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Sheets The Ceren Site: An Ancient Village Buried by Volcanic Ash in Central America 2

The Ceren Site: An Ancient Village Buried by Volcanic Ash in Central America

Payson Sheets

Second Edition

Case Studies in Archaeology Jeffrey Quilter, Series Editor

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The Ceren Site

The Ceren Site

An Ancient Village Buried by Volcanic Ash in Central America

Second Edition

Payson Sheets
University of Colorado, Boulder

Case Studies in Archaeology: Jeffrey Quilter, Series Editor

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About the Cover: Structure 4, the storehouse for Household 4, looking north. The back wall fell toward us. The two beams had disintegrated, so we replaced them to strengthen the building for the next earthquake. The tripod holds environmental monitoring instruments. The agave (maguey) garden was in the foreground, with the cacao tree. They were removed to the national museum.

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For Fran, Kayla, and Gabi

Brief Contents

Contents

Foreword

ABOUT THE SERIES

Case Studies in Archaeology bring the insights of leading archaeologists on the theory, practice, and results of archaeological investigations to students in beginning and intermediate courses in archaeology, anthropology, history, and related disciplines. Authors have had extensive and direct experience in archaeology in the various realms of investigation, from field, to laboratory, to library. They also are teachers, and in writing their books, they have kept the students who will read them foremost in their minds. Case Studies are intended to present a diversity of archaeological topics in a form and manner that will be more accessible than writings found in professional articles or books, yet at the same time preserve and present the significance of archaeological investigations for all.

ABOUT THE AUTHOR

Payson Sheets was born on New Year's Day in 1944 in Colorado, a fourth-generation Coloradan. He did his undergraduate studies at the University of Colorado in Boulder. As an undergraduate, he had a number of different majors, including chemistry, math, art history, and geology. He was unable to decide on a major because so many were of interest so he dropped out of school for a year to think it over. He spent most of that year traveling around Europe and became fascinated with archaeological sites and the reasoning process necessary to reconstruct past societies from their material remains left in the archaeological record. That solidified his decision, and he has been an archaeologist ever since.

Sheets completed his graduate studies at the University of Pennsylvania by receiving his PhD in 1974. During his graduate studies, he spent two seasons in fieldwork at Chalchuapa, El Salvador, where he met Fran Mandel, who had come from California to join the project. They married three years later and now have two children, Kayla and Gabrielle.

Sheets has conducted archaeological research in the southwestern United States, in western Canada, and in Guatemala, El Salvador, Nicaragua, Costa Rica, and Panama. He taught at Pitzer College (Claremont, California), California State University at Fresno, and since 1974 at the University of Colorado, Boulder, where he has chaired the department.

Sheets has published numerous books and articles, including (with Don Grayson) *Volcanic Activity and Human Ecology, Archaeology and Volcanism in Central America: The Zapotitan Valley of El Salvador,* (with Fred Lange and Suzanne Abel-Vidor) *The Archaeology of Pacific Nicaragua,* and (with Rafael Cobos) *San Andres y Joya de Ceren, Patrimonio de la Humanidad* (published by Bancasa, San Salvador). Sheets has developed an interactive website at http://ceren.colorado.edu. That website complements this book, and readers are encouraged to log on and interact with the buildings and see their artifacts.

ABOUT THIS CASE STUDY

The reissuing of this case study in revised form is a cause for celebration. It is hard to believe that this book, the first in the Case Studies in Archaeology series, was published a dozen years ago. In that twelve years, as series editor, I have had the opportunity to talk to and interact with many archaeologists, some of whom went on to publish books in the series and others who did not. Whatever the case, the opportunities provided to me to meet new colleagues and learn of their always-interesting work has been a wonderful experience.

Every archaeologist is enthusiastic about his or her research, and almost every one wants to publish. Many realize the importance of reaching out to undergraduate audiences because they are the archaeologists of the future. Even if they choose other professions, enthusiasm for the subject of archaeology developed in college or university translates into more subscriptions to popular magazines; more purchases of books; more watching of archaeology specials on television; more trips to visit archaeological sites and museums; and more support for local, state, national, and private foundation funding for archaeological research. Thus, books like these case studies are investments in the future of archaeology in a very real sense.

Archaeologists don't publish these books or any others as parts of strategies to ensure their profession's success. They do it in their role as educators. When I developed Case Studies in Archaeology, I modeled it on the very successful series in cultural anthropology. Although there are exceptions to the rule, it always seemed to me that cultural anthropologists had an advantage in telling good stories about their lives in the field. Because their chief job is to interact with living people, they often have fascinating tales to tell about their trials and tribulations in foreign cultures. Commonly, their personal story *is* their professional story. It seemed to me, however, that most archaeologists have stories that are just as good as most cultural anthropologists.

It might go without saying, but it bears repeating, that while archaeology is the study of the past, it is done in the present. Archaeologists have to deal with the living, breathing people who make up their field project teams, who are local residents, who represent local or national agencies, and who come and visit their sites and their field camps for a variety of reasons. Indeed, one of the great luxuries of field archaeology, when things go well, is that one gets to live in a community very different from one's own and yet not have the potential conflict of interest of having one's neighbors be the subject of one's study. Instead, locals and visiting archaeologists, alike, can share in a common enterprise. Thus, the tales told by archaeologists about life in the field are different than those of many cultural anthropologists, and yet they can richly inform the reader about human diversity and our common humanity at the same time.

Thus, Case Studies in Archaeology has been somewhat "postmodern" in its emphasis on getting the personal details and "behind the scenes" stories of what *doing* archaeology was like in particular times and situations. As series editor, however, I have not tried to force authors to write in any particular way, nor have I insisted that the human-interest aspect of their books be framed or presented in one manner or another. Each author is free to express the personal aspect of her or his research as she or he might wish to do, in her or his own voice. In the long run, it is the overall presentation of an interesting excavation or field project as an aid to education that is more important than any one aspect of the work.

It was my great fortune and that of the series that Payson Sheets was the first author to publish a case study. Anyone who has had the opportunity to spend time with him will know that his storytelling ability is only matched by his keen intellect and analytical precision while his mastery of prose is in evidence a few pages beyond this one. He not only produced the first case study in the series, but one of the best, and he even did it on time and according to schedule.

It is thus a great pleasure to introduce this revised version of Ceren. Payson Sheets has virtually rewritten the volume, adding up-dates to the research and new material on his personal experiences in the field. The site, of course, remains as spectacular as ever and truly deserves the title of the New World Pompeii. But even the most exciting sites can be boring if those who write about them do not do it with verve. Professor Sheets is blessed with having worked at an amazing archaeological site and with his ability to convey the importance of his research and his excitement in doing it.

I can think of no better way to celebrate twelve years of Case Studies in Archaeology than by the publishing of this revised edition of *Ceren*. I thank Payson Sheets for his sterling work in writing the revision and in the editorial staff at Thomson Learning for their enthusiasm in taking on this project. The most thanks of all, of course, go to the many professors and students who have been reading these books for the last dozen years. I hope that in another twelve years we may celebrate again, with a new version and new vistas of this case study and the many others past and to come.

Jeffrey Quilter
Garrett Park, Maryland

Preface

A principal objective of this monograph is to share what we have learned about life in Central America during the Classic period, some 1,400 years ago. In particular, we will be looking at households at the Ceren site in what is now El Salvador. During the past two centuries, archaeologists have learned a lot about the elite, the wealthy, and the powerful, by excavating their palaces, tomb burials, and associated areas. The traditional bias of archaeology was to excavate the visually spectacular artifacts, architecture, and art, and that bias still exists. The elite lived in palaces and other substantial buildings that tend to preserve better than housing of other segments of the society. Certainly, we should not think that the elite were unimportant because they were the decision makers at the top of society. But as we will see, commoners also could make decisions, and we can see that the elite were not in full economic, political, or religious control of all people. Further, there have been exciting developments in translating the hieroglyphs that describe major events in elite lives, including birth, marriage, assuming the leadership position, battles, and death. However, the balance of knowledge is vastly in their favor. Far too little is known about the "silent people of prehistory," the commoners who did the basic, everyday work to support the elites by supplying them with labor, food, and other goods. We know little about their daily lives, their houses, their artifacts, their activity areas, and other details. Our knowledge of the Maya is "top-heavy," and we need to know more about the vast majority of the population, the commoners.

The main impediment to understanding the commoners is that their houses, activity areas, and artifacts tend to preserve very poorly. Much of that is due to the heat and humidity in tropical climates that facilitate rapid decomposition of organic materials. Adobe (earthen) architecture lasts in a tropical climate only as long as the thatch roof remains in good condition, but thatch roofs need to be replaced every few years. When the roof is gone in an abandoned structure, the rains rapidly erode the walls and floors, and the sun dries and cracks the architecture. Also, families abandoning their houses take their most valuable possessions, leaving behind only things that they consider not worth carrying with them. The heat, humidity, termites, and bacteria of the tropical environment facilitate rapid decomposition of organic materials. Thus, archaeologists trying to excavate and understand the average remains of prehistoric housing that was abandoned for hundreds of years have two strikes against them before they begin. They must deal with a greatly impoverished data base.

Ceren is a striking exception to this generalization. It was a village on the southern periphery of the Maya area that was suddenly buried by a volcanic eruption. Had it not been for that eruption, Ceren after its abandonment probably would have been just like many village archaeological sites: barely worth excavating. However, the eruption preserved the village in an exceptional fashion. That eruption was not preceded by warnings such as strong earthquakes, and it came from the sudden opening of a volcanic vent under a nearby river, rather than from a mountain that was recognizable as a volcano before the eruption. In addition, it apparently happened at night, after the evening meal but before people went to sleep. Most of the villagers evidently were attending a feasting ritual at Structure 10 and may have fled the village from there. They had left their front doors of their household buildings closed. People did not have time to take their possessions with them, as they would have in an orderly abandonment. Rather, we have been excavating their possessions from their buildings as they were "frozen in time" by the sudden arrival and deep burial of volcanic ash from what is now known as Laguna Caldera volcano.

Although decades of excavations remain for the future, we have learned much about family life at Ceren from the various seasons of excavations conducted so far. Previously, we had no indications of the sophistication in adobe domestic architecture. Now we know that the Ceren residents routinely constructed multiple structures for various uses within each household. It appears that each household had a domicile building for sleeping, eating, and various daytime activities, and a storehouse, a kitchen, and sometimes other buildings. The Ceren residents roofed and protected the structures with very ample thatch roofs, most of which cover more area outside the walls than inside. The areas under the eaves and outside the walls were used for storage, as covered walkways, and for various activities such as grinding corn.

Households had gardens either immediately adjoining buildings, or separated from them only by a narrow walkway. With only one exception, all plants were cultivated in rows that line up with the dominant architectural orientation of the site, 30 degrees east of north. That orientation apparently was set by the river, flowing 30 degrees east of north by the site, and if that theory is correct, it fits in with the deep Maya reverence of, and need for, water. The exception is the agave (maguey) cactus garden of Household 4, where plants are haphazardly placed. Because agave plants sprout themselves from the roots of older plants, it would be difficult to maintain order among them. The agave leaves were used for fiber to make rope and twine. Other than the agave, all plants line up quite precisely with the architecture in the very ordered landscape. Garden plants include corn (maize), cacao (chocolate), and a range of other plants that have yet to be firmly identified.

Three maize fields have been found farther from structures, and most corn plants are mature, indicating that the eruption occurred at the end of the growing season. Many maize plants were doubled over, with the ears of maize still attached to the stalk, a storage-in-the-field procedure that still is performed in traditional areas of Mexico and Central America. Some maize ears were husked in the field, and others maintain the husks as they remained on the doubled-over stalk. One area has juvenile maize, only one to two feet tall, which probably is a second planting during the middle of the rainy season. These plants and the stage of growth of other annual plants indicate that the eruption that buried Ceren occurred during August.

Once food had been harvested and brought in from the field, it was stored in the household in a variety of facilities. Some grains were stored in large, fired clay vessels with tight lids, and other vessels were suspended from ceiling beams by ropes. In both cases, ants and mice occasionally got inside and were eating grains. Corn was stored in Structure 4 in a large corncrib made of poles and clay. Some grains were stored up in roofing, and some were suspended, such as chilies, hanging in bunches.

Four special purpose buildings evidently served more than one household. They were community buildings and functioned in very different ways. Structure 3, the largest building excavated at the site so far, evidently was a community center facing on the plaza, where disputes were resolved and perhaps other political matters were considered. The massive, low Structure 9 has an elegant adobe dome and a large firebox inside, and clearly functioned as a sauna. It seated as many as ten to twelve people at a time, more than a family or two. Structure 10 was built for community feasting and ritually celebrating the maize harvest. The ceremony was less than half completed when the eruption occurred, judging from the amount of food that had yet to be processed and distributed to ritual participants. We are beginning to think that it was from here that most of the villagers fled, rather than from their individual households. Structure 12, deliberately built as the most fragile structure in the village, evidently was the building where a shaman (diviner) practiced, and based on the artifacts found there, we believe the diviner was a woman.

The Ceren site provides us with an unusually clear window into the prehistoric past with which to view family activities on the frontier of the Maya area. It is an extraordinarily well-preserved site because of the sudden arrival of copious amounts of volcanic ash. That volcanic ash did not allow people to selectively remove artifacts, and it largely stopped natural processes of decomposition. What we see at the site is surprisingly sophisticated and ample domestic architecture. Public architecture was varied and generally of very solid construction. The artifacts within households are striking for their abundance and, in many cases, for their elegance and beauty.

ACKNOWLEDGMENTS

The first people I wish to acknowledge are the Salvadoran workers who labored with us under the intense sun and high humidity of the Zapotitan Valley day after day. They deserve much credit for the great increase in our knowledge of family life in the valley as it was practiced some fourteen centuries ago. They are Victor Manuel Murcia (foreman and longtime friend), Salvador Quintanilla, Salvador Ramirez Rojas, Marco Tulio Chinchilla, Jose Humberto Portillo, Pedro Ismael Giron, Jose Antonio Menjivar, Antonio Rivera Espinoza, Jose Mario Quintanilla, Lazaro Amaya Lopez, Hector Armando Guevara, Jaime Arturo Moron, Jose Cesar Cordova, Elias de Jesus Rivera, Francisco Alberto Escamilla, Carlos Nelson Leiva, Rodrigo Bautista Canton, Osmin Elisandro Granados, Pedro Ramirez Galdamez, Reyes Nelson Alvares, Rodrigo Hernandez Leon, Jose Guadalupe Funes Canton, Rene Antonio Quintanilla Carabantes, Salvador Antonio Quintanilla, Rene Antonio Coca de Paz, and Juan Rivera Rodas.

The project scientific staff worked long and hard, under less than ideal circumstances. I want to express my appreciation to Marilyn Beaudry-Corbett, Dan Miller, Hartmut Spetzler, Dan Wolfman, Andrea Gerstle, Brian McKee, Harriet Beaubien, Fran Mandel Sheets, David Tucker, Jeannie Mobley-Tanaka, Christine Dixon, Larry Conyers, and Anne Sheehan.

Many people in the Ministry of Education facilitated our research. I owe an immense debt of gratitude to Zulma Ricord de Mendoza, Director of the Patrimonio Nacional. Maria Isaura Arauz de Rodriguez, Director of the Patrimonio Cultural, has been of assistance throughout the project. The assistance of Evelyn Sanchez and Gloria de Gutierrez is appreciated. The staff in Restoration and other sections of the museum have helped many times, in so many ways.

Manuel Arrieta of IBM loaned us a computer and printer two consecutive years, which assisted in data analysis and writing of the preliminary report. Our friend Peter Nohbohm got us access to the Bayer Pharmaceutical's airplane, from which we obtained good aerial photographs of the site and the nearby volcanoes. Coronel Ochoa of CEL (the electronic company) graciously loaned us his helicopter to take additional air photos of volcanoes and sites. We appreciate the fact that the owners of surface-to-air missiles did not dispatch one in our direction while we were taking the air photos. Peter Doty was his usual enthusiastic and helpful self. Ricardo Recinos continued to be the best friend an archaeological site could have. ABANSA (a local nongovernmental organization) assisted by donating money that was used to expand the number of Salvadoran workers. TACA (the national airline) assisted the project with free airline tickets to bring certain specialists into the country. Bob Dance, Pamela Corey-Archer, and the U.S. Information Service staff helped the project in manifold ways. David and Beverly Kitson, Agency for International Development, were instrumental in setting up donations by many people in the U.S. community in El Salvador. The Hotel Presidente, particularly Alicia de Landaverde, was gracious and beneficent to us on a number of occasions.

The Patronato Pro-Patrimonio Cultural has been instrumental in the success of the research. This nonprofit organization has backed the project in many ways. I particularly wish to thank Mario Cristiani, Ana Vilma de Choussy, Juan Carlos Choussy, Neto Raubusch, and Ricardo Recinos.

Principal funding for the research was awarded by the U.S. National Science Foundation, most recently by grant #9006482. Their financial support is heartily appreciated. The University of Colorado made a large contribution by awarding me a Faculty Fellowship so that I could be in El Salvador from August 1990 through January 1991 and April 1991 conducting the research.

Jeffrey Quilter and Brian McKee reviewed an earlier version of this manuscript. They cannot be held responsible for any of its shortcomings, but they certainly deserve recognition for improvements in its readability, order, and logic.

1/Introduction

This book focuses on an ancient village in tropical Central America (Figure 1-1) that was buried suddenly by volcanic ash about 1,400 years ago. People did not have time to abandon the village in an organized way and take their important possessions with them. Thus, the site provides an unusual opportunity to explore family and village life in detail. The site was discovered in the 1970s and has had only fifteen months of research conducted within it, to date. We have excavated a series of four households along with some specialized buildings and the areas surrounding them. Because the site was buried by 5 meters (almost 17 feet) of volcanic ash, specialized instruments are necessary to discover individual structures. With those instruments, we have detected anomalies that probably are the buildings of a few more households, but they have not been excavated yet. The eruption was not a single blast but a complex series of explosions that has required trained geologists to understand. The sudden burial by moist and fine-grained volcanic ash has resulted in unprecedented preservation of organic materials, especially in a tropical climate. Biologists have identified seeds, plant casts, wood, thatch roofing, and animal remains.

Although this is a monograph in archaeology, it shares certain objectives with monographs in ethnography—to present a different culture to undergraduate students in a readable and informative manner. Ethnographers have a huge advantage over archaeologists in that they can talk to the people they are studying. Unfortunately, as archaeologists, our informants died many centuries ago. We cannot hear what they say, we cannot question them and check their answers, we cannot record their spoken language. However, we are immersed in their material culture. What we study are the results of their behavior. And, in contrast to most ethnographers, we can study them for large periods. In this monograph, the emphasis is on the material culture of the Ceren site and how people in the site related to their natural, social, and supernatural environments. Given the nature of the sudden burial of Ceren by volcanic ash, our emphasis is on the community functioning just before the eruption, rather than over time. A highly unusual aspect of the Ceren site is its almost complete inventory of artifacts in

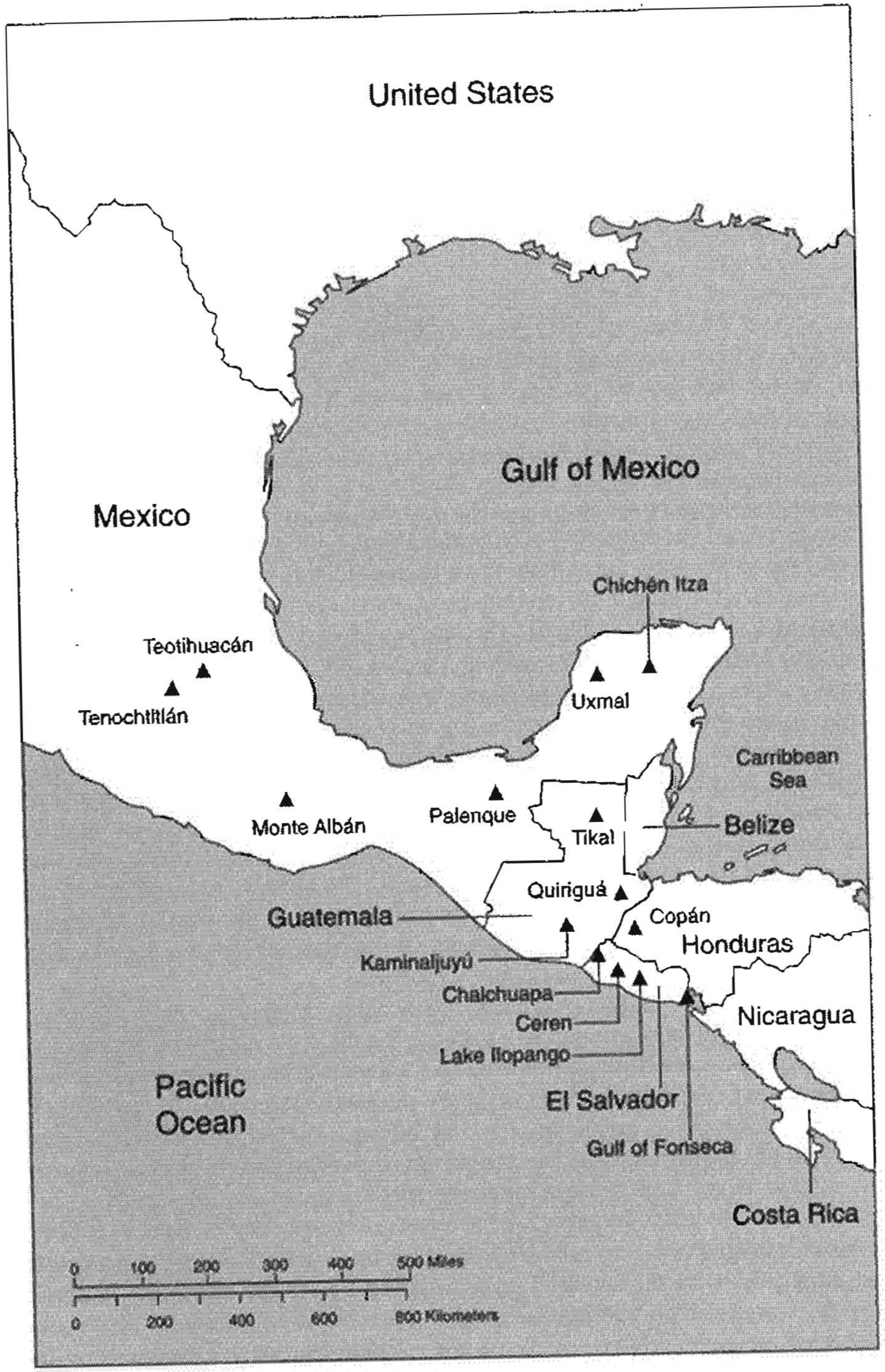


Figure 1-1 Map of Mexico and northern Central America. Prehistorically, Mesoamerica included central and southern Mexico and all of Central America through El Salvador and western Honduras.

