts it, and the higher parts adjacent to the higher east and west (front and back) walls. In future excavations, when the top surface is cleared, it may prove to have an even height along its entire length. Interestingly, it seems to be slightly shorter than the front and back walls.

The height of the north end wall (Wall 5) is unknown due to the damage to its upper part. It presumably mirrored the south end wall (Wall 4) described above.

Table 1. Str 3 wall thicknesses and heights, measured in several locations.

	Thickness	Height
Wall 1	45 cm	1.96 m
	42 cm	1.96 m
Wall 2	38 cm	1.82 m
	38 cm	1.83 m
Wall 3	54 cm	2.10 m
	48 cm	2.04 m
Wall4	ca 55 cm	1.82 m
		1.90 m
Wall5	50 cm	?
	50cm	

All of the Str 3 superstructure walls are faced with a smoothed layer of clay. This layer varies in thickness, as is visible in areas where it has peeled or flaked away from the underlaying surface. Its thickness varies from less than 0.5 cm to approximately 3.0 cm. The underlying surface is usually as smooth as the exterior surface, suggesting possible re-facing after the original construction of the walls. This refacing may account for much of the variability in wall thicknesses. For example, the exterior and probably the interior of Wall 3 (the east front wall) was clearly refaced; it is also the thickest of the superstructure walls. Remodelling of the superstructure will be discussed in more detail below.

a. *Cornices*

Projecting cornices were present around the tops of all of the exterior walls (Walls 1, 3, 4, and 5). These probably were strictly ornamental and did not serve any structural purpose. They projected 8.0 cm from the lower face of the walls and were 30 - 32 cm high. The condition in which the cornices are preserved is variable.

On Wall 3 (east front), excavations revealed that most of the cornice was still in place. It was very fragile and tended to fall off when the surrounding tephra was removed. Fractures were located primarily where the cornice had been attached to the already existing wall. Attempts to consolidate the cornice with Primal E-3-30 consolidant were only partially successful.

Parts of the Wall 3 cornice with faced surfaces (especially over the main doorway) were recovered within a few centimeters above the substructure and terrace surfaces. These were presumbaly knocked off by the force of the initial

FIGURE 2.

STR. 3, NORTH SIDE ELEVATION (Wall 5)

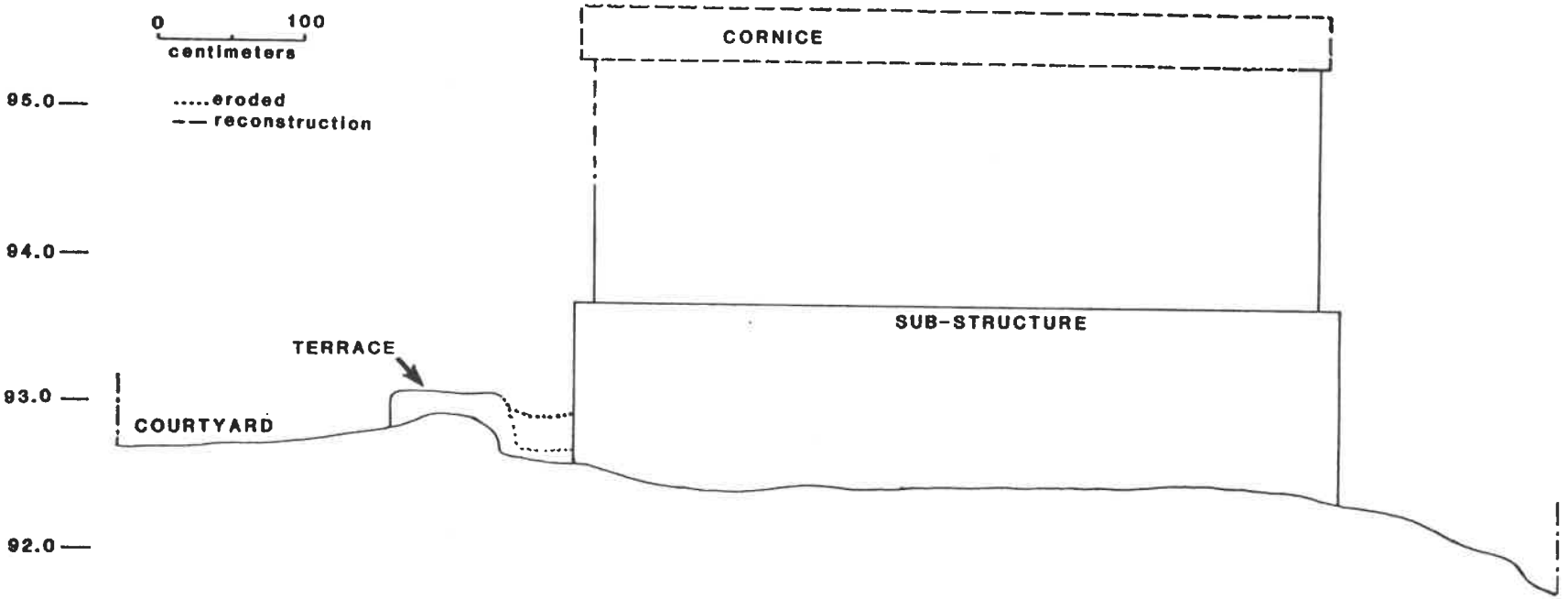


FIGURE 3a.

STR. 3, WEST SIDE ELEVATION
(Wall 3 and Terrace)

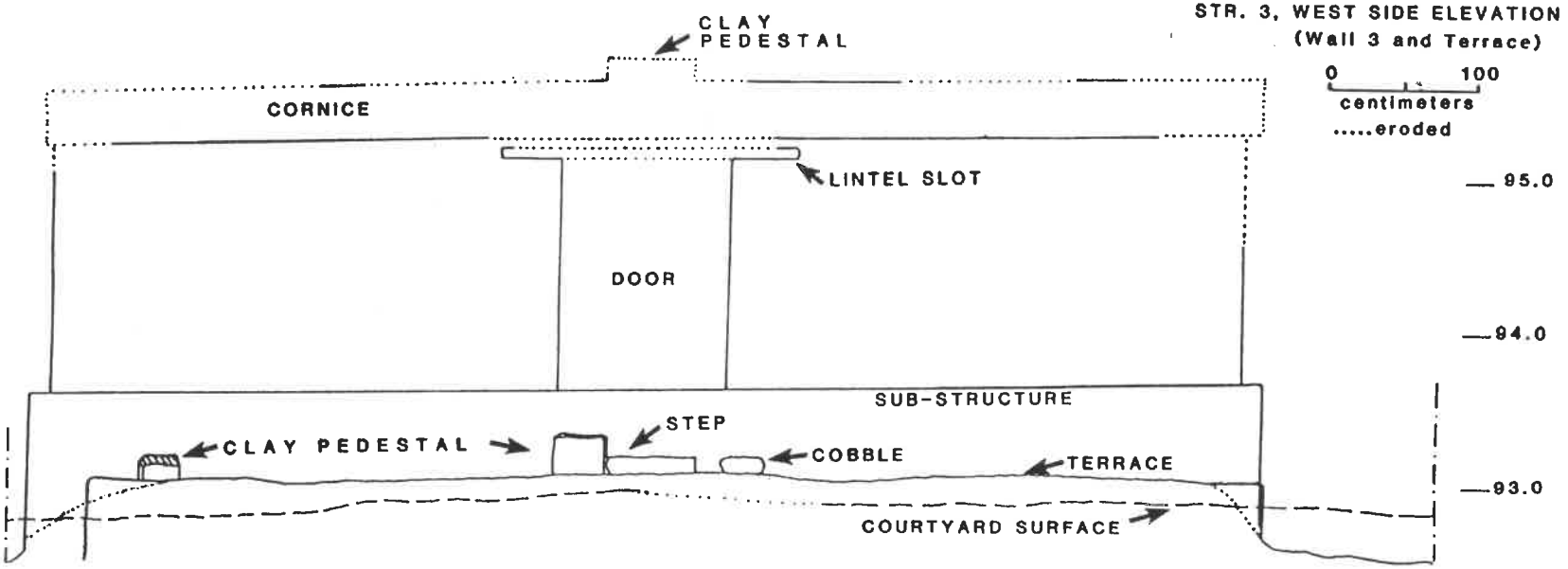
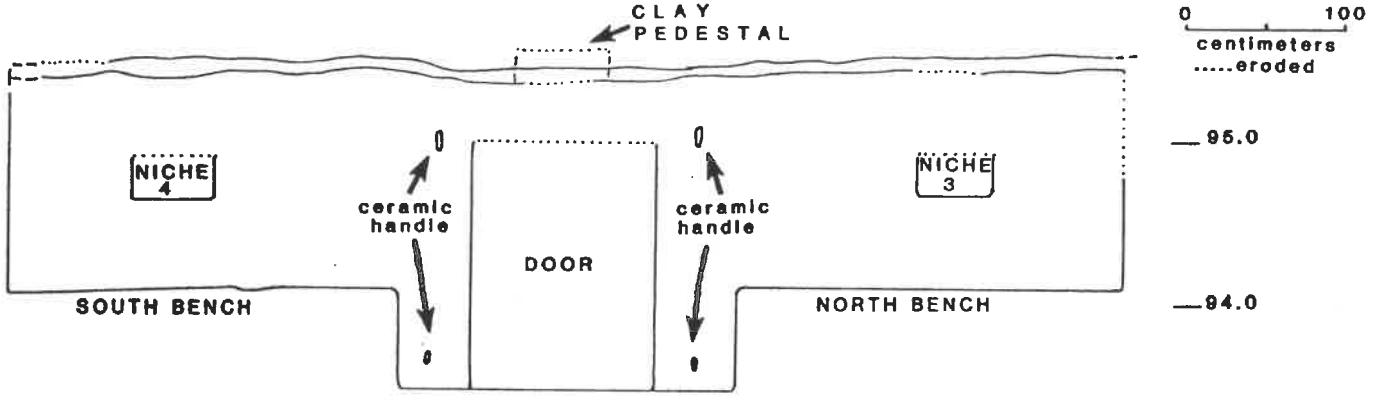


FIGURE 3b.

STR. 3, ROOM A, WALL 3 ELEVATION



volcanic base surge after the airfall tephra had left a thin layer of ash on the substructure.

On Wall 4 (west back), the cornice was preserved along the entire length of the wall. It was severely eroded, with only a stump remaining. Unlike Wall 3, no spalled pieces were held in place by surrounding ash deposits. Large pieces with faced surfaces were found on the clay-paved ground below, overlying a thin layer of airfall tephra. The bulk of the breakage and erosion presumably happened during the course of the volcanic eruption.

The cornices on Walls 4 and 5 (south and north end walls respectively) were visible only in profile. The south Wall 4 cornice was apparent at both the southwest and southeast corners of the superstructure. Its condition is unknown. The north Wall 5 cornice was evident only at the northwest corner of the superstructure, when the north end of Wall 1 was first exposed by the backhoe. Only a small (ca 10 cm long) segment of the cornice was present; it projected ca 8 cm from the lower north wall face and was severely eroded. No fallen pieces of the northern Wall 5 cornice were found on or above the clay-paved surface at the base of the structure, although several lumps of clay without preserved surfaces were present.

The variable condition of the exterior cornice of Str 3 can be explained in part by the source of destruction. The base surges of the volcanic eruption would have encountered the northwest structure corner first, with the full force of the surge striking the north and west walls of the superstructure. By contrast, the east and south sides of the building would have been relatively protected. This may account for the relatively highly eroded cornice of the west wall compared to the east wall, where the faced surfaces and corners of the extant portions are smooth.

The differential pattern of breakage, however, is probably due to differences in construction technique. The east Wall 3 spalling pattern can be attributed to the fact that the cornice was a later addition onto an already established wall (part of a remodelling effort). The west Wall 1 cornice is apparently an integral part of the wall construction, so there is no natural plane of fracture extant.

The interior dividing wall (Wall 2) also had a cornice running along its top edge. This cornice appeared only on its east face. Like the exterior cornices, it projected 8.0 cm from the lower wall face. However, it was only 24.0 cm high, compared with 33 - 32 cm for the exterior cornices.

The narrowness of the interior Wall 2 cornice was probably a function of the available space. There is less space available between the top of the doorway and the top of the Wall 2 because the wall itself is lower than the exterior walls of the superstructure. Presumably the height of the doorway was subject to more rigid specifications than the height of the cornice.

The interior Wall 2 cornice is similar to the exterior east Wall 3 cornice in its current condition. Most of the cornice was still in place upon excavation. The surfaces were smooth and corners were sharp; they showed little evidence of erosion. However, the cornice was spalling off of the wall in the same manner as on Wall 3: a vertical fracture plane existed between the cornice and the original wall, so that the cornice was being held in place only by the surrounding ash deposits. This suggests that the Wall 2 cornice was subject to the same remodelling effort as Wall 3.

The cornices run the full length of the walls. Two of these walls (Wall 3 east, and Wall 2 interior) also had doorways. The cornices continue uninterrupted above these doorways as part of continuous clay lintels.

b. Doorways and Lintels

The main entrance to the superstructure is on the east side, through a doorway centered in Wall 3. This doorway is 1.50 - 1.52 m high and 1.08 - 1.10 m wide. The edges of the door jambs are formed by smoothed clay surfaces with slightly rounded edges (doorways were not cleared of volcanic deposits for fear of lintel collapse).

The top edge of the doorway is marked by a lintel connecting the southern and northern half of Wall 3. The lintel has two components: a wooden lintel supporting the clay lintel with the cornice. Although the wood of the lower lintel is no longer preserved, the space that it occupied is still evident (it is currently filled with coarse scoria). Apparently it was always visible from the exterior of the structure.

From the south door jamb, the wooden lintel extended 42 cm south and was 6 cm thick. To the north of the north jamb, it extended 45 cm north and was 6 - 8 cm thick. Apparently the wooden lintel was formed by a "board" about 7 cm thick and 1.97 m long. The width of the "board" (how deep it extended into the wall) is unknown, as the space could not be cleared without endangering the clay lintel above it. It was not visible on the interior (west) face of the wall.

The wooden lintel supported a clay lintel which, on the exterior of the wall, appears as an uninterrupted cornice along the entire wall. The lower edge of the cornice is approximately 5 - 6 cm above the top of the wooden lintel. In this intervening space, the plane of the lower wall continues across the top of the doorway. This provides further evidence that the cornice was a later addition to the wall.

The second doorway in Str 3 is in Wall 2 and leads from the first room to the second. As with the main entrance, it is centered in the wall and thus is in a direct line with it. Its height is also comparable to the main doorway: ca 1.5 m. The top edge of the Wall 2 doorway, however, is less well preserved and its exact position cannot be determined. Whereas the main doorway is over 1 m wide, the interior doorway is only 78 cm wide. The north and south door jambs are finished with smooth, slightly rounded edges.

There is no direct evidence for a wooden lintel above the interior Wall 2 doorway comparable to that found for the main doorway. Unfortunately, the area in which it would be located consists primarily of decomposed adobe which cannot be excavated for fear of lintel collapse.

However, there is evidence from the intact and fallen cornice pieces from the east side of the wall of a wood bar embedded in the cornice itself and perhaps forming a wooden lintel. Within one of the fallen pieces were the carbonized remains of a wooden bar running horizontal to the exterior and lower cornice surfaces. This bar is approximately 5-6 cm thick and at least 6 cm wide. Unfortunately, the cornice remaining in place on the wall is so fragmented or decomposed that it is impossible to determine the length or width of the bar. If it was wider than the 8 cm projection of the cornice itself, then it probably functioned as a lintel.

Currently, the lintels of both the interior Wall 2 dorrway and Wall 3 main doorway are supported by ash deposits within the doorframes. In both cases, the lintels are riddled with visible fractures and attempts to consolidate them have thus far (August 1989) been unsuccessful.

c. Construction Techniques

Examination of the damaged sections suggests the type of construction and material that were used to construct the walls. The walls appear to be virtually solid clay. The clay is red in color (although partial or full firing by the heat of the volcanic explosion has deepened it in some areas to a darker brick-red). Inclusions in the clay consist of cut grass and coarse "temper" of sand and small

FIGURE 4a.
STR. 3, ROOM B, WALL 2 ELEVATION

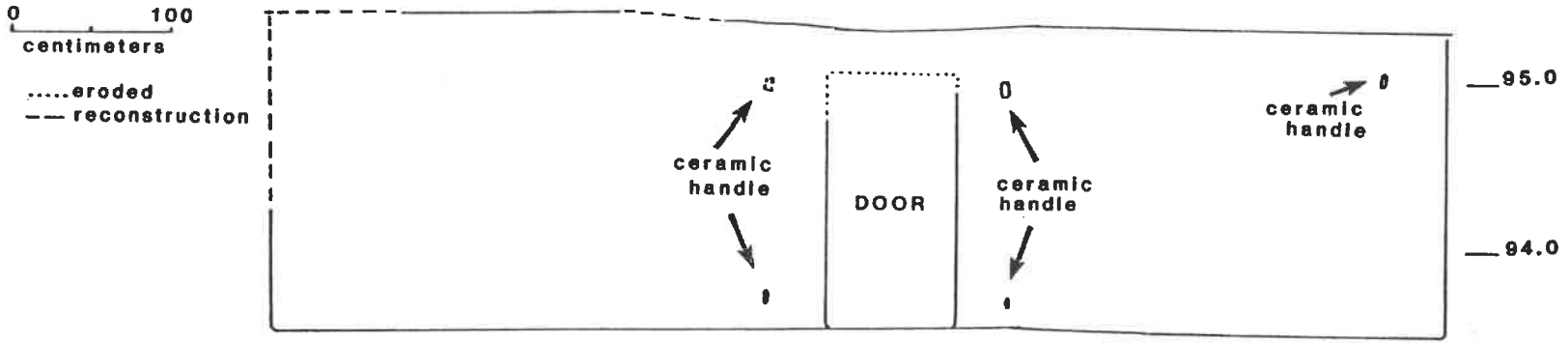


FIGURE 4b.
STR. 3, ROOM B, WALL 1 ELEVATION

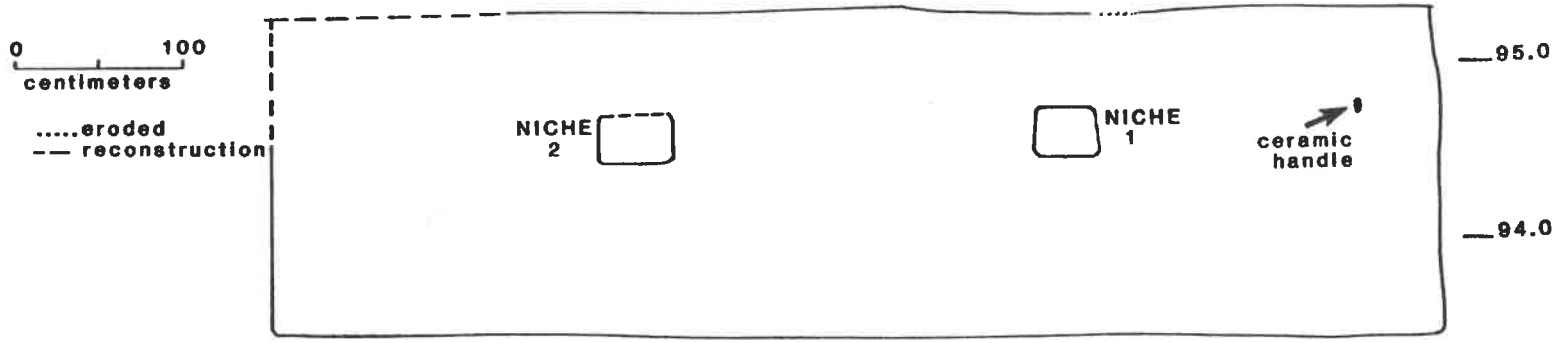


FIGURE 5a.

STR. 3, NORTH SIDE SECTIONS (Wall 5)

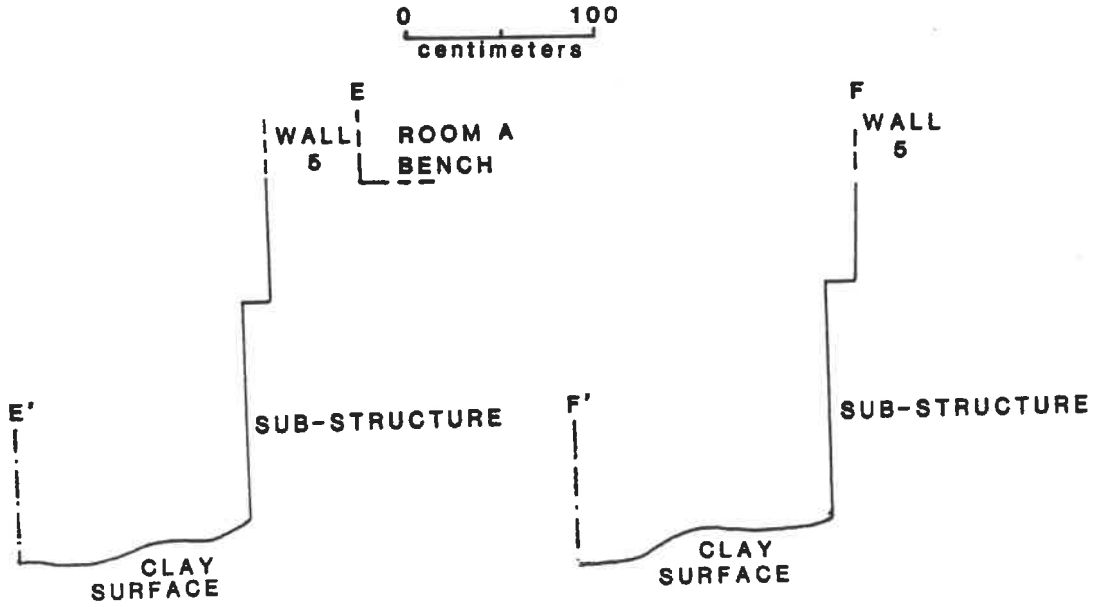
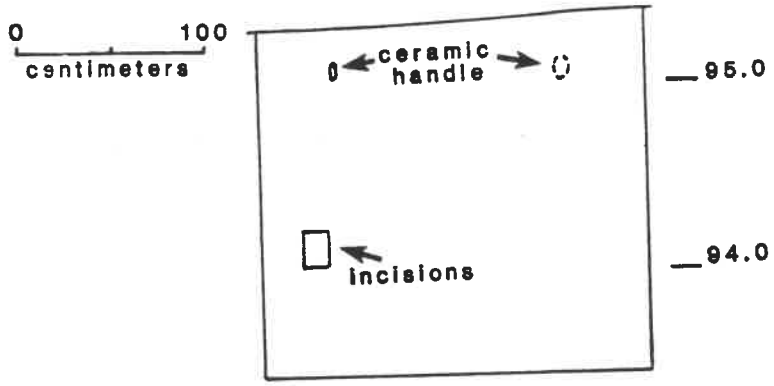


FIGURE 5b.

STR. 3, ROOM B, WALL 4 ELEVATION



gravel. The grass is clearly an additive and provided the bonding strength necessary to prevent cracking as the clay dried. The sand and gravel may be natural inclusions. There is no evidence that adobe bricks (either sun-dried or fired) were used to construct the walls, although the clay was probably mixed according to a similar recipe as adobe bricks.

Examination of the broken Wall 5 did not reveal an internal pole framework in the core of the wall, and only one possible pole cavity was observed in the broken top of Wall 1 at the damaged north end. This suggests that a pole framework was not an integral part of the original wall construction. The original walls were probably of rammed earth (puddled adobe) construction. Very likely, molds were made matching the plane of the vertical wall surfaces, and the clay mixture was pounded down between the molds. There is no evidence to indicate how these molds were prepared. The small areas of original vertical wall surface that are exposed seem to be fairly flat; possibly adzed planks were used.

Use of a pole framework for wall remodelling is indicated by occasional areas where the elongated hollow cavities are exposed. These are the spaces left by poles after they have rotted. They are round in section, range from ca 3-6 cm in diameter, and are either vertical or horizontal in orientation. Several were over 50 cm in length, as determined by inserting a tape measure as far as possible until some blockage was encountered. Most of the exposed pole cavities are in the surface layer of clay covering the wall faces, and are most commonly exposed in corners where two walls abut. Such a framework may have been used to ensure that added layers of clay remained in place even if they did not adhere well to the original wall surface.

2. Rooms

As described above, the five walls of the Str 3 superstructure define two rooms. The east room (Room A) is accessible through the main doorway from the east side of the structure. The second room (Room B) is accessible only from Room A, through the narrower doorway in Wall 2. Both rooms are long and narrow, with the long axis running north-south. The doorways are centered on the long axis of the rooms. The floors of both rooms are formed by the surface of the substructure. However, they are not the same in size or other characteristics.

Room A is 6.94 m long (north-south) and 1.76 m wide (east-west). Its interior space forms a perfect rectangle with an area of 12.22 sq meters. Room B is 6.98 m long (north-south) but varies in its east-west dimension. At the south end of the room, it is 2.18 m wide; at the north end, it is 1.96 m wide. Thus, the back room is trapezoidal rather than rectangular in shape, and has an area of 14.27 sq meters. This is undoubtedly due to the slightly irregular shape of the supporting substructure.

The two rooms share some characteristics but are distinctive in others. They are similar in that both rooms have ceramic vessel handles embedded in the walls, and each has two niches. However, the distribution and size of these features are not identical in the two rooms. Additionally, Room A has two large benches which are lacking in Room B.

a. Ceramic Handles

In both rooms, ceramic loop handles from large jars or basins have been embedded into the walls in several locations. They are consistently placed in a vertical position. Presumably they were recycled from vessels that broke during regular use.

In both Rooms A and B, four handles were placed around the respective doorways on the west face of the wall in which the doorway is located. In Room A, they are on the west face of Wall 3; in Room B, they are on the west face of Wall 2.

In Room A, the two largest handles are near the top of the doorway approximately in line with the lower lintel edge. The northern handle is ca 25 cm north of the north door jamb and its lower edge is aligned approximately to match the line of the lower lintel border (ca 1.49 m above the floor). The south handle is about 22 cm south of the south door jamb and is slightly lower than the north handle (ca 1.44 cm above the floor). The handles are about 12 cm long from top to bottom, and about 4 cm wide.

The two lower handles around the main doorway in Room A are much smaller than the upper ones. The north lower handle is about 7 cm long; the south lower handle is about 9 cm long. They are both 2-3 cm wide. They are slightly farther from the door jambs than the upper handles: the north lower handle is 24 cm from the north jamb and the south lower handle is 27 cm from the south jamb. Their lower edges are 10-11 cm above the room floor.

A similar pattern of handle placement occurs in Room B: two larger handles were embedded in the adobe on either side of the doorway near the line of the lintel, and two smaller handles were placed on either side of the doorway near the floor. Of the upper handles, only the south one was still in situ. It is ca 10 cm long and 5 cm wide. Its lower edge is 1.36 m above the room floor, and it is located 28 cm south of the south door jamb. The upper north handle had fallen out of the wall and was recovered in the tephra deposits filling the room (the wall itself is very decomposed in the presumed area of its emplacement).

The north lower handle is 10 cm long but only about 3 cm wide. Its lower edge is ca 13 cm above the room floor, and it is about 38 cm north of the north door jamb. The south lower handle is ca 7 cm long and 3 cm wide. Its lower edge is ca 10 cm above the floor, and it is ca 29 cm south of the south door jamb.

The ceramic handles embedded in the walls surrounding both the main and interior doorways were presumably used as curtain holders. The larger upper handles may have supported a rigid rod or been used to knot cord. A curtain of some perishable material (possibly a woven petate or bark or cotton cloth) probably hung from the rod or rope. The lower handles could have been used to secure the curtain from the inside to prevent entry when privacy was desired. Interestingly, it was impossible to secure the curtain from the outside using these handles; none were embedded in the exterior wall near the main doorway.

In Room A, only the four handles near the doorway were present. In Room B, however, handles were embedded in other parts of the room as well. A small handle (9 cm long, 2 cm wide) was placed in Wall 2 near the SE room corner. It is located ca 1.62 cm above the floor and 39 cm north of the south room wall (Wall 4). Two others were located on the south room wall (Wall 4). A small handle (ca 7 cm long and 4 cm wide) was near the SE room corner (ca 1.58 cm above the floor and 40 cm west of Wall 2). A much larger handle (ca 14 cm long and 4-6 cm wide) was near the SW room corner (ca 1.54 above the room floor and 45 cm east of Wall 1). These are at approximately the same height above the floor, and are separated by ca 1.2 m.