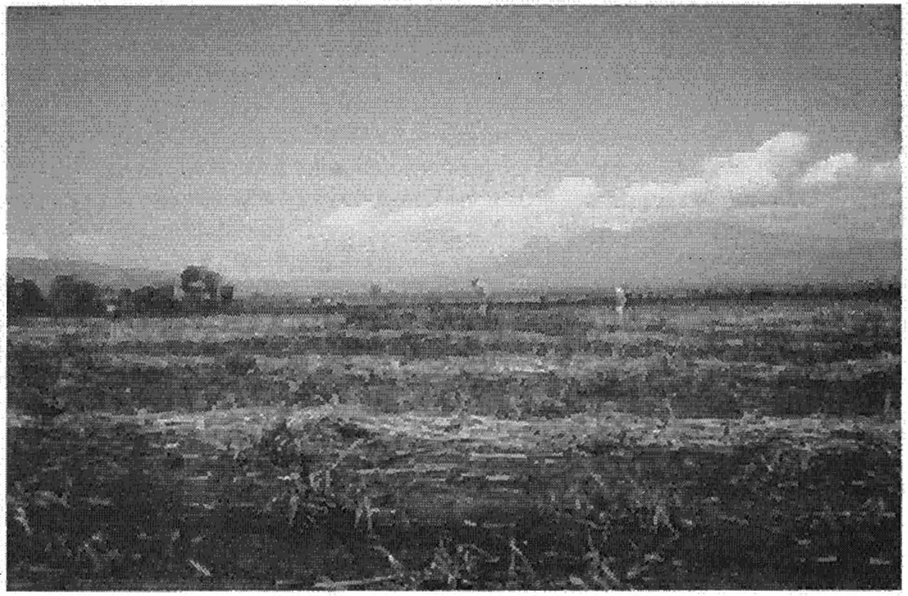
the buildings, so one objective of this book is to describe and interpret the wealth of material culture we found.

Ethnographic research typically is done by a single investigator moving into the society to be studied and living there as unobtrusively as possible. In contrast, archaeology more commonly is a team effort, and the Ceren project is an example. The research team is composed of professional scientists, students, and local workers. The students, primarily from the University of Colorado, are selected for their relevant coursework, their abilities in Spanish, and their abilities to live under difficult conditions and contribute to the overall research effort. Certain specialists have been essential to the success of the research, particularly in geophysics, volcanology, and biology. Their contributions are described in Chapter 3.

THE NATURAL ENVIRONMENT

The Ceren site, named after the nearby town of Joya de Ceren (translated "Jewel of Ceren"), is located at an elevation of 450 meters (1,500 feet) alongside the Rio Sucio, in the Zapotitan Valley (Figure 1-2) of what now is El Salvador. The climate and natural vegetation is tropical, with hot daytime temperatures year round. Fortunately, the area cools off rather well at night. The average annual temperature is 24 degrees Celsius (75 degrees Fahrenheit), with a low in December of 22 degrees (72 degrees F) and a high in April of 26 degrees (79 degrees F). The daytime-nighttime fluctuation is greater than is the annual seasonal fluctuation. In the United States, the main difference between winter and summer is temperature. In Central America, however, the real difference between their "invierno" (winter) and "verano" (summer) is precipitation. The rainy season is the invierno, from May through October, and the dry season is the verano, from November through April.

The site area receives an average or mean of 1,700 millimeters of precipitation, with a standard deviation of 300 millimeters. This means that in one-third of the years, the area receives more than 2,000 or less than 1,400 millimeters of rainfall. This also means that one out of twenty years, the area receives more than 2,300 or less than 1,100 millimeters.[1] The mean is a statistical abstraction, and almost never does that precise amount of rain fall in a particular year. The rainfall variability is what is significant, and a farmer must be able to cope with years of low rainfall as well as years of abundance. He[2] must also cope with years of overabundance of rain, as that can cause erosion and thus result in production declines for years in the future. A peasant farmer pointed this out many years ago, when I was a fresh and rather naive graduate student in El Salvador. I commented to him that an average of 1,700 millimeters seemed to me to be ideal for corn (maize) agriculture. He said that, yes, it would be ideal, but when did the average ever show up? Rather, he has to deal with the lean years as well as the soggy years, to feed his family every year. His family could not tolerate a single year with insufficient food production, and so he maintained various strategies to deal with uncertainty. We would not consider him well educated in our terms, but I was impressed with his wisdom and experience because he viewed the environment as opportunity and as hazard, and he accommodated to both simultaneously and successfully.



Payson Sheets

Figure 1-2 The flat valley floor of the Zapotitan Valley, El Salvador, with volcanoes in the background. The Santa Ana volcanic complex is at the right, with Izalco volcano in the center. The crew members are doing an archaeological survey on the periphery of the San Andres site; the middle worker is standing on a housemound, all that is left of a gradually abandoned house the same age as the Ceren houses.

The rainfall in the Zapotitan Valley, as with most of the Pacific slope of Central America and Mexico, is highly seasonal. The dichotomy is strong, with only 6 percent of the rain falling in the dry season, and almost all of that in the "transitional" months of November and April. The rains usually begin in May, but that can be early or late May, or occasionally in late April or even in early June. All these factors can cause great agricultural difficulties. Maize seeds, for instance, need to be planted just before the rains, so that they can germinate in a warm, porous soil, but then they need moisture right away, in significant amounts, to begin their rapid growth. Because most of the Salvadoran countryside cannot be irrigated, annual crops can grow only during the rainy season.

The successful traditional agriculturalist (Figure 1-3) must also adapt to the form in which the precipitation comes. Most storms are gentle and allow the moisture to filter into the soil. However, the strong cloudbursts that often occur during July through September can severely erode exposed soil. Traditional agriculturalists in many areas of Central America plant maize along the tops of ridges that block the lateral movement of water, minimizing erosion and aiding infiltration. This has the additional benefit of people walking between the ridges and thus avoiding compaction that slows plant growth. To our surprise, we found the technology of planting on top of blocking ridges fully developed at Ceren 1,400 years ago.

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Figure 1-3 Two traditional agriculturalists planting a field at Chalchuapa, El Salvador, which is essentially unchanged from the prehistoric past. The field was cleared of vegetation during the dry season, and low ridges were built up. The planting is done in May, at the beginning of the rainy season, by making a hole along the top of the ridge with the digging stick, putting four or five maize kernels in the hole, and filling in the hole by kicking dirt into it. Each agriculturalist wears a gourd with seed in it strapped to his waist.

Another factor to be coped with is wind. Although the Zapotitan Valley is not unusually windy, strong winds do accompany cloudbursts during the rainy season. That is particularly dangerous for maize because it is unusually vulnerable to wind-throw. Planting on the ridges, with some soil packed up around the maize stalks, helps. We found one instance, near Household 2, where five mature maize plants were tied together with agave twine; we think it was to strengthen the bunch of them against wind-throw. In the valley today, traditional agriculturalists plant in May so the harvest can be completed by August. That has the timing benefit of not exposing the growing maize plants to the "nortes," the strong winds from the north that are the southernmost tail of big North American winter storms. Those generally strike in November, December, or January, long after the corn has been harvested.

The strong seasonality of precipitation means that many small and medium-sized streams only flow during the rainy season. Because people need sources of fresh water year-round, it is not surprising that prehistoric settlements in the valley tend to cluster along permanent streams, near springs, and around the large lake that existed in the center of the valley. That lake was drained for agriculture in the middle of the last century.

Biologically, El Salvador lies within the Neotropical Realm, which extends from southern Mexico down into lowland South America. This area is characterized

TABLE 1 EXPLOSIVE ERUPTIONS DEPOSITING AIRFALL VOLCANIC ASH IN THE ZAPOTITAN VALLEY

Eruption	Date	Sq. Km. Buried	Plume Direction
Playón	AD 1658	30	SSW
Boquerón (V. San Salvador)	est. AD 900	300 > 7cm	SSW
Loma Caldera	AD early 600s	20	Southerly
Ilopango	AD early 400s	10,000 > 50cm	NW
Coatepeque	40,000–10,000 BC	?	

Notes on Table 1: The Boquerón eruption, from San Salvador volcano, is not yet radiometrically dated, and could be a century or more before or after this date. The Loma Caldera eruption is dated by a series of radiocarbon analyses, with a composite date of AD 650, with a single standard deviation range of AD 636 to 660. Ilopango's composite radiocarbon date was AD 260 + 114, but Dull et al. (2001) dated more samples that indicate the early AD 400s. Coatepeque has not been radiometrically dated, but is estimated. Coatepeque volcanic ash formed the base materials for much soil development in the Zapotitan Valley before the more recent eruptions. It was a big eruption, perhaps on the scale of Ilopango. The other eruptions were much smaller and had more localized effects. From Sheets (1983, 5–6, and 2002).

by high biomass and high biodiversity in plants and by high diversity but not high biomass in animals. Unfortunately, the human population explosion in the country during the past 150 years has almost destroyed all natural habitats. But it should be noted that this recent habitat destruction is not the first—expanding human populations (see Table 1) toward the end of the Formative period, about 2,000 years ago, had fundamentally altered most areas under 1,000 meters (3,000 feet). Then, the Ilopango eruption, evidently in the fourth or early fifth century (Dull, Southon, and Sheets 2001), wiped out the remaining vegetation along with people, animals, insects, and other critters. The tropical environment recovered from this mega catastrophe within a century or so, as evidenced by people moving into the valley and establishing the Ceren village. Human pressure on the natural environment increased to another prehistoric maximum toward the end of the Classic period, about AD 900. Population declined somewhat during the Postclassic period, from AD 900 to 1500, and declined precipitously in the 1500s and 1600s as diseases introduced by the Spanish devastated native populations. New World Indians had no resistance to diseases such as yellow fever, malaria, influenza, measles, and others, and the population of the country dwindled to only a few tens of thousands (Barron Castro 1942).

Daugherty (1969) has reconstructed the native climax vegetation of the Zapotitan Valley. Most of the area was covered by a dense deciduous forest, watered by the rains of the wet season. Many of the trees shed their leaves toward the end of the dry season, to preserve moisture. The most common trees are balsam (*Myroxylon balsamum*), madre cacao (*Gliricidia sepium*), ceiba (*Ceiba pentandra*), conacaste (*Enterolobium cyclocarpum*), amate (*Ficus* spp.), volador (*Terminalia obovata*), ramon (ujushte or ojushte; formal name *Brosimum terrabanum* or *alacastrum*), and cedar (*Cedrela* spp.). Also growing in the forest, particularly where encouraged or planted by people, were avocado, jocote, nance, papaya, sapote, and anona. All these have edible fruits. Along water courses, a lush evergreen forest grew that did not need to shed its leaves in the dry season. At higher elevations, between 1,000 and 2,000 meters (3,000 to 6,500 feet), a pine and oak forest predominated. Only one species of pine was there, but there were a dozen species of oak. Above this was the cloud forest, generally enshrouded by mist, with trees covered with orchids, vines, and other plants.

Unfortunately, the Salvadoran fauna has been even more devastated than the flora in recent decades. Only mice, rats, cockroaches, flies, mosquitoes, ants, and vultures have done well. The mammals, reptiles, amphibians, birds, and fish have suffered. Of these, birds have suffered less, with some 480 species and subspecies still in the country. A bizarre result of the civil war that plagued the country from 1979 to 1992 is that vegetation and animals were recovering in "conflictive zones" where people feared to tread. Trees had recolonized many of these depopulated areas, and deer and other animals had come back into areas where they had not been seen for many generations.

As with most of Central America, the Zapotitan Valley is a volcanic landscape. The valley is dominated by the huge volcanic complexes of San Salvador volcano on the east and Santa Ana volcano on the west. Some volcanoes are quite recent, such as Izalco. It started erupting from a side vent of Santa Ana in 1770 and continued for two centuries. Izalco was so visible from the Pacific Ocean, day and night, that sailors called it the "lighthouse of the Pacific." It built itself from nothing to a cone 1900 meters high, but then it ceased erupting in 1965. That was particularly unfortunate because a fancy hotel and volcanic observatory had just been constructed on nearby Cerro Verde, and the official opening ceremonies were to begin a couple months later.[3]

The frequency of lava flows within the Zapotitan Valley during the past few hundred years also give some indication of how volcanically active the area is. Within the valley, Playón erupted in 1658 and buried about 15 square kilometers (9 square miles) under lava. San Marcelino erupted in 1722 and buried a similarly sized area under lava. And most recently, in 1917 San Salvador volcano covered about 30 square kilometers with lava. Accompanying that eruption was a violent earthquake that destroyed San Salvador and other nearby communities. The crater lake inside San Salvador volcano boiled away just before the earthquake and the lava eruption. Soils form very slowly on lava flows, in contrast to volcanic ash, and all these flows continue to stunt the vegetation, even after all this time.

In addition to Santa Ana and San Salvador, other volcanic cones and mountains encircle the big, broad valley. The bottom of the valley is a wide plain that held Lake Zapotitan in the center. The soils in the flat valley bottom, weathered from volcanic ash, were particularly fertile. Freshly fallen volcanic ash is not fertile because it is basically fine-grained rock. After weathering releases nutrients, however, it can be very fertile, so there is some truth to Juan Valdez's claims of the high fertility of volcanic soils, as depicted in coffee advertisements on TV.

Table 1 lists five explosive eruptions that deposited airfall volcanic ash in the Zapotitan Valley (Figure 1-4). Only two of the eruptions were massive regional natural disasters, Coatepeque and Ilopango. It is not known if people lived in the area when Coatepeque erupted. However, it is important in that sufficient time passed after its eruption that a very mature soil formed, and that soil was very

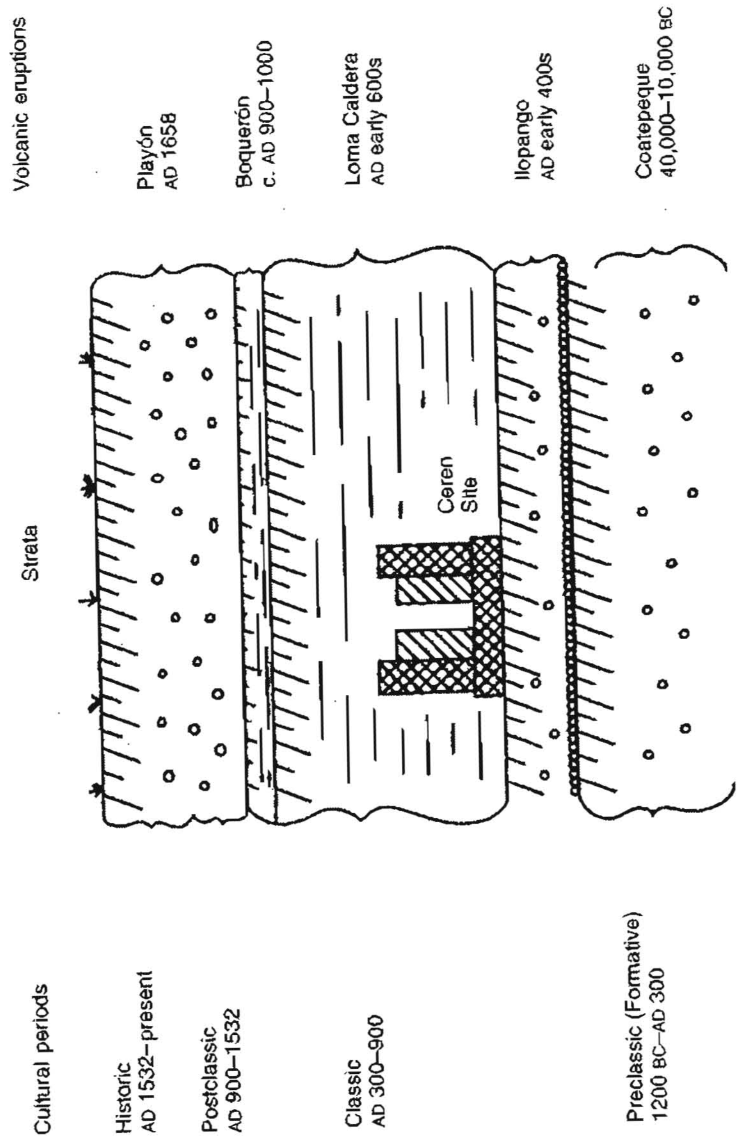

Figure 1-4 Schematic diagram of stratigraphy in the Zapotitan Valley, with the earliest eruptions at the bottom, and the most recent eruption in 1658.

fertile. It had high organic content, had a balanced pH very near 7, and was high in trace elements that facilitated plant growth. Such soils, with their high clay content, were the source of adobe material for construction at the Ceren site and for clays that were worked into vessels and other ceramic artifacts. There must have been a number of explosive eruptions affecting the valley between Coatepeque and Ilopango, but we have yet to find any direct evidence of them.

The Ilopango eruption was massive, depositing a meter to a few meters thick blanket of white, acid volcanic ash all over the valley, probably in the early 400s. This killed most vegetation within the valley, polluted water supplies, and rendered most fields uncultivatable. It turned a lush cultivated environment into a white desert overnight. People largely abandoned the Zapotitan Valley for approximately a century, while the volcanic ash weathered into soil and plants and other animals gradually recolonized the area. Beaudry (1983) notes the lack of Early Classic period (AD 300–600) ceramics in the Zapotitan Valley, collected during the valleywide survey, and this probably is evidence of the long time of abandonment.

Ceren may be one of the earlier sites colonized as people moved back into the Zapotitan Valley. Their pottery is a middle-to-late Classic assemblage, based on Beaudry's analysis (1983). The radiocarbon dates support this, placing the end of the occupation in the early 600s. The beginning of the occupation perhaps was a century earlier, in the early 500s. Living in El Salvador is a bit like living in California, where you know when the last earthquake was, but don't know when the next one will hit. After living in the Ceren village for about a century, they were buried by the nearby Loma Caldera volcano, which is located only 600 meters to the north, about a third of a mile away. According to the studies of volcanologists (Hoblitt 1983, Miller 1989), Loma Caldera erupted suddenly with a series of base surge and pyroclastic flow deposits (fast moving clouds of ash and gasses) and airfall layers. Not a volcano before the eruption, it was only a place where an underground fissure opened and magma moved upward. It formed a volcanic cone during the eruption, which probably lasted for only a few days, and has not erupted since. Although it was devastating to the Ceren site, and probably other nearby sites, it was not a regional natural disaster as was the Ilopango eruption. Rather, Loma Caldera adversely affected only about 20 square kilometers (12.4 square miles). The Loma Caldera eruption is described in more detail in Chapter 2, in the volcanology section.

A few centuries after the Loma Caldera eruption, San Salvador volcano erupted. The volcanic ash came from the main crater, called the large mouth, or "Boquerón." The Boquerón eruption has never been dated by radiocarbon or other quantitative means, but an estimated date is c. AD 900, plus or minus a century or two. It deposited a thick layer of pasty wet volcanic ash over the southeast corner of the Zapotitan Valley, but the Ceren area received only a thin layer, perhaps 20 or 30 centimeters (8 to 12 inches) thick. The area was reoccupied, at least lightly, after the Boquerón eruption, as evidenced by some artifacts being found stratigraphically above it.

The most recent explosive eruption to affect the Ceren area was of Playón volcano, located about 4 kilometers (2.5 miles) east, which began erupting in AD 1658 and continued into 1659. Playón deposited a layer, almost a meter thick, of coarse dark ash, and its lava flow covered many square kilometers. In the three and a half centuries that have passed since its eruption, soils have yet to fully recover on the lava flow, as they are thin, and moisture is not well-retained in the soil for plant growth. Soils on the volcanic ash recovered much more rapidly because it is granular and weathers quickly into a fertile soil. Much as they did in the past, people in the area today are taking advantage of the benefits of living in a volcanically active area, but they also suffer difficulties.

Earthquakes are common in the Zapotitan Valley—it is an unusual year to not feel one. Every few years, or at least every few decades, an earthquake occurs that does structural damage and causes some injuries and deaths. We will see in subsequent chapters how the prehistoric residents of Ceren developed an architecture that was very earthquake resistant for their household architecture (but not for religious and public architecture!), and superior to much construction in Central America today.

THE SOCIAL ENVIRONMENT

The Zapotitan Valley is a small part of the large pre-Columbian (before Columbus) culture area known as Mesoamerica. Mesoamerica extended from central Mexico into northern Central America and was the area in which complex societies, called states or civilizations, developed. A number of civilizations emerged in this area, of which the Maya and the Aztec are the best known. All civilizations based their agriculture on maize and beans, and most areas had sedentary villages as far back as 2000 BC. Cultures developed stratified social systems, with the elite making decisions for the commoners, who were farmers and other workers. Religions became more formalized and hierarchical, and directly associated with the state. The "separation of church and state" concept would have been considered strange and unnatural. The economies became more centralized, with the elite controlling long-distance trade and redistribution of many commodities within the society. What the elite did not control is an important lesson we are learning from Ceren, a topic we turn to later in the book. The physical manifestations of this centralization in the social, economic, and religious systems are not difficult to see in the archaeological record. Within the capital of each civilization, the religious center is marked by tall pyramids surrounded by broad plazas where the multitudes would gather to participate in religious events and be impressed by the supernatural powers of their religious leaders, in addition to their political and economic powers. A central marketplace, usually not far from the religious center, would be maintained for exchanges of food, clothing, tools, spices, pigments, and other goods. The palaces, where the elite lived, often overlooked the plazas and marketplaces where they could keep track of the elaborate systems under their control.