The west (back) wall of the room (Wall 1) also had at least one handle embedded in it toward the SW corner of the room. It is a small handle (ca 7 cm long and 2 cm wide) and is located ca 1.25 m above the floor and 45 cm north of the south room wall (Wall 4). There is no corresponding handle at the north end of Wall 1.

Unfortunately, the north end wall (Wall 5) is missing at the level of the handles found in Walls 4 and 1, so it is impossible to determine if these features were present on the north wall.

The use of the handles embedded in walls far from doorways is more difficult to infer than for the curtain holders. They are all located at the south end of Room B. It seems less likely that they were curtain holders because the

area which would be enclosed by a curtain between any two of them is very small. It is possible that they were simply used to hang items for storage: e.g., baskets, bags, clothing, etc. No trace of such items was found in the room, suggesting that whatever was suspended was highly perishable.

Several observations indicate that the embedded handles were part of the original wall construction. The first observation concerns the large handles located near the tops of the doorways in both Rooms A and B. These handles project from the surface of the original wall faces, and were intentionally left exposed when the walls were re-surfaced with an additional layer of clay. The rough edges of the added layer forms an irregular boundary to the depression left around the handles; these depressions and the loops of the handles were filled with the fine airfall tephra of the initial volcanic explosion. The large handle in the SE corner of Room B (on the south Wall 4) probably was left exposed in a similar fashion (although the one looting incident resulted in the removal of this handle from the wall before detailed observations could be made).

The second observation involves the smaller handles located near the bottom of the both doorways and in the south end of Room B. These handles were eventually covered by the resurfacing of the walls. Although the added layer of clay has spalled in the area of the handles, it tends to be somewhat thicker near the handles and, in some cases, curves up onto and over the surface of the handles. None of the smaller handles have volcanic ash in the loops.

These observations suggest that, during the final occupation of the structure, only the upper curtain holders of both doorways and possibly a single handle in the SW corner of Room B were still in use.

b. Niches

Wall niches are present in both rooms of Str 3. In Room A, two niches are located on the interior face of the east wall (Wall 1), one on either side of the main doorway. In Room B, two niches are present in the back wall (Wall 1).

The Room A niches are symmetrical with respect to the east-west room axis. The north wall of the north niche (Niche 3) is located 79 cm south of the NE room corner; the south wall of the south niche (Niche 4) is located the same distance north of the SE room corner. The niche walls nearest the doorway are located 1.58-1.60 m from the nearest respective door jamb. The niche floors are 1.15-1.17 m above the level of the room floor by the doorway.

The Room A niches vary only slightly in their dimensions. The north Niche 3 is 48-49 cm wide, 27-28 cm high, and 31 cm deep. The south Niche 4 is ca 52 cm wide, between 27 and 32 cm high, and 32 cm deep. In both niches, all of the preserved interior surfaces are smoothed and corners are slightly rounded.

The two niches in Room B (Niche 1 to the south, Niche 2 to the north) are also symmetrically located with respect to the east-west room axis. The south wall of the south niche and north wall of the north niche are located 1.90-1.92 m from the south and north end walls of the room, respectively (Walls 5 and 4). The base of the south niche is 1.04 m above the room floor; the north niche is 98 cm above the floor. The distance between the two niches is 2.11 m.

The north niche (Niche 2) is 45 cm wide, 29 cm high, and 30 cm deep. The south niche (Niche 1) has similar height (28 cm) and depth (ca 30 cm) dimensions, but is slightly narrower (40 cm at the base). It is also slightly trapezoidal in shape, with the top edge only 36 cm wide. As in Room A, the niche surfaces are smoothed and the edges and corners slightly rounded.

The only niche to survive the volcanic explosion intact is the south niche in Room B (Niche 1). In all of the others, the roofs have fractured and caved down into the niche itself. In all of these, the roof pieces were found with their smoothed surfaces facing down, resting on a thin layer of airfall tephra on the floors of the niches. The height of the niches is measurable because the side and

back walls were preserved in some places as high as the beginning of the curved upper interior corners of the niches.

The collapse of the niche roofs provides an opportunity to understand some aspects of niche construction technique. In the north niche of Room A (Niche 3), horizontal hollow shaft cavities are apparent along the north and south upper edges of the niche, above the line of the niche roof. These mark the location of four horizontal bars, each about 3-4 cm in diameter, which form a lintel across the top of the niche. Apparently clay was pressed into the bars from below to form the roof the niche. Traces of similar lintel bars were found in Niches 4 (south niche, Room A) and 2 (north niche, Room B), although they were not so well preserved.

c. Benches

Room A also contains two benches, one in the north end and one in the south end of the room. These benches are surfaced with clay and together occupy ca 69% of the total room area (8.43 of 12.22 m sq).

The two benches are virtually identical in area and height. Both occupy the full east-west width of the room and are therefore 1.76 m wide. The north bench is 2.38 m long north-south and 63 cm high. Its area is 4.19 sq m. The south bench is 2.41 m long north-south and is 62 cm high. Its total area is 4.24 sq m.

The condition of the benches is very good. The north bench is virtually undamaged. The north edge of the south bench suffered some breakage as the result of a volcanic bomb that landed on it and became embedded in it.

The construction of the benches is poorly understood because of the minimal damage by the volcanic explosion and because no trench was excavated into them. The smooth clay surfacing of the benches abuts the adjacent walls in a smooth upward curve, but it is likely that the benches were constructed after the walls were already in place.

D. Terrace

Abutting the east side of the Str 3 substructure, in front of and below the main entrance to the superstructure, is a long terrace.

The terrace is 7.88 m long north-south, almost as long as the substructure. However, its south and north ends are not perfectly aligned with the south and north sides of the substructure. The south end of the terrace is ca 30 cm north of the SE substructure corner. The north end of the terrace is a similar distance north of the NE corner of the substructure.

Terrace width is variable. At the south end, it is 1.02 m wide; at the north end, it is 1.22 m wide. Average terrace height is ca 18 cm, but this varies depending on the level of the surrounding clay-paved plaza surface. Maximum height along the east edge of the terrace is ca 24 cm, near the south end of the terrace.

The terrace has several areas of severe erosion that predate the volcanic explosion. These occur along the east side of the terrace, and at the north and south ends adjacent to the substructure.

Along the east side of the terrace, the upper edge is worn down and clay lumps have accumulated on and been pressed into the clay-paved surface immediately below, producing a somewhat irregular ramp-like effect. The erosion is concentrated in an area ca 1.2 m wide (north-south) located not directly in front of the doorway, but slightly north, in front of the north door jamb. This appears to be wear from foot traffic in and out of Str 3, heading at a northerly angle to and from Str 3.

At the north and south ends of the terrace, a space about 40 cm wide adjacent to the substructure is worn down to a steep slope from the terrace surface to the clay-paved surface below. At the north end, the eroded slope is about 30 cm long, from the north terrace edge to the south. The lower clay-

FIGURE 6a.

STR. 3, NORTH SECTION C-D'

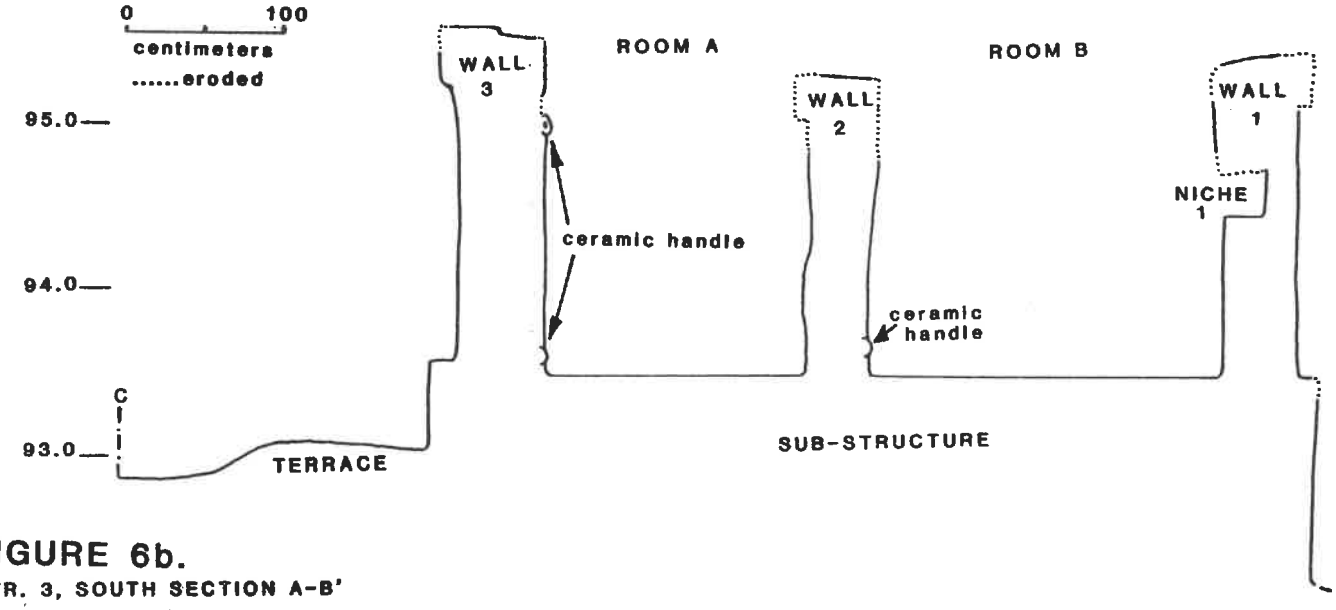
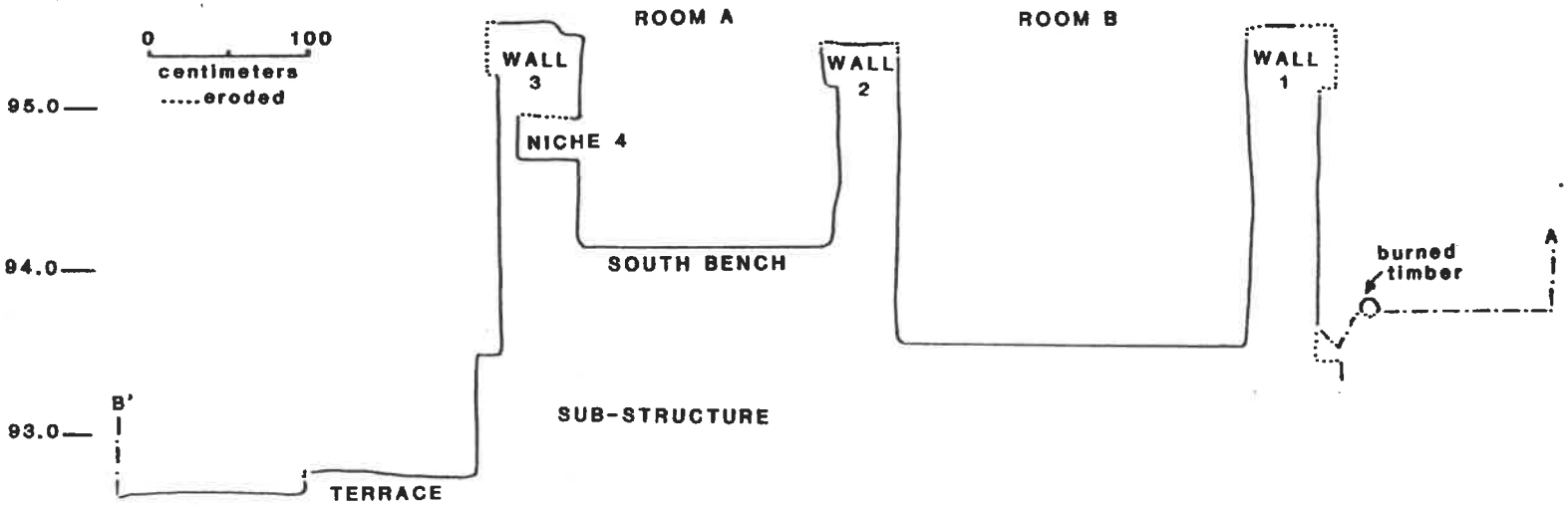


FIGURE 6b.

STR. 3, SOUTH SECTION A-B'



paved surface at the northeast corner of Str 3 is at least 35 cm below the level of the terrace surface, and the erosional surface is quite steep (ca 86% slope).

At the south end of the terrace, the eroded strip on the terrace is about 60 cm long, and accumulated lumps of clay to the south of the terrace extend its surface at least another 40 cm (to the limits of the excavation). The slope of the erosional surface on the terrace is fairly shallow (ca 23%), and somewhat steeper to the south in the area of accumulation (ca 63%). The 40 cm -wide strip adjacent to the substructure is the most heavily worn, but some erosion is evident for the next 40 cm east along the south terrace edge as well. The lower clay-paved surface at the southeast corner of the substructure has not been exposed, so its elevation relative to the terrace surface is unknown.

These erosional surfaces at both ends of the terrace by the substructure may also be areas of heavy foot traffic. They exhibit the same kind of wear pattern as the area on the east edge of the terrace, and are located on the quickest route from the front to the sides and back of the structure.

Several features are present on the terrace surface, including an adobe block step in front of and below the main structure entrance, two clay pedestals on the south half of the terrace, and, on the north half of the terrace, a large cobble and two small stone slabs.

The adobe step on the terrace is located in front of and below the main doorway into Room A. The step is a single adobe block (cracked before the eruption) and is sub-rectangular. It is ca 67 cm long (north-south) and 35 cm wide (east-west), and ca 11 cm in height. The side and top surfaces are relatively smooth, and the corners are rounded. It is unclear if the block was fired prior to the eruption.

The step is not an integral part of the terrace construction, but is a separate block placed on the terrace surface. Its west edge is about 10 cm from the substructure wall. Although it is located in front of and below the Str 3 main doorway, it is offset ca 10 cm to the north of the doorway centerline. In conjunction with the location of the erosion along the east of the terrace, this also suggests the direction of most of the traffic in and out of the structure.

The two clay pedestals were located on the south half of the terrace. A large stone cobble and two small stone slabs were located on the north half of the terrace. These are described in more detail below, in the section pertaining to the roof of Str 3.

The terrace was apparently added to the east side of Str 3 after the latter (at least the substructure) was completed. This is evident from the fact that, at both the north and south ends of the terrace where erosion occurred, the east wall of the substructure continues behind the terrace. Further support for the notion derives from more general observations concerning the quality of construction.

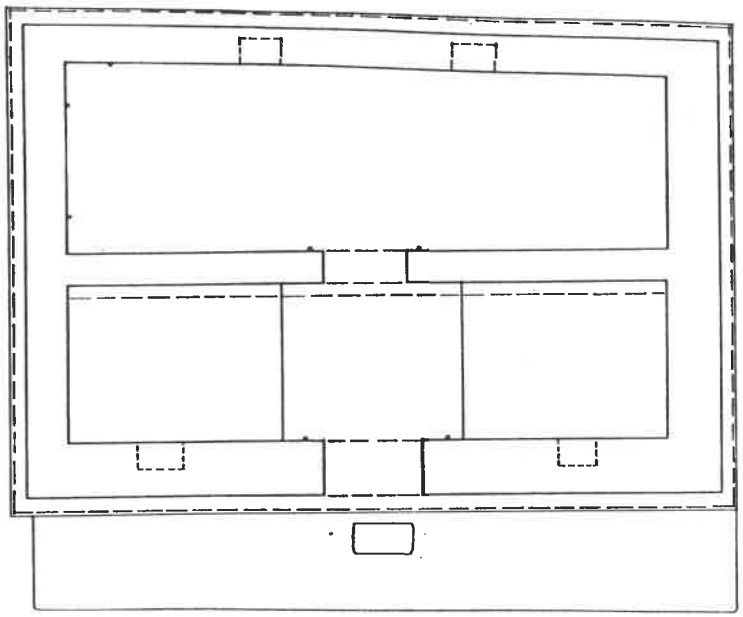
The terrace was built with less attention to symmetry and quality of adobe construction than the substructure and superstructure. For example, the superstructure walls were placed on the substructure with a great deal of care, creating a ledge which is consistently 15-16 cm wide around the entire building. The terrace, on the other hand, is offset at both north and south ends from the substructure, and its width is variable from one end to the other as well. The orientations of the pedestals and adobe step on the terrace are also at variance with both structure and terrace orientations (see Roof Fixtures below).

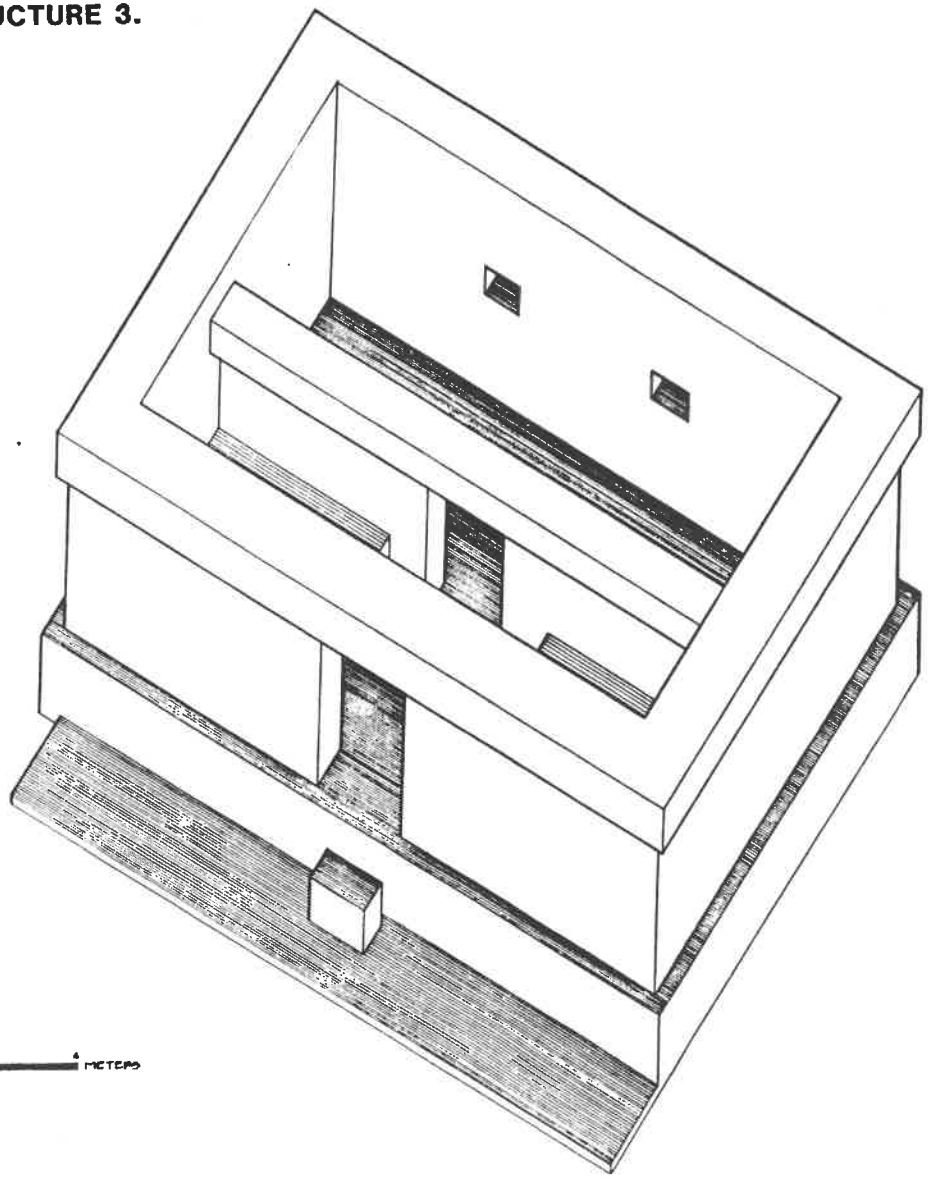
E. Surrounding Areas

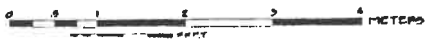
The base of the 1989 excavations exposed clay-paved surfaces surrounding Str 3 on the west, north and east sides. These were cleared in strips between 1.0 and 1.5 m wide along each side; future excavations will expose greater expanses of this surface.

FIGURE 8. PLAN AND ISOMETRIC PERSPECTIVE OF STRUCTURE 3.

DRAWING BY KAREN KIEVIT







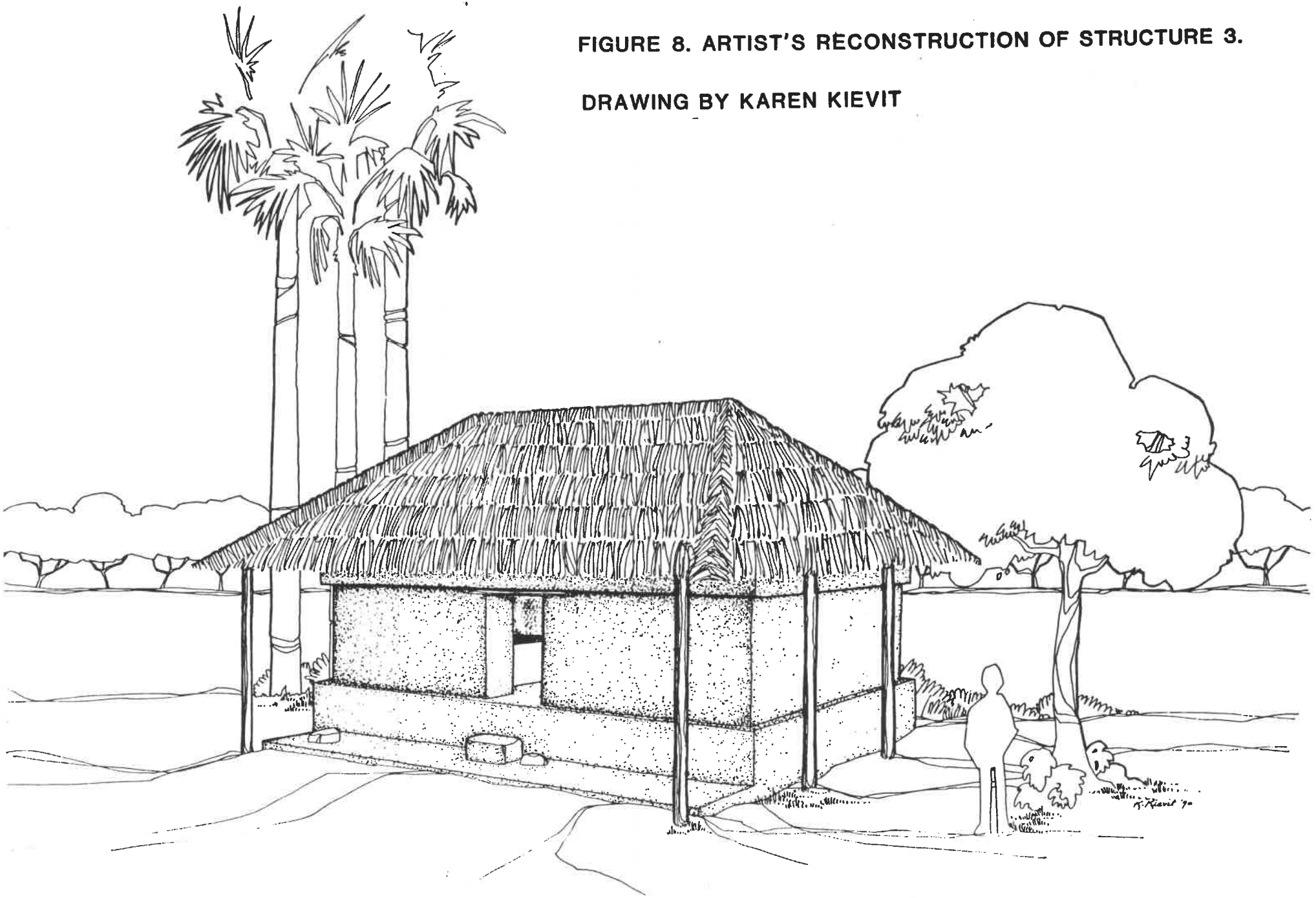


FIGURE 8. ARTIST'S RECONSTRUCTION OF STRUCTURE 3.

DRAWING BY KAREN KIEVIT

To the west and north of the substructure, the surface slopes down steeply away from the building. On the west side, the slope within 1 m of the building averages ca 32% (from east to west). On the north side, average slope is ca 10% from south to north. On the east side of the building, the clay-paved surface is close to horizontal (a slope of ca 2% from west to east in the 1 m-wide strip to the east of the terrace). The eastern relatively horizontal surface is not contiguous with the northern and western surfaces, but is separated by a step running north-south about 30-35 cm high located ca 40 cm east of the substructure east wall.

That the clay surface around Structure 3 is an artificial paving is indicated by the mixing of cut grass into the clay. It is possible that the clay paving surrounding the structure on the north and west sides conforms closely to the contours of the original ground surface below. If so, than probably the ground on which the substructure was built was not level. The substructure may have been erected (at least in part) to compensate for the slope. However, it also seems likely that a cut was made into the original ground surface on the west and north sides of the substructure to provide further elevation and/or drainage. As described by Wauchope (1938), both techniques are common throughout the Maya area.

Some support for the latter is suggested by the uneven slopes on the west and north sides of the building. On the north, a strip ca 50-75 cm wide alongside the building is relatively flat; the steepest slope occurs away from the building. Similarly, along the west side, the slope begins about 30 cm away from the building, with a much steeper slope ca 1.10 m from the building. The steepest segments of these slopes are close to 100%.

The horizontal clay surface to the east of Str 3 is more likely to have been created by a filling operation, rather than cutting. This is suggested by the observation that it is at least 35 cm higher than the surfaces to its west and by the fact that the clay layer is more than 30 cm thick. Indeed, the area on which Str 3 was built and the area to its east may have been artificially elevated by imported fill.

Some data suggest that the clay-paved surface does not necessarily reflect the topography of the original ground surface. The drill cores from the east side of the terrace indicate that the clay paving is over 30 cm thick. A post hole on the north side of the building is 40 cm deep and totally within the clay paving, suggesting that the clay paving is over 40 cm thick in this area. It may be that the Str 3 substructure was built on top of an artificially raised surface covering a much larger area than the structure itself (i.e., the entire plaza/courtyard area).

F. Roof

The roof of Str 3 had collapsed into and around the building as a result of the volcanic eruption. However, it is possible to make inferences regarding the materials of which it was made, and to a certain extent, the construction technology. Several categories of evidence are important: the remains of the roof itself (thatching), remains of the roof framework (wooden posts and poles), and the permanent fixtures associated with the roof supports (clay pedestals, stone cobbles and slabs, and postholes). These are described and then used to infer details of the Str 3 roof.

1. Roof Thatching

Remains of the thatched roof of Str 3 are preserved both inside and outside of the structure. The thatching occurs in both carbonized and uncarbonized form, and consists of a mixture of grass and palm thatch, with palm predominating. The location and orientation of the thatching material in and around the structure indicates the original standing orientation of the roof.

Inside the superstructure, a layer of thatching was found in both rooms. In Room A, the thatching was found on the north bench (it was thickest against the north Wall 5) and in the northern part of the central floor space, but none was present on the south bench. In Room B, it covered the entire floor of the structure, and was thickest in the east half of the room, along Wall 2 which divides Room A from Room B. In this area, the top of the layer was 10-20 cm higher than elsewhere in the room.

In both rooms, the layer of thatching invariably rested on top of volcanic ash, including both airfall ash and base surge material. There were also areas where the thatching was directly overlying lenses or chunks of Tierra Blanca from the earlier Ilopango eruption. This material was mixed with grass and had small air bubbles in it; it's use is unknown.

The thatching was mostly uncarbonized, although the top and lower surfaces of the layers sometimes were lightly charred. Above Room B, the thatching was almost entirely of palm. Above Room A, some of the thatching material included grass.

Outside of Str 3, a layer of thatching was exposed in all of the trenches around the east, north, and west sides of the structure. It was thickest around the northeast corner of the substructure (east end of north wall and north end of terrace). The only area where thatching material was absent was around the northwest corner of the structure; this is probably because the lateral force of the base surge eruption blew it away.