Not surprisingly, Mesoamerican archaeologists have traditionally emphasized the elite. Most Mesoamerican archaeologists have preferred to excavate a palace rather than the humble dwelling of a farmer, or to excavate a pyramid rather than the plain religious shrine in the periphery of town. The massive construction of the palaces and main pyramids make them much easier to find, and their preservation is generally much better than those of the commoners' humble dwellings. Also, archaeology was still under the "fancier is better" approach, so it was assumed without question that it was better to search for the elegant grave offerings of fancy jade masks and gold ornaments (the Indiana Jones syndrome) than to look for the things that were important and available to most of the population. Thus, we now know much about the top 10 percent of society in Mesoamerica, but we know very little about the remaining 90 percent. Only recently have archaeologists turned directly toward learning about the silent people of prehistory. This book is dedicated to their finding a voice and becoming known for their accomplishments in ancient cultures.

The Ceren site, a village of commoners, functioned in a populated landscape. The Zapotitan Valley had completely recovered demographically from the Ilopango eruption by the Late Classic period (AD 600–900). Black (1983, 75) found forty-two sites contemporary with Ceren in his survey of the valley that comprised eleven hamlets, fourteen small villages, seven large villages, three isolated ritual precincts, four large villages with ritual construction, two secondary regional centers, and one primary regional center. Because he surveyed a probability-based statistical sample of 15 percent of the valley, the estimates for the valley as a whole would be 280 sites at that time, and statistically these site types can be multiplied by 6.7 to obtain the estimated valleywide figure. There was only one primary regional center, however—the site of San Andres (Figure 1-5) in the center of the valley. It was the largest religious, political, and economic center of the valley, and people from Ceren would go there for special purposes. San Andres and Ceren are only 5 kilometers (3 miles) apart in a straight line. As we will see, it was not the *only* elite center in the valley. A big question is the degree of economic, political, and religious control that San Andres elites wielded over the Ceren commoners.

Those special purposes at San Andres probably included major religious events. Routine religious practices were handled in the Ceren household or community, but the priests at San Andres likely would have directed the principal ceremonies involving the society as a whole. San Andres evidently was the economic hub of the valley, importing obsidian from the Ixtepeque source in Guatemala, and providing occupational specialists to shape the cores and use percussion and pressure techniques to make sharp knives, scrapers, and utility cutting tools. San Andres also likely mediated the trade of jade into the valley. The natural source of jade is farther into Guatemala than is that of the obsidian, but in the same northern direction, and so the same traders probably brought both. Jade was used for decorative and practical purposes at Ceren, as beads and axes. Also standardized are the cylinders of hematite red paint; they probably were purchased at an elite-run market. The source of the other red pigment, the very pure cinnabar (mercuric sulfide, HgS), is unknown. Finally, San Andres probably served as the political center of the valley population. If disputes arose that could not be resolved locally, people probably went to San Andres for final adjudication. Disputes could have emerged over access to arable land or other resources, over possessions, or a variety of other issues.

Black (1983, 82) estimates that there were between 40,000 and 100,000 people living in the Zapotitan Valley during the Late Classic period. Based on his

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Figure 1-5 One of the pyramids of the San Andres site, the political-economic-religious hub of the Zapotitan Valley during the Classic period. The pyramid was partially excavated and consolidated. The stairway probably led to a temple on top, made of poles with a thatch roof. The plaza is at the left. Beyond the pyramid, in the sugar cane field, are unexcavated residences of elite and commoners. The Ceren site is only 5 kilometers away.

figures, after the Late Classic populations nucleated somewhat (during the Early Postclassic, AD 900–1200), and declined only slightly. They further declined during the Late Postclassic (AD 1200–1500) to barely more than half of the Late Classic figures. The hierarchical and interrelated nature of the social, political, economic, and religious system in the valley during the Late Classic indicates that Ceren was functioning within a complex culture. There was no such thing as a "typical" site of the time because each was performing different functions within the whole society. The range in size of sites was great, and some had pyramid complexes whereas others do not. The reality is in the diversity and interrelatedness of social components.

SITE DISCOVERY, AND HISTORY OF RESEARCH

A bulldozer operator first discovered the Ceren site in 1976. He was leveling a low hill just north of what we now call the Ceren site, to create a flat platform on which to build some grain storage silos. As he was working, he noticed that the blade cut the corner of a building buried by volcanic ash. He hopped down and dug around a bit, finding more of the floor and edge of the building, and some pottery that was inside the building. Acting more responsibly than most bulldozer operators in any country in the world, he called the National Museum in San Salvador and notified them of his discovery. It took the museum three

days to send someone to the site to look it over and assess its potential importance. The museum archaeologist noted how well preserved it was, and therefore thought it was very recent, and thus not very important, so he gave the green light to keep bulldozing. A number of structures were completely destroyed, and their contents crushed. One building had only its northern fringe bulldozed away, with the rest left in the cut bank. Of course, the bulldozing was damaging, but the site might never be known to us had it not been done. It is unfortunate that its significance was not recognized upon first discovery.

Two years later, I was in El Salvador with a team of students from the University of Colorado doing an archaeological survey of the Zapotitan Valley. I had not learned of the discovery from people at the museum, but heard of it from people living near the site, when I asked permission to inspect their property. Hearing that it probably was a historic or recent house buried under volcanic ash, I had no expectations that it could be prehistoric. Rather, I was puzzled that I did not know about such a recent eruption because I thought that I understood the volcanic eruptions of the area rather well. So, I set out to find the remains of the buried building. It was relatively easy to find, in the bulldozer cut at the south end of the silo property. A floor and the tops of a couple of adobe columns were immediately visible, as was a low platform a few meters to the west. I grabbed my trowel and began clearing volcanic ash off the hardened clay floor of the house, looking for artifacts that would help date the building (Figure 1-6). I expected to find a bit of plastic, part of a Coke bottle, some aluminum foil, or perhaps some newspaper that would shed light on its date. The first artifacts I found were some pieces of Classic period polychrome (multicolor painted) pottery that I could date to about AD 500–800, based on the style and manufacturing techniques. Even that did not shake my belief that the house was recent because the thatch roof was so well preserved, collapsed to the floor under all the overburden of 5 meters (almost 17 feet) of volcanic ash, and the houses of most peasant agriculturalists in the area today have some prehistoric artifacts in them. Farmers today often bring interesting pieces of pottery or other artifacts back to their houses. It is a rare farmer in the area today that does not have his own collection.

However, after a few hours of excavating I had found only prehistoric artifacts, and not a single artifact that I could identify as historic or recent. I began to perceive two very different possibilities: (1) I was on the brink of a massive professional embarrassment if I prematurely announced the find of these structures as prehistoric and they turned out to be recent, or (2) they were in fact prehistoric and therefore the site is extremely important. The real key was dating, and I carefully collected samples of the thatch roofing for radiocarbon dating. My colleague Sam Valastro at the University of Texas Radiocarbon Laboratory agreed to date the samples by measuring their radioactivity. The older the sample, the less the radioactivity, and I could collect large samples to increase his dating accuracy. And, there is an advantage of submitting thatch roofing over pieces of wooden roofing support, or pieces of charcoal from a fire pit or hearth. Those pieces could be from inner growth rings from trees that had lived quite a while earlier than the burial of the house by the volcanic ash. Analyzing earlier growth rings would tend to push

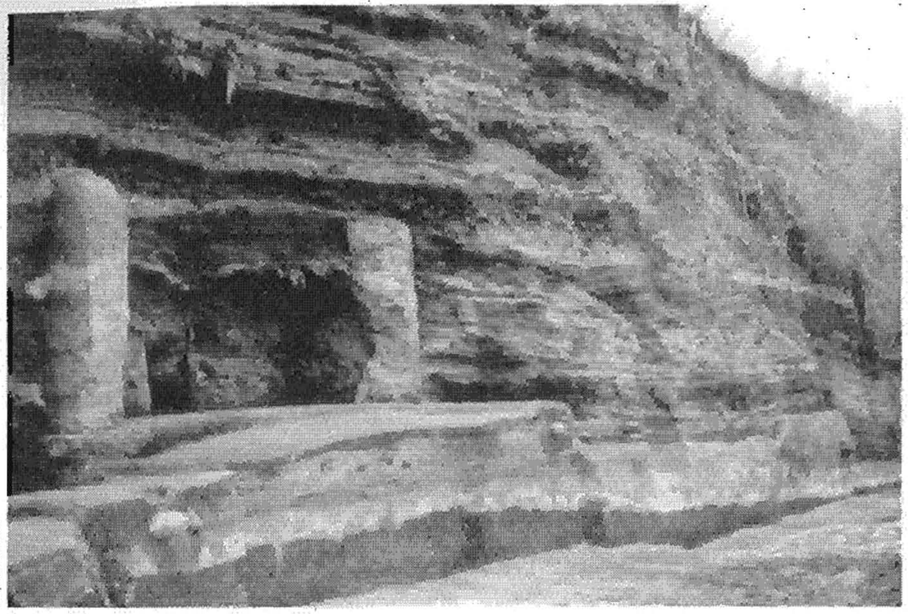

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Figure 1-6 The Ceren site after limited excavations in 1978; the bulldozer had removed the northern part of the domicile (left) and the workshop (right). The two adobe columns and the floor of the domicile can be seen, along with the doorway between them that leads to the innermost room. The white layer of volcanic ash below the building is from the Ilopango eruption; it buries the clay-rich soil that is the source of construction material.

the date back in time. In contrast, thatch needs to be replaced about every five years, so there was little difference in the age of the organic material and the time I wished to date, the eruption and burial of the site. I eagerly awaited the telephone call from Sam; when it came, he said that all samples were about 1,400 years old. All samples dated since then have substantiated the 1,400-year age as well, so there is no longer any doubt about the antiquity of the site. Awesome!!

We were able to excavate a little in two buildings, now called Structures 1 and 5, before the end of the field season in 1978. We returned in 1979 and 1980 to do geophysical work, to search for more structures buried under the volcanic ash, and were successful. However, the Salvadoran Civil War was worsening, and we did not get back to Ceren until 1989 to excavate more buildings. The 1989, 1990–1991, 1992, and 1993 seasons were successful in excavating quite a few buildings that belonged to four households, as well as some specialized buildings (Figure 1-7), and lots of crops. The emphasis of work at the site, to today, has shifted to conservation. The architecture is so fragile that careful work will have to be done to every square inch to make sure that these delicate buildings have a long future. It would be a disgrace to take them from their "time capsule" and bring them abruptly into the present, without giving them the best conservation possible.

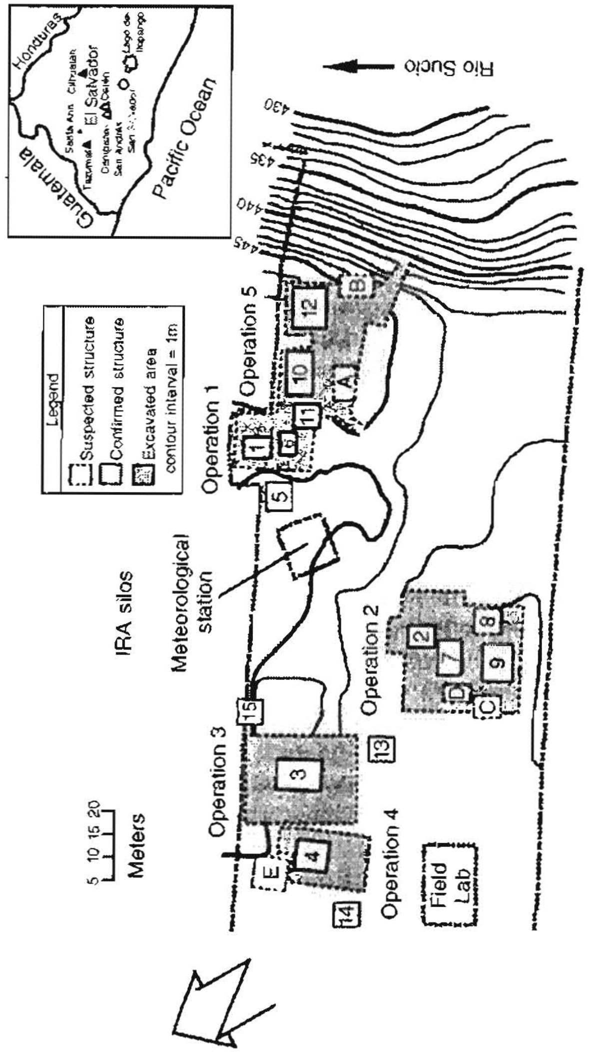


Figure 1-7 Map of the Ceren Site, 1991. The northern part of the village was destroyed by bulldozing for the IRA silos in 1976. Known structures are indicated by solid lines and suspected structures by dashed lines. Suspected structures are ones for which indications of architecture have been found, but they have not been confirmed and excavated yet.

ABANDONMENT

When a family leaves its house for just a short time, family members leave artifacts in their position of use or storage, and a relatively complete household assemblage is left intact. When a family decides to abandon a house, however, the most important and valued possessions are taken along, and others are sold or bartered. After the family departs, other people in the area often take things that may be useful to them, including parts of the architecture. In Ceren, people fled the village to save their lives, so took little with them, leaving virtually complete inventories of their possessions, in contrast to most prehistoric villages archaeologists excavate that were abandoned gradually. Dean (1987) documented the strong bias in material remains as modern households in northern Honduras are gradually abandoned and people remove many important items. Lange and Rydberg (1972) noted the same as a family abandoned its domicile in Costa Rica, leaving behind a greatly impoverished material culture. Wilshusen (1986) documented how the mode of abandonment affected preservation of artifacts and activity areas, and the superior nature of sudden abandonment for detailed reconstruction of Anasazi behavior in the U.S. Southwest. A wide range of abandonment modes are being explored by archaeologists; by comparison, the Ceren site anchors an end of the spectrum because it was abandoned so suddenly. That is why it is so exciting, and we can learn so much about life there. It is almost too well preserved—I occasionally have the feeling that I am violating their rights to privacy. Fortunately, they have no access to lawyers, or we would never be able to get any work done.

PRESERVATION

The sudden volcanic burial did not allow a gradual abandonment, thus preserving artifacts in their position of use or storage. In addition, the nature of the volcanic ash preserved organic materials in a way almost unprecedented in a tropical wet environment. The finger swipes of food still left in pottery serving bowls from their literal "last supper" are still preserved; we found their dirty dishes! (Forks were not invented until recently, in the 1700s, in Italy.) Some obsidian (volcanic glass) knives still have some organic residues preserved from their last use. Thatch roofs are preserved even to the point of some of them having mice. We even developed the "mouse index" of expectation of how much stored food we were going to find in each building after excavating through the thatch roof, and it never failed us. Under the roofs of structures, painted gourds, organic spindle whorls, and baskets are preserved. The stored grains are preserved inside fired clay vessels, even with two species of ants that got inside and were nibbling away. Gardens and agricultural fields are preserved, even with footprints of the farmers. Such extraordinary preservation of architecture, plants, and artifacts demands extraordinary efforts to conserve and preserve them. It would be an outrage to bring such wonderful items from their entombed past into the present and then give them a very short future by inadequate treatment.

CONSERVATION

The excavations are being conducted under a very strong ethic of conservation. There are three components to the conservation program: plants, artifacts, and architecture. Some plant remains are well preserved in carbonized or direct forms and need little or no special treatment. They are submitted to biologists, mostly Salvadorans, for identification and interpretation.

Many plant remains are preserved as a cast. The fine-grained moist volcanic ash packed completely around the plants, whether they were trees, maize plants, or smaller items. Then, the plant decomposed, probably within a few years of burial, leaving a hollow space in the ash for centuries. When we excavate within a meter or so of the previous ground surface, we do so with exceptional care looking for hollow spaces. When a cavity is encountered, we look into it with a fiber optic proctoscope, which is ideal for looking into small dark spaces.[4] It shines a bright light into the dark hole through a fiber optic bundle to the end, to illuminate the cavity. A coherent bundle of optical fibers transmits the image to our eyes, so we can identify what made the void, and to determine the best mode of preservation. Although some plant voids are merely branches from trees blown in during the early blasts of the eruption, many are planted and tended species. A specialist from the U.S. National Museum of Health and Medicine, Sean Murphy, trained us in the field in the use of dental plaster to fill the voids and preserve the plant as a plaster mold. Dental plaster has two advantages: It hardens to a very tough substance, and it preserves minute details. Often it even picks up the original colors of the decayed plants, and we have cast maize plants, many different seeds, trees, manioc plants, agave plants, maize cobs and ears of maize, storage cribs, front doors of structures, and many other organic materials.

Architectural conservation was assisted by the consultation of numerous specialists from the United States, El Salvador, Guatemala, Italy, and Peru. A major effort of architectural conservation continues simultaneous to our excavations. The Ministry of Education of El Salvador hired a permanent crew of fourteen workers, under the supervision of Victor Manuel Murcia, to do architectural conservation. To my knowledge, they established an archeological "first" by consolidating the walls of Structure 4 before they were excavated. When only the top surface of the walls was found, and before the ash from the sides of the walls was excavated, the conservation crew was able to insert straight wooden poles called "varas" into the walls. The prehistoric varas were virtually identical to the ones we inserted. Had we not replaced the varas, the walls would be too weak to stand up to even a moderate earthquake. Architectural conservation is done on all buildings as excavations are conducted.

With the assistance of Harriet "Rae" Beaubien, of the Conservation Analytic Laboratory, Smithsonian Institution, a field laboratory for object conservation was established. Both nonperishable and perishable artifacts were treated, including ceramics, chipped stone, groundstone, baskets, painted gourds, cloth, twine, seeds, thatch, bone, antler, and other materials. Beaubien is creating a reference collection of the pigments used at Ceren, particularly those used on small fragile artifacts and other special applications. Each is being characterized chemically.

CEREN HOUSEHOLDS

Ceren households hid all their fine obsidian prismatic blades, when they were not in actual use, generally in the roofing thatch. Obsidian is natural volcanic glass, and the Maya fractured it into long cutting knives we call prismatic blades. Storing their blades up in the thatch, at predictable locations such as above doorways and in corners, was done to protect the edges as well as to protect children from being cut. The Ceren site is the only one I know of in Latin America that is so well preserved that we can learn how people did "child-proofing" of houses in prehistory. Valued and fragile items, such as polychrome pots, or "donut" stone mortars, were often placed on top of adobe walls or with roofing for safe-keeping.

In the United States, the typical household lives in a single structure, be that a house, condominium, or apartment. Within that structure, functionally specific areas are demarcated by internal walls, separating bedrooms from the kitchen, living room, and other rooms. In contrast, Ceren residents constructed multiple buildings for specific functions per household. That also is in contrast to Lower Central America and northern Mesoamerica. In Lower Central America, a household is encompassed by a single structure that is internally subdivided (see, for example, Lange and Stone 1984). In central Mexico, Oaxacan families constructed large rectangular buildings for multiple household activities (e.g., Whalen 1981), and internally subdivided them for particular activities. The same is true for Teotihuacan (Millon 1973) and later societies in the Basin of Mexico. Stone (1948) describes the Lenca earlier this century, in Honduras and El Salvador, living in single structures per family, and most have only one room. The Chorti Maya of southeastern Guatemala (Wisdom 1940) presently construct a number of functionally specific buildings per household. The Classic Maya of Copán, the antecedents of the Chorti, constructed multiple structures per household (Webster and Gonlin 1988). The Kekchi Maya of Guatemala space families at least 30 meters from each other, and each family generally lives in a multiple-structure complex internally facing a patio (Wilk 1988). Gerstle (1990) finds many architectural and space-use similarities with Ceren and the Maya at Copan. Given these similarities and differences, can we say if the Ceren residents were Maya or Lenca? The issue of cultural affiliation of Ceren residents is not clearly resolved, but architectural data would favor Maya over Lenca. However, in a frontier situation, with flux of goods and people, and acculturation occurring, it may be an oversimplification to expect Ceren residents to be clearly one or the other.

SUMMARY

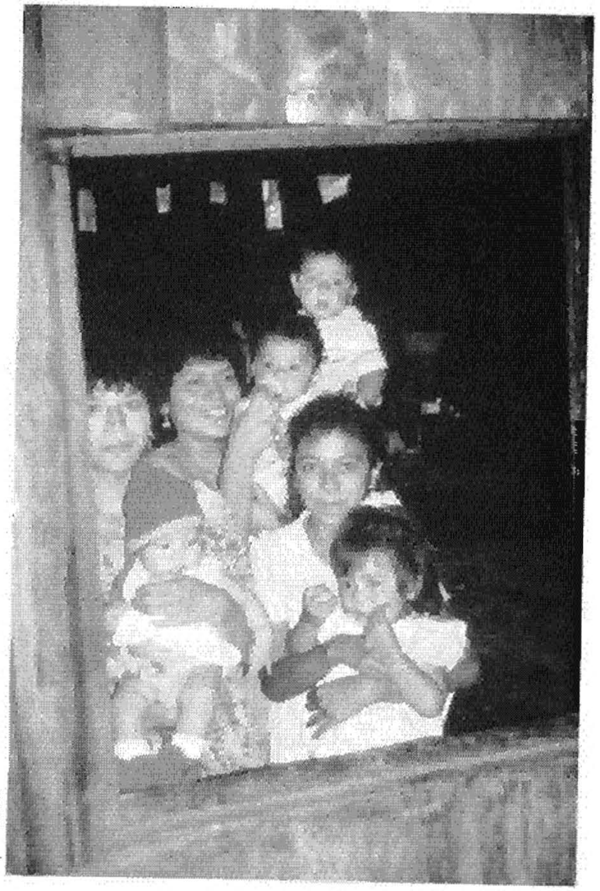
The nature of volcanic preservation at the Ceren site provides an unusual opportunity to study southern Mesoamerican Classic period households. The Loma Caldera explosive eruption occurred with little or no warning, a characteristic of phreatomagmatic eruptions (magma in contact with water) of basaltic magmas. Hot, fluid basaltic magmas migrating upward caused minor earthquakes, but one was large enough to cause ground cracking and some cracking of Structure 12. We estimate its strength at about 4 on the Richter scale. The site evidence agrees—round-bottomed pots remained on top of flat adobe wall tops, and adobe platforms and most walls were not cracked. However, when the magma struck water, probably from the Rio Sucio, a series of violent steam explosions occurred. Structures, artifacts, plants, animals, and evidently people were enveloped by hot (almost 100 degrees C) moist clouds of volcanic ash and gasses that were moving between 50 and 200 kilometers (31 to 125 miles) per hour. The eruption rapidly buried the site under 5 to 7 meters (16 to 23 feet) of volcanic ash, sealing it from the factors of natural and human disturbance that so impoverish the archaeological record at most sites. This also preserved organic materials, often to the cellular level. Those include palm and grass roofing thatch, roofing support posts and beams, grains in storage as well as the insects and field mice consuming them, and organic residues in food serving vessels and on food grinding and cutting implements. Thus, the Ceren site is an unusually clear window on the ancient past, on commoners in a village on the southern periphery of the Maya area.

2/The Theoretical Framework: Household Archaeology

If research is to be more than merely collecting miscellaneous facts, curiosities, or snazzy items to put in a museum display case, it must be done in a theoretical framework. A theoretical framework gives us a system of expected relationships, where a piece of data or an artifact can be related to a broader field. We can formulate hypotheses and test them, and thus assess them by finding them either supported or unsupported by the data. This allows an individual bit of data to be related to other artifacts and structures within an interpretive system. I believe the most powerful and appropriate body of theory to help us in understanding the Ceren site is household archaeology. Household archaeology is a recently emerging subfield in anthropology that focuses on the group sharing the same residence and participating in certain common functions. In most cases, this is a family, but there have been exceptions found in various parts of the world. For our purposes in this book, we assume the household is composed of a family, evidently a nuclear family but in some cases perhaps an extended family, until we encounter evidence to the contrary.

HOUSEHOLD ARCHAEOLOGY

Household archaeology focuses on the domestic co-residential group (Figures 2-1, 2-2), and attempts to reconstruct activities regarding the functions of (1) *production* of food, artifacts, housing, and so forth; (2) *sharing and redistribution;* (3) *reproduction* of people in the biological sense, and their culture and society; and (4) *transmission* of goods and property to the next generation (Wilk and Rathje 1982). All four functions can be studied at a single point in time (synchronic) or through time on a processual basis (diachronic). The field of household archaeology is contributing to a "democratization" in Mesoamerican archeology, as scholars shift from the elite emphasis of so many earlier projects. That traditional approach focused excavations in the centers of big sites, looking for the richly stocked tombs of past rulers, fancy pyramids, elegant palaces, and the like. Fortunately, household archaeology begins from the "ground up" by



Payson Sheets

Figure 2-1 A traditional Salvadoran family living on the slopes of Santa Ana volcano. The mother (feeding baby), her sister (top left), and her five children are looking through the window of their kitchen, in mid-afternoon. The father is in the fields thatching a field house—see Figure 2-2.

investigating the functioning of prehistoric societies beginning with their basic building blocks, the household.

However, a major limiting factor inhibiting ample understanding and interpretation of prehistoric households is the quality of data, often because of poor preservation. The agents of natural disturbance, particularly strong in tropical climates, deleteriously affect most sites, particularly sites of commoners. The agents include erosion, solar radiation, bioturbation (disturbance) by flora and fauna, and other deranging variables interposing themselves between prehistoric activities and the archaeologist wishing to reconstruct them. As mentioned in Chapter 1, gradual abandonments allow people to remove their most valued possessions, and later people "mine" the site for usable materials. This introduces biases that are difficult to detect and measure unless cases such as Ceren are known where such factors were not operable.

Household archaeology is a rapidly developing subfield of anthropology. There is an expanding methodological and theoretical literature, primarily by ethnologists and ethnoarchaeologists. Ethnologists study contemporary functioning societies, ranging from the isolated hunting and gathering peoples in southern

Figure 2-2 The father of the family placing thatch on a small field house in the cornfield, to be used as shelter in a sudden rainstorm. The grass thatch is tied to the roofing supports. Good thatch roofing was essential to the adobe architecture of Ceren. The other man (left) is a friend who helped gather the wooden supports and thatching material. The two unrelated men are good friends and often help each other with various agricultural activities.

Africa to self-sufficient agricultural villages in the Amazon to industrialized communities in Europe. Household archaeology has roots in settlement archeology (Willey et al. 1965, Chang 1968), in ethnoarchaeology (Kramer 1982, Wauchope 1938), ethnography (Wilk 1988, Wisdom 1940), and in affiliated social sciences (Arnould 1986). Settlement archaeologists study the distribution of residences of all levels of society, and try to understand how those residences functioned and related to each other. Ethnoarchaeology is the study of live, functioning societies by archaeologists to try to understand the role material culture (including architecture) plays in society. Thus, when archaeologists are trying to interpret prehistoric patterns, they are working from a more broad interpretive basis.

Household archaeology has changed during the past couple decades or so from a field with a few isolated practitioners to one with ethnographic sophistication, improving archaeological recovery techniques, and an emerging corpus of appropriate method and theory (Netting, Wilk and Arnould 1984, Ringle and Andrews 1983, Wilk and Ashmore 1988, and Wilk and Rathje 1982). Migratory hunter-gatherers deliberately maintain few material possessions and prefer multifunctional tools because they have to carry everything when they relocate their base camps. In contrast, households in sedentary societies are immersed in material culture (Wilk and Rathje 1982), allowing functional interpretations to reveal the nature of household activities. We have found that Wilk and Rathje's word

"immersed" to be appropriate for the Ceren households, as they had abundant personal possessions. But that should come as no surprise to us in this society—when we move from one residence to another, we are faced with a morass of loaded cardboard boxes, and a real hassle in moving them around. (The last person I need to say this to is a college student.)

Household archaeology has kept up with recent developments in archaeological style and theory. Archaeologists recently have been exploring the ways households can be culturally constructed, with internal heterogeneity and contestation (e.g., Hendon 1996). Practice theory, arguing that the large structures of society are played out by daily practices (Bourdieu 1977), has also had an effect on household archaeology. Importantly, archaeologists are also exploring symbolic and ideological aspects of households (Ashmore 1992). The realization that there was considerable variability among households in the same society, or in the same site, is certainly illustrated by the Ceren case.

The household is here defined as the co-residential task-oriented social and adaptive unit intermediate in organizational level between the individual and the neighborhood or village. Behavior is spatially focused on the house structure or structures, and includes activities inside and outside the buildings. The behavioral emphasis exemplified by the major contributions of Netting, Wilk, and Arnould (1984) and Wilk and Ashmore (1988) are appropriate to analyses and interpretations at Ceren, as are symbolic or mentalistic approaches to understanding ancient Ceren.

Symbolic studies often try to understand or speculate why people do things on a deep level, and that can be difficult to test archaeologically. For instance, we would like to know why the dominant architectural and agricultural field orientation is 30 degrees east of north. But, with rectangular structures, that could also be 30 degrees south of east, or 30 degrees west of south, or 30 degrees north of west. So, we don't know what their dominant direction was. Could they have been orienting on a celestial body, such as the rising or setting of the sun, moon, planet, constellation? Yes. Could they have been orienting on a feature of the natural environment, such as a prominent or sacred mountain? Yes. Could they have been organized somewhat arbitrarily by a central authority who dictated the internal orientation of property? Yes. We had been debating the various merits of these and other possible reasons for years. Then, Cynthia Robin, a colleague of mine at Northwestern University, suggested I check an orientation to water. All Mesoamerican societies revered water, as they do today, as it is both symbolic and functional as the basis of plant growth and sustenance and, thus, the future of people. I checked the orientation of the entrenched riverbank adjacent to the site. Bingo. It is 30 degrees east of north, just like the buildings. If this really is the reason, then other sites in the area should align to nearby river banks. The only other site in the valley with architecture that can be checked is San Andres, and its architecture aligns to its adjacent riverbank. Thus, I think they were ideologically connecting their buildings and agricultural fields to water and crop growth. As more sites are excavated, this will be tested.

Following Adams (1981), households here are studied as "adaptive vehicles," as units that directly interrelate with their natural, social, and ideological (my addition) contexts. As Laslett (1969) states, "A convincing case can be made out in favour of the household as the fundamental unit in pre-industrial . . . society for social, economic, even educational and political purposes . . . (The components) make up an intricate adaptive mechanism which we are only now beginning to understand." Households are localized and enumerable (countable) (Arnould 1986), in contrast to families, which are kin-based and not necessarily localized (Netting, Wilk, and Arnould 1984). In other words, the household is the observable co-residential functioning unit, although occasionally families are split up and do not reside together. Therefore, strictly speaking, households are more suitable units for archaeological study than are families.

According to Arnould (1986), all households share five spheres of activity: (1) production, including food, implements, vessels, and housing; (2) pooling, such as storage, distribution, maintenance, and curation of the common goods, including exchanges between households and communities; (3) transmission of information, knowledge, materials, possessions, including inheritance and access rights to resources; (4) reproduction in biological and social-cultural senses, including the need to recruit spouses from outside the household and often outside the community; and (5) co-residence or membership, with the activity areas of the household group revealing communal living and working.

Laslet's taxonomy (1972) of households is sensitive to the household developmental cycle, which is especially important when various households are being compared at a single point in time as at Ceren, or when a single household is studied through time. At any point in time, a household is expected to be one of Laslet's following six types: solitaries (widowed or single individual), non-family (co-resident siblings or unrelated members), simple family (married couple with or without children), extended family (extended laterally, upward, or downward in generations), multiple family, or indeterminate. As a household evolves, it can change from one type to another.

What is the boundary of a household? I believe it is a mistake to ask this question in the singular because there are several different kinds of boundaries. A structural boundary is the house construction itself, but a functional boundary includes the areas outside the walls and under the eaves, the adjacent activity areas, and outbuildings. Most Ceren structures excavated to date have more roofed area under the eves and outside the walls of the structure than within the walls, providing roofed activity areas and walkways on all sides. And, each household had a number of specialized structures. A subsistence boundary is the far edge of a garden adjacent to the kitchen, or the agricultural fields surrounding the household. Field boundaries are discernable by changes in vegetation, hedgerows, and so on. Also, Ceren residents often separated a field from a building by a walkway. An economic boundary encompasses the maximal geographic extent of commodities traded; this extended into Guatemala for jade, serpentine (used for a green pigment), and Ixtepeque obsidian and to the Pacific Coast for salt and shells. The sources of some other materials, such as hematite and cinnabar for red pigments, are yet unknown, but we do know that they were from volcanic sources, and thus likely from within a hundred kilometer radius or less. In this broader domain, household boundaries are expected to overlap considerably, and that overlap is an index of community and regional economic integration.

A chronic weakness of household archaeology in Mesoamerica has been the paucity of household-oriented excavations and publications. As Flannery (1976, 13) noted, there existed "not a single published plan of a complete Early Formative [pre 1200 BC] house" anywhere in Mesoamerica. Classic and Postclassic houses, and occasionally households, are somewhat better known. Research in Oaxaca (Flannery 1976, Spencer 1981, Whalen 1981), south of Mexico City, has provided a strong stimulus to household archeology elsewhere in Mesoamerica.

Researchers in Oaxaca provide comparative data and useful methods and concepts (Flannery 1976, Winter 1976). Winter (1976, 25) defines a "household cluster" as the houses, storage pits, graves, and associated ovens and middens. The household includes these features along with the activity areas inside and directly outside the house. Thus, the term *household* includes the physical data and the interpretations of past human behavior of the functioning social unit. Oaxacan households varied somewhat in their features and were commonly spaced 20 to 40 meters apart. Winter estimates the individual Tierras Largas "household cluster" occupied 300 square meters, somewhat smaller than Ceren household areas.

Whalen (1981) excavated one of the best preserved houses found at that time in Mesoamerica; most of the house floor and contact artifacts were preserved by the adding of fill for a new floor. Cooking and weaving were done on the "right side" of the house, as viewed from the doorway, probably by females. Archaeologists have disagreed about which artifacts were in situ, that is, in their original position, which were somewhat misplaced, and which were inadvertent inclusions in construction fill. Spencer (1981) took a conservative approach and only included artifacts partially impressed into the floor. Parry (1987) argued for a more inclusive approach and included artifacts that seem to have been involved in intra-house activities. It is not known what artifacts were in the house but were removed before the refurbishing buried some of the artifacts. Fortunately, the sudden burial by 5 meters of tephra at Ceren obviates these problems.

Although still small, the number of excavated southern Mesoamerican houses has increased in recent years. Ringle and Andrews (1983) recorded hundreds of Formative residences at Komchen, in northeastern Yucatán, and hundreds of other enigmatic smaller features of stone and soil, but excavated few. A range from small features to apparent housemounds to larger structures is representative of many Maya sites, which makes it difficult to distinguish residences from outbuildings. Eaton (1975) has identified farmsteads (one room stone walled houses with fenced enclosures) and housemounds (raised platforms supporting perishable structures) in the Rio Bec area. Blake's excavations (1987) at Paso de la Amada, Chiapas, uncovered surprisingly large houses of an Early Formative chiefdom. Hammond et al. (1979) report on an early apsidal structure at Cuello, but the dating of the structure is not as early as originally claimed. It now appears to date to the Middle Formative period.

Many significant advances in household archeology in southern Mesoamerica have been accomplished at Copan and environs (Webster and Gonlin 1988), a major Maya site in western Honduras (see Figure 1-1). Maya commoners, as agrarian "producers," had very basic housing, usually consisting of multiple small rectangular structures per household, sometimes on a platform, and active use of the "peripheral spaces" surrounding each structure. Structures were consistently aligned to the same azimuth, as at Ceren. Maya households in Copan proper had more substantial construction and more "ideal" Maya architecture consisting of rectangular substructures with steps in front, terraces, and interior benches (Webster and Gonlin 1988, 186), when compared with houses in the periphery. Ceren architecture is more similar to the Copan core than to its agrarian periphery. A detailed comparison of Ceren and Copan households is available in Webster, Gonlin, and Sheets (1997).

SUMMARY

Household archaeology in Mesoamerica has contributed to a process of democratization, as the elite-only bias to former research is broadening to include all components of society. The household is the co-residential group that shares many communal tasks. In most cases, the household is a family, but not always. The household works together in activities of production, storage, distribution, curation, transmission, reproduction, and other functions including rituals. Household archaeologists are addressing both behavioral and religious-ideational concerns today. The household has been a neglected component of Mesoamerican studies, but recently has become a mainstream component.

3/Interdisciplinary Studies: Integrating Geophysics, Volcanology, and Biology with Archaeology

I think it is unfortunate that we have to make such an effort to conduct multidisciplinary studies. It is a sign of the times, of the fragmentation of knowledge, of isolated disciplines in separate departments in universities, of funding agencies preferring "mainstream" research within specific fields. Disciplines as we now know them became formally separated in British and German universities a few centuries ago, and when universities in the United States and Canada began to be set up, they followed the European model. Thus, we have separate departments of physics, chemistry, geology, biology, anthropology, psychology, and so forth, and they compete with each other for funding, faculty positions, and facilities.

Many research problems, particularly when they are narrowly defined, are quite appropriate to be investigated by highly specialized research teams from a single discipline, or even a small subfield within that discipline. However, many times important insights or worthwhile research opportunities are lost because of an overspecialized approach. We realized as early as 1978 that to understand what was happening at the Ceren site some 1,400 years ago we would have to broaden our perspectives rather than to become highly specialized as archaeologists. The other branches of science that have contributed fundamentally to the research effort are geophysics, volcanology, and biology. We will look carefully at their essential contributions in this chapter.

GEOPHYSICS

I must admit that I turned to geophysics more out of desperation than confidence. The problem was clear to me when I first saw the house in the bulldozer cut in 1978, buried under the 5 meters of volcanic ash. Were there any other buried structures? If yes, how could I find them? I certainly could not do so by following traditional archaeological survey procedures, of walking the present ground surface and looking for evidence of prehistoric artifacts or architecture. Imagine the frustration of walking a flat ground surface and knowing that there could be lots of super important structures, artifacts, and agricultural fields some 16 feet below your feet, but you can't tell what or where they are. I know the feeling, because I have done it often while walking the area.

Because the first structures were found by bulldozing, it was clear that more bulldozing could find more structures. However, the bulldozing would have to be random, on a massive scale, costing many tens of thousands of dollars per season, probably doing quite a bit of damage to fragile buildings, and generating immense amounts of backdirt (bulldozed loose waste of volcanic ash). What could we do with all those tons of volcanic ash? Where could we put them? How do we get them there? And, more importantly, I would need to write a very compelling research proposal to get funding. I had experienced some success and some failure in getting earlier research proposals funded by the National Science Foundation (NSF), so I knew how well they had to be written. Because NSF receives so many proposals, yet they have a finite amount of money to award, most proposals are turned down. Often the rejection rate is about 80 percent. I was certain that including a line item for some $30,000 of random bulldozing would be the kiss of death for a proposal. Also, the term "random bulldozing" would inevitably strike the reader as far from an acceptable scientific procedure!

We needed a way to "see" through the volcanic ash layers to detect buried structures. However, there is no book or journal that one can consult on ways to look for Classic period houses under 5 meters of volcanic ash. Rather, in desperation, I decided to take some samples of the ash and of the earthen construction material back to the University of Colorado when I returned to Boulder in 1978. I knew that some unsuspecting geologist was about to have some plastic bags of ash and adobe architecture plopped down on his desk, but I had to try to find one that would not laugh me out of his office. Hence, I made some discrete enquiries of the geology departmental chair, and he suggested that I talk with Dr. Hartmut Spetzler. The chair said that Hartmut had a reputation for enjoying challenges that he had not anticipated, and he enjoyed forays into fields outside his specialty of tectonics within geophysics.

Within an hour of my calling Hartmut to introduce myself and see if he would consider thinking about the problem, I was in his office with the samples and some photographs and stratigraphic drawings. He understood the problem immediately and began testing the samples in his laboratory. He needed to know the properties of the volcanic ash because it forms the general matrix across the countryside. The first step is to know what the "background" is like before trying to find a buried building. To find the proverbial needle in the haystack, you first need to understand the properties of the hay. Next, Hartmut measured the properties of the construction material, which he would try to detect as an unusual feature, as an anomaly in an otherwise uniform field. He was encouraged by the porosity of the volcanic ash and the density and high clay content of the earthen adobe construction. Also, the adobe construction material conducted electricity much better than the volcanic ash. We did the best we could to duplicate the moisture below the ground surface in the samples I had, but that was difficult because of the seasonal variations in El Salvador, and because my samples had dried a lot after I collected them. We decided that most geophysical instruments would not be appropriate because of the size of the target (floors of buildings some 3 to 5 meters on each side), depth of burial (about 5 meters down), nature of construction material, nature of the volcanic ash, and practicalities of shipping and running equipment in the field. We decided to try three instrument systems in the field, a portable seismograph, a ground-penetrating radar, and a resistivity instrument.

We wrote a proposal to the National Geographic Society Committee on Research and Exploration, which funded our proposal. So, off to the Ceren site we went in the summer of 1979. Shipping the radar unit presented massive problems. The biggest problem we did not anticipate—at the last moment, the U.S. government prohibited us from shipping the instruments out of the country. Some of the components, such as the instrumentation tape recorder and the radar, were so sophisticated that they might fall into the "wrong hands." Our state congressman in Washington had to intervene before we received permission to ship. We packed all the radar equipment into seven crates and took it to Stapleton airport in Denver to be shipped to El Salvador. We then faced the odds of having all seven crates arrive there at the same time, undamaged, and then getting them all through Salvadoran customs. We were greatly pleased and surprised that the airlines lost or delayed not a single crate. Customs in El Salvador was no problem—the customs inspector had never seen anything remotely like it, so he had no grounds to be suspicious, and he waved us through.

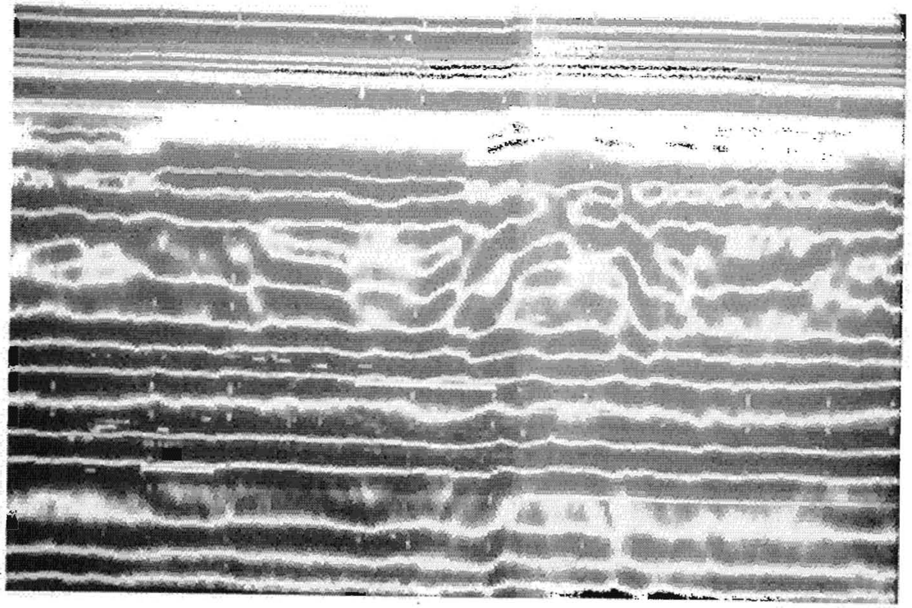
We began work in the field south of the bulldozed area in the summer of 1979, with the portable seismograph. Most of the remainder of this section on geophysical research is taken from the writing of Loker (1983), Spetzler and Tucker (1989), and Conyers and Spetzler (2002); the reader interested in more detail could consult these sources.

A seismograph records shock waves as they pass through the earth. Usually, geologists are looking for deep features, and they use a dynamite blast for the shock, and the waves pass through a few kilometers of the earth's crust. However, a dynamite blast 5 meters above a fragile Classic period structure was clearly a bad idea, so we used a sledgehammer striking a steel plate set firmly on the ground as our energy source. It imparted plenty of seismic energy for our purposes, and the instrument detected the shock waves with an array of twelve geophones (sensitive microphones). We then looked for an anomaly. We expected, correctly, that a buried house floor would conduct the shock wave faster than would the volcanic ash around it. The ash is less dense, somewhat like packed, coarse beach sand, and therefore is not as good a conductor. The shock point and the geophones can be laid out in an almost infinite number of patterns; we experimented until we found the best array for our possible target in its matrix. We did find some anomalies, and later checking has proven that some of them were in fact Classic period structures, but many were not ancient architecture and we generally could not figure out what caused those anomalies. The principal difficulty with this instrument was that we were pushing its limits of accuracy at such shallow depths and short distances, and we were often getting equivocal results that were very difficult to interpret. It was made for detecting huge geological anomalies deep within the earth, not small buildings under shallow burial. Had we relied on seismicity alone, the geophysical research would have had very limited success.