The outer limits of the thatching layer on the west and north sides was not discovered; it is beyond the limits of the excavation trenches on these sides and therefore is more than 1.5 m from the structure. On the east side, the edge of the fallen thatching was discovered approximately 50 cm east of the east terrace edge (ca 1.7 m from the substructure east wall).

Both inside and outside the structure, most of the thatching appeared to have an east-west or close to east-west orientation, although some patches were more than 45 degrees off of this. Only the thatching on the north exterior trench had an orientation consistently closer to north-south.

Parts of the thatching may have been held down with stone slabs. On the west side of the building, about midway between the NW and SW substructure corners and about 20-60 cm from the west substructure wall, a series of heat-fractured andesitic stone flakes were found directly overlying the thatch (FS 24). Some of these have been refitted to form the original stone slab. Its location suggests that it fell with the thatching but retained its relative position.

2. Roof Framework

The framework supporting the roof was made of wooden posts and poles ranging from less than 3 cm to 13 cm in diameter. Most of these are represented by hollow shaft cavities in the volcanic tephra, left after the wood itself disintegrated and disappeared. However, sometimes the wood was carbonized and thus preserved.

Not all cavities were recorded in terms of exact provenience. However, major pieces were so noted, and in areas where cavities were particularly numerous, notes were made on their general characteristics, location and orientations.

In Room A of the superstructure, numerous hollow shafts and some carbonized wood were observed. In the north end of the room, they were either above or within the layer of thatching. In the south end of the room, they were primarily in the volcanic ash overlying the south bench surface.

Many of the sticks in Room A were oriented in a north-south direction and were largely in a horizontal or close to horizontal position. Most were close to either Wall 3 (east room wall) or Wall 2 (west room wall). At the south end of the

room, there were also some pieces oriented in an east-west direction, and positioned close to the south room wall (Wall 4). Some vertical pieces were also observed in the northwest room corner, oriented either parallel to Wall 2 or diagonally between Walls 2 and 5. Most of these pieces had diameters between 3 and 7 cm, although a few had diameters up to 10 cm. The longest measured shaft cavity was 1.85 m long, but most were between ca 20 and 50 cm in length. Virtually all of the measured lengths are probably far short of the original length of the piece.

One larger carbonized log fragment was found in Room A. It was located on the south edge of the north bench, about 14 cm west of the east room wall (Wall 2). It was below the layer of fallen thatching and rested on the bench surface. Its diameter was 11 cm; only about 20 cm of its length was preserved.

In Room B, no particular pattern was observed in the distribution of sticks above the layer of thatch. There were several vertical sticks near and adjacent to the south room wall (Wall 5), including curved and straight pieces. The diameters of these ranged from just under 3 cm to 9 cm. In the SE corner of the room, a stick over 1.0 m long and with several curves in it was oriented vertically. It was in a cluster of horizontally oriented sticks in that corner of the room, with diameters ranging from 3 to 10 cm and with measured lengths between 10 and 30 cm. Near the west room wall (Wall 1), a 4 cm diameter stick was noted between the niches and oriented parallel to the wall.

Within and below the layer of thatching in Room B, the organization of fallen sticks was slightly more obvious. In the south end of the room, lying on the airfall tephra covering the room floor, were two carbonized poles, each with diameters of 8 to 10 cm. They were oriented diagonally, emanating from the two south room corners and meeting on the room centerline about 80 cm north of the south room wall (Wall 4).

Other medium and large diameter carbonized sticks were also exposed in the room. One horizontal piece with a diameter of ca 9 cm was located adjacent to the east room wall (Wall 2), about 85 cm north of the south room wall (Wall 4). An 8 cm diameter piece about 1.10 m long and also horizontal in orientation was exposed in the north half of the room, parallel to and about 23 cm from the east room wall. In the NW part of the room, a stick with a diameter of 13 cm was in a horizontal position but oriented diagonally across the corner of the room from SW to NE. Its preserved length is about 1.0 m.

Outside of the structure, some hollow shafts and carbonized pieces of wood were found on both the east and west sides of the structure.

No particular pattern was observed in the arrangement of sticks overlying the thatch on the east side of the structure. Less than half a dozen were observed; their diameters ranged from about 4 cm to 10. One of them was slightly curved.

Within the thatch layer on the east side of the structure, several sticks were exposed in an arrangement that probably matches their original relative positions. These were found just east of the south door jamb of the main entrance. Three small sticks (each with a diameter of 3 cm and about 10-15 cm long) were lying in a horizontal position, parallel to the substructure wall and each other. They were separated from each other by about 7 cm. The western-most of the three was 10 cm from the substructure wall. Just to the south of these sticks, a slightly larger stick was similarly placed (10 cm from and oriented parallel to the substructure wall, horizontal position, 4 cm diameter).

On the west side of the structure, various carbonized poles and hollow shafts were exposed. Some of these may still be relatively close to their original positions.

About 1.9 m north of the southwest substructure corner and adjacent to the substructure, a hollow shaft cavity with an orientation steeply down and northwards was located. Immediately south of it, in a horizontal position and parallel to the west structure wall (Wall 1), was a carbonized log with a diameter of 10 cm (FS 54).

These two features were undoubtedly part of the same vertical roof support post. The lower 1.4 m of the post was apparently buried by airfall and cooler base surge deposits. These may have tipped the post slightly to the south, leaving a diagonal cavity once the post had rotted away. The upper part (at least 1.9 m long and extending into unexcavated deposits along the south side of the structure), was carbonized by hotter ashfall which also broke it off at the top of the buried portion. The total length of this post was more that 3.3 m (future excavations should reveal how much longer).

A similar hollow shaft cavity was found in an analogous position to the northwest structure corner. At a height equivalent to the top of the south cavity, the cavity is located about 1.3 m south of the NW structure corner and 25 cm west of the substructure west wall. The cavity slopes down steeply to the south (in mirror image the the south pole, which slopes down steeply to the north). Excavations around the cavity indicated that the base of the pole was located approximately 2.10 m south the NW substructure corner, but was not inserted into a posthole in the clay-paved surface.

The carbonized remains of other poles were found around the northwest substructure corner. Approximately 3.0 m west of the NW substructure corner (on a line with the north substructure wall), a forked stick was found among the ash deposits. The longer fork was ca 70 cm long, the shorter fork was about 22 cm long, and the largest diameter (above and below the fork) was 10 cm. This piece may be part of the the Str 3 roof construction, but may also have been blown in from the northwest by the force of the volcanic explosion.

Other carbonized remains and cavities were located at various depths and distances from the structure, mostly running parallel to the west side of the building. These include one that extends from about the location of the north vertical post cavity described above (ca 30 cm west of the substructure) to a point about 1.1 m north of the NW substructure corner (diameter ca 10 cm at the south end, 4-6 cm at the north end). A second one is located ca 1.9 m west of the substructure, running parallel to the west side of the structure, and extending at least 1.5 m north of the line of the north substructure wall (diameter 6-7 cm). Various small branches were present on this piece, suggesting that it was not part of the roof framework, but was burned and blown in by the volcanic explosion.

There were relatively few remains of poles or posts on the north side of the structure. The major discovery was a single, 1.97 m long, carbonized pole above the layer of thatching. Its west end was located about 90 cm east of the NW substructure corner. It was lying approximately horizontal, with its west end 32 cm and its east end 60 cm from the substructure north wall. The diameter varied from 5 cm at the east end to 3 cm at the west end.

3. Roof Fixtures

Five features on the east terrace of Str 3 may be fixtures related to the construction of the roof. These include two clay pedestals on the southern half of the terrace, and one large cobble and two small stone slabs on the northern half of the terrace. These are presumed to pedestals for roof supports (posts).

Of the two clay pedestals on the south half of the terrace, one is located near the SE corner of the terrace; the other is located near the substructure below the southern door jamb and adjacent to the adobe step described above.

The southern-most pedestal measures about 18 cm (east-west) by 15 cm (north-south) and is ca 10 cm high. Its edges are not aligned with the terrace edge. It is from 36 to 40 cm from the south terrace edge and 18 to 22 cm from the east terrace edge. The vertical faces of the pedestal are smoothed and the edges are rounded. The top surface is uneven and slightly convex. The highest point on the pedestal is near the west edge of the pedestal. It is unclear whether this is due to wear or erosion, but the latter seems more likely.

The second pedestal is slightly larger, measuring 24 x 24 cm in area, and ca 24 cm in height. It is similar in appearance to the southern pedestal, with smooth surfaces and rounded edges. The top surface is flatter than that of the southern column, but does not have the smooth finished surface of the sides. Like the southern pedestal, its sides are not aligned with terrace or substructure edges. The east edge of the pedestal is from 15 to 20 cm from the substructure wall. The northwest corner of the pedestal abuts the south end of the adobe step below the main structure entrance (and may account for the non-centered position of the step).

The north half of the terrace contains two stone features which may be analogous in function to the clay pedestals on the southern half of the terrace. Fifteen cm north of the adobe step is a large unworked cobble. It is about 5 cm from the wall of the substructure. The cobble is sub-rectangular, measuring 34 cm (north-south) by 38 cm (east-west). It is about 11 cm high. Its upper surface is flat and horizontal; it is at the same level as the surface of the adobe step. Like the clay pedestals, the edges of the cobble are not aligned with any of the substructure or terrace edges.

To the north and east of the unworked cobble, a small flat stone slab rests on the terrace surface. This slab, irregular in shape, is about 15 cm x 18 cm in area. It is only a few cm thick and its surface is flush with the terrace surface. It is an andesitic stone, with unweathered surfaces and edges. It is unclear whether it was intentionally flaked or not.

A similar andesitic slab was found along the east edge of the terrace only 28 cm from the north end. It is oriented vertically against the east terrace wall. It is about 20 cm long and 8 cm wide. Its outer face is flush with the east face of the terrace. It is unclear whether or not this was its original position.

The clay pedestals, large cobble and stone slabs found on the terrace of Str 3 have counterparts on the west and north sides of the substructure. As discussed in more detail below, they are interpreted as foundations for wooden roof supports.

Along the west (back) side of the substructure are three pedestals similar to those found on the east terrace. These were found in the trench exposing the northern 4.3 m of the west substructure wall, and are built on the sloping clay-paved surface. All have smoothed vertical faces and rounded corners.

The northern-most pedestal measures about 31 cm (north-south) by 28 cm (east-west). The southwest corner of the pedestal is broken off. On the upslope (east) side, it is 4 cm high; on the downslope (west) side, it is 12-13 cm high. It is located just over 1.0 m south the substructure north wall line, and is ca 52 cm west of the substructure west wall.

About 70 cm south is a second clay pedestal. It is ca 40 cm west of the substructure wall. It measures 34 x 34 cm in area. The east corner, closest to Str 3, is 3 cm high; the north and south corners are 9 cm high; and the west corner is 21 cm high. The top surface is slightly convex, but sloping down from east to west.

The southern-most pedestal along the west substructure wall was only partially exposed in the excavation. It is located 3.85 m south of the substructure north wall line and approximately the same distance from the substructure south

wall line. It is ca 90 cm west of the substructure west wall. It measures 35 cm (north-south) by 28 cm (east-west). Its east side is 9-10 cm high and the northwest corner is 18 cm high. The southwest corner is not exposed. The top surface is uneven and generally convex.

No clay pedestals were present along the north side of the substructure, but a large stone cobble and several small slabs of andesitic stone were discovered.

The cobble (FS 75) measures 24 cm (east-west) by 30 cm (north-south). Its top surface is flat and horizontal; close examination indicated some grinding on projections to create a smooth surface. Its location is approximately central between the northwest and northeast substructures corners (2.65 m west of the northeast substructure corner and 2.30 east of the northwest substructure corner). It is about 25 cm from the north substructure wall. Its shape is an irregular ovoid; no straight edge is aligned with the substructure wall.

Two small andesitic slabs were found, both with their surfaces flush with the clay paving. The eastern-most slab is located ca 20 cm east and 26 cm north of the northeast substructure corner, just west of the step between the lower clay-paved surface north of the substructure and the higher clay-paved surface to the east of the substructure. The slab is about 20 cm long (north-south) and 9 cm wide (east-west).

The western slab (FS 74) is located ca 83 cm north of the substructure wall and about 1.32 m east of the northwest substructure corner. It is about 20 cm long (north-south) and 16 cm wide (east-west).

Two features on the superstructure itself are probably related to the roof support system. These are clay pedestals located on top of the west and east superstructure walls (Walls 1 and 3 respectively).

The west pedestal is best preserved. It is located approximately midway between the south and north room walls (3.18 m from the south interior room wall and 3.34 m from the north interior room wall). It is rectangular in shape and measures 45 cm from north to south. Its east (interior) edge is inset 7 cm from the interior face of Wall 1. Its west (exterior) face is too badly eroded to determine if it was similarly inset from the exterior wall face (i.e., cornice face). If it was inset 7 cm on its west side, than the east-west width of the column would be approximately 34 cm. The height of the pedestal is 13 cm. The top surface of the pedestal, however, is severely eroded.

The east pedestal, on top of Wall 3, is is very poor condition: only a fragment of the south face is preserved in situ. It is located in the center of the east superstructure wall, directly on the lintel over the main doorway. Lack of evidence precludes any conclusions regarding its size or height; these were presumably comparable to the pedestal on the west wall.

Another feature relating to the roof construction is the bi-level top surface of the east superstructure wall (Wall 3). As mentioned above, the top surface of this wall has two components: a lower level toward to the west (interior) and an exterior (east) level about 8 cm higher. The transition between these levels is by a slightly curved and irregular vertical face.

4. Roof Construction

The evidence described above is enough to allow some inferences regarding the type of roof over Str 3. Clearly, it was a thatched roof, probably involving both palm and grass thatching materials. This mixture may be a reflection of thatch renewal episodes, with grass used to repair the originally palm roof.

The thatched roof was supported by a framework of vertical posts and horizontal beams and rafters. The orientation of the thatching (primarily east-west) suggests that the gable was oriented north-south. Further support for this reconstruction comes from the top of the east superstructure wall (Wall 3), with

its two levels. It seems likely that a horizontal pole placed on the lower level was prevented from rolling out by the presence of the higher level. It could have supported the diagonal cross-members of the peaked roof.

The two pedestals centered on the east and west superstructure walls may have supported a horizontal cross-beam spanning the short axis of the roof, or vertical posts which elevated the roof some distance above the tops of the walls.

The largest post recovered has a diameter of about 13 cm and a number have diameters of approximately 9-11 cm. The posthole on the north side of the structure has a diameter of ca 11 cm; this was very likely one of the major vertical posts. The larger diameter pieces probably provided the vertical posts and main horizontal members. Smaller sticks (3-7 cm in diameter) were probably used as rafters; the thatching was probably tied to these.

Reconstruction of the roof support framework is made difficult by the effects of the volcanic base surges. These surges both carried away parts of the roof and deposited them elsewhere (for example, the roof over the NW corner and the south part of Room A), and created whirlpool effects inside the structure that attracted material from elsewhere. The latter is evident in the thicker deposits of thatching in the north part of Room A and along the east wall of the Room B. Chapter 3 considers these forces and their effects in more detail.

The thatched roof probably extended at least 1.5 m out from the exterior walls of the superstructure on the west and north sides. This is indicated both by the layer of fallen thatch which extends at least that far out from the room walls. On the east side, the roof probably extended far enough to cover the terrace, possibly as far as 2.0 m or more from the east superstructure wall.

At the north end (and presumably at the unexcavated south end) the roof was thatched with a north-south oriented section. This is apparent from the orientation of the fallen thatch layers along the exterior of the north end of the structure. It is unclear whether the ends of the roof were squared or rounded. Wauchope (1938) documents both techniques in the Maya area. The presence of curved sticks in the roof fall suggests that the ends may have been rounded, although this is far from certain.

5. Roof Remodelling

The roof of Str 3 was thatch, and this would have been replaced periodically. The mixture of grass and palm thatching in the fallen roof may be evidence of this.

It is also possible that the entire original roof, including the pole and post framework, was replaced at some point. This is suggested by the presence of numerous but irregularly placed clay pedestals, cobbles, and stone slabs which may have served as post and pole foundations. These features are clearly not integral parts of the structure or terrace. They contrast strongly in placement and symmetry to integral features such as the ledge on the top of the east superstructure wall (Wall 3) and the clay pedestals centered on the tops of the west and east walls (Walls 1 and 3). Given the evidence for extensive remodelling of the superstructure itself, the possibility for roof reconstruction should also be considered.

III. Description of Artifacts

By comparison to other excavated structures in the site, very few artifacts were found in and around Str 3. These are briefly described here, with special emphasis on their locations. The field specimen catalog attached lists each item collected. More specialized typological and functional analysis is included in other chapters.

A. Interior

A total of five artifacts were found in situ in the Str 3 superstructure. Artifacts found in Room A include two ceramic vessels and one bone tool. In Room B, one perforated stone and one facetted stone were found.

1. Room A

One of the ceramic vessels found in Room A was a large basin (type: Guazapa Scraped Slip, FS 17). It is ca 60 cm high and about 60-65 cm in maximum diameter. It was resting directly on the south bench, against the south room wall and just east of the north-south centerline of the bench. No organic remains were identified in the deposits within the vessel; it may have held some liquid which evaporated in the heat of the volcanic explosion.

The second vessel (FS 6), a large Copador melon bowl with a rim diameter of ca 16 cm, was placed on top of the wall dividing Rooms A and B (Wall 2), about 2 m from the south room wall and ca 45 cm south of the line marking the north edge of the bench. It was placed near the east edge of the wall and sherds from the bowl, broken by the weight of the volcanic ash, had fallen onto the bench surface.

The third artifact found in Room A was a worked bone tool (FS 11). It was on the floor of the north niche (Niche 3) and had been broken by the falling roof of the niche. The tool was made from a mammal longbone (probably deer) which had been split lengthwise. Subsequently, the cut edges and the ends were shaped and polished. Both ends of the tool are rounded. Maximum dimensions are as follows: length - 20.8 cm; width - 2.2 cm; thickness - 1.4 cm.

2. Room B

Two artifacts were found in Room B. One of these, a perforated "donut" stone (FS 21), was resting on the room floor in the NW corner of the room, 73 cm south of the north room wall (Wall 5) and 50 cm east of the west room wall (Wall 1). The stone was standing on one edge, its position just off of vertical. Very likely, it had a stick projecting through the hole which kept it in position while ash accumulated around it. However, no trace of the stick was observed during excavations.

The second artifact (FS 36) was also stone. It is a large cobble with naturally flat faces. The corners between these faces have been pecked to round them off. It is unclear whether or not this is a finished artifact. It was located near the east wall of the room (Wall 2), about 1.5 m north of the south room wall (Wall 4). It was resting on the layer of fine airfall ash, so must have fallen from some location: the top of Wall 2, or the roof.

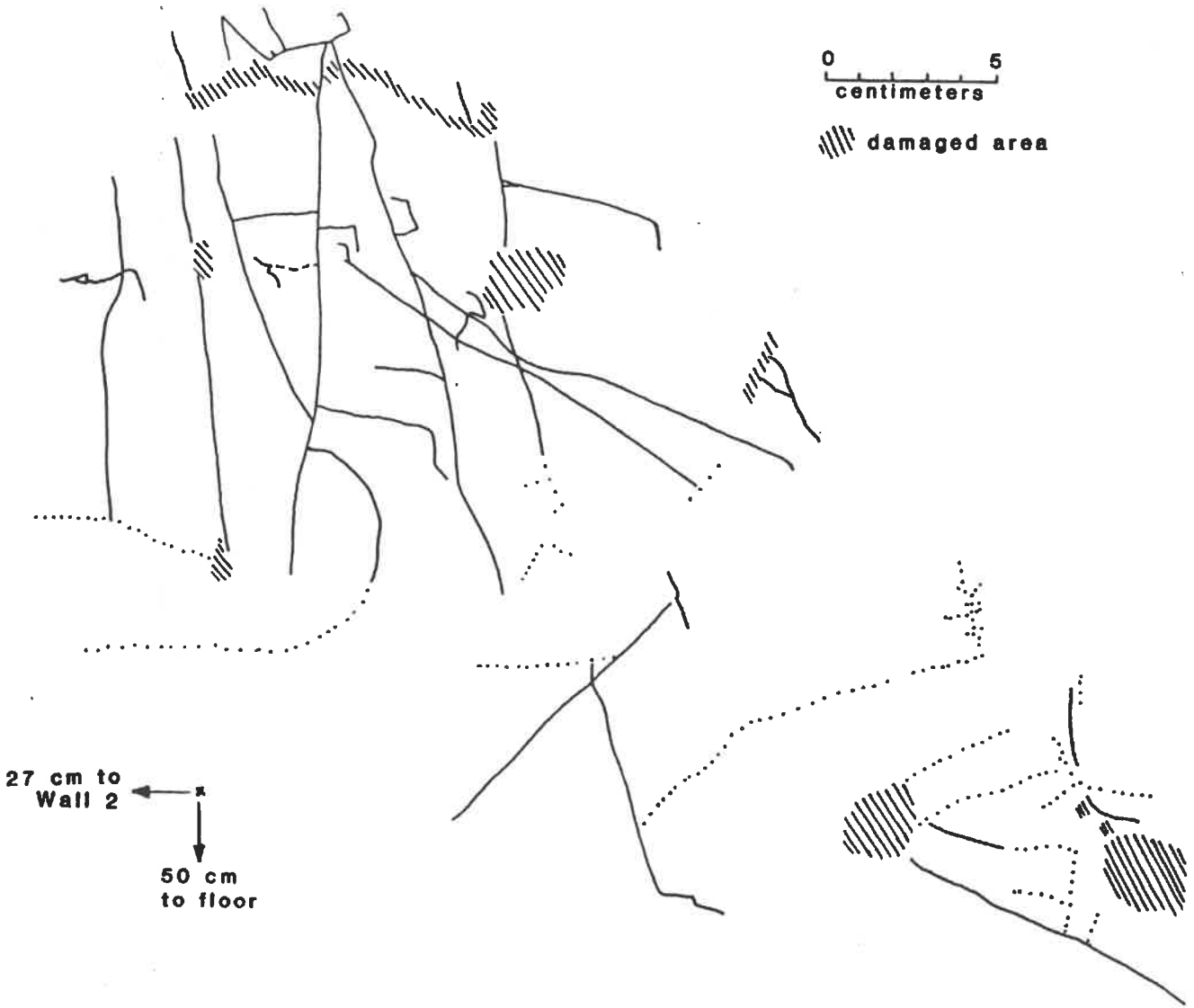
Some small rodent bones were recovered from the roof thatch that had fallen into Room B (FS 18). They are unworked. Genus and species identifications of these bones are presented in Chapter 14).

The final "artifact" in Room B is some grafitti scratched into the south room wall (Wall 4; Fig. 7,8). They are located about 20 cm from the SE room corner and ca 55 cm above the room floor. They cover an area about 20 high by 30 cm wide. The scratchings are made directly into the clay surface of the wall. Some are continuous lines; others are punctate. Although they have not been thoroughly studied, they do not appear to be representative drawings or writing. Rather, they resemble a child's scribbling.

B. Exterior

More artifacts were found outside of Str 3 than inside the rooms. The only complete artifacts were found on the terrace outside the front entrance. Other artifacts found on the east, north and west sides of the structure were probably discarded by the occupants of the structure.

FIGURE 7.
STR. 3, ROOM B, WALL 4 INCISIONS



1. Terrace

Several artifacts were found on the terrace to the east of the structure. Still in situ were a ceramic vessel and a perforated stone.

The vessel, a moderately large Guazapa Scraped Slip neckless jar (FS 34) was resting on the terrace surface ca 33 cm to the south of the south jamb of the main doorway. It was just 2 cm from the east substructure wall. No macrobotanical remains were found in the deposits within the vessel. The vessel had obviously seen extensive use before the volcanic explosion: both handles and a piece of the rim had been broken off in antiquity.

The perforated stone (FS 35) was about 5 cm south of the vessel. One edge was resting on the terrace surface and the opposite leaning against the east substructure wall. From its position, it seems unlikely that a stick was projecting from the perforation.

A third vessel (FS 31), also Guazapa Scraped Slip, was found on the SE corner of the terrace. The recovered sherds form about half of the complete vessel (other sherds may be recovered when excavations are expanded in the future). This vessel clearly had fallen from some higher elevation, as it was broken and the sherds were scattered over an area about 75 cm x 40 cm., including the terrace surface and the adjacent clay-paved plaza surface. The fact that the sherds had fallen directly onto the clay surface (rather than onto a layer of airfall tephra) suggests that a minor earthquake preceding the volcanic eruption may have knocked it off a hanger in the thatched roof over the terrace.

A large sherd was found in several pieces in and below the main doorway to the superstructure (FS 43). It comes from a large Guazapa Scraped Slip vessel, but apparently was used as a large sherd rather than a whole vessel. It must have fallen from some high position, as the pieces were found in various layers of ash within and in front of the doorway.

East of the terrace, on the lower clay-paved surface, a few sherds were found flush with the clay surface. These were presumably trampled into the ground after being discarded near the structure before the eruption.

2. North and West Sides of Structure

Virtually all of the artifacts found to the north of Str 3 were small sherds pressed into the clay-paved surface. Nine such sherds, none larger than ca 5 cm in their largest dimension, were found directly north of the structure.

The concentration increased to the northwest of the structure, where 12 sherds were found. The largest of these was over 10 cm wide, and two were ceramic handles. Additionally, the broken end of a mano (FS 68) was recovered approximately 3.0 m west of the NW substructure corner.

A few ceramic fragments were recovered from ash layers above the north clay-paved surface. These include two ceramic handles. Conceivably, these may have originated as handles embedded in the north superstructure wall (Wall 5). However, given their location to the north of the structure, and the fact that virtually no other lumps of wall clay were found in the area, it seems unlikely.

The west side of the structure yielded very few artifacts. One small sherd and one ceramic handle had been discarded and pressed into the clay-paved surface behind the structure.

IV. Preliminary Interpretations

After only one season of excavation, most of Str 3, including its substructure, superstructure, and front terrace, were excavated. The resulting data are sufficient to allow some tentative interpretations regarding its construction history and its ultimate use.

Str 3 also exhibits many of the formal attributes of residential architecture found elsewhere in southeastern Mesoamerica. By analogy to archaeological and

ethnographic data, it is also possible to understand how the building was used, who used it, and the relative social status of its occupants. The suggested answers to these questions should be regarded as hypotheses subject to testing in future seasons of excavation.

A. Construction History

Initial construction activities in the area of Str 3 must have included some kind of ground-levelling operation: either cutting or filling, or both. This was followed by paving with clay the area around the house site. It is unknown if an early small structure was built in the current location of Str 3.

Str 3 appears to have been constructed in at least two phases. The first phase included construction of the substructure and the two-room superstructure. These were built to fairly exact specifications (e.g., the superstructure walls inset 15-16 cm from the substructure walls) and with a great deal of attention to symmetry (e.g., the placement and sizes of the niches and benches). A subsequent addition was the terrace on the east side of the structure. This was not constructed as carefully, and possibly was not constructed by the same group as the sub- and superstructure.

The second construction phase involved remodelling of the superstructure. This phase included refacing many of the walls and rebuilding the interior and front (east) exterior cornices. The thatched roof the superstructure may have been replaced at this time, using a support system external to the house itself.

B. Function

The function of Str 3 can only be understood in the context of the site as a whole. Joya de Ceren is probably an ancient residential site, and most of the structures within the community likely had residential functions.

The term "residential," however, encompasses many different activities, including sleeping, food preparation and consumption, tool manufacture and use, household ritual, and others. General and specific literature relating to the ethnography and archaeology of Mesoamerica indicates that there was spatial differentiation of activities within residential sites. Clearly, structures in a site will have different specific functions if these activities were spatially distinct.

The ethnographic and archaeological literature also indicates that residential sites were organized into living areas inhabited by individual families. In general, extended families lived in plaza groups with the structures arranged around a central courtyard area. These structures were fairly function-specific, and included dormitory-living structures, kitchens, store-houses, and other special-function structures. The dormitory-living structures generally were used by individual nuclear families within the extended family.

Given this pattern, it is reasonable to assume that Str 3 is only one of an unknown number of structures in a compound or plaza group. Its "residential" function is probably only a small part of the spectrum of residential activities that take place within such compounds. Keeping this in mind, the form of Str 3 and the associated artifacts can be used to infer the specific activities which may have taken place in the structure.