Payson Sheets

Figure 3-1 Ground-penetrating radar unit collecting data on subsurface stratigraphy. The sending-receiving antenna is attached to the rear of the oxcart. Inside the oxcart are the oscilloscope, instrumentation tape recorder, graphic recorder, gas-powered electric generator, and the geophysicist Hartmut Spetzler. Bill Loker is walking alongside, and Salvador Quintanilla is leading the oxen, named Senate and Cubano, along the grid line.

Fortunately, the ground penetrating radar antenna, gas-powered electrical generator, oscilloscope, instrumentation tape recorder, graphic recorder, and all the other components arrived simultaneously and undamaged. We did have a problem with heat. The daytime air temperatures were about 92 degrees Fahrenheit, and that, coupled with the sunlight shining directly on the instruments, was enough to damage the data. We created a white cotton cloth cover, which lowered the temperature enough that the instruments could function (Figure 3-1). That gave us, inadvertently, a kind of Conestoga wagon look as we moved across the countryside. This radar was developed to study permafrost melting along the Alaska Pipeline, where geophysicists attached it to the tailgate of a pickup truck or suspended from a helicopter. All the Alaskan data had so much electrical interference from those vehicles that it had to be digitized and computer manipulated, and that took months of tedious work. We avoided vehicle electrical interference by employing an oxcart that has no electrical or moving metal parts. A trained team of oxen and driver can move at a very steady rate across a field in a straight line, along a string marked in 5 meter intervals. The clean data we obtained without digitizing was the envy of geophysicists at the Petrophysics division of the U.S. Geological Survey, who loaned us the instrument. They had never seen raw data so clean. They insisted that the next time we went to El Salvador we need to bring them back an ox cart, two oxen, and a driver. I had to gently tell them that they are living in an overly developed world and could not go back to that superior transport technology.



Payson Sheets

Figure 3-2 Raw data as it comes off the graphic recorder in the oxcart as it moves across the surface. Each vertical line is five meters apart, and the depth recorded is about six meters. The black layers indicate a good radar reflector (such as a fine-grained dense tephra layer, a building floor, or the clay soil before Ilopango). A sizable anomaly can be seen to the right of the center, with a good reflector buried by layers of tephra that bow up over it. This was later excavated and is now knows as Structure 2, the domicile of Household 2.

A ground-penetrating radar unit has to be very powerful because it has to emit much more energy than radar antennas that emit energy through the air. Rather, the radar unit sends microwave energy deep into the soil and detects energy as it is reflected back. The antenna sends and receives energy 50,000 times a second. The data can be monitored on an oscilloscope in the oxcart as the equipment is moving across the ground surface. It is being recorded on special paper at the same time as the oxcart is moving, and one can see the subsurface stratigraphy unfurl (Figure 3-2). Today's instruments have a monitor that shows the subsurface reflections in real time, as they are happening (Conyers and Spetzler 2002). The black layers are strong reflectors, generally a dense volcanic ash layer covered by a looser coarse layer. The anomaly visible to the right of center in Figure 3-2 shows the volcanic ash layers bowing up over a strong reflector. That strong reflector is the clay surface of a prepared house floor. This anomaly certainly looked to us like what we would expect, if it had been a building buried by the ash layers. However, it is a big step to go from a geophysical anomaly to the knowledge of what caused the anomaly.

The Centro de Estudios Geotecnicos (Geotechnical Studies Center) in San Salvador graciously loaned us a drill rig and crew to pull up a sample of the anomaly to see what it was. The drill rig uses a large impact hammer to pound a hollow pipe into the ground, and then winch it back out again. The pipe is threaded and split, so when it is pulled up, it can be opened and the stratigraphic layers studied and recorded. The anomaly turned out to be deliberate construction, and we considered the anomaly confirmed as an ancient cultural feature.

Some anomalies detected with the radar have turned out to be natural, as the ash layers in one area had been eroded and redeposited during the eruption. Fortunately, other anomalies have been confirmed as cultural features. The anomaly shown in Figure 3-2 was drilled and confirmed as prehistoric construction. It was excavated in 1989, and is now known as Structure 2, the domicile for Household 2 (see Chapter 5). The ground-penetrating radar can detect the larger structures quite well, but the raw data are not sufficient to detect the smaller structures. The next step in geophysical research was to digitize the data to see if it can discriminate the smaller structures from the background, and perhaps even map the preexisting ground surface before the Loma Caldera eruption. Both of these have been accomplished (Conyers and Spetzler 2002). Of all the instruments used at Ceren, radar gives the most detailed results, and faster. And the newer models are much smaller and more portable than the instrument used in the 1970s.

The third geophysical instrument used at Ceren measures resistivity (Figure 3-3). The basic idea is that a house floor should conduct electricity better than the surrounding volcanic ash because it is denser and is made of clay that had been fired. In addition, it would retain more moisture than would the sloping layers of volcanic ash just outside a structure. Thus, we expected that the resistivity, or resistance to electricity passing, would increase near a structure, but decline right over the structure, and then increase on the other side of the structure. Our expectations were borne out by the results, although we now realize that many other factors contribute to resistivity variation. In individual resistivity traverses we found interesting M-shaped anomalies (Figure 3-4), and when we entered our data into our laptop portable computer with three-dimensional software, we saw interesting double and triple peaks popping out in various areas. Later explorations with the core-drilling rig of the Centro de Estudios Geotecnicos indicated that all the strong double-peaked anomalies were sizable prehistoric structures. Structures 2, 3, and 4 were so detected. Resistivity does not have the sensitivity or resolution to detect the smaller structures but it certainly works well with the bigger ones.

So, the geophysical research directed by Hartmut Spetzler and more recently by Larry Conyers has been very successful in detecting the larger buried structures. We then excavate around the larger structures and find the smaller ancillary structures that make up the household group. We have thus been able to avoid wasting funds and time in random bulldozing, or, more likely, having our research proposal asking for large amounts of money to pay for random bulldozing rejected.

There is an unfortunate reason why it may become more important to archaeology in the future to be able to employ geophysical instruments to detect deeply buried archaeological sites. The amount of looting of archaeological sites in El Salvador, like most countries of the world, is very discouraging. People illegally excavate sites looking for polychrome pots, jade artifacts, and other things that they can either add to their personal collections or sell to make money. The result

Figure 3-3 Kayla Sheets and Hartmut Spetzler conducting the resistivity survey in a sugar cane field. The instrument at their feet records the resistance of the subsurface to the passage of electricity; rods to their left and right are the electrodes (not visible in this photograph).

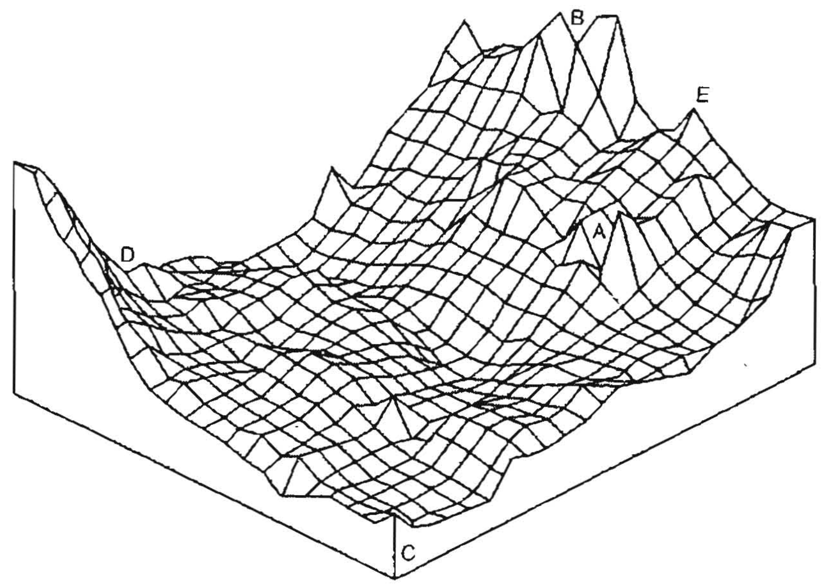


Figure 3-4 Each of the resistivity measurements, at 5-meter intervals within the 100 × 100 meter grid, are entered into the computer in the field, resulting in a three-dimensional plot. The anomaly known as "A," when excavated, is now known as Structure 2, and the anomaly "B" is known as Structure 3. Structure 4's anomaly is just beginning to the left of "B." Anomaly "C" seems to be natural, and "E" and "D" have yet to be explored.

is the destruction of archaeological sites, and more than half of the sites in El Salvador are scarcely worth excavating because they have been so badly looted. Unless looting is halted soon, and that prospect seems unlikely, we are facing a situation where only the few carefully protected sites, or sites deeply buried, will be worth expending the funds and effort necessary to excavate them. The deeply buried sites require special instrumentation, and we are trying to develop some of that for the future.

VOLCANOLOGY: INSTANT BURIAL AND FREEZING A MOMENT IN TIME

Had Loma Caldera not erupted, and had the Ceren village been abandoned under the usual circumstances, the Ceren site would not be very special. It would be much like the common Classic period sites dotting the Central American landscape. When the thatch roofs are no longer maintained, they deteriorate badly in a few years. Once the roof is gone, the rain and sun rapidly "melt" the adobe architecture. The structures deteriorate to just about nothing, and the more important artifacts would have been removed by the people leaving, or others after abandonment, leaving only trash. Thus, any archaeologist excavating there would have found a greatly diminished database. Fortunately for us, Loma Caldera erupted suddenly and buried the site. Because the eruption was so critical for preservation, we need to understand the nature of the eruption.

A number of volcanologists, geologists specializing in volcanic eruptions, have contributed to our understanding of the eruption. They include Virginia Steen-McIntyre, William Hart, Richard Hoblitt, and Dan Miller. Our present knowledge is summarized in Hoblitt (1983) and Miller (1989 and 2002). This section on volcanology is largely taken from those sources, and the inquisitive reader is encouraged to consult them for more detail.

The factor that led up to the eruption is that, unbeknownst to the villagers, there was a very hot basaltic magma gradually moving upward, dissolving the rock above it, very near the village. The eruption itself began when that magma came into contact with water, the Rio Sucio. Before the eruption, there was no volcano there, only a tranquil valley with the river flowing down the middle. Two things happened early, a relatively small earthquake, and noisy steam emission. The earthquake was about 4 on the Richter scale, enough to cause cracking of the ground near Structure 12 and the building itself. The earthquake would have gotten villagers' attention but certainly not caused an evacuation. The shrieking of the steam emission just 600 meters north of the villagers would have been unlike anything they had ever heard before, and that may have been sufficient reason for people to literally "head south." The next stage began when the magma contacted a considerable amount of water and instantly vaporized it, causing a massive steam explosion. That initiated a lateral blast, called a pyroclastic ("pyro" means fire, and "clastic" means broken) surge that consisted of hot gasses, water vapor and steam, and fine-to-coarse fragments of magma that were blasted through the air as tephra. The first layer of deposit is known as Unit 1. Unit 1 did not collapse buildings, so it is possible that if some people remained in buildings during its violent emplacement, they could have survived.

At the opening vent under the river, the steam explosions were violent enough to blast the river water away and create a temporary tephra dam; thus, the second phase was dry. Unit 2 and all the other dry phases are composed of tephra particles ranging from very small to larger than a basketball. The smaller particles cooled in the air before landing, but any particle larger than a hen's egg was still hot inside when it landed in the village. Each dry phase ended when the river eroded through the temporary tephra dam, and a steam explosion ensued. The various layers of the eruption are alternations of airfall and pyroclastic surge phases of the eruption. The odd-numbered units, such as 1, 3, and 5, are surges from steam explosions, and the even numbered units that followed each of them are dry phases. The surges were about the boiling temperature of water, 100 degrees Celsius, because they were steam explosions, and they were propelled into the site laterally. They had velocities between 50 and 200 kilometers per hour. The overall duration of the entire eruption was days or at most a few weeks. We call it the Loma Caldera eruption, and indeed most of the tephra came from that volcanic vent, but it is possible that other materials came from other portions of the active fault or fissure.

The first phase of the Loma Caldera eruption, which deposited Unit 1, was composed of pyroclastic surge beds. The particles are small, "fire-broken" because they were very hot and the contact with water fractured them into tiny pieces. The Unit 1 deposit generally is 20 to 30 centimeters thick throughout the site. Hot steaming deposits of fine-grained Unit 1 tephra blasted through the village, and packed on roofs, around walls, trees, and corn plants growing in the fields. The turbulence of Unit 1 arriving was sufficient to tip over some pots, knock some artifacts off wall tops and from rafters, and detach some parts of adobe cornices of buildings. *Tephra* is the generic term for all kinds of volcanic ash, lapilli, bombs, and so forth, that traveled through the air, in contrast to lava, which stays on the ground. Most buildings and roofs survived this stage of the eruption. A person overtaken by a surge in an exposed position would only live a minute or two because death from asphyxiation would soon follow the first inhaling of this noxious cloud. So, anyone who ran from town because of the initial steam shrieking was in a footrace to see if he or she could get far enough away before Unit 1 blasted in.

Unit 2 represents the second phase. So far, we have not been able to devise a means to estimate the time between the end of Unit 1 arriving and the beginning of Unit 2. If it was significant, such as an hour or more, there would have been time for people who were protected from Unit 1 by buildings to flee before Unit 2 arrived. Unit 2 varies from 5 to 15 centimeter in thickness and is a lapilli (pea-sized particles) and block (large pieces) airfall deposit. The larger pieces are of hot juvenile magma, and Hoblitt (1983) determined that they were hotter than 575 degrees Celsius.[5] These larger pieces were so big that they followed ballistic trajectories, whereas the others were direct vertical airfall. Some lava bombs, which fell during most units, are almost a meter in diameter, and were tremendously destructive when they fell. Many exploded on impact, and most left bomb sags or bomb craters. These pieces explode because the crust that cools through the air does not let gasses in the magma escape, so pent-up energy is released on impact. To anyone witnessing Unit 2 arriving, it must have seemed that all hell had suddenly broken out. As the larger hot lava bombs punctured thatch roofs, the roofs caught fire and burned intensely. They only burned on the underside because all were coated with Unit 1 fine, moist tephra on their tops. All roofs continued to burn until Unit 3 arrived and weighted them down. When the roofs collapsed, the fires were snuffed out. Most roofs failed during Unit 3 emplacement. The only exception known to date is the thin roof of Structure 11, the kitchen, which failed during Unit 1.

We know that there was very little time between the ending of Unit 2 and the beginning of Unit 3, for the following reasons. A thatch roof burns rapidly, so had there been as much as a quarter hour between Unit 2 ending and 3 beginning, the thatch roofs would have burned and collapsed. However, virtually all the thatch roofs at Ceren failed when Unit 3 arrived, accumulated on top of the roofs, and overloaded them while the burning was weakening them from below. Thus, roof collapse was the result of both the burning weakening the roofs from below and, especially, the accumulating overburden above.

Unit 3 is a thick layer, two-thirds to three-quarters of a meter thick, and like Unit 1, it is composed of a series of pyroclastic surges that were blasted laterally by steam explosions. This was a time of intense surge activity from the volcanic vent, and thick wedges or ramparts of material accumulated in drifts on sides of walls toward the volcano, and on downwind sides after the roofs failed. Often these ramparts served to reinforce walls and aided them in resisting volcanic blasts from later phases of the eruption. Most tephra arrived as pasty gobs the temperature of boiling water. Some ballistic blocks continued to fall during Unit 3. Unit 3 arrived with considerable horizontal force, being propelled by turbulent winds traveling between 50 and 200 kilometers per hour. Unit 3, as with Unit 1, was fine grained and moist, so it packed around plants, poles, trees, and other organic materials, and helped preserve them.

Units 4 through 14 are an alternating series of vertically deposited airfall beds and pyroclastic surge deposits that largely repeat the sequence of Units 1 through 3 just described. It is likely that they represent a few days in total elapsed time, as this type of volcanic eruption is generally short-lived. The fact that standing walls of buildings, and elevated platforms, acted as barriers and trapped tephra both upwind and downwind assists us as we try to find buried structures with geophysical instruments. The bulging of the tephra layers is detected directly with radar or indirectly with resistivity. Even the smallest structures create some humping or bulging of tephra layers. Even fragile Structure 11, with its floor barely above the surrounding ground surface and thin walls, created a bulge in Unit 3 that was visually detectable as we were excavating, and assisted us in planning its excavation. The bigger structures create very large tephra bulges; the bulge from Structure 9 was visible as high up as Unit 10 and was more than 8 meters wide. When we found a bulge of that magnitude, we were pretty sure that there was a sizable structure buried under it.

Dating the eruption, and the village preserved by it, is of equally great concern to volcanologists as it is to archaeologists. As mentioned in Chapter 1, we have run many radiocarbon dates and the composite indicates the first half of the seventh century AD. Ironically, we can date the eruption's time of day more precisely. The evidence is consistent that the eruption began at night because most artifacts were "put away" from their locations of daytime use. The cooking pot had been removed from the hearth, and the fire had been allowed to die down. We can even be more precise about when at night it occurred. Dinner had been served, but not all the vessels had been washed, as we found their "dirty dishes" in structures 2 and 4. In the tropics, people wash their dishes soon after a meal to avoid attracting a hoard of noxious animals and insects. And the eruption did not start late at night because the sleeping mats were still stored wrapped up in the rafters. They had not yet been spread on the benches for sleeping. Therefore, based on the evidence collected so far, we believe the eruption began in the evening. It would have been dark, which does not convey an advantage for people running for their lives from their village because the farther they ran, the less familiar they would be with their surroundings.

BIOLOGY

Biologists are excited by the exceptional preservation of cultivated plants, trees, flowers, and weeds, as well as stored foods in houses at Ceren. Maria Luisa Reyna de Aguilar (1991), a Salvadoran botanist, identified a number of species at Ceren. Some were seeds being stored in structures, some were plants growing at the time of the eruption, and some were wood or thatch used for roofing before the eruption. David Lentz and Carlos Ramirez-Sosa (2002) provided an update and overview, which is the source for this biological section unless otherwise indicated.

The most common cultivated plant at Ceren is maize (corn), specifically the fast-growing Nal-Tel/Chapalote variety. Surrounding each household are cornfields, called milpas, where dense crops of corn were grown every year, with no fallowing. The Ceren pattern of planting three to five corn seeds together, on tops of rows of soil spaced almost a meter apart (see Figures 4-8 and 5-9), is strikingly similar to traditional milpas today. The soil ridges help infiltration of moisture and resist soil erosion. Corn is planted at the beginning of the rainy season, in mid-May, when the soil is still warm, but there is sufficient moisture for germination. The ears mature and are ready for harvesting in three months, in mid-August. That is the major crop, the first planting, which provides most of the maize for the year. Beans and then squash are planted amidst the mature corn, and the bean vines curl around and up the cornstalks. The beans fix nitrogen in the soil for the next crop of corn, a subsurface symbiosis that is very important because maize is so nitrogen-demanding. Many farmers today, as at Ceren, plant a second crop of corn after they harvest the first one, and hope that the rainy season is sufficient for good maturation. It is surprising that all the basic features of traditional maize agriculture were well developed at Ceren 1,400 years ago.

At Ceren, most corn plants had matured at the end of the first planting, which helps us date the eruption and site preservation to the middle of the rainy season, in August. That is corroborated by a number of other seasonal plants and some moisture-sensitive trees such as guayaba. We noticed a puzzling thing—the corn stalks were bent over at about the same height, about a meter above the soil, so the mature ear was upside down and almost touching the ground. Local traditional farmers quickly explained the two benefits. One, the stalk broken stops nutrients from reaching the ear of corn so the kernels dry and the inverted ear sheds rainwater. Two, parrots and other birds love to eat mature corn kernels but are reluctant to perch on ears of corn so close to the ground where they cannot see far enough to watch for predators. Temporary storage was done in the field. More permanent storage was done, husked but still on the cob, in large corn bins such as that found in Structure 4 (described later).

As we excavated mature maize plants surrounding each cluster of household buildings, we were struck by the density of plants. Ceren is the first archaeological site where we could actually calculate the productivity per unit area. The international standard for present productivity is dry weight of a food produced per hectare (100 by 100 meters, or a bit larger than a football field). My graduate student Michelle Woodward and I began careful measurements of mature ears of corn, based on the average density of 3.9 mature ears per square meter, which extrapolates to 52,000 maize ears per hectare (Sheets and Woodward 2002). Our measurements of kernels results in the amazingly high figure of 5,850 kilos of dry weight corn per hectare. Because this is based on plants close to the household, productivity would be higher because of people fertilizing closer crops, and herbivory would be lower. Therefore, we believe an average figure somewhere between 4000 and 5000 kilos per hectare is closer to actual widespread productivity. This is an impressive accomplishment by Ceren farmers, as comparable traditional agriculturalists often average between 2000 and 1000 kilos per hectare in Mesoamerica today. An important implication of this productivity is that in an average year, the first maize harvest from the milpas surrounding each household would produce almost half of what was needed for the year's consumption. The second planting, on average, would provide perhaps another third of what was needed. In a better-than-average year, a household could produce all the food needed from contiguous fields around the household's buildings. But no farmer relies on the average, let alone the above-average conditions. What we can conclude is that Ceren households regularly cultivated outfields, that is, fields outside the community, to make sure that even in poor years there was enough food. It is possible that slash-and-burn cultivation was done in the outfields.

Ceren farmers cultivated both common beans (*Phaseolus vulgaris*) and lima beans (*P. lunatus*) and collected wild beans as well. They did not separate the species in storage or cultivation. Squash (*Cucurbita moschata*) was the other common crop with seeds stored in most households. Chile peppers were stored in each household in long strands hung from the roof beams, but interestingly enough, they were only grown at Household 4, which may have produced all the chilies for the village. Chilies provide flavoring, and are packed with vitamins.