According to E. Shook (personal communication to P. D. Sheets, July 1989), Str 3 conforms extremely well to modern highland Maya dormitory-living room structures in its plan and furnishings. At night, these structures are used for sleeping, when the parents and infants sleep together on beds in the front room and the older children sleep on the ground elsewhere in the house. During the daytime, bedclothes are rolled up and stored in the back room, and the front room is used to receive and entertain guests. Although no evidence of bedclothes was found in Str 3, several observations support the analogy presented by Shook.

The grafitti in the back room of the structure look like children's scratchings, and is at an appropriate height for a small child's reach. It may have been done by restless children who were confined to the back room.

The presence of a large ceramic basin on a bench in the front room and a polychrome bowl on the wall above it suggest food serving and consumption. This may well have been in the context of daytime hospitality to guests in Str 3. The ceramic basin is large enough to serve many people, and heavy enough so that it may have had a permanent place on the bench. Certainly, there was sufficient sleeping space on the rest of that bench and the opposite one for a couple and one or two small children.

Negative evidence indicates that Str 3 was not used extensively for food preparation, tool manufacture and use, storage, or ritual activities. The scarcity of artifacts in general (and complete absence of obsidian) itself is a good indication that these were infrequent activities. That most of the items recovered were ancient discards is also indicative of the lack of active production in the immediate area.

In many respects, Str 3 is similar to structures in other Mesoamerican sites that have been interpreted as dormitories. For example, in the Sepulturas residential zone of Copan, Honduras, most of structures were dormitories. Benches were one of the ubiquitous features of these structures, and often the benches occupied over half of the area in the rooms.

Another similarity with Copan dormitory structures is the presence of curtain-holders. In Sepulturas, masonry construction was used, and the curtain holders are roughly chipped rings of stone which were inset into the masonry walls. Although the materials used at Ceren are different, the notion and placement of curtain-holders around doorways inside of the rooms is the same.

If Str 3 is a dormitory-living room structure, than it is probably only one of several structures in the residential compound of a family or household. Its orientation and the location of the doorway suggests that the other structures (for example, the kitchen, storehouse, and possibly other dormitories) were located to the east, northeast, and southeast of Str 3. The wear pattern on the 9Str 3 terrace, leading to the northeast, may indicate the location of the kitchen, which is probably the most-used part of a compound. For this reason, future excavations will focus on defining and exposing the entire residential compound associated with Str 3.

C. Social Status

Str 3 is the largest of the structures excavated so far in the Ceren site. It is notable for its large and high substructure, the size of the superstructure, and the height and thickness of the walls. The wall construction technique, using solid clay, also is unique in the site.

All of these features require a large investment of labor. Although it is unclear whether or not it was beyond the labor capacity of a single extended family, clearly more labor was expended on the construction of Str 3 than on structures in other compounds. This suggests that the inhabitants of Str 3 were relatively affluent in Ceren. Very likely, they were powerful or influential enough to draw on additional labor from other families in Ceren to help construct what was probably one of the more imposing structures in the community.

D. Ethnic Identity

The southeast periphery of Mesoamerica is an area that, in ethnohistoric times, was occupied by a number of different linguistic and ethnic groups. Western El Salvador and western Honduras form a zone a contact between Maya and non-Maya speakers, particularly the Lenca. For this reason, the question of ethnic differences in prehistory deserves investigation. The 1989 excavations at Ceren provide data pertinent to this problem

As mentioned above, many of the architectural attributes of the Ceren structures are consistent with the general pattern of residential structures in southeast Mesoamerica. However, some features of the architecture and artifacts may provide clues regarding the inhabitants' ethnic identity. The features that reflect habitual behavioral differences are most likely to reflect ethnic differences (especially those that fall into the realm of social and ideological behavior).

Although the Ceren site is unique because of the excellent preservation of bajareque and rammed earth architecture, these construction techniques were probably common throughout Mesoamerica. The lack of archaeological examples is undoubtedly a function of variable preservation conditions rather than cultural differences. The use of stone masonry at Copan and limestone and plaster at Peten sites (for examples) is probably a function both of available raw materials and social status, rather than ethnicity. The lower class residential architecture in these areas clearly was perishable, and probably bajareque was used.

Certain architectural features, however, may be more indicative of ethnic identity. For example, the exterior cornice surrounding the upper walls of Str 3 may be a decorative feature associated with the Lenca: it is found on a structure in a Lenca compound in the Copan Sepulturas area but not on structures that are in Maya compounds.

Both the architecture and artifact assemblages will require further detailed study to determine significant patterns in the styles, uses, and contexts of behavior. Ultimately, these will be the key to determining the ethnic identity of the prehistoric inhabitants of Ceren.

V. Future Research

The 1989 season of excavation at Ceren has stimulated a number of important questions which can be resolved by further excavation. For Str 3, some of these questions are:

If Str 3 is a residential dormitory structure, what are the characteristics of the entire residential compound, and the household inhabiting the compound? How does the construction history of the structure and compound reflect the development of the family? Do the observed differences in structures reflect status differences between households, or functional distinctions among structures within compounds? Is there any evidence of occupational specialization? To what extent was the household involved in trade with near and distant neighbors? What was their ethnic identity and did it play a role in their regional contacts?

These are the kinds of questions which can be answered with further excavation in and around Str 3. As a result, our understanding of life in 7th century El Salvador will be enhanced significantly.

VI. References Cited

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Chapter 10. CERAMICS

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Introduction and Methodology

Ceramics were collected during the three 1989 field operations centering on Structure 1, Structure 2, and Structure 3. Details of the collection procedures are covered in the sections related to each of those excavations.

This section will begin by describing new ceramic groupings not recovered during the 1978 work in the Zapotitan Basin. The ceramics from that project, including those from limited work at the Cerén site, have been published (Beaudry 1983a) and the reader is referred to that presentation for complete ceramic descriptions. Following the descriptions of new types is a summary of the ceramic inventory from each of the excavation operations; finally, a few preliminary observations on the Cerén pottery are presented.

As with the earlier work in the Zapotitan Basin, the method used to classify the current pottery is the type-variety system. The theory behind this system and its application to Mesoamerican ceramics can be found in Gifford 1960 and Willey, Culbert and Adams 1967. Briefly, this 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. Crosscutting the group-type-variety hierarchy is the ware, grouped according to paste characteristics (including Munsell color designations), inclusions, and firing results.

Because of the specialized excavation situation at Ceren -- studying residential units destroyed during their active use rather than following abandonment -- the recovered ceramics represented a greater number of whole vessels than usually is encountered in domestic situations. This is an advantage because it provides an opportunity for observing the complete configuration of vessels rather than having to reconstruct form from sherd lots. It is a disadvantage, however, in terms of paste analysis since vessels cannot be viewed in cross-section. Consequently, in this report less emphasis than usual is placed on paste considerations. Also, because of the intense heat generated by the eruption materials that destroyed and buried the site, color--both of paste and of surfaces--is frequently hard to determine precisely.

The ceramic materials have not been classified into a ceramic complex, the analytical unit above the ceramic group which represents the complete range of pottery available at a site during a specified time period (Gifford 1976). There is not yet a complete inventory of ceramics from Ceren since only one hearth has been found at Structure 2A and cooking vessels are not yet identified. Additionally, the ceramic corpus is biased toward the Household 1 area of the site which yielded the greatest percentage of the recovered pottery. The extent to which this household area is typical of the community at large is not yet known. Consequently, analysis and interpretation at this broader scale will be deferred until additional work at the site has been done.

Ceramic Type/Variety Descriptions

Ceramics recovered during the 1989 field season group into a number of categories:

1. Types and varieties recognized and described from the 1978 project -- descriptions not repeated here.

2. New varieties in previously described types -- Guazapa scraped slip: Miltitlan red painted variety; Cashal cream: Caldera red painted variety; Tazula Black: undecorated variety.

3. New types in previously described groups -- Guarumál Group: Huatales bichrome: Huatales variety.

4. New Group (and new paste ware) -- Zuluniche Group, Zuluniche Painted: Zuluniche. Alcantanilla light red ware.

5. Type previously described in the region but not recovered before in the Zapotitan area -- Mocal Modeled Applique: slipped and painted variety and unspecified variety (the type was identified at Chalchuapa).

6. Specialized vessels not classified but described -- cup incensario; miniature pot.

Descriptions will be presented in the order given above. It should be noted that names for ceramic groupings are provisional. Ceramicists working in Mesoamerica follow the procedure of submitting proposed pottery names to a central clearing house at Temple University so that confusing duplication of names can be avoided. This could cause some names in this report to be changed before the final report is prepared.

GUAZAPA CERAMIC GROUP

Ware: Boqueron Red

Type/variety: Guazapa Scraped Slip: Miltitlan red painted

Illustrations: Figure 1.

Basis for description: whole and partial vessels, Structure 1, 1B, 3; sherds from all excavation areas.

Identifying attributes: same as Majagual Variety (Beaudry 1983:171; Sharer 1978:3:49) 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: (Note: all bases are rounded) (1) jar, short outflaring rim with medial ridge, rounded lip; may or may not have handles; when present handles are placed on the shoulder; (Pots 1 and 14, Household 1) (Fig. 1a); (2) jar, medium-high slightly outslanting neck with medial ridge, globular body with sharply angled shoulder (no handles evident), (Pot 33, Household 1) (Fig. 1b);(3) jar, 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-body join (Pots 2, 3, and 35 Household 1) (Fig 1c); (4) jar, short outcurved neck, flattened or flattened and grooved lip, two handles placed just below the neck-body join, (Pots 9, 10, 16, and 20, Household 1) (Fig 1d); (5) jar, very short neck with interior rim thickened below the lip giving a slightly "cupped" effect, small handles on the upper shoulder (Pot 17, Household 1) (Fig. 1e); (6) Neckless small jar with a groove below a slightly thickened lip, sharply angled shoulder, two small handles placed just under the groove (Pot 31, Household 1) (Figure 1f); (7) open basin (large bowl) with rim thickened to the exterior, flattened and grooved lip, two handles from lip to vessel wall (Pots 15, 19 and 23 Household 1) (Fig 1g); (8) massive storage vessel with incurving upper area, exterior bolstered rim with slanted flattened lip, large round section handles with upper attachment 4 cm below rim. (Cat. # 295-3-17) (not illustrated).

Decoration: All vessels have a pattern of scraped slip on the upper wall and a solid red-painted low 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 with fingers or in some other manner to leave a generally curvilinear design. The swirls frequently are oriented horizontally on open vessels, vertically on jars. The pattern is made in sets of 4 to 6 lines; sometimes the lower part of vertically-oriented swirls is hidden by the solid red area. Occasionally vertical linear patterns or alternating straight vertical and horizontal lines are seen. Additionally, the area under a handle may have a horizontal pattern while the rest of the pot has a vertically oriented curvilinear design. The various vessel configurations have different treatments of the lip, neck, or rim :(Shapes 1 and 2) red paint from tip of ridge on the neck over neck-body join; (Shape 3) red-painted lip, cream slipped neck, 3 or 4 encircling scraped lines below the neck-body join; (Shape 4) lip red-painted, cream-slipped neck, two encircling lines above scraped slip register (a variant of this on Pot 20, Household 1 is a red-painted lip and handles without a lower red-painted area); (Shape 5) red paint from lip to the upper handle attachment; (Shape 6) (Pot 31 is refired to the point where the color of the upper area cannot be distinguished); (Shape 7) no paint on exterior; interior red-slipped; (Shape 8) lip not painted; interior red-slipped.

Note: this mode of the upper part of the vessel decorated with scraped slip and the lower part red painted was not reported at Chalchuapa nor recognized during the 1978 Zapotitan Basin project. The dominance of this mode in the 1989 collection suggests that it probably was present in the Zapotitan area but was not recognized previously. This may have happened because of the reliance on rim sherds for the classification in 1978.

GUAZAPA CERAMIC GROUP
Type/variety: Cashal cream slipped: Caldera red painted
Illustrations: Figure 2
Basis for description: whole vessels, Structures 1B and 2, sherds from same areas.
Identifying attributes: 1) cream slip as for Cashal variety; 2) addition of red paint in simple designs; 3) medium to thick wall vessels.
Forms: (1) globular jar with rounded base (rim not present on either specimen) (Pots 5 and 24 Household 1) (Fig. 2b); (2) small jar, short vertical neck with medial ridge, 2 small round-section handles placed a few cm below the neck-body join, rounded base (Pot 37, Household 1) (Fig. 2b); (3) globular jar with medium height outflaring neck (6 cm), medial ridge on neck, rounded base (no handles) (Cat. 295-2-107) (Fig. 2c); (4) jar (rim and neck height unknown) with prominent ridge on upper shoulder (no handle recovered) (Cat. 295-2-68) (Fig. 2d); (5) open bowl 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 (Pot 32, Household 1) (Fig. 2e); (6) deep bowl with outcurved rim, prominent sub-labial ridge and handle (probably placed from top of ridge--upper part of handle missing), lower shape unknown (Cat. 295-2-142) (Fig. 2f).
Decoration: lip is red painted; exterior is cream slipped with simple designs in red paint (T's, inverted L's, rectangular bands of color) One bowl has cream slip thickly but unevenly applied on the interior.

GUARUMAL CERAMIC GROUP
Ware: Boqueron Red
Type/variety: Huatales Bichrome: Huatales variety
Illustrations: Figure 3.
Basis for description: 1 partial vessel, Structure 1B (Pot 25)
Identifying attributes: 1) very thin wall; 2) cream slip with bold red-painted curvilinear design
Form: globular jar, high neck with medial ridge, base unknown.
Decoration: Interior -- thick cream slip from tip of lip to edge of neck-body join. Exterior -- neck red painted with paint continuing in a band below the neck-body join. Design of large curvilinear "comma" shaped elements in cream with red paint covering the rest of the upper wall areas; three repeats around the vessel; lower wall solid cream slipped. The large elements are not delineated at their lower edge; they become a part of the lower solid-painted area.
Note: A whole vessel of the same thin wall and with the same designs is known from San Andres (Stanley Boggs personal communication 1989)

TAZULA CERAMIC GROUP
Ware: Playon Red
Type/Variety: Tazula Black: undecorated variety
Basis for description: one partial vessel, Structure 2 (295-2-121)
Identifying attributes: as for Tazula variety except for lack of incision or excision.
Form: direct rim bowl with convex walls and flat base
Decoration: none.

ZULUNICHE CERAMIC GROUP
Ware: Alcantanilla light red
Type/Variety: Zuluniche painted: Zuluniche variety
Illustration: Figure 4
Basis for description: one partial vessel, Structure 1B (Pot 26).
Identifying attributes: 1) fine paste; 2) thin wall; 3) globular jar.

Form: globular jar with short vertical neck with three appliqued bosses (lip missing) no handles, slightly flattened base.
Decoration: very 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. 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.

Note: this vessel had been damaged prior to the site's destruction and had been repaired. The repair consists of a small pottery plug made from a shaped piece of Gualpopa polychrome (cream paste; black and non-specular hematite red paint). The hole and plug were ground to achieve a tight fit. The plug was found during the process of washing the sherds so the exact manner of keeping it in place is unknown although it seems fairly secure being held by friction alone. As far as currently known, this is the first time that pottery repair of this nature has been reported in Mesoamerica. However, "mend holes" have been observed where on a highly valued pot holes were drilled on each side of a break so that the vessel could be tied together.

Ware: Alcantanilla light red
Paste texture/wall thickness: dense but with a few linear voids; thin-walled.
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) existing color is 2.5YR 6/6
Core: light grey carbon core
Group: Zuluniche

UNSPECIFIED GROUP
Ware: unspecified
Notes: Mocal Modeled Applique: Mocal variety was identified at Chalchuapa by Sharer as part of the Chuquezate Ceramic Group (1978:3:61-62). He placed the type in the Matzin and Ahal (Postclassic) Ceramic Complexes but mentioned that the type may have begun during the Payu Complex (Late Classic). Its presence at Structure 1B confirms the earlier temporal placement. The paste of the Ceren examples are different from that described by Sharer, thus they are not classified as the Mocal variety.

Type/Variety: Mocal modeled applique: variety unspecified
Illustrations: Figure 5
Basis for description: one whole vessel, Structure 1B (Pot 28).
Identifying attributes: 1) specialized form; 2) modeled and applique effigy features.
Form: Slightly recurved bowl with incurved upper wall; single flattened oval handle from lip with effigy face; pedestal base.
Decoration: Spiked decoration on bowl body: one set of 3 vertically placed spikes on each side of the handle. Two other groups of vertical rows of spikes each about 18 cm across the rim from the handle. Group 1: one set has 5 spikes; other appears to have only four, middle area without indication of a scar. Group 2: only one set of four spikes with a plain middle area. The effigy face on the handle is crudely executed; it appears to be of an animal (a tapir?) with ears that protrude above the rim and that are placed directly above the eyes. The handle is attached at an unusual angle as if it were slightly twisted.
Type/Variety: Mocal Modeled applique: slipped and painted variety.
Illustration: Figure 6
Basis for description: One vessel, Structure 1 (Pot 8)
Identifying attributes: 1) black surface color; 2) effigy face on loop handle; 3) thickly applied cream slip, swirled or scraped; 4) red painted rim, handle, and base.
Form: shallow bowl with outcurving rim and flattened lip; oval section handle slightly flattened in cross-section, ladle form with effigy figure on upper surface.
Decoration: Exterior — cream slip, vaguely scraped with swirls going horizontally around vessel. Interior — scraped cream slip with straight lines rather than a swirling pattern. Lip, handle (including effigy) and exterior base all red painted. Modeled and appliqued head of an animal (probably an owl) on the upper handle surface.

DESCRIPTION OF SPECIALIZED VESSELS
1. Cup incensario (Structure 2, collected as field samples 295-2-44, -66, -80, 81, -89). A small vessel with three solid tapered supports, concave walls and probable vertical neck. The vessel apparently had a small handle at the neck-wall angle but shape and orientation are unknown. (The recovered rim and upper wall are not contiguous with the lower sections but they are almost

certainly from the same vessel.) The upper portion of the vessel is unslipped but polished (irregular polishing marks are visible); base and supports are unslipped and unpolished. The interior is extremely fire blackened as is the upper exterior body. When residue left in the bottom was removed and burned, it had an odor identified as copal. Rim diameter: 4 cm; overall height: @ 12 cm; height of support to base: 3.25 cm; maximum diameter: 8-9 cm; wall thickness at base: 0.6 cm; thickness at neck: 0.4 cm. (Figure 7). There are general similarities in shape and height with the tripod cups reported at Chalchuapa as part of the Chincontepec Unslipped type (Sharer 1978:3:43,fig. 20b 1-3, fig. 33 j and k).

2. Miniature vessel (295-1-88, Pot 22). Simple undecorated, crudely shaped little pot with flat base, convex walls and restricted opening; undecorated, slightly smoothed but not slipped or polished. Entire vessel fire altered; no indication of a heavy residue on the interior. Rim dia: 1.7 cm; height 3.5 cm; maximum dia: 4.5 cm. (Figure 8) (Note: a similar miniature vessel was found during the 1978 Ceren excavations in Area 1 of Structure 1 [Black 1983:193; Zier 1983:129]. That speciment was decorated with a simple pattern of incised lines alternating with punctations.).

CERAMIC INVENTORY BY EXCAVATION AREA

Structure 1 operation

Excavation in this area of the site uncovered the largest quantity of ceramic material, particularly whole and partial vessels in situations indicating active use or storage. A total of 45 whole or partial vessels are in this unit's inventory. Of these 29 would be classified as "utilitarian," 13 are painted, and 3 are of specialized forms. Ten different classification units are represented in this pottery. Sherd lots collected from Structure 1 areas also are varied in terms of their contents (Table 1 summarizes Structure 1 ceramic material.) The amount of pottery and its variety suggest easy accessibility to ceramics and underscore the availability of decorated serving vessels to households like that represented by the Structure 1 complex. There is a notable homogeneity in terms of designs and shapes of the painted serving vessels in this area of the site. This characteristic will be discussed in more detail in the subsequent section.

Structure 2 Operation

It must be emphasized that excavations in this part of the site are incomplete so that interpretation of the inventory would be premature. Some observations are in order, however. The most common pottery type found in and around Structure 2 is Guazapa Scraped Slip: Miltitlan variety. Cashal cream: Caldera red-painted variety seems more frequent here than at Structure 1. Copador and Gualpopa polychromes are fairly prevalent but with different forms predominating than at Structure 1. For instance, only one melon stripe bowl has been recovered at Structure 2 whereas this decorative pattern was the most frequent in the Structure 1 area.

Three whole vessels were recovered from a niche below a bench in Structure 2A. Two of these are classified as Copador Polychrome; the other as Gualpopa Polychrome. One of the Copador pieces is unusual in that it is a tripod dish with an everted rim. The supports are small, hollow conical shapes with flattened tips that were ground to achieve a totally flat surface. This form is extremely unusual for Copador Polychrome although the design motifs, particularly the bird or serpent head motif on the interior, are clearly within the Copador tradition. The other Copador piece, an open bowl with direct rim, has an atypical black-painted garland near the interior rim rather than the more

customary painted rim band. The orange slip color on this vessel also is quite dark rather than being the light orange-cream usually associated with Copador. Nevertheless, the paste seems light in color, the designs are standard (including the melon stripe lower exterior register) and the red paint is made from specular hematite: all identifying attributes of this polychrome type.
The third piece, a Gualpopa open bowl with direct rim, carries only a very simple fret and scroll design in the upper exterior register. (Table 2 summarizes Structure 2 pottery.)

Structure 3 Operation

As mentioned elsewhere, this operation was notable for the small quantity of artifacts uncovered (Table 3) . Nevertheless, a similarity with other excavation operations is noticed in that Guazapa Scraped Slip: Miltitlan variety was quite prevalent. It is interesting that one of the few whole vessels is classified as Obraje Red-painted: Obraje, a type not frequent at other operations. Also, a Copador melon stripe bowl found on the top of one of the walls (Cat. 295-3-6) was the best executed of any of this type of bowl encountered this season. The vessel is interesting in a number of other aspects: 1) it has a large rim diameter (23 cm) which puts it at the outside of the rim diameter range for Copador open bowls (Beaudry 1983b:168); 2) it has a black rim band which is unusual for this category of vessel (One of 46 Copador open bowls studied had a black rim band; only 7 of 141 Copador vessels of any shape had black rim bands [Beaudry 1983b:187]; 3) the design in the upper register is a silhouette monkey, an uncommon motif on Copador, especially on open bowls. The silhouette monkey is more frequently used on Gualpopa polychromes, particularly on a sub-class called spiral bowls where the decoration starts at the rim and continues in spiral fashion onto the base (Nine of 12 spiral bowls were decorated with monkeys [Beaudry 1983b:224].)

SUMMARY OBSERVATIONS AND COMMENTS ON THE CERAMICS FROM THE 1989 SEASON

At this preliminary stage of analysis and with incomplete excavation of the site areas investigated during the two-month season, interpretive comments are largely inappropriate. A few observations that will guide further analysis and interpretation should be mentioned, however. A favored mode of decoration at the Ceren site is cream slip. This factor had been noted for the Cambio site following the 1978 Zapotitan work and it seems even more dominant at Ceren. The Guazapa Ceramic Group uses cream slip in a variety of ways on a wide range of vessel forms and sizes with varied approaches to the decoration of specific pots. Cream slip is not widespread during this time period in the Southeastern Mesoamerican area, neither for utilitarian pottery nor for painted serving vessels. Cream-slipped painted pottery is prevalent, however, further south in the Greater Nicoya zone. The significance of this variation in slip preference will be investigated in future work.

Another noteworthy feature of the Ceren pottery is the prevalence of decoration on vessels of all categories. Admittedly we don't have cooking ware represented yet but almost all of the pottery recovered had, at least, been slipped and most had both slip and paint used as part of their decoration. This is important from the standpoint of the production economy of the period, that is, in terms of the labor investment in producing pottery. To do this much decoration, a wide variety of raw materials is needed and more time has to be spent in completing the vessels. These observations raise the issue of craft specialization and production organization--topics to be addressed as work at Ceren progresses.

An indication of the potters' skill is evident from the size of the largest vessels recovered. The prime example is 295-3-17, the massive storage vessel located on the south bench in Room A. This Guazapa: Miltitlan vessel stands 60 cm high, with a rim diameter of 45 cm, and a base thickness of 2 cm. A vessel of this size requires considerable skill--in shaping since it must be built over a period of days so that the wall dries enough to support the upper parts; in firing since the size and thickness require special handling with careful control of the firing conditions.

It is assumed that the utilitarian pottery was made at Ceren or at a nearby location, since the amount of pottery and the size of some of the pieces suggest local production rather than transport from a more distant source. Limited technological analysis supports this hypothesis (Southward and Kamilli 1983). However, more extensive analyses will be needed to thoroughly reconstruct the production system. Since temporal control at Cerén is so precise, there will be a unique opportunity to study the community's ceramics from the standpoint of the variability of resource utilization for specific functional and stylistic categories. For example, were all the scraped slip storage jars made from clay from the same deposit that had been prepared in a similar fashion or were different households using jars with different paste ware characteristica? Data like this can inform us about intra-community patterns of production and distribution that often are difficult to determine when temporal variability is less controlled.

Painted serving vessels are interesting from several viewpoints. First, the most prevalent polychrome types are those known from their distribution around Copan, Western El Salvador, and certain parts of Guatemala and their production in a restricted number of loci, that is, the cream paste types, Copador and Gualpopa. Conversely, the Campana Polychrome Group seemingly restricted to distribution within El Salvador is represented by only one vessel from Household 1 and a sherd possibly from a related type found in Area 6 of Household 1. Furthermore, only two sherds of Sacazil Bichrome of the Chilama Ceramic Group have been found in Structure 2. This last-mentioned pottery class was defined in 1978 at the Cambio site and was considered a local Zapotitan painted category (Beaudry 1983a: 173). This patttern is not what would have been expected since locally made pottery should be more widely available than that manufactured farther away from the consuming area. Nevertheless, the relative frequency of painted types from the 1978 work at Ceren showed a similar pattern (Beaudry 1983a:182). It is hoped that additional data will help to clarigy this seemingly illogical pattern. It is possible, of course, that a temporal difference could be the operative variable since precise chronological sequences have not been established for most of prehistoric El Salvador.

Detailed examination of the designs on the polychromes disclosed several interesting patterns. A very standardized set of designs was used on the exterior of open bowls. The design called "Glyph C" (Fig. 9a) is found in the upper register; the melon stripe design (Fig. 9b) in the lower register. The interior either is left plain or painted with a bird motif.

A consistent choice of a combination of motifs has been noted previously with the Arambala Ceramic Group — pottery that imitates Copador forms and designs but uses a quite different paste than the centrally produced cream paste types. That situation has been interpreted as representing decentralized production adhering to perceived "rules" of decoration based on obsevation of a few trade items (Beaudry 1983b:233). A similar circumstance could be operating in this case or some other mechanism could be causing the observed pattern. The situation does raise the issue of style, its behavioral basis and role in social identification and comparison within and between groups in the same area as well as between areas and language groups. (See Wiessner 1984 for a thorough

discussion of the behavioral basis for style and its use in interpreting variability in material culture.) In fact, it is expected that careful study of the formal variation or style of several components of the Cerén ceramic collection (the Guazapa Group and the various polychromes) will be important in making inferences about some of these less tangible aspects of prehistoric life.

The execution of Glyph C varies from being carefully painted to being very cursive or schematic. Among other possibilities, this observation could mean a wide range in craftsman ability or copying of designs by people unfamiliar with the motif's meaning. (The execution of the melon stripe part of the vessels also is variable and seems sketched rather than precisely done. The difference between the Structure 3 vessel (295-3-6) and others has already been mentioned.) If the imprecise execution is related to copying without fully understanding the nature of the designs there could be important ramifications concerning the ethnic identity of the group copying the designs as opposed to that originating the designs. A larger sample of the Ceren polychromes will be needed to evaluate these and other alternatives.

These observations and comments have been set forth to demonstrate some of the directions for future analysis and use of the Ceren cermic corpus. This cultural material will be one of the key sets of data for reconstructing the social organization both within the Ceren community and the wider cultural sphere in which the Ceren people functioned.

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TABLE 1. SUMMARY OF POTTERY TYPES, HOUSEHOLD 1 AREA EXCAVATIONS

Utilitarian types:
Guazapa Scraped Slip: Miltitlan Red-Painted Variety
Cashal Cream: Caldera Red-Painted Variety
Oberaje Red Painted: Obraje Variety

Painted types:
Gualpopa Polychrome: variety unspecified
Copador Polychrome: variety unspecified
Suquiapa Red-On-Orange: variety unspecified
Campana Polychrome: Soyate Variety
Huatales Bichrome: Huatales Variety
Zuluniche Painted: Zuluniche Variety
Mocal Modeled Applique: slipped and unspecified varieties
Unclassified: miniature vessel
Unclassified: thick cream slip, partial vessel

TABLE 2. SUMMARY OF POTTERY TYPES, STRUCTURES 2A AND 2B EXCAVATIONS

Utilitarian types:
Guazapa Scraped Slip: Miltitlan Variety
Cashal Cream: Caldera Red-Painted Variety
Obraje Red Painted: Obraje (R)

Painted types:
Copador Polychrome: variety unspecified
Gualpopa Polychrome: variety unspecified
La Presa Red: La Presa Variety (R)
Sacazil Bichrome: Sacazil Variety (R)
Tazula Black: Undecorated Variety (R)
Huascaha Unslipped: Huascaha Variety (R)

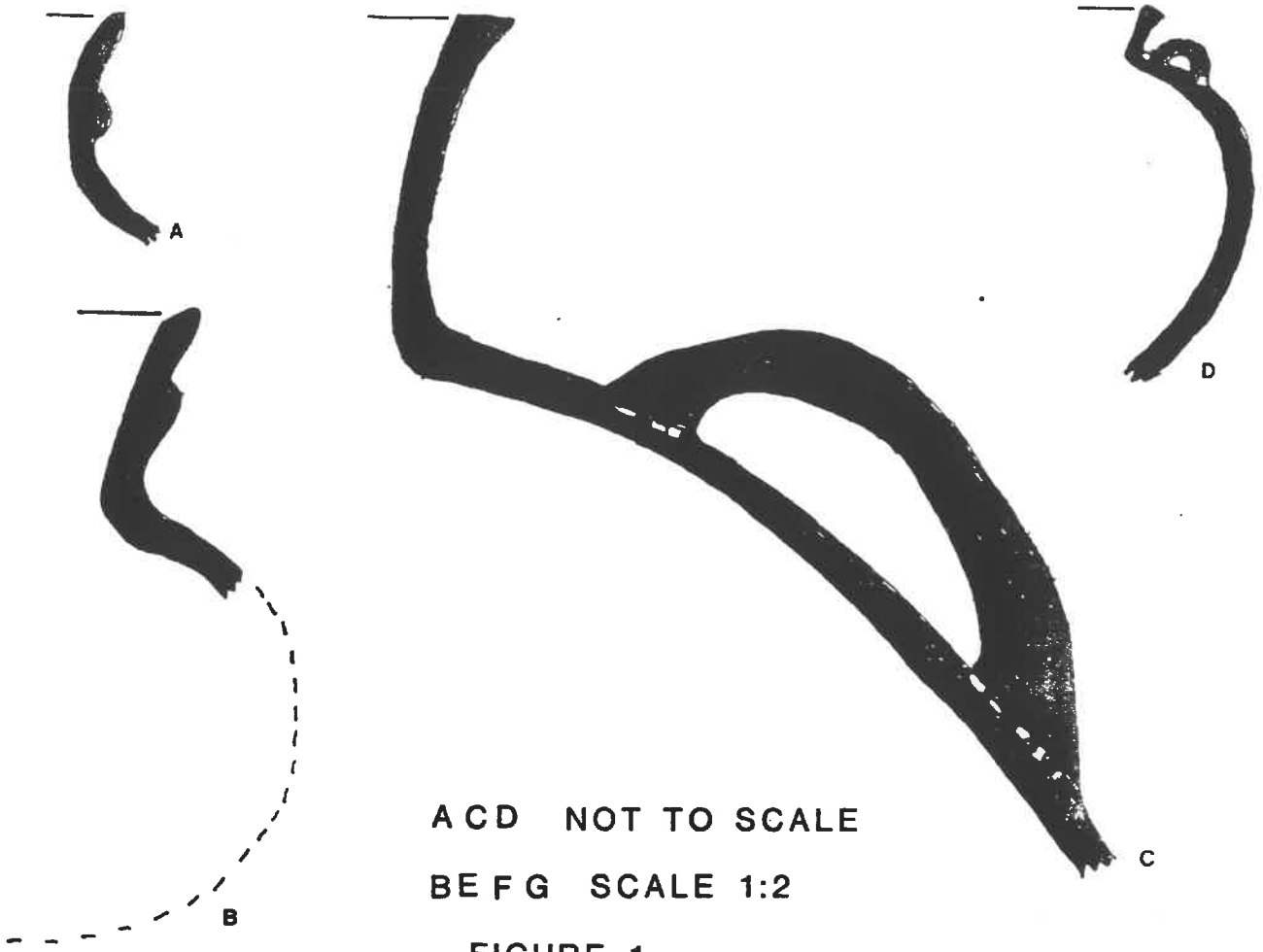
R=rare

TABLE 3. SUMMARY OF POTTEY TYPES, STRUCTURE 3 EXCAVATIONS

Utilitarian Types:
Guazapa Scraped Slip: Miltitlan Red-Painted Variety
Obraje Red-Painted: Obraje Variety (R)

Painted types:
Copador Polychrome: variety unspecified
La Presa Red: La Presa Variety (R)

R=rare



A C D NOT TO SCALE

B E F G SCALE 1:2

FIGURE 1.

PROFILES OF GUAZAPA SCRAPED SLIP: MILTITLAN VARIETY.

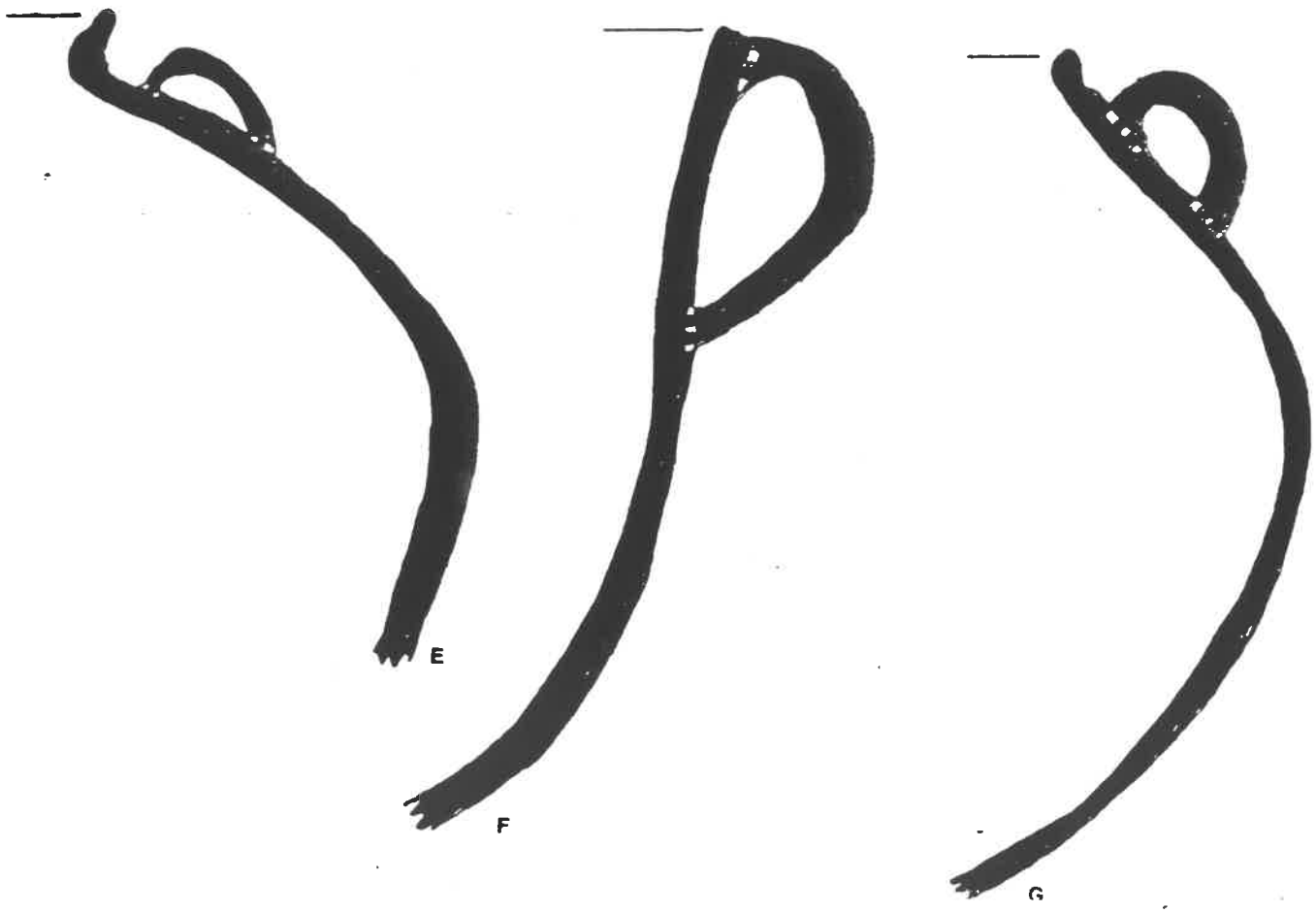
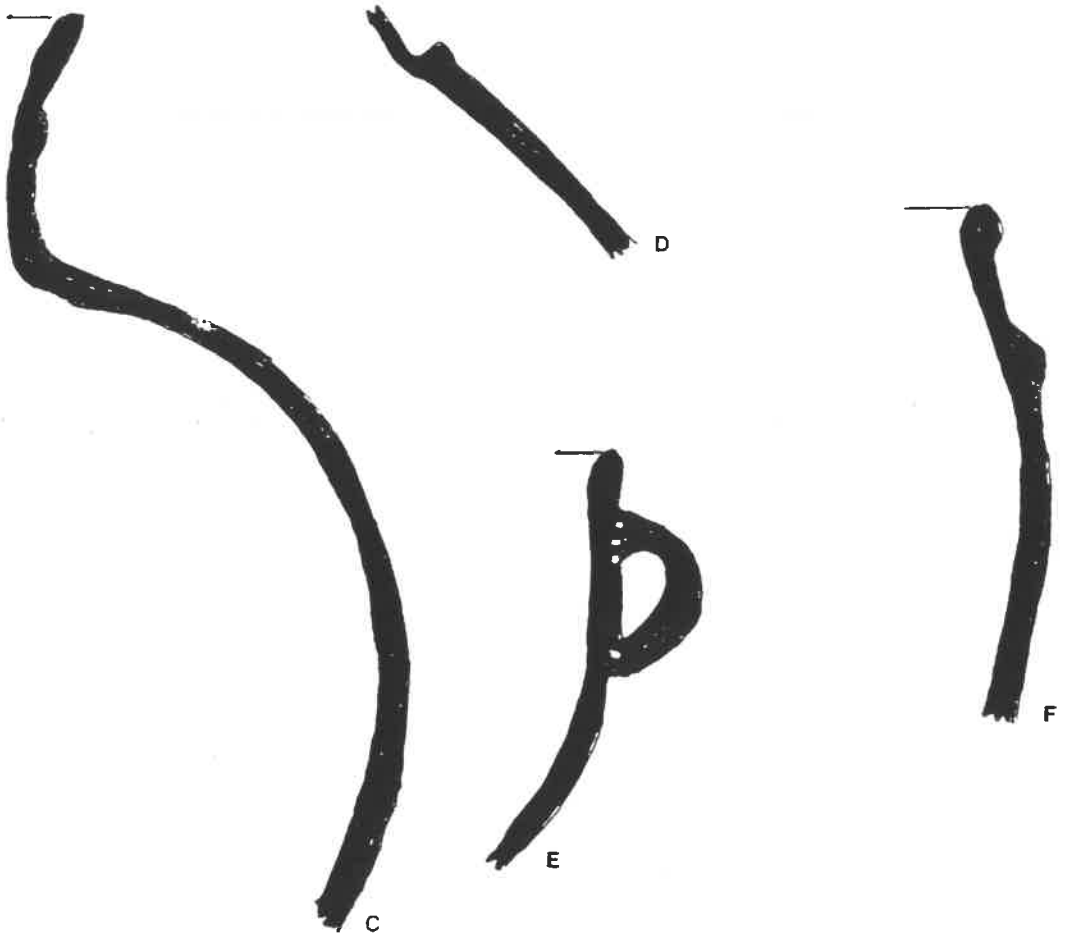


FIGURE 2. PROFILES OF CASHAL CREAM SLIPPED: CALDERA VARIETY.
SCALE 1:2



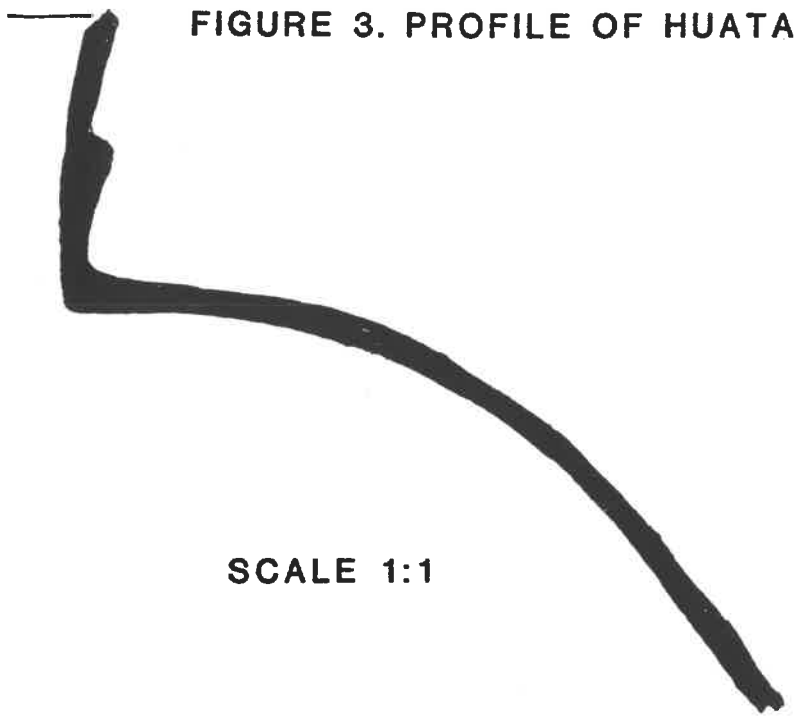


FIGURE 3. PROFILE OF HUATALES BICHROME.

SCALE 1:1

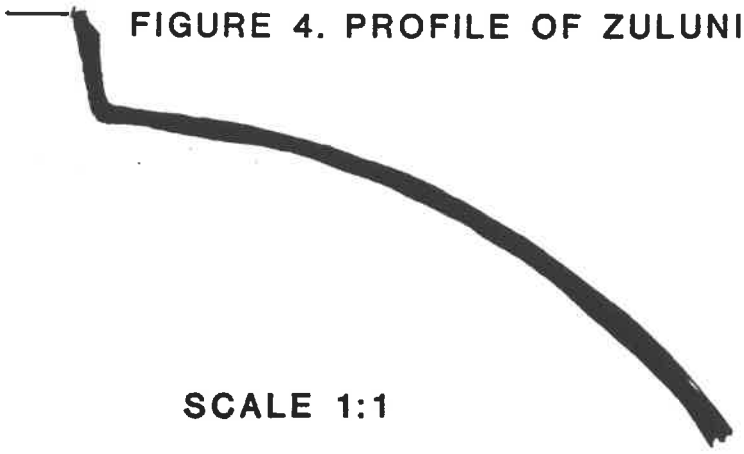
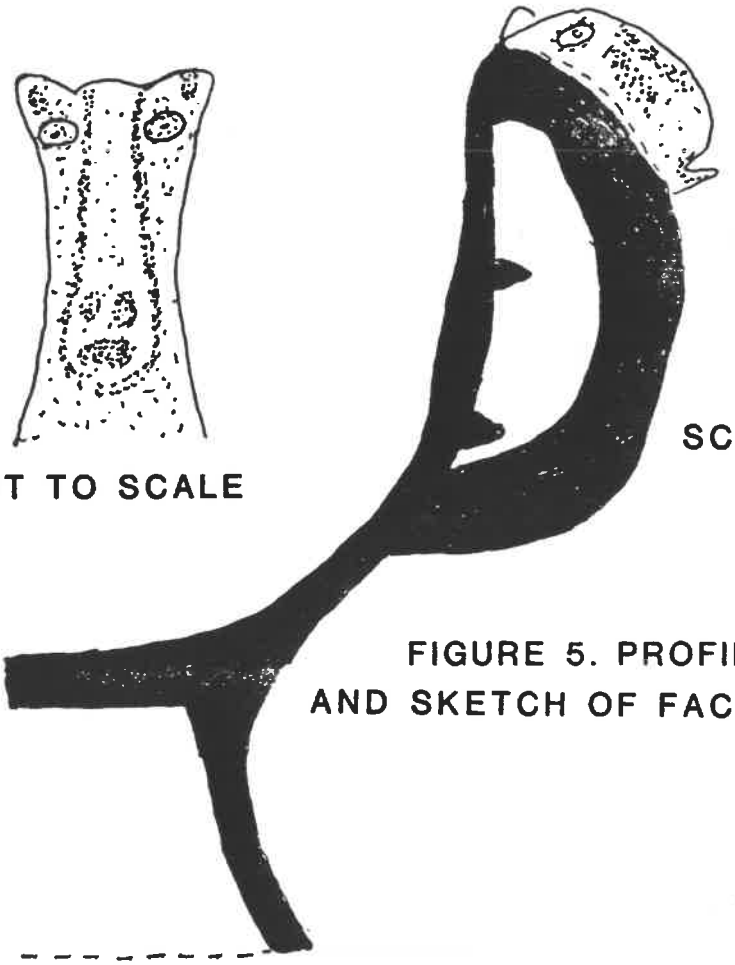


FIGURE 4. PROFILE OF ZULUNICHE PAINTED.

SCALE 1:1

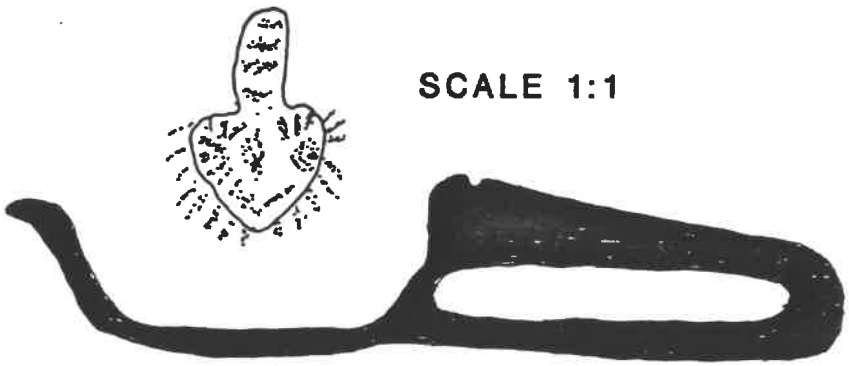


NOT TO SCALE

SCALE 1:2

FIGURE 5. PROFILE OF POT 28 AND SKETCH OF FACE ON HANDLE.

FIGURE 6. PROFILE OF POT 8 AND SKETCH OF FACE ON HANDLE.

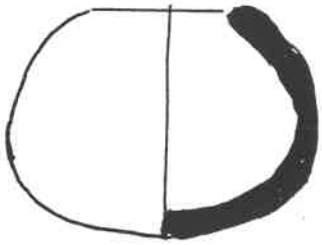


SCALE 1:1

FIGURE 7. PROFILE OF CUP INCENSARIO.

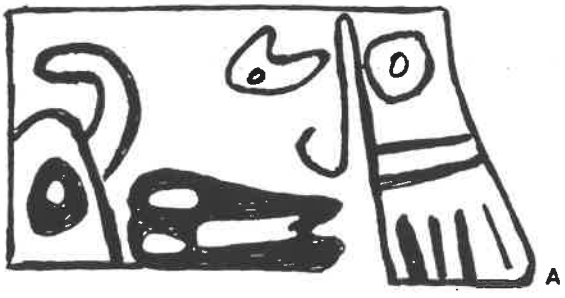
SCALE 1:1

FIGURE 8. PROFILE OF MINIATURE VESSEL.



SCALE 1:1

FIGURE 9a. GLYPH C.



A

9b. MELON STRIPE BOWL.

B

Chapter 11. CHIPPED STONE

Payson Sheets, University of Colorado

All chipped stone artifacts were carefully excavated in the field and bagged without cleaning the tephra from them, in hopes of finding organic residues on their working surfaces. Each item was then inspected using 10x magnification and many were examined with 100 to 1000x of an AO optical microscope, to check for usewear and residues. In many cases, organic residues were visible macroscopically. and those specimens were chosen for special study in the US. Cleaning of all specimens was done dry, with a soft toothbrush in a very light brushing motion to remove the volcanic ash to expose the artifacts, their working surfaces, and possible residues. Traditional treatment, by washing before inspection, would have removed organic residues. Thus, the stepwise dry fine brushing for cleaning was selected as the most effective way of exposing organic residues.

Prismatic Blades (19)

A largely complete prismatic blade (295-1-43) was found in the roof-fall of Area 3, House 1. It had palm thatch around it, and there was some tehpra on the floor below it. It has some black organic residue along both edges, and thus was not washed, so it can be subjected to energy-dispersive x-ray diffraction analysis in the U.S. Its length is 7.9 cm and its width is 1.0 cm, its thickness is 0.3 cm, and its estimated total length was 10 cm. Platform size is .3 by .2 cm, and it is moderately striated, with a relatvely slight degree of platform overhang removal achieved by a rapid scraping. Reasons to keep it up in the eves of the house include (1) to keep it out of the reach of children so they don't cut themselves, and (2) to avoid edge damage if kept in an active living area.

Four complete prismatic blades (295-1-71 a-d) were in roof fall of the bodega south of the main House 1 structure, and evidently had been tucked into the roof in a bundle. That they fell and stayed so tightly together probably indicates that they were in an organic container or bound together, although no direct evidence of a container or binding was found. Their platforms are characteristic of the Classic Period in size, with minimal platform removal by a rapid scraping motion. However, the core platform received only minimal abrasion; most Classic blades show more abrasion on their platforms. The blade edges show no evidence of use, either in nicking or in residue left behind, so these probably represent stored pristine blades. Three (a-c) probably were from the same core, based on the striking similarity of their platforms, size, and the visual characteristics of the obsidian. However, none of them refits onto another, so there is no definitive evidence of their being from the same core. The fourth blade (d) is thinner, with different platform morphology, and is not from as clear an obsidian as the other three. It has an incrustation of an unknown nature on the dorsal surface. Unfortunately, one of the excavators stepped on the tephra above the blades before they were excavated, without knowing they were there, and broke them. They have been glued back together.

Another blade (295-1-83) was found mixed with roof-fall associated with vessel 20. It appears to have been used, as both edges are nicked. Slight patches of what appear to be residues from use remain along both edges. It probably came from the same core as the three described above, but it does not refit to any of them precisely.

A proximal portion of a blade (295-1-70) was found in floor contact in Area 6, between the main house and the bodega (Str. 1b). It was found with some sherds lying on and somewhat imbedded into the tierra blanca soil. It, with the

sherds, had been walked upon frequently, perhaps for quite some time, and its edges and even the dorsal and ventral surfaces are abraded quite a lot.

Two more proximal segments of prismatic blades were found in roof fall in Str. 1b (295-1-110 and 127), which are 6 and 4.9 cm long respectively. Both have platforms as described above, and one (110) shows relatively extensive use-nicking along one edge. All other edges are in good condition.

Two small blade fragments (295-1-129 a and b) were found just outside the southern wall of the bodega (Str. 1b), lying on the soil surface and apparently trampled occasionally. Both show edge damage from use and probably from abuse (being walked upon by people passing to the south of the bodega), and the two are difficult to distinguish in these samples.

A complete prismatic blade was found in roof fall material in House 2 (295-2-53). It is an almost pristine blade, with only a few nicks from use, and only an occasional small amount of organic residue on the dorsal surface, and even more rarely on the ventral surface. The use nicks generally are smaller than .5mm, and only six were counted on one edge, and only three on the other. Organic preservation was best on the dorsal surface along the ridges. Platform characteristics are the same as the above-described blades from Str. 1.

A small distal fragment of a prismatic blade (295-2-69) was found in the loose tephra to the east of the porch of House 1. It clearly had been blown from its original position, but that location cannot be known. It is tempting to speculate that it was on top of the stubby column at the east side of the porch, as that is upwind from its findspot, and the stubby column on the other side of the porch had a small scraper on top of it. Use wear is light to moderate, with a few dozen use nicks on each side, and a slight bit of organic residue adhering, particularly to the dorsal surface.

The roof-fall of the porch of House 2, just north of the north wall, contained a proximal fragment of a prismatic blade (295-2-54). It has the characteristics common to Late Classic platforms, but is larger than usual, probably because its point of force application was a few mm to the left of a sizeable step fracture just below the core platform. The blademaker had erred, but was able to recover from the error by making a thicker-than-usual blade, and remove about 1/3 of the step-fractured area with this blade. A result of the large platform and error recovery is that one blade edge is not as acute as usual, because a dorsal ridge runs only 1-2 mm from the edge. The other edge is normal in all aspects. The more acute edge seems to have been used more, as evidenced by more edge-nicking and a bit more organic residue adhering.

An obsidian prismatic blade was recovered in rooffall just north of the doorway of Str. 2b (295-2-134). It represents most of a blade, with only the proximal/platform portion missing. The blade is in almost mint condition, with only a few tiny nicks from light use. Only a few tiny patches of what could be organic residue from use were encountered. As with virtually all other blades in good condition found thus far, this was stored up in the roof. The original length of the blade was at least 12 cm, and probably was about 15 cm.

Only a few centimeters away was a retouched medial segment of a prismatic blade (295-2-133); they likely were stored together, but separated somewhat during the falling of the roof early in the eruptive sequence. For a prismatic blade, it is rather heavily retouched, with a scraper-like steep unifacial retouching at both ends. It differs from scraper retouching in that it is on a much smaller blank and it resulted in a straight strengthened cutting edge, rather than the curving edge of scrapers. Each end is asymmetric, in that the longer working edge is about 40 degrees from the axis of the blade, and the shorter edge is about 60 degrees from the blade axis. The fact that both ends are mirror images of each other indicate they probably were prepared for some

specific function. The ends do show some microabrasion and microfracturing. The function is unknown. The fracturing along the blade edges, but with little evidence of use-wear, probably indicates that they were intentionally flaked to dull them, so when someone was holding the blade in their fingers it was not cutting them. Unfortunately, it was cleaned too much in the field by a worker, and whatever organic residue might have adhered was removed.

A blade from the general collection (295-2-32) was part of the general collection. It is a medial segment, small in size, and with a heavily fractured edge from use. It appears to have been discarded as trash.

A fairly small medial blade segment (295-2-83) was found on the original ground surface near Str. 2a, the top of the tierra blanca joven tephra with juvenile soil developed. Use wear, in the form of small to large flakes fractured away as well as some fine abrasion, is rather heavy on both margins. This evidently is a discarded specimen.

A proximal segment of a prismatic blade (295-2-138) was encountered on the tierra blanca joven surface east of Str. 2a. The platform is lightly striated, and platform overhang removal was fairly extensive, leaving a relatively small platform for a Classic Period blade. Use wear is extensive on both edges, consisting primarily of microflaking, but also some micro-hinge fracturing and fine abrasion. Ventral and dorsal surfaces show virtually no evidence of abrasion that would have come from trampling after discard, so the edge damage is believed to be a result of use, and not from trampling after discard.