A long-standing debate in Mesoamerican archaeology is the possible role of root crops, and Ceren provides some answers. Some scholars have emphasized the importance of seed crops, but others have thought root crops were important foods. Root crops preserve very poorly in most archaeological sites, so Ceren is important in providing a good sample of crops. Manioc (*Manihot esculenta*) was growing in the gardens of all households, but only a few plants. It is a short tree with very long starchy roots that provide lots of carbohydrates. It grows all year, and one can remove a root and the plant keeps growing, so it is an excellent resource when other foods are becoming scarce. Maize is the primary source of carbohydrates, with manioc as a supplement. The other root crop, more common than manioc, is "malanga" (*Xanthosoma violaceum*). It is a low-growing plant that thrives in clusters, with a tuber like a small potato per plant. It provided more carbohydrates than manioc, but still less than maize.

Cotton (*Gossypium hirsutum*) has been found in a number of forms at Ceren, and must have been cultivated in the village or nearby. Fine-weave cotton cloth has been discovered in various buildings, and cottonseeds were found stored in pottery vessels in Household 4. The metate in that same household had abundant cottonseeds remaining on it, so they probably were being ground for their oil content. The oil could have been used in cooking or as a base for paints, or most probably both.

Maguey (*Agave* spp.) plants were grown in abundance in Household 4, with an estimated 70 plants in total. This Central American variety is useful only for its fibers, and our calculations indicate that this garden may have supplied all the fiber needs for the village. The fibers were used primarily for twine and rope for construction of buildings and their pole doors, but also for fences, net bags, and other uses.

Just south of the Maguey garden was a cacao tree (*Theobroma cacao*) with an inflorescence just about to become a flower. Had the eruption not occurred, this inflorescence could have become a cacao pod full of seeds that are the natural source of chocolate. Household members were growing cacao and storing it in pottery vessels in their building. Chocolate was a special item for the elite, but Ceren commoners also got to partake. They may have sweetened it with bees' honey, or flavored it with chilies.

Also cultivated in Household 4 is a medicinal shrub called "ix-canan" by the Maya (*Hamelia patens*). Its documented effectiveness in combating infections in skin abrasions or cuts apparently was well known to the ancient Cerenians.

Where Cerenians obtained the grass for their thatch roofs is unknown, but it must have been near by. They used a native grass (*Trachypogon plumosus*) that must have been abundant in the Classic period, but is now largely extinct from El Salvador, eliminated by grazing, agriculture, and Old World grasses in recent centuries.

Other recovered plant remains include "achiote" (*Bixa orellana*) that is edible and has a brilliant red pigment, "pacun" (*Sapindus saponaria*), "conacaste" (*Enterolobium cyclocarpum*), "jocotes" (*Spondias* spp.), and "guayabas" (*Psidium* spp.)

The following fauna also have been identified: dog, domestic duck, deer, freshwater snail "jute," oliva shells, spondylus shells, and cowry shells.

The jute snail is important because it can only grow in very clean fresh water. It is compelling evidence for the purity of the river in ancient times. The river is now so polluted that the snail is extinct there. One of the worst polluters is the Kimberly Clark factory, a paper mill 3 kilometers upstream from the site. Before the paper mill was built, local residents caught fish for dinner, swam in the stream, and washed their clothes in it. Kimberly Clark began dumping so many chemicals and acids in the river that all fish died right after the plant began functioning. From a capitalist perspective, it is good business for them because they do not have to abide by Environmental Protection Agency standards. Local poor people have no political clout and are powerless against big business. Kimberly Clark's business profit margins are better than if they had to operate a clean plant and exhibited some respect for the environment and concern for people living nearby. People still do bathe in the river, but complain of skin burns and foul odors. They have no alternative. People still do wash their clothes in the river, but they note how they do not become clean, and they don't last very long. The river is appropriately named the "Rio Sucio," the "dirty river."

SUMMARY

Our use of scientists from other disciplines is not merely an attempt to be trendy and jump on the interdisciplinary bandwagon. To put it directly, the project could not operate without successful geophysics. How would we find structures buried under 5 meters of volcanic ash? Random bulldozing simply is not acceptable, for a number of reasons. Finding buried structures, first as anomalies with the radar and resistivity instruments, and then determining their nature with the core drill rig, is an essential first step in organizing the archaeological research.

The eruption of the Loma Caldera volcano was not a simple blast that deposited a layer of uniform volcanic ash across the countryside. Rather, it had at least fourteen discrete phases, and multiple vents along a fissure may have been involved. The larger lava bombs and most of the tephra came from less than a kilometer away. The grain size, original moisture content, temperature, and velocity of the volcanic ash deposits had clear impacts on the structures, their roofs, artifacts, food grains, plants, trees, and other things in the area. The trained eyes of volcanologists have been essential to revealing the phases of the eruption and their effects on the site.

Biologists have helped in identifying the flora and fauna of the site, which is an essential first step in understanding how people adapted to their landscape. Our excavations of the Ceren site are just beginning, so we have probably found and identified less than half the species of wood, seed, fruits, nuts, medicinal plants, and other plant species that they used. Despite that, the range of foods they consumed, the variety of woods they used in construction, and their adapting to the tropical environment in a way that did not lead to environmental degradation are all impressive.

4/The Ceren Site: Household 1

Of all the households excavated at Ceren, Household 1 is the best known because four separate structures have been excavated, along with outside activity areas, a kitchen garden, and a maize field (Figure 4-1). The building of multiple structures for a single household contrasts with our housing pattern in the United States where a single building is constructed. Then, many of our specialized activities receive their own partitioned spaces within the building, including the kitchen, dining and living room, bedrooms, and storage areas. There may have been a number of reasons for building separate structures for specific functions at Ceren. One may have been cultural tradition. The Chorti Maya who now live 100 kilometers north of Ceren have, for as long as they can remember, built separate structures for particular functions, and they state "es costumbre," ("it is our custom") as the reason. Another is practicality in thatch roofing. Many of the structures had roofs that were in the range of 5 by 5 meters, and if they had to combine all intramural spaces of a household under a single roof, it would have been huge, difficult to construct, and more vulnerable to wind damage than would a set of smaller, lower roofs. And, as we will see later, there is an advantage to having a detached kitchen because of fire danger.

The four structures of Household 1 are separated by 2 to 4 meters (Figure 4-2). The closest structures are less than 2 meters apart, meaning that the thatch of their roofs were almost touching. There was only a short gap for rain to drain into and run away, and sunlight and air to enter. The men's workshop, Structure 5, was almost 4 meters distant, perhaps deliberately located farther away.

THE DOMICILE (STRUCTURE 1)

Structure 1 is known to have been the principal family building of the complex. For lack of a better term, this is called the domicile, to avoid the awkward but descriptive term of "the daytime activity, eating, and sleeping structure of the household."

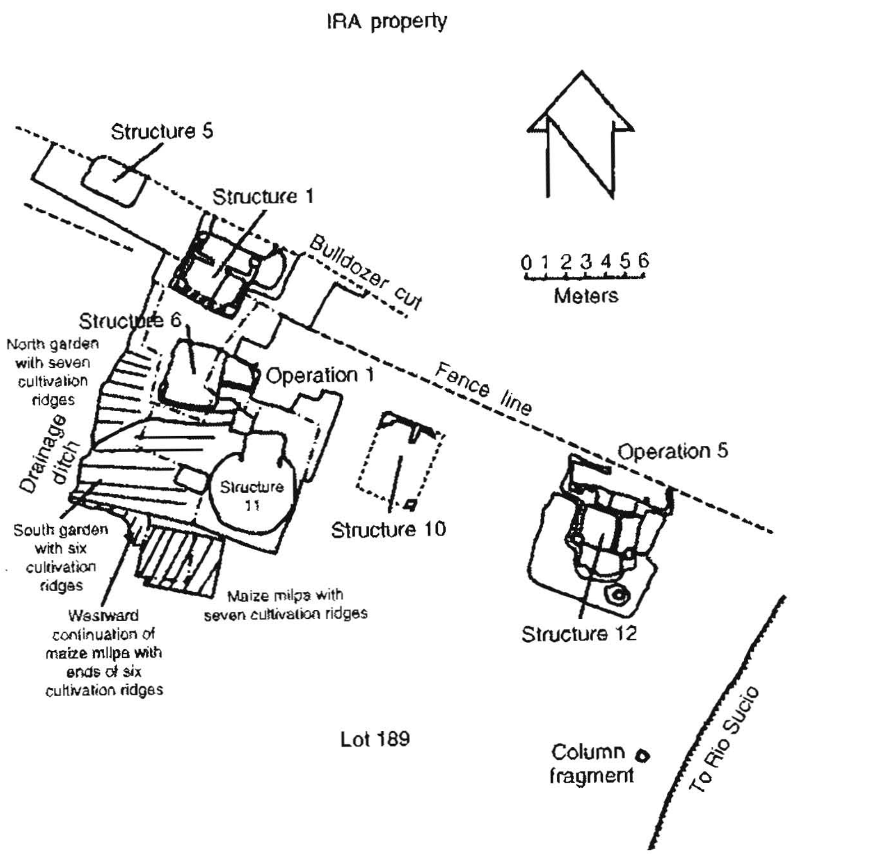


Figure 4-1 Map of Operation 1, known as Household 1. Structure 1 is the domicile, where the family ate, slept, made pottery and cotton thread, and stored some implements and food. Structure 5 is the male workshop. The storehouse is Structure 6, opening to the east. The kitchen, Structure 11, opens to the north. The north garden and the area around Test Pit 2 was all in maize cultivation, with plants up to about 20 centimeters high. The south garden had at least four different species growing; note how field ridges line up with the dominant architectural orientation.

The northern end of Structure 1 was bulldozed away in 1976, when the platform for the grain storage silos was being prepared. Originally, we feared that a substantial portion of the building was demolished, but it now looks like only a small portion was destroyed (Beaudry and Tucker 1989; Beaudry-Corbett, Simmons, and Tucker, 2002). Two other areas of structures, likely household complexes, were completely destroyed by the bulldozing. They were located about 50 meters northeast, and 100 meters northwest, of Structure 1. All we have regarding those structures are informants' accounts of their approximate locations and descriptions. Informants' accounts of human bodies seated on the floor of the destroyed northern portion of Structure 1, as reported by Zier

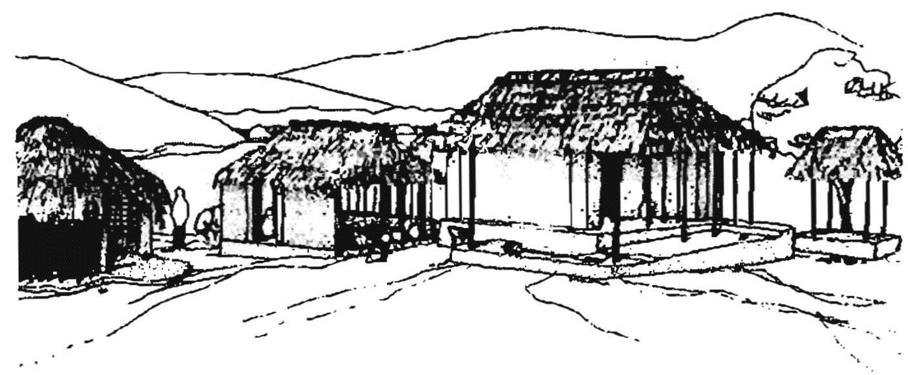


Figure 4-2 Artist's reconstruction of the domicile (Structure 1) of Household 1 in the center, with the workshop on the right (Structure 5) and the storehouse on the left (Structure 6). On the far left is Structure 11, the kitchen.

(1983, 123), are not considered reliable. This seems to be the rural version of an "urban legend."

As with virtually all buildings excavated at Ceren, Structure 1 is oriented 30 degrees east of magnetic north. As mentioned earlier, we did not know why until we checked correspondence with the riverbank's orientation.

Most structures at Ceren followed standardized earthen construction procedures. A description of the construction of Structure 1 will suffice for all buildings, unless otherwise noted. The first step in construction was to dig down through the Ilopango volcanic ash to the pre-eruption soil, and begin piling that soil into a low mound that was slightly longer and wider than the building to be constructed. Evidently, that was for drainage, so rain falling off the edge of the roof would run away from the structure. The edges of this informal mound correspond with the "dripline" of water off the roof to be constructed. Successful drainage is essential for earthen architecture in a wet tropical environment. The clay was mixed with some pieces of grass, as a kind of tempering material, so that it would not crack when it dried. That is similar to making pottery from clay, as it also needs temper so it will not crack during drying or firing.

After completing the low mound, the formal construction of the platform that creates the elevated floor of the building began. The platform was built with vertical sides and right-angle corners. Building platforms were quite precisely rectangular; construction was done with less than 5 percent variation in the lengths of north versus south walls, or east versus west walls. The platform was made of clay from the same source, mixed with grass. After it dried, a large fire was built all around and over it, oxidizing and hardening the surface of it like a large fired brick. In fact, the firing only affected the surface few millimeters, but it did harden it. Then, four solid adobe columns, about 1.5 meters high, were built at corners or at ends of planned walls (Figure 4-2). Household 4 grew those sticks (canes in the sunflower family), so residents of Household 1 did not have far to go to get them. Vertical poles were placed about every 15 centimeters along the east, south, and west sides of the platform, and connected with horizontal sticks. Then, the same moist clay and grass mixture was packed on the inside and outside to make a smooth, doubly reinforced adobe wall to about 1.5 meters tall. The wall is about 15 centimeters thick. This kind of internally reinforced earthen wall construction is called "bajareque," and it is very earthquake resistant. It is horizontally and vertically reinforced, and it takes a strong earthquake to crack it. It takes an even stronger earthquake to dislodge pieces, and even if dislodged, those pieces are small, being formed by the intersections of the horizontal and vertical reinforcements. The greatest injury one could cause is a scratch and a bruise. Not only are the vertical sticks anchored down into holes in the platform, they are tightly tied together with agave twine to the horizontal roofing beams. Thus, the walls are tightly integrated at the bottom and the top, and are doubly reinforced within the wall itself. This is one of the, if not the most, earthquake-resistant domestic architecture style the ancient world has known. Contrast that with the special-purpose architecture of the religious buildings, the public building, and the sauna (see Chapters 6 and 7), in which people would have spent little time.

After completing the walls and roofing framework, grass thatch was placed on top. A thatch roof is not air tight like a shingle or tile roof is. Rather, a thatch roof sheds water by wicking it away, which requires a minimum angle of about 30 degrees.

The vertical poles in the bajareque walls continue upward above the clay-daubed part of the wall to support the roof. Thus, an opening is left above the clay wall that does not diminish privacy but allows light to enter and air to circulate. The poles were tied firmly to the roof, to make a tightly integrated and reinforced structure. The solid earthen columns were not structurally connected with the bajareque walls, but just abutted the walls, with a smoothing coat of clay over both walls and columns. Thus, Structure 1 could withstand even a major earthquake. What Ceren architectural planners did not envision was the Loma Caldera eruption, with lava bombs hotter than 575 degrees Celsius, which burned the roofs, and tons of tephra raining down.

Area 1 of Figure 4-3 is the original front porch of the domicile, enclosed by bajareque walls on the east, south, and west. The original step up into the domicile is located under the words "Area 2" of Figure 4-3. That step was covered by the remodeling that created Area 2 as an extension of the front porch. It apparently was used as a multipurpose space because a pot and a spindle whorl (for making cotton thread) were found in one corner, and a crudely made miniature pot and twenty rounded potsherds (broken fragments from various pots) were found together in another corner. The miniature pot and the twenty sherds may have been a child's playthings. The pot was made with a child's finger impressions still preserved in the fired clay. Their numerical system probably was a base 20, as that was consistent throughout Mesoamerica, and the child may have been learning to count.

Area 2 is the lower porch formed by covering over the step and extending the floor northward. It more than doubled the original porch, but the northernmost edge was removed by the bulldozing of 1976, which likely carried away the front step. The porch was open on three sides. A pottery working

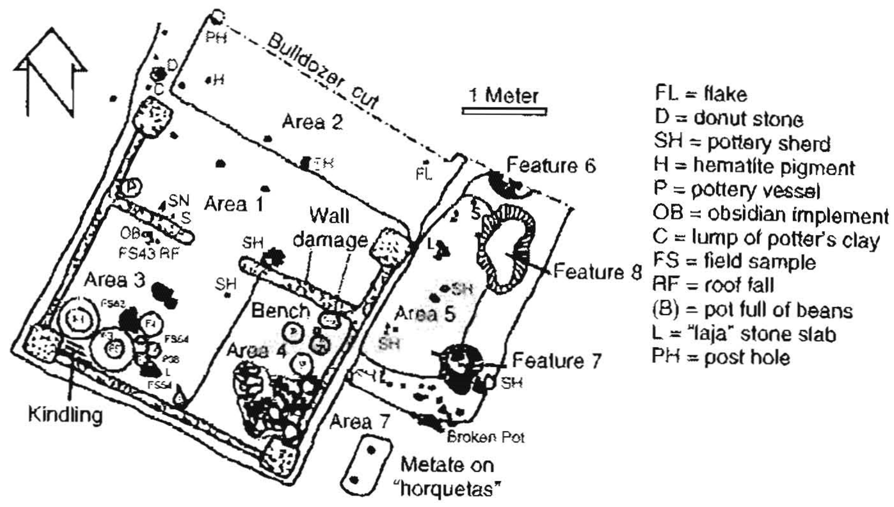


Figure 4-3 Map view of structure 1, the domicile, with artifacts. After it was constructed, the roof was extended over Area 5 and the floor was prepared for a work area, probably for females.

area was found on its western side, with a prepared lump of clay still bearing the fingerprints of the mature pottery maker, likely the child's mother. Most pottery in southern Mesoamerica is made by women. The clay matches the clay of the utilitarian (undecorated) pottery of the household, according to detailed studies done by Southward and Kamilli (1983). They conducted petrographic studies, which identified the component minerals and elements of clay and pottery. The clay lump and the utilitarian pottery are sufficiently similar to have derived from the same clay source, which probably indicates manufacture right in Area 2. The only chipped stone artifact found in the north half of the house was an andesite flake with edge abrasion characteristic of pottery smoothing. The Copador and Gualpopa polychrome pottery from this household, their fancy decorated pottery, was sufficiently different from the pottery known to have been made in the household to have come from a different source. The decorated pottery was probably manufactured a distance away, probably in the Copan valley dozens of kilometers to the north, and obtained at a marketplace.

Area 3 is the fairly sizable inner room, with 4 square meters of surface. The floor was kept largely clear of artifacts, as befits a high use zone. An obsidian prismatic blade was found in the roofing thatch. It, as with almost all other prismatic blades in usable condition in the site, was stored up in the roofing thatch. I believe this is to protect two things: cutting edges and children. The cutting edges were valuable because the obsidian had to be imported all the way from Ixtepeque Volcano in Guatemala, some 80 km to the northwest. It needed a fairly high degree of skill to manufacture and probably involved an occupational specialist. Both of these factors mean that it was expensive, so that quite a bit of something, such as maize, had to be exchanged for it. Also, a recently manufactured obsidian edge is very sharp, sharper than any steel edge, and it would do considerable damage to a young child who crawled across it. Storage in the soft roofing thatch protected the obsidian knives and the children.

Two large storage jars were resting on the floor in Area 3, against the back wall, with two smaller vessels sitting on top of them acting as caps. One small spherical jar was found on the floor, missing its rim. This is one of many vessels found at Ceren that had been partially broken, and thus was not complete, but still was being used. In many cases, the partial breakage made the initial function inappropriate, and they shifted it to a different use. Often we think, as archaeologists, that pots are complete or they were broken and thrown away. However, some pots were nearly complete and still in use, some big pots were broken but some large sherds of them were salvaged and used as informal large plates. Also, one of the more ingenious re-uses of pottery involves saving the handles of large broken storage vessels and mounting them in clay walls during building construction. These handles functioned as hangers or anchors to tie a variety of things. All adobe or bajareque doorways had four ex-jar handles mounted inside, two at the top and two at the bottom, to tie the wooden stick door shut. They had no way to lock a door, but they certainly could close it effectively.

One of the seven pots on the floor, tucked away against the back wall, was used to store valuable items, evidently of a female. It contained a spindle whorl probably used for making cotton thread, a miniature metate used for grinding hematite (iron oxide) red paint, three small cylinders of that red paint, and pieces of sea shell. It is possible she used the red pigment for body decoration, but other uses are possible too.

Area 4 is the elevated solid adobe bench that presumably was used by the family as a bed at night, by unrolling mats to make it comfortable. During the daytime, the mats were rolled up and stuck up in the rafters, and the bench probably was where the family ate, and engaged in other familial activities. A cornice, or overhanging "bar" of adobe, was added as decoration to the western edge of the bench. It seems that cornices were becoming quite popular, as they were used for architectural decoration of many buildings at Ceren, but this is the only one in Household 1. It was not very well constructed or connected to the bench, as the eruption dislodged much of it. Four pots were on the bench, in its northeastern corner, two of which were full of small beans. The other two were empty, but might have contained a liquid. The other artifacts in the area were suspended from the roofing. That included large amounts of chilie peppers that probably were hanging in strands. Above the chilies were two partial ceramic vessels; one was the lower half of a very large storage vessel .5 meter in diameter. This is an example of the salvaging of partial broken vessels and shifting their use. The other is a partial polychrome bowl.

Area 5 was added to the structure after it was built. The roof extended the roofline already established, so the roof must have been very low, especially at the eastern edge. That probably accounts for the sunken center and the low sitting bench with a woven mat around the outside. It was a craft area, judging by the spindle whorl on a spindle for making cotton thread, some broken pots, and an obsidian flake. A "donut stone," which is a round disk with a hole in the middle, was found in a most interesting position. The bajareque wall that divided Areas 1 and 5 fell eastward over Area 5 along with the donut stone still mounted on its stick. These artifacts have been the subject of considerable controversy, with some people arguing that they were religious, and functioned as scepters. Others argued that they were military, and served as club heads. Others thought they were agricultural, and functioned as digging stick weights. In this case, the latter interpretation is the correct one. As we will see later, other donut stones had different functions, and it now appears that it has been a basic error to ask the question, "What was *the* function?"

The general area between Structure 1 and the family's storehouse ("bodega"), or Structure 6, had a special use. A zone closest to Structure 1 was kept clean of artifacts, and served as a walkway, covered by the thatch roof eaves. However, the main use of Area 7 was for food grinding, as evidenced by a metate (bottom grinding stone) found on the forked sticks ("horquetas") that elevated it to waist level. A few large saved sherds, pots, and a little human figurine head were stored on the rafters above the grinding area.

THE BODEGA (STOREHOUSE; STRUCTURE 6)

The storehouse was built on a shallow platform, elevated only 20 to 30 centimeters above the surrounding area. The platform is square, measuring about 3.2 meters on a side. The two side walls and the back wall were a variant on bajareque. The vertical poles extended up to support the roof, but only the bottom 10 to 35 centimeters were adobe-coated. Hence, it was very open to air circulation. Curiously, the eastern wall received full bajareque treatment, with adobe coating up to 1.8 meters in height, and a well-made doorway. That is higher than most walls anywhere in Ceren excavated to date. The building gives me a vague remembrance of a false front building on a movie set, with so much effort in the front wall. It is likely that the building was being renovated, but they had completed only the east wall when the eruption struck. Bajareque walls need to be taken down every 10 to 15 years to have new vertical and horizontal reinforcements put in, and then re-mud the walls because the old reinforcements decompose with age and the building looses strength. Because not all walls were mudded before the eruption, people could come by and see into it, and reach through the gaps between the poles and take things from inside. We think that is why many small valuable items that usually would be stored in the bodega were stored in this household's domicile and kitchen temporarily. It is sad but apparent that theft was a concern.

The Household 1 bodega shares some characteristics with the other two bodegas, yet differs in others. As with the other two, it was loaded with pottery vessels, many with food. Each bodega had about a half dozen mice in the thatch roof. All bodegas are square in ground plan and are located just south of the domicile buildings. However, this bodega was different in a number of ways. It was set up for grain grinding inside the structure, with a metate set up on the horquetas. It had a duck tied to the back wall, which, unfortunately, became a dead duck during the eruption. It had a very low platform.

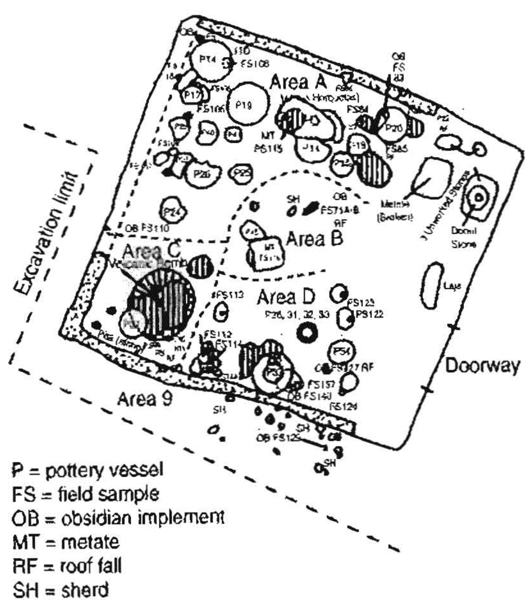


Figure 4-4 The storehouse (bodega) of Household 1 (Structure 6). A volcanic bomb landed on some pots in Area C and smashed them into tiny pieces into the floor. Most pottery vessels were stored along the south or the north walls. A metate was mounted on horquetas in Area A. A duck was found in Area D, with its leg tied with string to a pole of the south wall.

Beaudry and Tucker (1989) subdivide the bodega into four areas (Figure 4-4), and I shall follow their subdivision because there is some patterning of artifacts. The entrance was on the east, and the area inside the door extending most of the way across the structure was maintained largely free of artifacts, as an access corridor. The first area Beaudry and Tucker discuss is the northern segment, which has the greatest number and variety of artifacts of all four areas. It is the farthest from the door, and they note that these artifacts would have been the least frequently used. There is dense artifact storage of pottery vessels (some loaded with seeds), hammerstones, obsidian artifacts, and a mano and metate. The metate was mounted up on the horquetas, and was almost identical to the other two horqueta-mounted metates in Household 1 in its minimal use and its low height above the floor. It was only about 50 centimeters above the floor, indicating that a short female ground maize here. A mano and a metate are a matched pair that wear together to ensure a tight fit, and this metate's mano was found a meter to the west, on the floor. This is not in a use position, and the floor around the metate was cluttered with utilitarian pottery, so this was not a primary grinding area but, rather, a backup area. It would take only a few minutes to get it into grinding condition, by moving some pots out of the way and recovering the mano.

But, there is something unusual going on here. The common situation in a traditional household is a single mano and metate, and the principal woman is the maize grinder. There were five metates in this household, all but one of them on horquetas or ready to be mounted on horquetas. The exception is the floor-mounted metate with mano in the kitchen (see later). That metate was well used, while the others barely show use wear. We feel the most likely interpretation is that the floor metate was used regularly to grind grain used in the household, but for special occasions, other females would help in the grinding by using the

horqueta-mounted metates. What might a special occasion be? Many lines of evidence indicate that Household 1 supported the feasting and ceremonialism in Structure 10 just to the east (see below).

The northern part of the building had eighteen ceramic vessels, most of which, ten, had been damaged during use but had not been discarded. Damage entailed the breaking of part of a rim, or the like, but most of the damaged pots retained most of their storage capacity. There was a surprisingly high frequency of fancy polychrome pottery: five vessels. One pot had an ingenious way of filling in a small pencil-sized hole. Someone fashioned a cylindrical plug from a thick sherd and shaped it to fit the hole perfectly. Some other medium-sized jars with handles apparently have deliberate holes punctured in their sides, but the reason is unknown. The five hammerstones probably were used in groundstone manufacture, such as shaping metates, manos, donut stones, and other items. Also, when a mano and metate became smooth from use, pecking with a hammerstone would roughen them. Household 1 did more manufacture of its groundstone tools than the other households did, as evidenced by the high frequency of hammerstones. Household members made groundstone tools for their own use and many more for exchange with other households. This is an important window on part-time craft specialization. Each household produced something in amounts beyond what residents needed for their own consumption, which led to a social network of exchanges within the community, and likely with adjoining communities, all well beyond the control of the elite.

Because the treatment of obsidian artifacts at the bodega is a microcosm of treatment within the site, it is worth examining in detail here. An obsidian blade in good, usable condition was kept in the roofing thatch only 20 centimeters from the north wall. The roof peaks in the center and slopes down toward the edges, so it would be more reachable than if it were stored toward the center of the thatch roof. Because it was at a predictable location, one would not have to rummage through the thatch for an obsidian blade. It had been used, as some use wear in the form of small nicks can be seen along both edges, particularly when examined under a binocular microscope with more than 100-power magnification. Some organic residues were found along each edge, and they may be remains from the blade's last use. However, some organic residues were implanted on obsidian blades when the roofs burned, and we are working to develop criteria to distinguish the two. Another prismatic blade was discovered in roofing thatch just inside the doorway, about 30 centimeters from the south wall. It looks like someone could walk into the bodega, take one step in and one step to the left, and reach up for the blade. This blade shows virtually no use wear. Although it is relatively short (4.9 centimeters), it was in excellent condition. One other single blade was found in the bodega, in an unusual position. It was found tucked into a little crack at the bottom of the west wall of the structure. It is at the end of the access corridor across the structure, so if one knew where to look it would have been easy to find by entering the building, heading straight across, and reaching down to pull it out of the crack. This blade, of more typical length (6 centimeters), had relatively extensive use wear on one edge, and the other edge was essentially unused.

A cluster of four prismatic blades had been placed together, in a bundle, up in the roof in the center of the building. They would have been beyond the reach of someone shorter than Michael Jordan, and would have required someone stepping up on something at least a meter high in the center to reach them. They probably were wrapped or tied together, as they survived the roof collapsing in a tight group. None of the blades show any evidence of use, even under 500-power magnification. Three of the four probably are from the same core, judging by their similarity in shape and technology as well as the visual characteristics of the obsidian. However, none refits directly onto another, so they did not come off the same area of the core. The fourth is thinner and is of a darker and less striated obsidian. The four evidently are a valued cache of brand new obsidian blades that had yet to be put into use and were kept in one of the most inaccessible locations of the household.

An obsidian scraper was found behind the northern post, barely down into the posthole, behind the large fired clay storage vessel (pot 14). This was well hidden, and would have required moving at least two pots to reach behind the post. Such scrapers probably were used for processing deer hide, but could have been used for smoothing wooden artifacts or sharpening digging sticks. Its working end and the edges show considerable use, and it is likely that it had been resharpened numerous times by percussion blows to remove small flakes. Another scraper was found in the roofing thatch 30 centimeters from the south wall, where it would be reachable by someone walking straight into the bodega and then turning left when they had almost reached the back wall. It had been used extensively, resharpened a number of times, and is now only about half its original estimated length. It was used harshly. A small portion of a macroblade was found on the floor, wedged between a broken metate and the southern wall of the bodega. It was highly used for harsh cutting and scraping tasks, leaving a lot of use wear along both edges.

On the ground outside the structure were a few discarded obsidian blades. They have become so dull from use that they were thrown away, and they are so dull that they pose no threat to anyone walking or crawling over them. They generally are short broken segments, shorter than 4 centimeters.

The pattern of hiding individual obsidian knives or scrapers in roofing thatch in accessible locations is found in other buildings at Ceren, not just bodegas. Although it is not as common, it is not unusual to find other obsidian implements tucked into convenient hiding places. And, keeping a cache of mint-condition knives in a most inaccessible location is common. It is also common to find a few very worn fragments of blades discarded outside buildings. Most blades, however, must have been discarded at greater distances from the structures because relatively few have been found near the buildings. Household 2 had a disposal area for sharp blades, and it is likely all others did as well.

Parts of broken pottery were often retained, and broken metates were useful too. Broken pots and broken metates show rounding on the broken edges, indicating that they had been deliberately smoothed or had become rounded by use after breaking. Two broken metates were found on the floor, upside down, where they served as pot rests. Round bottomed pots need to be supported, and they were wedged in with other pots, against walls, or had rocks and broken metates wedged against them to hold them up. Hammerstones were often used for pot rests, but the most common item was a plain smooth river cobble. One hammerstone was, for unknown reasons, kept up in the roofing materials, likely on top of a rafter, east of the mounted metate.

Area B is the zone in the center of the structure, as designated by Beaudry and Tucker (1989), and it is largely devoid of artifacts. It connected with the doorway to the east, and forms an accessway into the storehouse. It did have the cache of new blades put way up into the roofing thatch, along with a sherd that was stored high. Only two artifacts were found on the floor in this area, an upside-down partial metate and a partial jar. The partial jar was a broken pot, and they had retained the lower portion because it could still be useful.

Area C is the southwest corner of the building, and it was kept relatively free of artifacts. Unfortunately, a large lava bomb, about one-half meter across, crashed through the roof, caught it on fire, and landed on and blasted into the floor in this area. It smashed a large storage vessel so badly that we could not tell if it was in floor contact or had been suspended from the ceiling. The pieces of string we found near the lava bomb could have been used for suspending the vessel, or for tying elements of the roof support, or both. An obsidian scraper, mentioned earlier, had been kept in the roof thatch and had been dislodged when the bomb landed. Our poor project ceramicist has a tremendous jigsaw puzzle job to put the hundreds and hundreds of tiny sherds back together to reconstruct the pot.

Area D is somewhat similar to Area A in that it was loaded with artifacts, some in the roof and some on the floor. It is not as large an area, and it is located immediately to the left, as one enters the building. A piece of carbonized wood with cut marks was found in this area, near the obsidian that was found in the roofing. Cutting wood for large flat boards was not done at Ceren, but cutting wood to shape smaller items, such as posts, beams, and digging sticks was common. Large boards are difficult to cut without steel tools, and when Ceren residents wanted an extensive flat wooden surface, for a door, a table, or a shelf, they lashed together a series of straight poles, and in some cases put a mat on top.

Just inside the doorway, to the left on entering, were a number of items kept on the floor. These are the most accessible items of the bodega. They include a spindle whorl probably used to make cotton thread, stored with hematite red pigment mixed with mica in an organic container, probably a gourd. The mixture of red paint and mica gives a glittery red color that is similar to, but not as glittery as, specular hematite paint. Specular hematite is a rare, and presumably more expensive, pigment that is loaded with glittering crystals of iron oxide. Mixing hematite and mica may be a "poor person's specular hematite" paint. More of the hematite and mica was found in the kitchen of Household 1 about 5 meters to the south. Next to this mixture was a Copador polychrome melon-stripe bowl, a food-serving vessel. It probably was in active daily use, being found immediately inside the bodega. Near it was a Guazapa scraped-slip jar that may have held a liquid. Both of these vessels are further examples of pots that were partially broken yet remained in service, perhaps with some changes in their function. That Household 1 retained more broken vessels than the other households may indicate that they were not quite so well off. Or it might indicate

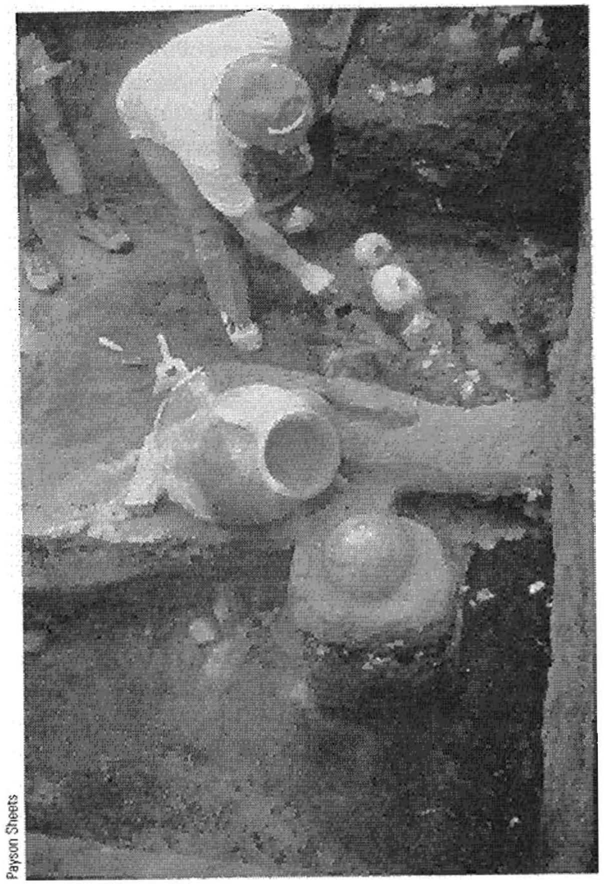


Figure 4-5 Southern part of the bodega. The smaller hemispherical pot at the bottom is upside down, and the larger pot is on its side. The smaller pot was capping the larger one, but the eruption pushed them over. The two donut stones were stored in the roofing and fell into similar orientations early during the eruption, for reasons that are not known.

a "packrat" syndrome like that of the author of this book, a reluctance to throw anything away that could conceivably have a use in the future.

Past the polychrome serving bowl was a stack of four pots, kept fairly near the door. The bottom vessel is an incensario (incense burner) with a pedestal base and a long handle with a face on it for decoration. It probably was used in household religious observances. We recently realized that every household structure, whether domicile, bodega, or kitchen, had its own incensario stored in it. This is indicative of the vitality of household religious practice, with copal incense burned in each building to help people regularly connect with the supernatural domain. Resting in the incensario bowl were three pots, two Guazapa scraped-slip jars and a Cashal cream-type bowl. These three pots may have been used in family rituals, but apart from their association with the incensario, there is no other evidence of this. All the pots evidently were empty at the time of the eruption.

Slightly farther into the bodega, and along the south wall, was a large Guazapa scraped-slip storage jar that was capped by a smaller hemispherical jar (Figure 4-5). The storage jar was tipped over to the south by the lateral force of the eruption, and the smaller jar capping it was pushed off of it, ending up to the

south of the south wall. The displacement evidently occurred during the arrival of Unit 3. Neither vessel had any discernable contents before the eruption. The larger vessel's round bottom was stabilized by a number of means. It was resting against the south wall, and it had four things wedged up against it: a broken metate, a laja (a flat slab of andesite rock), a wedge of clay, and a stream rock. Why so much effort was expended, to brace the vessel with five points of contact in addition to the floor, is unclear. It evidently was empty.

Just beyond the two vessels were a hammerstone, a pumice smoothing stone, and a duck. The duck, alive before the eruption, was tied to the south wall by a thin cord attached to its leg. It became a very dead duck early in the eruption, probably during Unit 1 deposition. It was more likely being kept for food than as a family pet. The very open walls of Structure 6 provided very little protection from the nasty tephra clouds coming in from the north, and it died during Unit 1's arrival.

Three donut stones were found in this area of the bodega. One was on the floor, toward the back of Area D. There was no evidence of a pole or anything inside it. Two other donut stones were stored above the doorway and almost a meter inside, up with roofing supports. They tumbled down when Unit 1 was being deposited (Figure 4-5). The curious thing is that both were tipped the same direction, with the holes pointed toward the southeast. They must have had a pole or wooden pestle in them that was not preserved because it was surrounded by thatch, rather than volcanic ash, and decomposed after the eruption.

THE KITCHEN (STRUCTURE 11)

As we were excavating down through the various tephra levels, we first suspected there was a structure under volcanic ash when we noticed that the layers were bulging a little, to the east of Structure 6. Two test pits were excavated through the bulging area, and a structure was confirmed.

Structure 11 was the kitchen for Household 1 (see Figure 4-6). We had been looking for a kitchen for years. In the excavations of 1978 and 1989, we had yet to find a single cooking vessel, with smoke incrusted on its bottom. We wondered where people were doing their food preparation and cooking.

It was an ample and well-organized kitchen, with some features not seen in other buildings excavated to date at the Ceren site. It is unusual in that it is circular, with very little bajareque and no solid adobe columns, and it was built on a very shallow platform. The floor was only 5 to 10 centimeters above the surrounding ground surface, and the interior floor was not of fired adobe, as in the other structures, but of volcanic ash from the Ilopango eruption. This would be a very practical floor, as spills would seep into the floor. When the floor became too organic-laden and dirty, it was easily replaced. The edge of the floor, following the line of postholes, was 15 to 20 centimeters above the surrounding terrain, forming a barrier to moisture during heavy rains. With a diameter of 4.5 meters and a small rectangular porch, it had about 20 square meters of roofed internal space. (Someday I hope to have a kitchen that large.) The building is also unusual in that it opens to the north, in contrast to most building orientations. Opening that direction is practical, facilitating access to the bodega and

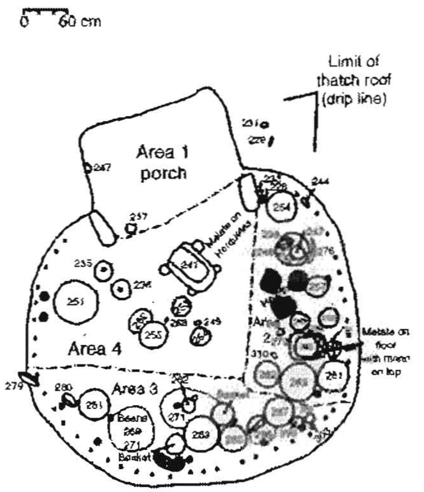


Figure 4-6 The kitchen of Household 1, known as Structure 11. The porch area was kept clean of artifacts; some artifacts were stored in the thatch roof. Area 4 was for food grinding and storage of cooking and other pots. Area 2 was the active food grinding, soaking, and cooking zone. Area 3 was for storage of food and implements.

domicile. The three buildings form two edges of a patio. At the east edge of the patio is the village feasting and ceremonial building (Structure 10).

The roof was supported by a series of forty-four thin vertical poles running around the circumference, by two large poles in the north end of the porch, and by two poles running up from the bajareque "columns" at the entrance (Figure 4-7). The bajareque "columns" are 1.3 meters tall, a relatively short height for bajareque at Ceren. They are the remnants of a more extensive bajareque wall that largely had been removed; it may have encircled the entire kitchen. That wall was replaced by the vertical poles with *vertical* thatch supporting the thatch roof. This is the first thatch wall found at Ceren. A thatch wall would permit more air circulation, but would permit more small creature circulation as well. The thatch roof was approximately a third the thickness of other thatch roofs excavated so far; this likely was to facilitate smoke leaving the structure. The roof collapsed earlier than that of any other building yet excavated at Ceren. It failed during the emplacement of Unit 1.

The early failure of the kitchen's roof had one beneficial aspect. It facilitated the preservation of painted gourds inside the structure. Usually, when painted gourds decompose, the painted surface falls apart and only a few disassociated paint flecks are left for the archaeologist, at best. However, at the Ceren kitchen, tephra filled in the inside and packed around the outside while the gourd still had strength. That gave us the opportunity to recover the gourds whole. It appears that Household 1 was using quite a few painted gourds in the kitchen, possibly in food preparation and probably in food serving.

The kitchen's south side, farthest from the entrance, had a shelf and many artifacts. A metate mounted on horquetas was just inside the entry. As with all the other metates associated with horquetas in Household 1, this metate showed very little use. A matching mano has yet to be found. All Household 1 metates may have been put on horquetas at about the same time, and all were used only slightly. All are mounted relatively close to the ground, about 50 centimeters high. If contemporary standards of mounting the metates so the grinding surface

Payson Sheets

Figure 4-7 The kitchen, with the porch at the top, past the two bajareque columns. This area is now being excavated.

is just below waist level can be applied to the past, this indicates that the women doing the grinding were short.

The southern end of the kitchen was used for storage. A shelf or long table was constructed at the southern end. Vertical posts supported the surface of horizontal poles. Many artifacts were placed on top of the shelf, and some artifacts were stored on the floor under the shelf. Two large round-bottomed jars still were resting on their fiber rings that held them upright on the shelf. These fiber rings or donuts are the organic alternative to the pot rests of stone and clay described from the bodega, earlier. Cerenians preferred fiber rings as pot rests for the vessels in daily use, and stone pot rests for vessels used only occasionally (moved rarely). Also on the shelf were a celt (unhafted, like others at the site) and two small polychrome jars. Someone placed a red pigment with mica added on the shelf. It may have been by itself, not in a container because no sign of a container was found. This appears identical to the hematite-mica mixture found just inside the door of the bodega. A large jar was suspended above the shelf with a fiber rope, probably of agave.