Scrapers (3)

An obsidian scraper (295-1-101) was found in roof fall of Str. 1b, near the lava bomb that landed in the southwest corner of the building. Like the intact prismatic blades, it was tucked into the roof for safekeeping. It was made from a percussion blade that appears to have been removed from a macrocore about midway in its shaping toward becoming a polyhedral core for prismatic blade manufacture. The scraper blank probably was about half again longer than the present specimen; repeated resharpenings apparently have shortened it. Its edges show quite harsh use, resulting in a welter of step and hinge fractured microflakes. No organic residues were visible along its edges. It is somewhat crudely shaped.

A very well-shaped obsidian scraper (295-1-119) was found tucked behind the westernmost large corner support post of the bodega (Str. 1b), on the floor, and slightly down into the posthole. It was made from a large macroblade, which probably was 15 to 20 cm long. It was made by steep retouching of the distal end, and probably has seen many cycles of use and resharpening, but it had a few more cycles remaining, had Laguna Caldera not erupted. The distal end exhibits considerable evidence of wear, in the form of a welter of step and hinge fractures extending from the ventral surface an average of 2mm up onto the retouched surface. Also, the juncture of the microfractured surface and the ventral surface shows some fine abrasion, leaving a rounded, and micro-frosted surface. The bulbar area and the dorsal ridge have a surprising amount of fine abrasion. The dorsal ridge has abrasion directly perpendicular to it, as if it was used as an obtuse cutting edge (suggested by Don Crabtree, personal communication 1972). The abrasion on the bulb is surprising, and is largely perpendicular to the blade's axis, with some minor components in other directions. The cause of such bulbar abrasion is unknown.

A small, irregular side-scraper (295-2-67) was found on top of the western stubby column by the porch of Structure 2. Only a small portion of its periphery, 2.4 cm, is laterally retouched by the steep flaking characteristic of

scrapers. No evidence of use was encountered, either use-wear or organic residues.

Stemmed Macroblade

A complete macroblade, with lateral retouch of the proximal end to make a stem, was found in roof-fall in Structure 2 (295-2-58). It was made from a well-shaped macrocore which was at least 15 cm long. Some organic material was observed adhering to both edges, and particularly on the dorsal surface of one edge. All of the thatching material that was adhering to both surfaces was not cleaned off, for display purposes in the museum. Both edges show some minimal use-nicking, in terms of very small flakes being detached, especially along the edge that retains more organic residues. The knife had a favored edge for cutting. It apparently was not hafted, as there was no evidence of a handle, hafting material, or haft-wear.

Macroblade Fragments (2)

The distal end of a macroblade (295-1-140) was found wedged between a broken metate and the back (southern) wall of the bodega (Str. 1b). It could be the distal portion of the macroblade from which the abovementioned scraper (295-1-119) was made, but without the intervening flakes, that cannot be determined for sure. This is a highly utilized implement, as many of the use-nicking left scars of 1 or 2 or even 3 mm in length. No abrasion was found on the dorsal ridge or on any other surface.

A small medial fragment of a macroblade (295-2-139) was encountered on the soil formed on the tierra blanca joven, near Structure 2a. The original macroblade was narrow and thick, and probably longer than 12 cm. It was utilized for cutting purposes, as evidenced by the medium and large size flakes detached from both edges. Apparently it broke, and was discarded. A number of quite large flakes were detached, by perucussion, after the macroblade broke. The reason for detaching those flakes is unclear.

Non-obsidian Chipped Stone

A large percussion flake (295-1-118) was found on the ground surface near the bodega behind Str. 1b. Although the platform collapsed under the blow, the flake is largely complete. It is of a fine-grained andesite, which flakes reasonably well. The platform was near a structural imperfection, probably a small cooling cleavage fracture, which contributed to its collapse. It shows no evidence of use. The outside is the shiny surface which results from a long period of stream polishing.

Summary and Conclusions

After having to analyze collections from other Mesoamerican sites with tens of thousands of prismatic blades, and hundreds of thousands of bifacial debitage flakes, it is a pleasure to analyze a collection of relatively few chipped stone artifacts where there are exceptional contextual and functional data available. One of this season's discoveries is the consistency with which Ceren residents hid their good obisidan. That is, the prismatic blades, macroblades, and scrapers that had good, sharp edges usually were tucked away in the ceiling, or ocassionally on top of walls, in cracks under walls, or behind posts partly in the postholes. In contrast, all the obsidian blades found in open areas near structures had been used and discarded, and rarely were longer than 4 cm. None of the used and discarded blades retained organic residues from use, as far as could be determined, but many of the blades in use did retain organic

material. Thus, obsidian is the material of choice for cutting soft organic substances. Forensic examination of those residues may shed light on their use.

One of the most striking aspects of the collection is the fact that not a single piece of obsidian was encountered in the Structure 3 excavations, yet obsidian was frequently found in excavations in the other households. The composition of the Household 2 and 3 assemblages were quite similar, with a predominance of prismatic blades, along with a few scrapers and macroblades. Both Households 2 and 1 had at least one scraper and one macroblade in their domestic assemblages. It should be emphasized here that a few months more excavations are needed to excavate the full domestic area of Households 2 and 3, and I suspect that the bodega or work area of Household 3 probably will be well-stocked with obsidian. We may find that Household 3 was exhibiting a greater degree of spatial segregation than the other households.

So far, there is no evidence of hafting of any obsidian tool. The stemmed macroblade would seem to have been a good candidate for hafting, and the conditions for organic preservation were very good in its immediate context (thatch from the roof was preserved all around the implement), so had it been hafted, I am confident that we would have found the evidence. Also, there was no evidence of hafting of prismatic blades, or of wrapping them in an organic substance such as deer hide to protect the edge and protect the hand of the user.

Another insight into lithic use is that prismatic blades were used whole, and were not snapped into shorter segments prior to use. As they were used, they eventually became dull or broke into shorter segments, and were discarded. The standards for discard are a very dulled edge and a length of the segment less than 4 cm. There is no evidence that prismatic blades were manufactured at any of the three households.

Chapter 12. GROUND STONE

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Introduction

The objective of this chapter is to describe and interpret, at least in a preliminary fashion, all the artifacts of ground stone which were excavated during the 1989 season of the Ceren Project, from the three households. Featured are the manos, metates, biconically-perforated "donut" stones, and other expectable items in a ground stone chapter. Also included are some less well known items such as shaped laja, abraded laja, and other types. Thus, the term "ground stone" is used in a broad rather than a narrow sense. All groundstone artifacts were carefully excavated and cleaned to explore possible organic residue preservation on their working surfaces, as described above in the chipped stone chapter. In some cases, with donut stones, some organic residues were found still adhering to their surfaces. No organic substances were detected adhering to manos or metates, whether they were in their use positions or not.

Metates (6)

The House 1 excavations yielded two complete, one almost complete, and three partial metates. The complete metates were both found in their original working positions mounted on forked sticks to support them, an indication of the extraordinary preservation at the Ceren site.

The metate found in the bodega, Str. 1b (295-1-84), is a large one, measuring 55.2 by 30.5 by 17.4 cm, with a grinding surface 25 cm wide. The metate is quite early in its use-life, and had just begun to have the higher lip at the upper end and the open surface at the lower end. It was found in the small bodega structure (Str. 1b) behind House 1, above two large pole casts. Each pole cast was below each end of the metate, suggesting that each was a forked stick for metate support, locally called a "horqueta". The metate was gently inclined, with a slope of about 5 degrees from the enclosed end down to the open end. Thus, it appears that the metate was in a position of use. An important aspect is that the metate was surrounded by complete vessels on all sides. That is curious for a metate that is in use, but not surprising for a metate that was not being used at the time of the eruption. This might indicate the eruption occurred at night, when food was not being processed. The mano that matches the metate (see below) was found along the west wall of Str. 1b. Had the metate actually been in use when the eruption struck, the mano would have been found on top of the metate, or immediately beside it.

This large metate (295-1-84) is made of a vesicular lava, probably an andesite. Most vesicles are in the 1-5 mm range, but some are larger than a square cm. As with most grinding stones in El Salvador, the natural vesicularity of the lava and the toughness of the material provide excellent materials for grinding.

Another complete metate (295-1-132) was found mounted on its pair of forked sticks just to the west of Str. 1. It had been barely used prior to the eruption, as there is only the slightest amount of use-wear, and only the slightest beginnings of an upper lip to begin the trough is discernable on the grinding surface. The hollows left by the forked sticks were well-preserved by the tephra packing around the sticks, and the forked portions of the sticks in contact with the bottom of the metate were relatively well preserved. The top grinding surface had been pecked to shape fairly extensively, but the sides and bottom have been only roughly shaped. The material is a moderately vesicular andesite, virtually identical to the abovementioned complete metate. Access to this metate was not blocked by vessels on all sides, but some vessels were close

to it. Its matching mano was not found, but may lie in the unexcavated area to the east. Had this been in active use at the time of the eruption, the mano would have been found on top of, or beside, the metate.

An almost complete metate (295-1-116) of a slightly vesicular andesite was found upside-down on the floor of the bodega south of House 1. Its estimated length is slightly more than 45 cm. It had been used a lot, as it had begun with an estimated thickness of 15 cm, but the grinding surface had worn down to within 4.5 cm of the bottom surface. This metate probably had been retired from use, but it may have been kept as a handy stone to stabilize round-bottomed pots in the bodega.

A partial metate, less than a quarter of the original, was found on the floor of the bodega (295-1-115) in contact with the abovementioned partial metate. It does not fit with it, and the reason to save such a small metate fragment is unknown. Its estimated width was slightly more than 30 cm, and thickness was 12.5 cm, with the minimal thickness of the metate's grinding surface at 4.7 cm. It is made of a fine-grained and slightly vesicular andesite, and appears to have been fairly well through its use-life when it broke. This quadrant of the original includes the open end of the trough metate.

A metate fragment (295-1-137), about a quarter of the original, was found near the south wall of Str. 1b. It is made of a moderately-vesicular andesite, and was very well-shaped. It is the open end of a trough metate which apparently became so thin at the bottom that it broke. After breaking it was not discarded, but was employed as a pot support. It was one of three rocks supporting a large round-bottomed fired clay vessel.

Another broken metate, in this case a small fragment (295-1-134), was found on the floor of Str. 1b. It was made of a slightly vesicular andesite that evidently required pecking to resharpen. This appears to be the bottom part of an extensively utilized trough metate.

Manos (3)

A long mano (295-1-104) was found on the floor of Str. 1b, the bodega of Household 1. A mano and a metate are useful only as a matched set, as the corresponding grinding surfaces must meet each other and grind down together. This mano was not found on or adjacent to the metate which it matches (295-1-84), but a few meters away and against the west wall of the bodega, on the floor. That indicates that the metate was not in active use when the eruption occurred. The mano is of a moderately vesicular andesite. It may have been used by a left-handed person, as the portion under the left hand shows more use wear than the right side. The metate may have a slightly greater abrasion on its left side, but if so, it is very slight. Virtually all the use of the mano was on only one side, with the top only very slightly used.

Another mano (295-1-107) was found near the above mano, on the floor of the bodega along the west wall. It is what would be called a "one-hand mano" in the US Southwest, as it is only 13.6 cm long; its width is 8 cm and thickness is 5.1 cm. The material is a slightly to moderately vesicular andesite. It is a loaf-shaped mano, very well shaped, with use on only one side.

A small mano fragment, about a quarter of the original, was found on the north side of Structure 3 (295-3-68). It was very well shaped by pecking, and had been used quite a bit, particularly on one side. It was made of a moderately vesicular andesite.

Miniature Metate

A miniature metate (295-1-39) was found inside of Vessel 7 near the back wall of Structure 1, Area 3, along with two cylinders of prepared hematite, a

spindle whorl, and a piece of mother-of-pearl shell. Made of a slightly vesicular andesite, the small vesicles in the working surface contain hematite, indicating that it was used to grind hematite prior to using it in decorating people or pottery. It measures 5.0 by 3.3 by 2.6 cm, with four legs each measuring 1 cm long, 1.4 cm wide, and 0.8 cm thick. It, along with the other contents, are probably female-associated, based on ethnographic and historic accounts.

Hematite Cylinders (3)

Three prepared hematite cylinders (295-1-40 and -41) were found inside Vessel 7, House 1, Area 3, associated with the miniature metate, a spindle whorl, and a thin piece of shell. They average 2.0 cm in length and all measure 1.9 cm in diameter. Each is a deep red color, with no visible impurities. Their round shape, and the uniformity of the diameters, may indicate that they were purchased at a market. A consolidating agent probably was added to them to help them maintain their form. They were ground on the miniature metate, as evidenced by the abundant hematite on its surface, to make pigment to decorate ceramics, people, and perhaps other substances.

Andesite Laja (12)

Two pieces of flat-fracturing andesite, called "laja", were found on the floor of Area 3 of House 1. Both had been used as lower ("nether") grinding stones. As they are considerably lighter than metates, they may have functioned as portable grinding stones. Both show wear in multiple directions, as judged from the striations showing no favored orientation. Neither shows evidence of having been "pecked" to roughen and enhance the grinding surfaces.

The larger of the two (295-1-55) had been used minimally. It measures 37.4 x 28 x 4.1 cm. Only the most protruding crystals on one face show abrasion. It was minimally shaped by percussion blows to the periphery along the thinnest margins, probably to strengthen the edge.

The other (295-1-54) measures 31.8 x 29.9 x 4.4 cm, and shows considerable evidence of use as a grinding stone on one face, and no evidence of use on the other face. The used side was facing downward, in floor contact, when the eruption occurred. Grinding was multidirectional.

An andesite laja stone much like the above was found on the "tierra blanca" original ground surface just northwest of the northwest corner of Structure 2a (295-2-98). It was only slightly shaped around its peripheries by strong percussion blows. One face shows evidence of use in the form of a smoothed area about 10 by 17 cm in shape.

A thin, fragile piece of laja, minimally worked, was encountered on the soil developed from the "tierra blanca" just outside Str. 2a (295-2-84). Both faces show evidence of some abrasion, but only on the most protruding bumps. The abrasion is minimal, and striations are predominantly parallel to the long dimension of the piece. Its function is unknown.

A small worked piece of laja was found near Structure 2a (295-2-144), and it was worked in that it had a shaped edge, and one face shows evidence of some grinding. It is a small corner of what was a much larger piece. The edge was shaped by some mild percussion flaking or "nibbling", followed by a slight degree of grinding. Only one face shows some grinding, and that only on protruding bumps. The direction of motion is multiple.

A surprise was to find that laja had been placed up in roofing material. It either was on top of the thatching or it was placed up on a beam or small wooden support connected with the roof. It was thermally fractured into 15 pieces, five of which could be glued back together (295-3-24). The pieces have broad, curving fractures with no point of force application or other features of

deliberate percussion manufacture. A small fragment of what probably was another laja was also found (measuring 10.4 x 8 x 0.5 cm) in the same place. The reason for placing two laja on or in the roof is unknown.

Many pieces of laja were found around the peripheries of both houses, and those are described collectively here. They include specimens 295-2-97, 96, and 122, and 3-55, -74, and -77. They are artifacts only in the sense of being transported to the site, but they show no physical evidence of being shaped or used. Many appear to have been placed on the ground surface, the young soil developed on the "tierra blanca joven" from Ilopango, as informal steps or as checks against erosion.

Whetstone

A small whetstone (295-2-39) apparently had been placed on top of the bajareque wall along the western side of House 2. It stayed there during the various explosive surges, but was dislodged by one almost 2m up in the sequence, and was found in the tephra just outside the top of the wall. It was near the donut stone that was similarly placed on top of the wall. It is made of a fine sandstone or siltstone, rather well cemented, which may have come from the Metapan area of NW El Salvador, where sedimentary rocks outcrop. It has multiple used surfaces, as it apparently was used to sharpen numerous small items rather than large long items. One face has 10 such surfaces, the other has seven, and two sides have two each. It may have been used to sharpen jadeite or greenstone axes, but none have been found yet at the site. It could have been used to grind ceramic vessel legs such as the tripod Vessel 3 from House 2.

Biconically-perforated "Donut" Stones (8)

Many biconically-perforated "donut" stones were found in the 1989 excavations. It probably is significant that the perforations are not proportional to the size of the stone, but rather begin with a whole approximately 5 cm in size, and constrict to one 2.5 cm or smaller. Use expanded the whole, and use could have involved more than one function. Given the use wear, the organic residues found in some, and the finding of a short stick with a blunt end in one at House 2, it appears that many of the donut stones were used to grind organic materials. Some smaller donut stones, such as that found in Str. 1 in 1978 which was still on a long stick, probably were digging stick weights.

A relatively large and undecorated donut stone (295-1-113) was found on the floor of the bodega (Str. 1b). It is roughly shaped, so that it is not completely circular. It measures 16.4 x 14.6 x 7.4 cm; the perforation constricts from 5.3 down to 2.5 cm. It may have been manufactured not too long before the eruption, as there is no detectable use wear at the constricted portion of the perforation. No pole was found with or in it. The circle which is the maximum constriction is canted, that is, it is not perpendicular to the two faces. I would estimate this is about 20 degrees from perpendicular, and for reasons argued below, I believe this is an indicator of a perforated mortar.

Two medium-sized donut stones were found near each other in the bodega (Str. 1b). The larger of the two (295-1-122) is made of a slightly vesicular andesite, and shows moderate to slight use wear in the perforation, but no signs of an organic residue. It too has a canted circle of maximum constriction, about 10 degrees from perpendicular. It was quite well shaped, but undecorated. It probably functioned as a perforated mortar. The other (295-1-123), of a moderately vesicular andesite, was well shaped but undecorated. The amount of use wear is relatively great in the perforation, when compared to other donut stones from El Salvador. It still retains some organic residue inside the perforation, especially at the point of greatest constriction.

A relatively small, decorated donut stone (295-2-34) was found just outside the western bajareque wall of House 2, in a coarse gray tephra unit (Unit 4), at the height of the top of the wall. It apparently was being stored on top of the clay portion of the bajareque, and was dislodged a short distance by the eruption. It was one of three being stored on top of the same wall (the other 2 are described below), and was the last to fall from that location. It maintained its position during many episodes of base surges, finally to be dislodged by Unit 4. It was made of an essentially nonvesicular basalt, and it is decorated by eight shallow vertical grooves, leaving a shape reminiscent of a squash or a cog wheel. The donut stone found in 1978 on the floor of House 1 was similarly decorated, but was better made and much larger. Only a slight amount of use wear was detected at the point of maximum constriction. It evidently was not on a stick when the eruption occurred, as it would be difficult to store a hafted stone on a long stick up on top of a bajareque wall. Dimensions: 12.4 x 11.9 x 6 cm; perforation constricts from 5.3 to 2.2 cm.

A medium-sized donut stone (295-2-86) was found at the base of the Unit 3 volcanic ash layer, to the west of the southwest corner of Structure 2a. It evidently fell from the bajareque wall top where it was stored; the turbulence of Units 1 and 2 were not enough to dislodge it, but the turbulence of the beginning of Unit 3 was sufficient. It was found in two pieces, about 20 cm from each other. It broke as it fell. The material, a slightly vesicular lava, is a poor material, as two other cracks have developed in its inner circumference. Judging from the striations, the dominant motion of use is parallel to the perforation, and the greatest degree of wear is at the point of maximum constriction. It is likely that this was a perforated mortar.

A large donut stone (295-2-74) was found with the other two just outside the west wall of Str. 2a; as with the others it apparently had been placed on top of that bajareque wall, but was dislodged by the turbulence of the arrival of the tephra cloud as Unit 3 was being deposited. Remains of part of an organic cast were found inside the hole, and the lower parts of that hole contained some carbonized wood that had been shaped. The carbonized wood was removed from the hole in a number of fragments, and dental plaster was used in an attempt to cast the cavity. The attempt was unsuccessful because of the poor condition of the cavity, with much fallen tephra. The carbonized wood was in very fragmentary condition, but sufficient remained to estimate the original diameter of the wood shaft, about 3 to 3.5 cm at maximum. The length of the shaft is unknown, but it probably was not very long, as the cavity only extended above the donut stone for a few cm. The carbonization of the wood probably occurred due to its proximity to the hot Unit 2; the stone and wood was encased in the bottomost part of Unit 3. The carbonization probably indicates very little time elapsed between the emplacement of Unit 2 and Unit 3, so that Unit 2 did not have time to cool. The wood seems to be a dense hardwood. The lower end of the wood tapered down to a blunt end. The perforation is 5.5 cm in diameter at maximum on both sides, and it tapers down to 2.7 cm at its maximum constriction. An unusual aspect of the perforation is that the circle of maximum constriction is not perpendicular to the hole, but is canted about 30 degrees from that perpendicular. I suspect that it was manufactured to be perpendicular, but sustained use resulted in a canted constriction. Considering the wooden implement, the use-wear, and the stone morphology together, it is apparent that this is a perforated mortar with a hardwood pestle. The motion of use was with short strokes down into the hole, whereas pestles probably were rotated in other donut stones. Thus, the items to be ground, apparently organic materials in many cases, were placed in the small round space between the pestle and the

top of the perforation, and the ground product fell down below the constricted part of the hole to be collected below.

A rather large donut stone (295-3-21) was found on its edge on the floor of room B in Structure 3. It was at a very slight angle from vertical, suggesting that it may have had a stick or pole in it at the time of the eruption, which held it on end until the volcanic ash could pack around it, but no evidence of associated wood was found. It is undecorated, but quite well-formed, and it was used extensively, judging from the worn condition of the perforation. A black organic residue adheres to the inside of the perforation, and a sample will be examined at the Armed Forces Institute of Pathology to determine its nature. A little of the same organic residue was found on one surface of the stone, evidently "leaking" from the hole, and supporting an interpretation of this specimen as a grinding stone, with the grinding taking place in the hole, likely with a wooden pestle.

A relatively small donut stone (295-3-35) was found on the porch of Str. 3, just south of the step and the pot, angled against the vertical wall of the platform. No evidence of a cavity was found. It does have a moderate amount of use wear at the point of greatest constriction of the perforation, and some organic residue was noted inside the hole. It is made of a very slightly vesicular andesite. It is quite round, and is relatively well-shaped by rough and then fine pecking, but has no decoration.

Hammerstones (8)

A total of six hammerstones were found in the 1989 excavations of Structures 1 and 1b. They were fist-sized river cobbles, with the battering characteristic of hammerstones showing up on prominences and ridges.

A river cobble was collected, and used as a hammerstone (295-1-56), with its final resting place being Area 3 of House 1, in between the two laja grinding slabs. It has been extensively used, as all projecting ridges and surfaces show battering and components of Hertzian cones. The impact energies were greater than generally required in obsidian percussion flaking, suggesting that it may have been employed for other uses. A possibility is re-pecking large metates to keep the surfaces rough enough for efficient grain grinding. It is made of a dense basalt, with stream polish still visible on four of its six faces.

The remaining five hammerstones are described here in the composite. They vary from the above specimen only slightly in terms of shape, degree of use, and vesicularity (moderate to non-vesicular). All but one was also playing a double function as a pot-rest, to stabilize a round-bottomed fired clay vessel on the flat floor. Their average diameter is about 8 cm, and most exhibit the pecking wear from use along a few prominent ridges or protuberances. Hammerstones probably were used to manufacture stone tools, and to roughen metates and manos. However, the number of hammerstones seems very great when compared to the chipped stone indicating local manufacture, and to the rare need to roughen grinding surfaces. I suspect the main use of hammerstones was to shape groundstone tools such as donut stones, manos, metates, and the like.

The above-mentioned characteristics also apply to a probable hammerstone (295-2-57) encountered in House 2, although it is somewhat smaller than most of the others, and only exhibits the battering use in one small area of one protrusion.

Shaped Laja

A shaped laja with a handle (295-1-111), more common in lower Central America, was found in a pile of largely unshaped rocks on the floor of Str 1b. The handle was well-shaped by pecking, but the upper portion is largely

fractured away, apparently by harsh percussive use. It presently is 19.7 cm long, 11.4 cm wide, and 5.6 cm thick. Its original length was probably twice as long.

Pumice Abrader

Near the abovementioned shaped laja with the handle was a pumice abrader, with dimensions of 5.6 x 4.8 x 3.9 cm. This appears to be only a small fragment of a much larger abrader. It has one surface which is worn down by use.

Pot-rests

Numerous pot-rests were found in the bodega, Str. 1b, wedged in against the lower bottom portions of round-bottomed vessels so that they would not tip over. Six of them were also hammerstones, but most were simply river cobbles collected for that purpose. Pots against walls sometimes had two, but pots in the more open floor areas had three or four pot-rests to help support them.

Occasional other stones were found, that had been brought in to the site, for purposes that remain unclear. For instance, a small rock (295-2-93) was found on the tierra blance joven ground surface west of Structure 2a. It shows no evidence of having been used for pecking, griding, or other activities, but it is foreign to the tbj, and thus clearly is an item transported in by people..

Large Shaped Rock

A large rock, shaped by pecking the edges and corners with hammerstones, was found in Structure 3. Its function is unknown. Surprisingly, it was not found in floor contact, but was well above the floor originally, at least on top of the inner wall, and it may even have been up with the roofing materials. Given its great size, one wonders if this is a case of prehistoric parental irresponsibility, having such a large rock in a hazardous location from which it could have fallen and injured someone.

Large Stepping Stone

Somewhat similar to the walkway between Structures 1 and 1a, this large stone was placed on the surface just outside and north of Structure 3. A slight amount of multidirectional use-wear is detectable on both surfaces, and I suspect that this is abrasion from many years of use as a stepping stone. The stone shows no evidence of having been shaped. It probably was collected from the Rio Sucio, as it does appear to have been stream-smoothed. The material is a dense, non-vesicular basalt.

Summary and Conclusions

The overall composition of this collection of groundstone is not surprising for a Southern Mesoamerican site, with the plethora of hammerstones, manos and metates, laja, and donut stones. What is suprising is that two metates were found in their original positions still mounted on their forked stick support framework, and that a few groundstone implements sitll retained organic residues from their uses some 14 centuries ago.

Horquetas to hold metates are designed specifically for the woman doing the grinding so that the grinding surface is just below waist level. The distance from the middle of the two metates to the ground surface in Household 1 was 46 and 48 cm, yet the distances measured in the contemporary Joya de Ceren community are between 55 and 70 cm. Thus, both at Hh 1 appear to have been designed for a short female, perhaps both for the same person. Both were quite new, based on the minimal use wear. The fact that both are short and quite new might be merely coincidental, or they might be indicators that the female head of household had recently died and been replaced by her short successor. The

food grinding areas for Households 2 and 3 have yet to be found, but they probably will be found during the next field season. If we are fortunate enough to also find the female head of the household, it will be interesting to compare the height of her metate above the ground with her stature to waist height.

The slabs of flat-fracturing andesite, known throughout the area as "laja" were found in and around all structures. They are most common just outside structures, where they apparently function as stepping stones. What two were doing up in or on the roof of Str. 3 is unknown. Two found in Str. 1b were used as portable nether grinding stones.

Some archaeologists have wondered why broken metates were kept around occupied sites, and Ceren has supplied an answer. The abundance of round-bottomed pottery vessels requires a large number of stones to support and wedge them, so they do not roll over, and metate fragements were frequently so employed. Because it is unlikely that people would have transported broken metates in for such a purpose, with river stones available within a few hundred meters, there may be a rough chronological indicator here. If the household was responsible for all these metate fragments, and if (as local residents claim) a metate can last a lifetime of a user, then the family probably was present for at least a century at this locality. In addition to all the broken metate fragments, the family used many river rocks and some hammerstones to help keep their pots upright.

The miniature metate, with the hematite residue on top, clearly was used to grind hematite, and two prepared cylinders of hematite were found with it in the small vessel toward the back of Str. 1. A major activity of Household 1 was pottery making and painting, as had been discovered in the previous research at Ceren, and finding the hematite processor is further evidence of that craft. It is likely that the hematite cylinder was merely rubbed onto the top of the metate, with no miniature mano needed.

Manos are traditionally stored under or immediately beside the metate, yet neither metate had its mano nearby. The metate in Str. 1b had its mano a few meters away, and it was surrounded by vessels. Thus, the eruption certainly did not occur when either was in use, and this may be an indication that the eruption occurred at night, when things would have been maximally "put away".

Virtually every archaeologist who has seen a biconically-perforated "donut" stone has wondered about its use, and many have argued or speculated about their use. Too often it has been assumed that there is a single use to which they were put in the past, as it appears from the Ceren excavations that there were at least two very different uses, and there may well have been more. One digging stick with a relatively small donut stone on it was found in Structure 1 in the earlier excavations. A number of the donut stones from this year's excavations had visible organic residues on them, and one of those still had the remains of a wooden pestle in it. In addition to serving as digging stick weights and as perforated mortars, I suspect that they may have had even more uses. Certainly, the variation in size, decoration, usewear, and location of storage and use is considerable, and all households apparently owned a few of them, and likely made them themselves.

The number of hammerstones is way out of line with the amount of intra-household manufacture of chipped stone tools, i.e. very little indeed. However, it is likely that the manufacture and occasional refurbishing of groundstone tools is the major task of the hammerstones. The bodega of Household 1 had abundant hammerstones, and it is predicted that the bodegas of the two other families will be well-stocked with hammerstones as well. The frequency of hammerstones at Ceren may prove to be an indicator of the amount of groundstone manufacture

done within the household, and there may have been significant variation among households in this regard.

In summary, all households had donut stones, in all structures excavated to date (except Str. 1a). They evidently served a variety of functions from grinding to weighting sticks. The finding of two metates on their original elevated wooden framework allowed for grinding surface-to-floor measurements to get an estimate of the stature of the female using it. She apparently was quite short. Broken metates, hammerstones, and stream cobbles were used as potrests, to wedge round-bottomed pots so that they would not roll over. Large numbers of laja were used for a wide variety of purposes, including as flagstones along walkways, as portable grinding stones, as a cap to an adobe column, and two for some obscure reason were up in the roofing material of Structure 3.

Wall tops were used for storage areas for valued items, and four pieces of groundstone were apparently stored in a bajareque wall top storage area in Structure 2a. Probably at the top of the adobe portion of the western bajareque wall were stored three donut stones and one whetstone-lap stone. They remained intact during the emplacement of Units 1 and 2, but Units 3 and 4 knocked them off their wall tops at different times.

Chapter 13: CONSERVATION REPORT ON THE CEREN CODEX

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INTRODUCTION

On 14 July 1989, excavation of a niche beneath an interior platform 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. These appeared in a generally horizontal plane approximately 3 centimeters above the adobe floor and occupied a roughly rectangular zone 13 cm x 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 deposition was interpreted as the remains of a painted codex.

Although representations of books appear throughout the Classic Mayan Period in wallpaintings, no examples have ever been successfully excavated. In fact only three or four Mayan codices are extant and all are much later in date (variously dated from the 10th or 12th to the 15th centuries). Each of these is made of a long sheet of amate, a fig bark paper, folded like an accordion with each pleat measuring 10-13 cm x 20-22 cm. The two sides are painted first with a thin white sizing or ground layer, followed by figural and glyph decoration using various mineral pigments (red, black, etc.). If the Ceren artifact were a codex, it would be both the earliest of the known Mayan examples, and the only one from an archaeological context. The possibility of such a unique find resulted in a decision to remove the object from the niche immediately for safe-keeping and to bring in a conservator for proper follow-up treatment.

The procedure carried out by the archaeologists for lifting the remains was as follows. The tephra (volcanic ash) surrounding the object was removed down to the adobe floor. A piece of thin but rigid galvanized steel measuring 15 cm x 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 very damp ash. It was packed in order to prevent the ash from becoming more concrete-like 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 at the excavation house in San Salvador.

Remaining on the adobe floor of the niche following the lift was a portion of the object. In a similarly rectangular format, this consisted of a loose jumble of pigment particles in the eastern half (to the 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 particulates. The niche opening was blockaded with several large bags of volcanic ash, and the platform with the niche completely draped with plastic.

The report which follows details the conservator's activities for the week-long period beginning with her arrival on 20 July, 1989. The objectives of this intervention were:

- to stabilize the block-lifted remains to minimize immediate deterioration from handling and exposure to ambient environmental conditions;

- if appropriate, to lift the portion of the object still in situ;

- to examine the remains for more information leading, if possible, to identification of the artifact;

- to assess the condition and determine appropriate follow-up treatment.

- If the object remains on-site (in El Salvador): to carry out treatment as needed, and/or arrange for proper storage in the Museo Nacional.

- If treatment is to be continued off-site: to stabilize as needed, and arrange for safe transport to the Smithsonian Institution for further analysis and treatment, with subsequent return to the Museo Nacional.

CONDITION OF THE CODEX BLOCK

The block-lifted remains were examined on 21 July, seven days after excavation. There was evidence of mold growth on both notebook and tissue papers, and condensed moisture on the inside of the foil wrap. To provide better support, a cardboard box was constructed to the dimensions of the metal sheet, and the block with its metal base was placed in it. A single thickness of foil was retained to hold in the sides of the block during this transfer, trimmed to the height of the block. Because the metal sheet was longer than the block, a piece of Ethafoam (polyethylene) was cut to fill the space and provide support for that side of the block. The tension at the corners of the cardboard box was adjusted to give maximum support to the block. For temporary storage, a sheet of Pellon (fine polyester web) was laid on the surface as protection, and a single piece of foil was loosely wrapped around the box. This was placed in an open plastic bag inside a cupboard, in order to retain some of the block's moisture content until the drying behavior of the tephra in contact with the pain fragments is more fully understood.

The current surface of the block is not level, being considerably thicker toward the rear portion where less of the tephra overburden was removed. Particularly noticeable in the lower western portion, the dense scatter of paint fragments gives the impression of a horizontally layered orientation despite extensive fracture and dislocation from volcanic events and subsequent burial. These white, red-on-white, and green-on white fragments are extremely friable, having a thickness of only 0.2 to 0.5 mm. In some places, contiguous fragments cohere as thin flat patches (none bigger than 2 cm); in other areas, more than four distinct paint layers are visible in cross-section. There is no evidence that any of the foundation material on which these fragile paint layers were applied remains. Given the limits of this examination, it is impossible to determine the extent of preservation of the object encased within the block of volcanic ash. If it is composed of a stack of flat painted components, it seems likely that the lowest strata (just above the metal sheet and in contact with the portion left on the floor) may retain more of their original planar form than the uppermost ones. None of these, however, is likely to preserve the organic substrate, articulated instead only by their inorganic paint layers.

Successful consolidation of the upper surface of the block would be difficult and would interfere with subsequent analysis. Consequently, packing

for transport will require gentle but very firm support to minimize disturbance. In this case, retention of some of the block's moisture content is recommended until the drying behavior of the tephra in contact with the paint fragments is more fully understood.

CONDITION AND ON-SITE TREATMENT OF THE FOLIO

The lowermost portion of the object left in the niche (referred to as "folio" henceforth) was examined on 21 July, with a subsequent decision to lift it on 22 July. Particles of ash, roofing material and other debris were carefully removed from the better preserved western half of the folio using tweezers. While 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 0.5 cm thick patch of tephra resting directly on portions of the 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 layer which were free of the tephra deposit showed green upper surfaces. The resulting 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, tephra.

In order to protect the planar portion of the folio during lifting, this area was first consolidated with Acrysol WS-24 (an acrylic emulsion manufactured by Rohm & Haas, diluted 1:2 with filtered water), applied with a pipette. This consolidant performed more satisfactorily than Acryloid B-72 (a Rohm & Haas acrylic resin, diluted to 10% in acetone), which turned milky in contact with the moist surface. Care was taken to consolidate only the area visible as a single white layer; the tephra patches were left unconsolidated. The folio's disrupted half (to the east) was not consolidated, except for several scattered fragment-clusters of paint. The niche was left open to promote drying of the consolidant.

On 22 July, the lowemost component of the codex was lifted. Several centimeters' margin was left on three sides and the surrounding adobe excavated down about 3 to 4 cm. A thin, rigid galvanized steel sheet (15 cm x 25 cm) with a sharpened leading edge was slid underneath, moving from south to north (parallel to the long side). Beneath the compact upper surface, the adobe was found to be crumbly and nonhomogeneous, with harder inclusions, causing some disturbance to the folio as the metal slid beneath. One crack developed in the consolidated planar area which was otherwise relatively unaffected by the lift; segments of the noncohesive area shifted noticeably. At the niche wall, a knife was used to cut through the adobe down to the metal sheet. The block was lifted, placed in a pre-fitted cardboard box lined with aluminum foil, and plaster of Paris was poured around the block to hold it securely in place.

To better understand the layered structure, a piece of Japanese tengujo tissue paper was adhered with Acryloid B-72 (10% in acetone) to a small chunk of the tephra resting on the folio surface. When the piece was lifted with its tissue support, the white layer on the underside appeared to preserve minute impressions of a fibrous material. This may be evidence of the now disintegrated organic substrate for the paint layers. The remainder of the tephra patch was then reinforced with Japanese tissue and Acryloid B-72 and gently "peeled" off the lower white folio surface. The completely exposed folio surface (which would originally have been in contact with the other side of the organic substrate) was carefully reinforced with small strips of Japanese tissue and methyl cellulose paste (manufactured by Archivart, soluble in water). The purpose of the facing is to keep the many tiny fragments making up this planar surface in their

original positions, conferring some protection during transport the surface was allowed to dry out in ambient conditions.

PROPOSED FOLLOW-UP ANALYSIS AND TREATMENT

The size of the deposition, the presence of paint and the particular layered structure lend credence to the identification of this object as a codex. While 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.

Materials Identification:

Disassociated fragments of the various colors of paint and the white ground may be analyzed by techniques such as X-ray diffraction to determine the exact nature of their mineral constituents. The exposed white surface of the "peels" may be microscopically examined, including with a scanning electron microscope, for possible identification of the organic substrate whose imprint was left in the white ground layer.

Structure and Decoration:

The block may 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.

Finally, the painted decoration on the underside of the folio's white surface might be revealed by careful excavation through the adobe on which it rests. Previous consolidation and the Japanese tissue facing will lend some strength and cohesiveness to this fragile layer.

PACKING AND TRANSPORT

With the approval of the Ministro de Educacion de El Salvador and the Proyecto Prehistorico de Ceren, the two lifted segments -- the codex block and the folio, plus its "peels" -- were hand-carried by the conservator to the Conservation Analytical Laboratory of the Smithsonian Institution on 28 July, 1989 for further analysis. In preparation, two small wooden crates were constructed by staff at the Palacio Nacional, San Salvador. The excavated items were gently and firmly cushioned and packed for safe transport. In particular, no consolidants were used on the codex block to avoid interference with subsequent analysis.

Upon completion of the analytical work, all materials will be returned to the Museo Nacional for permanent storage. Included will be a full report on analyses and any treatment undertaken, with appropriate photodocumentation.

Chapter 14. ORGANIC REMAINS

Dr. Andrea I. Gerstle, Edy Montalvo Western Michigan University, Universidad de El Salvador

I. Introduction

The sudden abandonment of the site of Joya de Ceren due to the violent explosion of the Laguna Caldera volcano created extraordinary conditions for the preservation and recovery of normally perishable organic remains. As explained in Chapter 3, the burial of the site involved a series of events, beginning with relatively cool airfall tephra, and then a series of surges and blasts of various temperatures and ash types. The type of preservation of organic remains varies depending on the ash temperature, moisture content, and other variables.

II. Type of Preservation and Recovery Methods

A. Hollow Cavities

Items resting on the ground or structure surfaces were coated with a layer of fine, cool airfall tephra. This layer eventually hardened to create a coating that conformed to the shape of the object underneath. The hardened ash coating retains the detailed texture of the surface of organic item it covered. In many cases, these objects were organic and eventually rotted, leaving a hollow space or cavity in its original location. The variety of organic materials thus preserved include living plants, cut wood, some seeds, and other materials.

When such hollows were discovered (usually when a small area of the ash coating was penetrated), the shape of the cavity was usually explored with a sigmoidoscope powered with a small generator. If it seemed interesting (i.e., more than just a straight stick), a cast of the cavity was made. The material used in casting was dental stone; it was either poured into the cavity or injected with a syringe (see Chapter 6).

B. Carbonization

Following the initial fine ashfall were numerous base surge eruptions of material varying in temperature, moisture content, and coarseness. Some of these (involving coarse ash) were extremely hot (500-600 degrees C) and carbonized some of the less-protected organic remains.

These items are preserved in their original form except for the fact that they are thoroughly burned. The materials most subject to this form of preservation are wood (especially cut and dried wood), seeds, and items made from plant material such as twine.

Recovery of carbonized remains usually involved consolidation with Primal E-3-30 before removal and careful wrapping in aluminum foil. The exception is seeds: most of these were recovered by sifting through samples of soil from in and around ceramic vessels.

C. Other Organic Remains

Some organic items were preserved without either being carbonized or rotting. Some were subject to charring by ash falling at a temperature of about 100x C (not hot enough to carbonize completely). The materials recovered in this condition include roof thatching (especially palm), as well as bone and some seeds. The conditions allowing such preservation are unclear, but probably involve specific environmental conditions (ash acidity, drainage attributes, etc) and perhaps the moisture content of the organic material at the time of the explosion (e.g., of thatching and ceramic vessel contents). Some of the larger objects were consolidated with Primal E-3-30 before removal; others were collected without special treatment beyond

careful wrapping in aluminum foil. Items found in ceramic vessels were recovered by screening and sorting through samples taken from inside the vessels.

Other organic remains are microscopic and were collected in the form of soil samples and scrapings. The former include pollen samples. The latter include deposits on artifacts such as vessel interiors and worn surfaces of ground stone artifacts, especially those suspected of being milling stones (metates and donut stones). These samples were placed in clean bags or small glass or plastic containers.

Samples of carbonized material were also taken for radiocarbon dating. These were carefully excavated and wrapped in aluminum foil for submission to a specialized radiocarbon dating laboratory.

III. Analysis of Samples

The catalog of samples of organic remains collected during the 1989 season of excavation at Ceren is presented in Table 1. It includes samples for genus/species identification, soil and special samples, and samples for radiocarbon dating.

Some samples of macroscopic floral and faunal material have been submitted to Zulma Ricord de Mendoza (Director, Museum of Natural History) and to Edy Montalvo (Universidad Nacional) for genus/species identification. The results of these identifications are summarized in the reports appended here. Analysis is continuing and further results are pending.

Samples of microscopic remains have also been selected for further analysis by specialists in the United States. Thse include samples of scraping from surfaces of ground stone and ceramic artifacts. Results of these analyses will be forthcoming.

Although the identification of organic remains from the 1989 excavations at Ceren is just beginning, it is clear that the preservation of these remains is excellent. Expectations for generic and species-specific identification of macroscopic remains is high. These identifications will be invaluable for understanding various aspects of the prehistoric adaptation of the Ceren inhabitants. It will be possible to explore such topics as local environmental conditions and patterns of exploitation. Reconstructing the availability and differential use of various building materials, plant and animal foods, condiments, and medicines will be crucial to a complete understanding of the life of the Ceren inhabitants.

Table 1: Organic Remains, Ceren site, 1989

Structures 1, 1B

Cat. No.	Excavation Date/Initials		Description
295-1-1	6-20-89	SM	Plant cast H (3 parts)
295-1-2	6-22-89	SM	Plant cast F
295-1-3	6-22-89	SM	Plant cast E
295-1-4	6-21-89	SM	Plant cast *: bottom (3 pieces), middle (3 pieces)
295-1-5	---	--	Plant cast (no id)
295-1-6	6-20-89	SM	Plant cast X: 3 pieces
295-1-7	6-20-89	SM	Plant cast G: 5 pieces + upper piece
295-1-8	6-20-89	SM	Plant cast I
295-1-9	6-22-89	SM	Plant casts AB top, AB bottom, gravel end
295-1-10	6-21-89	SM	Plant cast J
295-1-11	---	SM	Plant cast P1"C"
295-1-12	6-26-89	MB	Plant cast K: 7 pieces
295-1-13	---	--	Carbon sample #1
295-1-14	6-23-89	AG	Carbon sample #2
295-1-15	---	MB	Plant material? from near W column
295-1-16	6-23-89	--	Seeds, Vessel 3
295-1-17	6-22-89	--	Contents under Sherd 1
295-1-18	---	--	Contents, Pot 5
295-1-19	---	DBT	Contents, Pot 4
295-1-20	6-19-89	AG	Contents, Pot 1: with beans?
295-1-21	---	--	Fill in & around Pot 4
295-1-22	6-22-89	--	Contents, Pot 6
295-1-23	6-19-89	DT	Pollen sample, Pot 2
295-1-24	---	--	Contents, Pot 7
295-1-25	6-19-89	AG	Carbon S of Pot 2
295-1-26	6-19-89	AG,MB	Upper contents, Pot 2
295-1-27	6-19-89	MB	Contents, Pot 2: relatively pure
295-1-28	---	--	Pot 7, shell (4 frags)
295-1-44	6-27-89	MB	Seeds from pot near SE column
295-1-47	6-28-89	MB	Contents, Pot A
295-1-48	6-28-89	MB	Contents, Pot B
295-1-49	6-28-89	MB	Contents, Pot C
295-1-50	6-28-89	MB	Contents, Pot D
295-1-51	6-28-89	MB	Contents, Pot E
295-1-52	6-28-89	MB	Under Pot E
295-1-57	6-28-89	PDS	Pollen sample, milpa NE of Test Pit 2 below maize cast
295-1-58	6-27-89	MB+	Contents, Pot 8
295-1-59	6-28-89	PDS	Pollen sample on metate surface
295-1-60	6-28-89	MB	Plant cast D, a & b: lower part
295-1-60	6-28-89	MB	Cast of plant assoc. with D-series plants
295-1-60	6-28-89	MB	Half of lower part, Dc
295-1-64	6-30-89	MB,DT	Contents, Pot 10
295-1-68	6-30-89	MB,DT	Contents, Pot 12 (pigment)
295-1-99	---	--	Twine mixed with thatching S1.40 W7.00
295-1-121	7-10-89	--	Cut wood, Str 1B near S wall
295-1-139	7-11-89	MB	Plant casts, Area 6 (part 1 = upper; part 2 = lower)

295-1-142	7-10-89	--	Pigment near donut stones, south part of Str 1B
295-1-144	---	--	Bird skeleton
295-1-146	---	--	Contents, Pot 28 (organic?)
295-1-148	7-5-89	FMS	Contents, Pot 18 (upper & lower)
295-1-149	---	--	Contents of Pot 295-1-125 (including vial)
295-1-150	---	--	Contents, Pot 28 (effigy incensario)
295-?-?	---	--	Plant cast: 5 stems

Structure 2

295-2-1	6-22-89	BRM	Canine tooth
295-2-13	6-23-89	BRM	Seed cast
295-2-16	6-23-89	BRM	Snail cast
295-2-36	7-11-89	BRM	Forked stick, consolidated
295-2-38	7-14-89	BRM	Consolidated roofing
295-2-40	7-13-89	BRM	Carbon sample: thatch immediately above interior wall
295-2-41	7-13-89	FS	Wood samples, from S of south wall
295-2-48	---	--	Contents, Pot 3 (vial)
295-2-49	---	--	Oyster? shell from niche
295-2-56	7-17-89	FS,JS	Roofing timber on top of E wall
295-2-60	7-18-89	JS,FS	Bone tool (2 frags): S12.08 W49.02, 4 cm above floor
295-2-62	7-19-89	FS,BRM	Twine, S11.80 W49.80, central floor area
295-2-63	7-19-89	FS,BRM	Wood & thatch: S11.80 W49.80, 20 cm above room floor
295-2-64	7-19-89	DT	Casts of small holes, Str 2A, S8.94 W48.66
295-2-70	7-20-89	FPS	Wood implement? S12.06 W49.67
295-2-75	7-21-89	DM	TBj mixture
295-2-76	7-20-89	FS	Wood frags from raised floor: S12.00-12.60 W49.15-49.60
295-2-77	7-13-89	DT+	Adobe with thatch impressions, from "raised platform" outside W wall
295-2-90	7-26-89		Bone tool, South pit, floor contact
295-2-108	7-29-89	BRM,DT	Contents, Pot 295-2-107, S13.88 W53.92
295-2-117	7-29-89		Rodent skeleton,S13.81 W53.78, floor contact
295-2-118	7-31-89	BRM	Str 2B, Seed casts (uhushte), S13.56-98 W54.30-64, floor contact
295-2-119	7-31-89	BRM	Wood ash, Str 2B, floor contact
295-2-132	7-31-89	BRM	Hearth fill, Str 2A, S8.55-9.10 W50.75-51.30
295-2-133	7-31-89	BRM	Paint chips, Str 2B, S12.38 W54.10
295-2-136	7-31-89	DT	Loose chips from S area Str 2B, S12.78 W54.65

Structure 3

295-3-1	6-26-89	AG	Carbon sample N21.05 W60.80
295-3-2	6-27-89	AG	Carbon sample N21.80 W62.20
295-3-9	7-6-89	AG	Carbon sample
295-3-10	7-6-89	AG	Soil sample, Niche 2 floor
295-3-13	7-7-89	AG	Bone tool, Niche 3
295-3-14	7-6-89	AG	Small gastropod, Room B
295-3-16	7-10-89	AG	Small long bone, Niche 4
295-3-18	---	AG	Rodent bones, Room B in thatching, 70 cm E of of Wall 1, 80 cm S of Wall 5, 160 cm below

			top of Wall 1
295-3-19	7-14-89	AG,MB	Lower contents, Vessel 295-3-17, Room A
295-3-21	---	AG	Organic residue inside donut stone, Room B
295-3-22	7-18-89	AG	Carbon sample (wood)
295-3-23	7-18-89	AG	Carbonized thatching
295-3-25	7-19-89	AG	Consolidated unburned thatch, Room B
295-3-29	7-19-89	AG	Spine/thorn assoc w/ wood, E of Wall 3
295-3-37	7-22-89	AG,MB	Lower contents, Vessel 295-3-34, Terrace
295-3-38	7-19-89	AG	Carbonized thatch (grass), Room B
295-3-39	7-19-89	AG	Carbonized log (13 cm diam), NE quad Room B
295-3-40	7-19-89	AG	Carbonized grass thatching (=295-3-38)
295-3-41	7-23-89	AG	Interior deposit, partial vessel 295-3-31
295-3-42	7-24-89	AG	Carbonized forked stick, NW of substr
295-3-44	7-25-89	AG	Thatching (palm?), Room A, N bench
295-3-45	7-25-89	AG	Seeds? with burned wood, Room A, N bench
295-3-46	7-25-89	AG	Thatching w/ stem (palm?), NE terrace corner
295-3-49	7-27-89	AG	Carbonized log B, NW of str
295-3-58	7-24-89	AG	Shell frag (worked), Room B

Table 2. Preliminary identifications of botanical material by Edy Montalvo, Universidad de El Salvador

Casts C, D, F, G, H, I, J, K, X, and all other casts from the milpa were identified as either Zea Mays (maize) or Heckelochloa granularis (maicillo).

The roofing thatch recovered from Structure 2a was tentatively identified as from a palm, likely Cocos nucifera.

Sample 295-2-41, carbonized wood from the south wall of Structure 2a was likely either Tithonia sp (varaboja or Veronia sp. (Suquinayo), both of which are species present in the area.

Sample 295-2-56 was identified as a branch fragment with the bark removed, possibly Trema sp.

Field specimen 295-2-63 was a piece of fine wood, tentatively identified as Enterolobium cyclocarpum.

Field Specimen 295-2-75, the "beige unit" discussed by Miller (Chapter 3, this volume) consisted of volcanic ash with marks from sprouts of grass. The sprouts and seeds were not positively identified.

Field Specimen 295-2-76, wood fragments from on top of the bench, were identified as tree branches possibly from Spondias sp. (jocote).

Specimen 295-2-77, adobe from the raised platform outside of Structure 2a, had impressions of Graminae.

Specimen 295-3-25 was thatch from Structure 3. Some holes found in the thatch may be due to termites or other insects.

Field Specimen 295-2-38 was carbonized roofing thatch. It appeared to be from of a species of Gramineae, possibly Hyparrhenia sp.

Chapter 15: POSTCLASSIC OCCUPATION AT CEREN

Brian R. McKee and David Tucker, University of Colorado

Introduction

Although the primary occupation preserved at the Cerén site dated to the Classic Period, the area was occupied during the Postclassic as well. Rock foundations of three or four rectangular structures were found in the road between the Cerén site and the town of Joya de Cerén, and the remnants of a burial also likely dating to the Postclassic were found on the site, stratigraphically above the tephra from the Laguna Caldera eruption.

Postclassic Structures

Residents of the town of Joya de Cerén informed Proyecto Cerén Project members that other prehistoric houses were located between the site and the town. Inspection revealed the foundations of three and possibly four structures located in the dirt road into town, just north of the north edge of town. The rocks forming the foundations were exposed by the erosion caused by vehicle and foot traffic as well as rainfall.

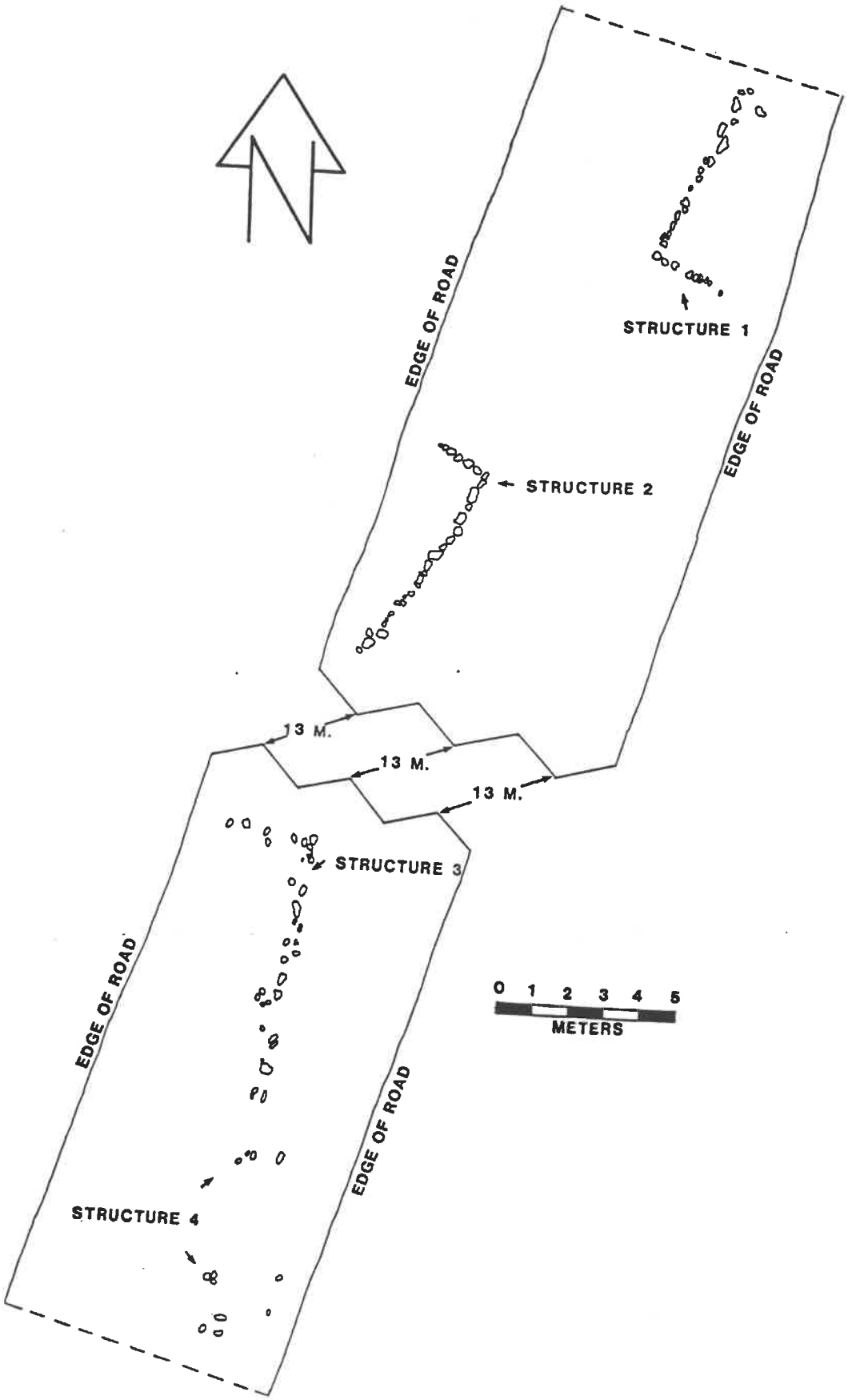
On 25 July, 1989, the authors mapped and described the remains of the structures (Figure 1). The foundations consisted of linear patterns of basalt cobbles. No excavations were conducted, and only those rocks visible on the surface were mapped. The height of the rocks above the road surface varied between 0 and 10 cm, and it is likely that other buried rocks were present that were not visible on the ground surface. Others may have eroded out. The rocks varied in diameter between 10 and 50 cm. The majority of the rocks utilized were of vesicular basalt, although some non-vesicular basalt and andesite were used as well. The structures are approximately rectangular, and the longest side recorded was approximately 6.0 meters (for Structure # 1). The orientation of the structures varied between 15 and 30 degrees east of magnetic north. It is interesting that this is approximately the same orientation noted at the Cerén site (30 degrees east of magnetic north), although the orientation at Cerén is more precise. Remains of two walls were exposed for three of the structures, while only a few rocks in a roughly linear arrangement were present for the fourth. Therefore the fourth feature is only tentatively described as a structure.

The stratigraphic position of the structures is unclear, but it is certain that they post-date the A.D. 590 $\pm$ 90 eruption of Laguna Caldera Volcano. The road has been subjected to much erosion, and so without excavations, it is impossible to tell whether they pre-date or post-date the ca. A.D. 900 eruption of El Boqueron, and the AD 1658 eruption of Playon. At the nearby Cambio site, a rock allignment which was probably the remains of a similar structure was found in a roadcut (Chandler 1983). Here, the structure was lying on top of the San Andrés tuff from the Boqueron eruption, and beneath the 1658 Playon tephra.

No artifacts were present on the ground surface near the structures, but Sheets (personal communication 1989) has stated that this type of rectangular foundation of vesicular basalt cobbles is common during the Postclassic period in the Zapotitan Valley and surrounding areas.

The Postclassic period had the second highest number of sites of any period studied during the Zapotitan Valley Survey, behind only the Late Classic (Black 1983). This is partly due to the better exposure of later sites due to the lack of volcanic overburden, but Black estimates a relatively high Early Postclassic population of 30,000 to 70,000 people in the Zapotitan Basin, with an average density of 165 to 385 people/sq km, and 21,000-50,000 in the Late Postclassic, with an average density of 115-275 people/sq km.

FIGURE 1. POSTCLASSIC STRUCTURES NORTH OF JOYA DE CERÉN
LOCATION OF STRUCTURES RELATIVE TO SITE
CAN BE SEEN IN FIGURE 16-1.



Several of the factors listed by Black as important determinants of Postclassic site location favor location in the area of these structures. One is that Postclassic sites are usually found at low elevations near to rivers. The Rio Sucio is less than 300 meters to the east of this site, and the elevation difference between the site and the river is no more than 25 meters. He states that Postclassic sites are also generally located on relatively flat terrain, as characterizes this locality. Surface indications lend support to the theory that these are indeed Postclassic structures. Excavations would be necessary to add support.

Postclassic Burial

During the excavation of a drainage ditch on the site, a bulldozer impacted a burial which postdated the eruption of Laguna Caldera Volcano (Figure 2). Much of the burial was carried away, but Salvador Quintanilla noted potsherds in the backdirt pile from the ditch, and located bones and ceramic sherds approximately in situ on the floor of the ditch. The burial was heavily impacted, but enough remained for a partial understanding of the nature of the burial. Excavation occurred August 21-24, 1989.

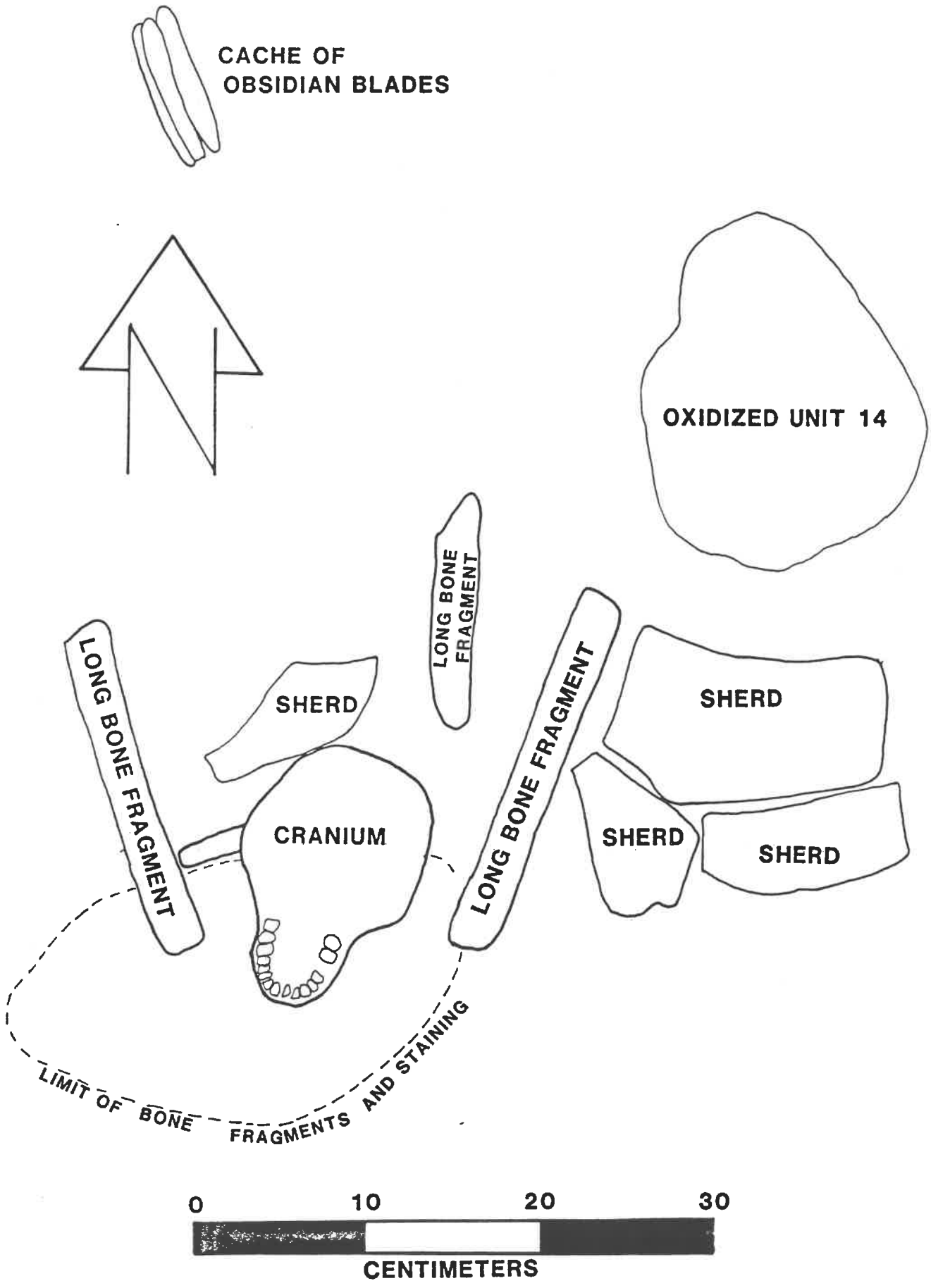
The burial was secondary, with a number of disarticulated bones apparently interred inside of a large ceramic burial urn. The pot and the majority of the bones had been moved to varying extents by the bulldozer. It appears that the urn was tipped on its side prior to the impact of the bulldozer, and that some of the bones had fallen out. Human remains included the cranium and portions of several long bones, including the shafts of the two femora and the shafts of two other undetermined long bones. The condition of all of the bones was poor, and they were therefore consolidated with a chemical known as paraloy, with the aid of Mario Castro, before removal from the ground. No pathological or age/sex studies were conducted on the bones.

Several artifacts were associated with the burial. The urn had broken into 25 sherds. It was a scraped-slip vessel with constriction at the neck. The neck diameter at the point of maximum constriction was approximately 20-25 cm. A cache of seven obsidian prismatic blades was found associated with the burial. Five of the seven blades were approximately the same size, and of the same material, indicating that they may have been from the same core. The other two were considerably smaller. The blades in the cache were all in contact with one another.

The stratigraphic position of the burial is uncertain, as the bulldozer destroyed any indications of the burial pit. It is clear, however, that the burial post-dates the Laguna Caldera eruption. Portions of the highly oxidized and weathered orange layer from the final level of the Laguna Caldera eruption, Unit 14, were found lying in the bottom of the pit. It is clear that this tephra was placed in the hole during backfilling of the burial. There are also a number of sherds visible in the wall of the drainage trench lying above this distinctive orange layer. Exact dating of this stratigraphic layer is uncertain, but several centuries must have lapsed after the time of the eruption to account for this degree of weathering.

In summary, follow up work based on informant reports of additional structures located to the north of Joya de Cerén resulted in the mapping of three and possibly four structures post-dating the eruption of Laguna Caldera eruption. The location of this site fits the patterns observed for Postclassic sites during the 1978 Zapotitan Valley Survey (Black 1983). Further indications of Postclassic occupation in the area included an urn burial that was fortuitously discovered during the excavation of a drainage ditch across the site. The recording of these structures, the burial, and other sites and features not

FIGURE 2. POSTCLASSIC BURIAL.



directly related to the project goals will in future years add to the data base begun in 1978, and will aid in an overall understanding of Postclassic settlement patterns and adaptation in the Zapotitan Valley.

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Chapter 16. SUMMARY AND CONCLUSIONS

Payson Sheets, University of Colorado

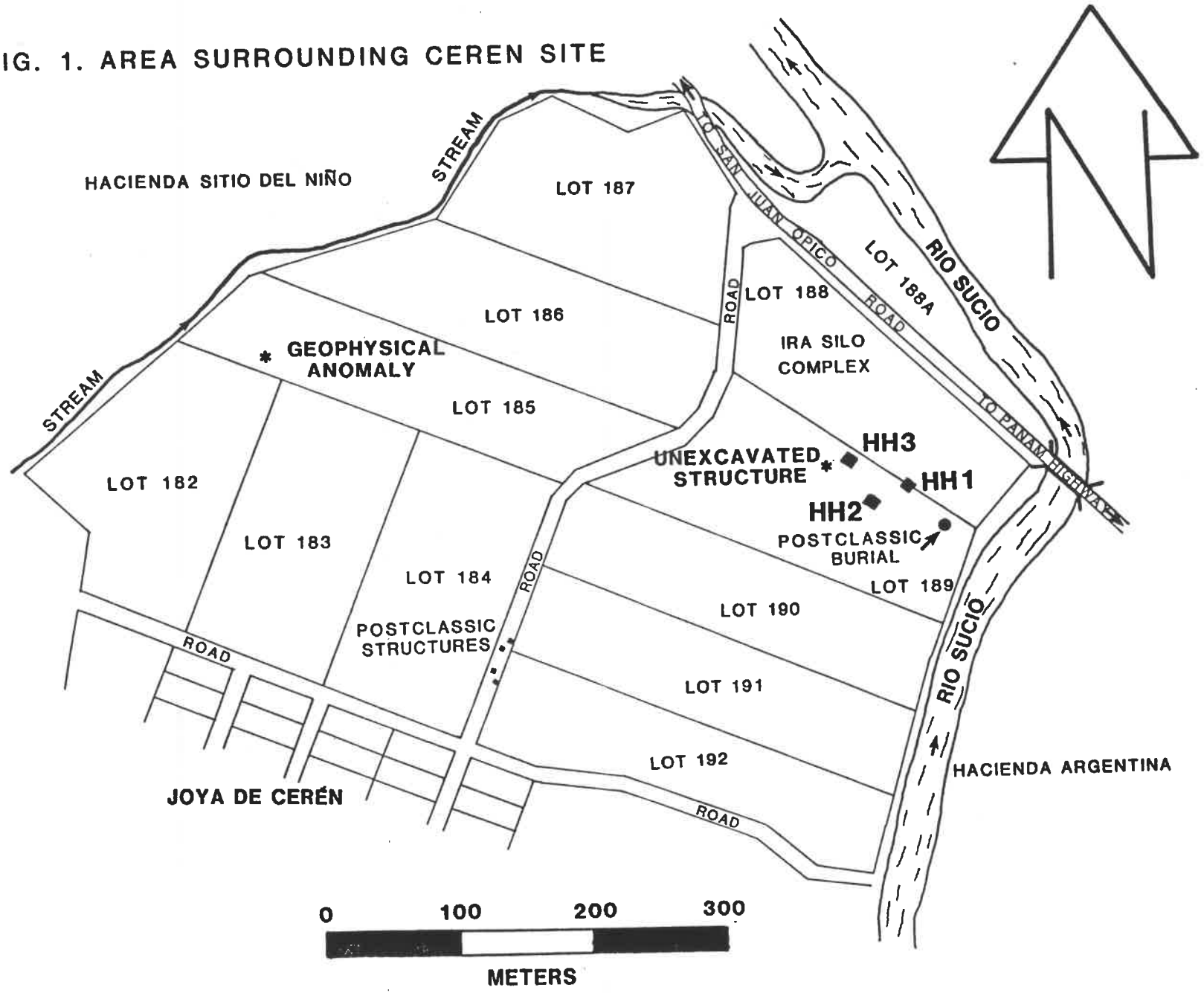
Although our expectations were very high for this field season, in terms of the kinds of data we had hoped to be able to collect, we were not disappointed. In all but one area of the objectives as stated in the proposal to the National Science Foundation the data exceeded our expectations. The only area of disappointment was the lack of human remains. According to informant's reports in 1978, human bones were found on the floor of Structure 1 in 1976, but that was bulldozed away two years before our arrival. We had hoped to find human remains in Household 2 or 3, but during the 1989 season we were able to excavate less than half of the structures of each of those households, so the chances are good to find human remains in the associated structures during the next field season.

One aspect in which we had unancipated success is in community relations. The Patrimonio Cultural showed forsight in appointing Evelyn Guadelupe Sanchez to our project to relate with the community of Joya de Ceren, and that she did with alacrity. She organized a number of public presentations by project members, she organized site visits by townspeople, and she organized the great "ash haul". She generated sufficient interest in our volcanic ash backdirt that people were eager to have it dumped on their roads, to fill in holes and improve patios, to fix up the school yard, and myriad other applications. Also, she set up the visits by school children; the first group of 400 young children (ages 5-8) was the best-behaved and most attentive group to visit the site ever, and the next group of 400 was almost as attentive. She also helped set up the dental clinics offered, at no charge, by Marilyn's husband Don.

There were some problems we faced during the season, and they began when Continental Airlines took all our film developing chemicals away from us and threw them away, supposedly because of the threat they posed to the aircraft. They also left all of Sean Murphy's luggage in Houston for almost half of the time he was in El Salvador. There were two incidences of vandalism at the site, one of them serious, and the armed guards at the site are the unfortunate but necessary response. The delay in construction of the large protective roofing over Structures 1, 2a, and 3 was unfortunate, as two days of heavy rain during the "temporal" did some damage. The effects of civil war were noticed occasionally in San Salvador and other areas, as electricity and telephones occasionally were knocked out by bombs, or we would be halted by military roadblocks, or a week was lost because of the "paro" called by the guerillas. However, these were relatively minor difficulties in a field season notable for success.

An absolutely key factor for the success of the project, this season and in the future, was for the complex system of geophysics-core drilling-power equipment tephra removal to be effective. At the beginning of the season we were not completely confident that the geophysical instruments were in fact able to detect prehistoric structures under 5-6 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 cubic meters. Thus, we were ecstatic when Structure 3 was discovered by the power equipment, as it had been detected as an anomaly by the ground-penetrating radar and the resistivity instruments, and it apparently had been confirmed as cultural by the drill rig samples. Using a power shovel instead of a bulldozer moved the pressure and movement of the heavy equipment

FIG. 1. AREA SURROUNDING CEREN SITE



away from the structures, and allowed us to excavate much closer to the structures.

Previous volcanological reseach had identified Laguna Caldera Volcano as the culprit which sent so much volcanic ash to bury the Ceren site. Dan Miller's microstratigraphic approach has refined our understandings of the various components of the Laguna Caldera eruption, which dates to about 600 AD. Previously we had thought that the eruption began with an airfall deposit, Unit 1, but Dr. Miller has convinced us that the initial deposition was a base surge. It arrived fast, propelled by winds between 100 and 200 km/hr, at a temperature approaching 100 degrees Centigrade. Because it was moist and very fine-grained, it often packed around things in its path, such as buildings, posts, sticks, pottery vessels, and trees. That was followed by Unit 2 with its hot clasts, at about 600 degrees centigrade. Those were followed by a series of fine moist and coarse-grained hot beds, generally deposited by rapidly moving hot turbulent clouds, but occasionally deposited by direct vertical airfall. The turbulence of the initial deposits is graphically illustrated by his descriptions of the deposits made in the pot in Structure 1b partially overturned and facing away from Laguna Caldera; had there been no turbulence, there would have been little or no tephra deposited inside that narrow-necked vessel.

Dr. Miller also studied the relationships between structures, structural collapses, and the tehpra 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 Str. 2b fell toward the northeast), and those apparently were caused by the turbulence. Bajareque walls and columns evidently were built as separate structural units, without reinforcements interconnecting them with each other or with the floor of buildings. However, they were strongly interconnected from above, as the vertical posts went into the ceiling support system for the roof. Evidently the buildings were quite resistent to lateral blasts so long as the upper structural integration remained intact, but when that was lost, individual structural members were vulnerable to collapse if they still were exposed above the tephra layers.

All structures excavated to date are oriented 30 degrees clockwise from our magnetic directions; i.e. 30 degrees east of magnetic north. Although we apparently have the material remains of three separate households, they are not independent households, and they had a strong sense of proper structural orientation, and they were economically interrelated. In contrast with what we first thought in 1978, this clearly is not an isolated agrarian household. Rather, these three households are part of a village of undetermined size.

The cultural affiliation of the Ceren 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. Both chipped and ground stone artifacts are clearly Southern Mesoamerican in their form, function, and sophistication, but it is difficult to be more specific. An assessment of their being more Maya or Lenca requires a more detailed archaeological record. The architecture appears to be more Maya (Ed Shook, personal communication 1989), with its porches, platforms, large benches, cornices, niches, and spatial segregation of function. Continued research in the future, particularly if something can be salvaged from the fragments of the "codex" or folio, may be of assistance in answering the cultural affiliation question.

The chipped stone implements were dominated by prismatic blades, with a scattering of macroblades and scrapers. All good 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 up in the roof, but cases 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 uses, is encouraging. Laboratory forensic examination is planned, with the objective of determining the substances on which they were employed.

Some groundstone implements also retained organic substances from their latest uses, and fragments of those will also be subjected to forensic laboratory examination. Donut stones, more formally known as biconically perforated stone disks, commonly had organic residues, and some of them apparently functioned as perforated mortars. One was found with a wooden pestle still in place. Two metates were encountered still on top of the forked wooden posts that supported them when they were in use during the Classic Period. Both were quite low, less than 1/2 meter from grinding surface to the ground, likely indicating that they were designed for a short female head of household. Both were fairly new, judging from the very slight degree of use wear of both. We would like to know if she was short enough to use the 1.50 meter high doorways without ducking, but until we find her body, we will not know.

The Laguna Caldera eruption was sufficiently sudden, and of a nature that led to good organic preservation in addition to structural preservation. In fact, two Italian volcanologists with research experience in Pompeii, Dr. Antonio Frullani and Dr. Marcello Ghigliotti, said that organic and structural preservation is better at Ceren than at Pompeii. A fairly wide range of fauna was preserved, including a dog's tooth, a duck (apparently domesticated), snails, and deer bone made into spatulate instruments. Flora include a palm tree some 12 m west of Str. 2a, uhushte seeds, chiles, beans, and numerous other items. The assistance of Zulma Ricord de Mendoza, Edy Montalvo, and the staff at the Museo de Historia Natural, is greatly appreciated. Sean Murphy was very helpful in teaching us fine casting techniques with dental plaster; we were able to cast numerous branches and other wooden items, seeds, curious organic forms, and numerous maize stems.

The architecture exhibits a degree of sophistication in the use of reinforced and massive adobe unsuspected in domestic architecture in Southern Mesoamerica. They were able to construct vertical walls over 3 meters tall in massive adobe, and platforms some 5 by 8 meters. They usually decorated massive adobe walls with sizeable cornices, and even decorated some internal benches with cornices and some bajareque walls with cornices. Bajareque walls were well-made, with the vertical poles continuing upward to help support the roofs. The corner where two bajareque walls met were generally anchored with a massive adobe column. The columns were sometimes employed as bases to support vertical wooden posts to support the roof, but evidently a remodeling of the roof, particularly when it involved new bajareque walls (e.g. Str. 1), could bypass the columns as post-supports and leave them without function in roof support. It is unclear whether the columns were made in situ or were made elsewhere, probably horizontally, and then erected and attached to the walls and floor with fine adobe mortar. They often placed niches inside of massive adobe walls, and sometimes in benches. They even had doorways in massive adobe and in bajareque walls, with wooden lintels and adobe caps above the doorways. They preferred doorways only 1.50 m high. Although they had adobe bricks, they rarely used them. They would create handles or rope-ties (curtain holders) by building the handles of broken large pottery vessels ("ollas") into the walls. The tops of walls were favored locations for storing special items, such as pottery vessels, donut stones, a whetstone, or obsidian tools. Deer bone spatulas were found on benches or in niches. A part of Structure 2a had a "tabanco", an elevated wooden platform created by horizontal poles spanning from one bajareque wall to the other, and

resting in small notches made for each pole. That "tabanco" extended outside the 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 was generally offset from the midline of the structure, probably an indication of the direction of movement of the majority of foot traffic into and out of the structure.

The most solidly-constructed architectural element at the Ceren site clearly is the platform. Platforms were made of high-quality clay mixed with some grass or other organic material to minimize cracking when drying. It appears that they were fired after they dried, to make a very solid platform. Massive adobe walls and columns were similarly well-made, and generally 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 as they joined and supported the roof. After the hotter tephra layers burned those poles and lashings, those walls often collapsed. Porches which 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 foot traffic patterns on and near structures, and that will be utilized in future field seasons as excavations attempt to recover all the structures and activity areas of Households 2 and 3.

The grafitti in the back room of Structure 3 are fascinating, and they may well be the scratchings of a child. The fact that more artifacts were found outside Str. 3 than inside, as well as the large floor and bench areas, support Andrea Gerstle's interpretation that it was the sleeping area for the family at night, and the eating and other family activity area during the daytine. 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 and/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 yet excavated at Ceren, yet it had the fewest internal artifacts. Structure 1b, the bodega behind Structure 1, was the most humble building yet found at Ceren, yet it contained by far the most artifacts. Structures 1 and 2a are intermediate in massiveness of construction and in the number of artifacts found. Somewhat more specifically, a ranking of the massiveness of construction of all buildings excavated in 1989 would begin with the humble Str. 1b, followed by 2a, then 1, and finally end with the massive Str. 3. A ranking of the structures by the abundance of artifacts would begin with Str. 3 almost devoid of artifacts, followed by Str. 2a, then Str. 1, followed by the densely-stocked Str. 1b. It will be important to compare the nature and organization of the bodegas for Households 2 and 3, and of other Ceren households excavated in the future.

Structure 2a does share some general characteristics with Structure 3. Both have 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 those elements are arranged, their size, and other factors. Structure 2a was much smaller, used bajareque construction for walls, had a porch what was part of the platform, had very little massive adobe above the platform, yet had a richly-stocked niche under the bench.

The niche in Structure 2a had three polychrome vessels, a clam shell, and the "codex". One of the three vessels, a hemispherical bowl, was upside down on top of another. When inspected inside, to our surprise, the vessel had yet to be washed since its last use about AD 600. It still has 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 hurredly, and the sealing of the niche by the layers of hot, moist volcanic ash helped preserve the food swipes for 14 centuries. The efforts to rescue something of what evidently was a codex are described by Harriet Beaubien in Chapter 13. Although the chances are not very good of rescuing much of the original document, because of its poor condition, it is of such potential significance that it was decided a major effort should be launched to do everything possible to save it, or at least part of it. It does indeed seem to have been a folio or folded document, and the turbulence of the early eruptive stages evidently flapped it up against the northern wall of the niche enough times, with sufficient force, to detach some paint fragments that still adhere to that adobe surface. The uppermost page or pages are disintegrated beyond repair, but it is hoped that the innermost pages may have some surfaces that can be saved. The turbulence of Units 1 and 3, and the slight deposition of fine volcanic ash that occurred with it may have assisted in preserving some of the folio. The organic material that was its backing, probably amate bark paper, had completely decomposed. With nothing else to separate the leaves or to help hold it together, a codex at most archaeological sites simply disintegrates into a pile of tiny fragments of pigment, a major frustration for an archaeologist. That apparently is what happened at some other sites where some paint fragments of what probably were codices were found, but a page in the form of a painted plane was not salvageable. Those sites include Uaxactun, San Agustin Acasaguastlan, Nebaj, and Piedras Negras. For example, multiple thin layers of stucco with traces of red and green paint were found in two Tzacol phase burials at Uaxactun, and Kidder (1947:70) felt they might have been codices. More recently, fragments of "a very eroded codex" serefound in a Classic tomb at Santa Rita, Belize (D. and A. Chase 1988:33). They were too fragmentary to salvage. However, at Ceren it is hoped that sufficient fine tephra was deposited between the layers of the folio to allow for them to remain separated, to give conservators a chance to separate at least parts of the original plane or planes of painted surfaces.

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) has had a sizeable container (1/2 m diameter or greater) in or near the center of the building which was full of fine silicic volcanic ash that had been mixed with water and grass, and suspended from the ceiling. The container 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 Structure 2a and 2b had a small feature made of vertical small sticks or cane, tied together at top and bottom with twine, and forming a rough U shape. They are small, perhaps 10 cm high, 40 cm long, and 30 cm wide. Their function is entirely unknown, although not devoid of speculation.

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 available to the public. There is potential for conflict in values, as the archaeologist needs to excavate all activity areas to get a complete record of architecture and artifacts, and needs to test the inside of structures to understand their construction and refurbishings. In contrast, the structural conservator does not wish 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 Ceren 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.

The future of the site looks good if some nagging problems can be solved. Salvador Quintanilla, the landowner of Lot 189 where the excavations have been taking place, has been very patient with the project, and very supportive. However, he has lost two years of crops, and he deserves to have his own plot of land free of archaeologists. The long-term protection of the site needs to be under the responsibility of the Ministerio de Educacion, with trained guards who can also help interpret the site to visitors. The roofing of structures is underway, and plans need to be developed to roof structures soon after they are excavated, to avoid damage by the weather. If features have survived for a millenium and a half, they should be treated so they can survive a significant amount of time longer, and not simply become part of the technical archaeological literature.

I also would like to express my appreciation to the following firms, groups, and individuals for their willingness to assist the project in the future. The free room and board offers from the Hotel Presidente, the Camino Real, and the Sheraton are without precident, and are greatly appreciated. The TACA free airfare offer will assist in reducing the amount of funding that goes into transportation, and those funds can be better spent on the research. Other offers of assistance, from La Constancia and Roberto Murray, from Coca Cola, from Pollo Campero, from Fereteria Panades, from the new Comision within the Patronato, and from many other firms and individuals make the future look very good indeed for the site and the research program.

Acknowledgements

One of the most important reasons for the success of the May-August 1989 field season is the exceptionally capable and well-trained crew of Salvadoran workers, headed by Victor Manuel Murcia. Mr. Murcia was successful in recruiting and retaining an excellent group of workers from Chalchuapa and from Joya de Ceren. Instead of having problems with experienced versus inexperienced subgroups of workers, he was able to use the diversity to advantage, as various people trained others, and worked exceptionally well together. We are proud to have worked with the following Salvadorans in the field: Marco Tulio Chinchilla, Lazaro Amaya Lopez, Jose Antonio Menjivar, Jose Mario Quintanilla Ramirez, Antonio Rivera Espinoza, Manuel Antonio Bueno Quintanilla, Salvador Ramirez Rojas, Osmin Elisandro Granados, Rodrigo Bautista Canton, Pedro Ramirez Galdamez, Jose Guadalupe Funez Canton, Jose Cesar Cordova Bonilla, Salvador Quintanilla Carabantes, Jose Humberto Portillo Padilla, Pedro Ismael Grion, y Elias de Jesus Rivera Espinoza. They are a credit to their country.

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