Under the shelf were two baskets, the kitchen's incensario, a large jar, and a small bowl. A miniature ceramic pot containing red pigment fell into the large jar, probably from the shelf above. Below the end of the shelf, and resting on the floor, was a surface of leaf matting which had a pile of beans placed on top of it. Two domesticated and one wild variety of beans were being stored together. This is similar to bean storage at Structure 4, insofar as having an organic layer between adobe and the beans. The organic layer, in both cases, probably is to decrease capillary moisture from below and to keep the beans clean. Two mouse skeletons were found, one near the beans and one with the shelf; they died as Unit 1 blasted in. Chilies were stored on the shelf or hanging from rafters. Other species identified include achiote, cacao, and pumpkin. No vessel from this area was soot-incrusted, indicating that they were used for food storage and preparation rather than for cooking.

The northwestern area was used for vessel storage. Two cooking vessels were stored there as well as some empty food storage and serving vessels. Two mice were in the thatch above this area and one was on the floor.

The eastern side of the kitchen was the most actively used, and here we finally found their cooking vessels, appropriately smoke-blackened on their undersides. East of the mounted metate was a well-used trough metate resting on the ground, stabilized by a rock, with its mano resting at the lower end, farther from where the woman grinding would kneel. (Here I use a gender role as it was performed generally; of course, under unusual circumstances a male could do the grinding.) Both a large sherd and an open bowl were placed at the far end of the metate to catch the "masa." The masa is the mixture of ground maize and water. After it is ground, it is ready to be cooked. It is likely that Cerenians made tamales; no evidence of tortilla griddles has been found. Nearby was the three-stone hearth, with a pot with maize kernels soaking in it, as people consistently do in the evening so the kernels soften and can be ground in the morning. This is another indicator that the eruption began in the evening. The hearth had only a little charcoal in it, and no pot on top. Cooking pots, with their smoke-blackened bottoms, were concentrated in this area. Cooking vessels were kept in the kitchen, and food was taken from the kitchen in serving vessels to the main structure for consumption. Cooking vessels are not found outside the kitchen. This area gives the appearance of being cleaned up for the night, rather than in active use during the day. The thatch roof was used to store an obsidian prismatic blade with an excellent cutting edge, and five red pigment lumps. It is consistent with the storage of other knives in active use that this blade was stored immediately inside the doorway, to the left upon entering, up in the thatch.

The center of the room was kept relatively clear of artifacts. The porch-entryway and the clear center of the structure give access to the three functionally different kitchen areas. One, the east side, for food processing, was described earlier. The porch surface was kept clean, but the roof was used for storing an obsidian scraper, a deer-sized mammal long bone, and a bone tool. As with obsidian tool storage elsewhere, the obsidian scraper in frequent use was kept easily available by storage in the thatch roof past the east edge of the porch. Why an obsidian scraper was kept in the kitchen is unclear.

Many hemispherical painted gourds were found in the structure. Many of the gourds were painted red all over, but others were painted green, yellow, and other colors. That their greatest concentration in the site to date is in this kitchen, with a painted gourd in the niche in Structure 2, probably indicates functions as food ladles, food preparation vessels, and as food serving vessels for individuals. Cerenians probably used the large polychrome pottery bowls to serve the main course, and the smaller gourds to serve other components of the meals. The Classic Maya consistently used cylinder vessels for beverages, and we believe Cerenians followed this custom.

Based on ethnographic analogy in the gender division of labor, Structure 11 probably was a female activity area focusing on food processing. A probable male activity structure for daytime activities evidently was Structure 5 (see next section), on the other side of the domicile. The kitchen was constructed with practicality in mind, and it was internally well organized. It was amply stocked with cooking, storage, and food processing vessels and implements. And, those implements often went beyond the minimal requirements for function because decoration of them was common and sometimes quite elaborate. People had a sufficiently high standard of living, and reliable food supply, to afford elegantly decorated gourds and pottery vessels. An aesthetic sense was well developed among the Ceren commoners.

THE POSSIBLE WORKSHOP (STRUCTURE 5)

A ramada structure—that is, a platform with a roof but without walls—was located about 3.5 meters west of Structure 1. The bulldozer cut into this structure in 1976, leaving only its southern end. It was connected with Structure 1 by a walkway of stones. Its floor was kept clean of artifacts, and no artifacts were stored in its thatch roof. Its possible function was indicated by some obsidian wastage from tool manufacture found to the south. It may have been a workshop for resharpening obsidian tools such as scrapers. Ethnographically (looking for similar procedures in comparable living societies), chipped stone tool manufacture is a male activity, so this may have been a men's workshop for daytime activities. It probably had a more clear function at some time before the eruption because it was a more substantial building with bajareque walls. The fragments of removed bajareque mud were found south of the building along with the obsidian remains.

In overview, Household 1 had an astounding number of ceramic vessels. We excavated seventy-four vessels from this household, including damaged but still serviceable vessels, but excluding the large sherds that they saved and used. Of that total, twenty-eight came from the bodega, fifteen from the domicile, five from the area under the eves of the domicile, and twenty-six from the kitchen. Moreover, as far as we can tell so far, Household 1 was the most humble found at the site to date in its architecture. Given the variety of ceramic vessels, the volume of storage, the variety of grains stored, the amount and quality of roofed space, I would judge the quality of life to have been quite good 1,400 years ago at Ceren. Unfortunately, the quality of life in the nearby town today, by these same standards, is not as good.

ACTIVITY AREAS BETWEEN STRUCTURES

There are basically four kinds of spaces at Ceren: under roofs and inside walls, under roofs outside of walls, open patio or plaza areas, and cultivated areas. The amount of space outside the walls and under the eaves of most structures exceeds the amount of roofed space inside the walls. In this section, we look at the spaces under the eaves and at the open areas, beginning with Structure 5, and moving east and south in Operation 1.

Most of the area around Structure 5 was kept clean of artifacts and features, with two exceptions. An area of obsidian wastage, of used up tools and resharpening debris, had accumulated to the south of the structure, along with some pieces of removed walls. A walkway was constructed from the structure to the main domicile, Structure 1, of stones and flat pieces of tuff. Tuff is a semi-consolidated volcanic ash from an eruption before Ilopango, and makes a good material for a walkway. A thin scatter of sherds and charcoal was found along the walkway.

The area around Structure 1, under the eaves, was kept clean of artifacts for about three-quarters of a meter. It was built up as a raised walkway along the south side of the structure, indicating that the surface received a lot of traffic. However, the eaves past the southern corner of the structure were packed with artifacts, with some artifacts on the ground surface. The two forked sticks, the horquetas, were mounted into the ground to support a metate. Its mano has not been found. This is a convenient grinding area, just outside the domicile, close to the entrance to the bodega, and about 7 meters from the kitchen. Stored above the metate, in the roof, were a figurine head and a polychrome bowl. On the ground surface were a few discarded sherds and a metate fragment. Just south of the mounted metate, and up in the roofing supports, were five pottery vessels. Two were polychrome bowls, two were globular jars, and one was the lower part of a jar. One of the polychrome pots was partially broken, and had changed function into a pigment container. Beyond the clear raised walkway was the original ground surface with occasional discarded sherds pressed into it. All had rounded edges from being trampled and moved around, in contrast to the sharp fresh breaks on sherds that broke from pots during the eruption.

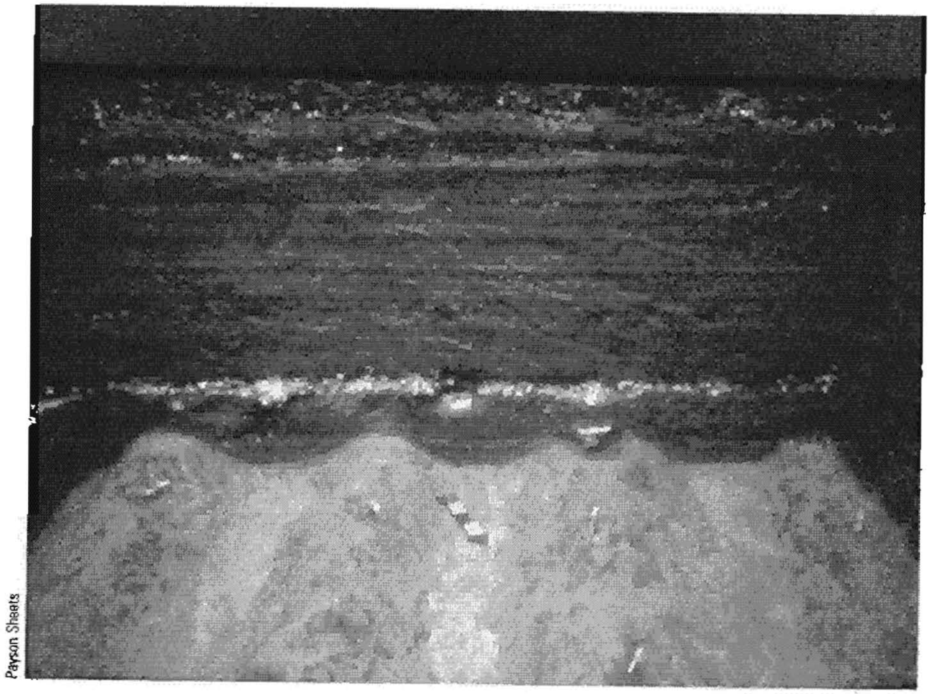
The zones under the roof of Structure 6, outside all four walls, extending 60 to 70 centimeters away from the walls, were kept clean of artifacts. Thus, the eves of Structure 6 provided covered walkways. Perhaps it is not surprising that it would do so, as it is located toward the center of the Household 1 compound. The time frozen by the eruption apparently was mid rainy season (probably August), and the covered walkways were used a lot. It is likely that there was less foot traffic on these covered walkways during the dry season, when it is also likely that these shady areas with good air circulation would have been used for daytime craft activities.

THE KITCHEN GARDEN

A 4 by 6 meter area was excavated to the south of Structure 6, to explore the area between the bodega and the cornfield. A kitchen garden was found, organized into six neat rows paralleling the side of the bodega. The garden began only a few centimeters beyond the edge of the bodega's thatch roof. The rows follow the overall orientation of the site, 30 degrees south of magnetic east. Each row is about a meter apart, and the plants are spaced about 75 centimeters apart. There were clearly three species of plants growing on the neat row tops. Manioc occupied most of the row closest to the bodega. The rest of that row was occupied by Xanthosoma ("malanga"), the most common and productive root crop at Ceren. The other rows alternated Xanthosoma with what Maria Reina de Aguilar identified as "cebadilla" (*Schoenocaulon officianalis*), a medicinal plant used to cure upset stomachs. It is still used for that by traditional peoples in Central America.

THE MILPA (MAIZE FIELD)

Zier (1983) described the two test pits excavated on the south side of the Household 1 area in 1978. One found a series of ridges, approximately following the overarching alignment of the site's architecture, with juvenile maize plants that had sprouted from the tops of the ridges (Figure 4-8). As with all the agricultural fields at Ceren, this field was not irrigated, so the juvenile maize was obtaining moisture from the rainy season. As it turns out, this is the only second planting cornfield excavated at Ceren to date. In most cases, when the eruption hit, most farmers were beginning to harvest the first planting. The plants had grown to about 20 to 40 centimeters high. (One of the ironies of archaeology is that we can date the eruption, and entombment of Ceren, to the month, and to time of day, but our best dating to the year is from radiocarbon dating, to the first half of the seventh century.) The diameters of the juvenile maize plants range



Payson Sheets

Figure 4-8 Maize field excavated south of the kitchen. Ridges had clusters of two to five corn plants growing on top, spaced about every 60 centimeters, where small markers can be seen. The lowermost tephra layer is Unit 1, and the coarse layer above it is Unit 2, which fell very hot. Unit 3 is the thick, fine-grained layer at the top of the photograph.

from .6 to 1.3 centimeters. The maize plants are about .5 meters apart along the ridges, and the ridge tops are about .6 meters apart. Subsequent work around this test pit has indicated that multiple seeds were planted, and multiple maize plants had sprouted per location, with four being the most common (Murphy 1989). That is a pattern still practiced in many areas of Central America.

The other test pit (#1) excavated in 1978 (Zier 1983) encountered a maize field in fallow. The maize had been planted in ridges, as in the other test pit, but the ridge tops had been trampled. Some hazy footprints could be seen, and the successional grasses that had recolonized the fallow field were preserved as rust-colored plant impressions in the lowermost 1 to 3 centimeters of volcanic ash. The field had parallel ridges, also following the overall orientation of the site, but perpendicular ridges blocked the parallel ridges. Thus, these are blocking ridges, probably designed to maximize infiltration of water and minimize erosion. The young soil, formed on top of the volcanic ash from the Ilopango eruption a few centuries earlier, had suffered some erosion from cultivation by earlier Ceren residents, and evidently they had learned how to control, or at least minimize, erosion. If this interpretation is correct, this is rather sophisticated microtopographic slope management. The soil, analyzed by Olson (1983), indicated that it had minimal organic content, a pH of 7.1 indicating neutral, was good in nitrogen and iron, but was weak in phosphorous, potassium, magnesium, calcium, and manganese.

SUMMARY

Household 1 was agrarian and craft oriented. Residents had a garden nearby where they grew root crops and a medicinal plant, and they grew maize farther out. It is likely that the men had to walk a considerable distance to their outer fields. The women made cotton garments, made agave fiber rope and twine, and scraped-slip utility storage and cooking vessels. Household 1 residents, perhaps of both genders, made their own grinding stones, including metates, manos, and donut stones. They used hematite, sometimes with mica added, to paint things red, probably including themselves. The household lived in a complex of buildings, each specialized to various tasks. One building was a storehouse, one may have been a male workshop, one was the kitchen, and one functioned as the living room, dining room, and bedroom. The household lived well, based on the ampleness of the architecture, the number and variety of the pottery vessels, the stored foods, and the range of stone and perishable artifacts. Their strong roofs, of grass thatch, protected the buildings and their residents from the rain and sun. But they did not protect them from the sudden eruption of what is now known as the Loma Caldera volcano, particularly the second and third units of the eruption. We have yet to find someone killed by the eruption. The warnings before the first volcanic ash unit arrived might have been enough to cause them to flee, or they might have escaped in a time interval between units one and two.

5/The Ceren Site: Household 2

Household 2 is not quite as thoroughly excavated as Household 1, but we do know quite a lot about it, certainly enough for a relatively detailed treatment here. Both the domicile and the bodega have been excavated, and some surrounding ground surface (Figure 5-1). Also, a large sauna building was excavated to the south (Structure 9), along with a sizable extent of maize milpa. There are some strong similarities in domiciles and bodegas between the two households, which tell us something about patterning in the culture. And, there are some interesting differences, which provide inklings about household specialization in a complex economic and social matrix.

Brian McKee has been in charge of the excavations in Operation 2, and his reports (1989, 1990a and b, 2002a) and an article (Sheets et al. 1990) are used as the basic material for this chapter.

THE DOMICILE (STRUCTURE 2)

This structure was first suspected to be a prehistoric construction when geophysical anomalies were detected at this location. In 1979 and 1980, we detected an M-shaped anomaly in the resistivity data (Figure 3-4), and the radar data generated in 1979 also contained an intriguing anomaly at this location. The radar showed a strong reflector, now known to be the house floor, with bowed tephra layers on top. That is from the raw radar data; I am afraid that if we digitize and mathematically caress the data we will have such detail that we will not have to excavate, and that could put archaeologists out of business! Seriously, though, the resistivity and radar anomalies were strong and both were in the same location, so we decided to investigate further. The core drill rig borrowed from the Centro de Estudios Geotecnicos was put to use pulling up stratigraphic samples. This was the real test to see if the geophysical instruments really could detect buried structures, and I became more anxious each time the hollow pipe brought up another sample. We photographed, measured, and described each, to keep track of each layer. Any deviation from the natural stratigraphic sequence could be an indication of human cultural activity, or it could be caused by natural

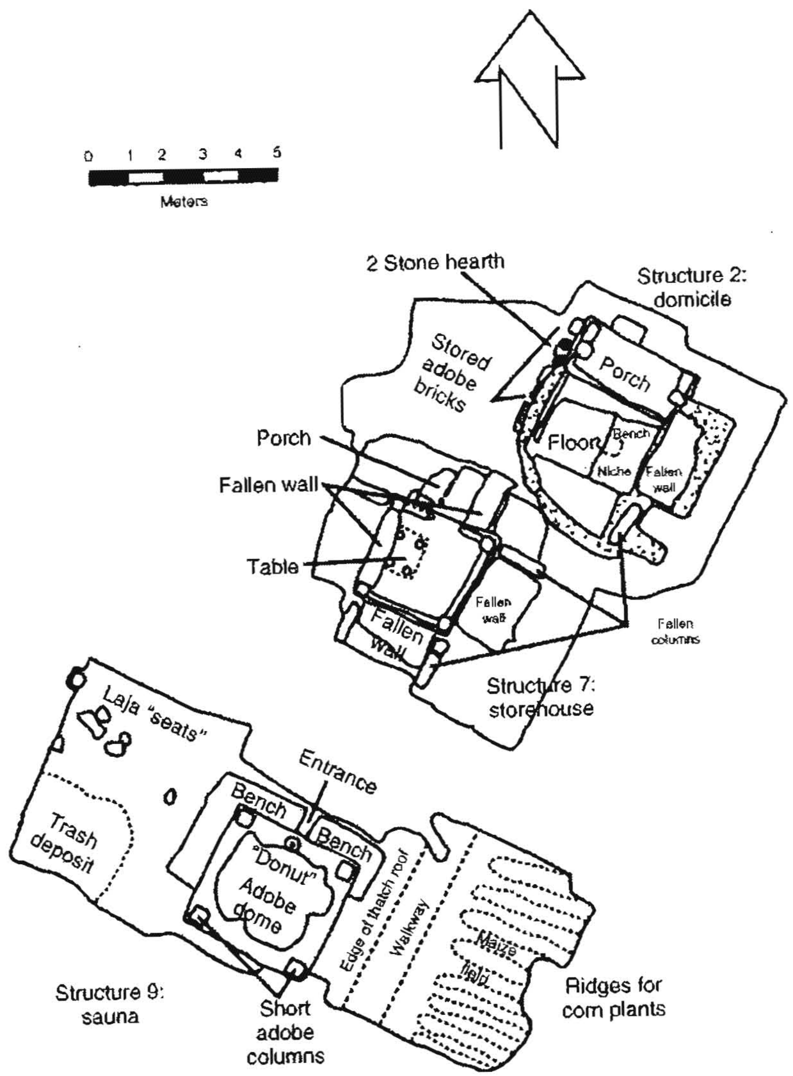


Figure 5-1 Map of Operation 2.

processes such as erosion or redeposition, and it was essential that we be able to tell these apart.

My turning to geophysics, with desperation and a little bit of hope, was about to be tested. My anxiety was fed also because I had convinced the National Geographic Society, Committee on Research and Exploration, that geophysical instruments might be able to detect buried structures as anomalies. The proposal was clearly written that it was a risk, and that it might not work. However, it certainly would not help my credibility, if I went back to them in the future, if it all failed. Down deep, I had to admit that we had less than a fifty-fifty chance, but it was worth the try. Unknown to me, Bill Loker,

my wonderful graduate student assistant, had smuggled a bottle of champagne out into the field every day of the 1980 field season, in case it worked. And it did! A deep sample, from about 5 meters down, pulled up a sample that had the Preclassic clay soil made into a building floor, with a thin wisp of thatch roofing on top of the prepared clay surface! We celebrated for a long time, even going into town and ordering a few rounds of beers for everyone. This "inverted stratigraphy" means that people took the clay that occurs naturally under the Ilopango ash and moved it on top of the ash, while constructing a dwelling. Although we did not know it at the time, the drill was perfectly situated. It pulled up a sample of the subplatform mound to the southwest of the structure, so the drill bit did not affect any of the structure itself. I also had a nagging fear that it might work too well, and we might pull up part of a polychrome vessel or part of someone's cranium. We have calculated that the odds of either of them are very low, but they are real. We are now able to do less drilling, now that we know where principal structure groups are located.

We considered using a bulldozer to remove the sterile (no artifacts) volcanic overburden from above and around Structure 2, as doing that by hand would be a long and arduous process. Many tons of ash needed to be hauled. Unfortunately, even a small bulldozer weighs a lot and the vibration or compression can be destructive if a bulldozer gets too close to a prehistoric structure. Thus, we would have to leave more than a meter and a half of volcanic ash above all structures. That would mean many extra weeks of removal of volcanic ash by hand. We enlisted the assistance of a heavy equipment firm in San Salvador, and they suggested a large power shovel. That was ideal for our purposes because the weight and vibration of the machine are well to the side of where the bucket is doing the excavations. The bucket that can lift almost a cubic meter, and it takes less than a minute to fill the bucket and empty it into a dump truck. The shovel would fill the dump truck in just a few minutes, but we soon ran out of places to put all that ash. We developed the "hauling ash" project, by spreading the word that we were making volcanic ash from the site available to anyone at no cost. By that time the site had developed a local mystique, so people really wanted it to level their patios, improve roads, and the school used it to level their soccer field. In fact, the "hauling ash" project was so successful that people wanting it would show up outside the site before dawn with oxcarts, pickup trucks, or wheelbarrows to be first in line.

Structure 2 (see Figure 5-2) is very similar to Structure 1, which should not be too surprising because both are the domiciles for their respective households. The construction processes were similar, beginning with an irregular mound of clay that presently extends beyond the platform in all directions, for drainage purposes. The platform, oriented 30 degrees east of magnetic north, is larger than Structure 1. Structure 2 is 4.33 meters long, 3.4 meters wide, and .75 meters high. The platform, and exposed surfaces of the substructure mound, were fired before the walls and roof were built. The four solid adobe columns are so similar in size that we suspect a mold was used for their construction. The walls of the front porch have a feature not seen in other excavated structures, two solid adobe slab wing walls. Each measures 35 by 65 by 105 centimeters.

The doorway from the porch into the inner room passes through the bajareque partition wall. The top of the doorway is an adobe lintel supported by

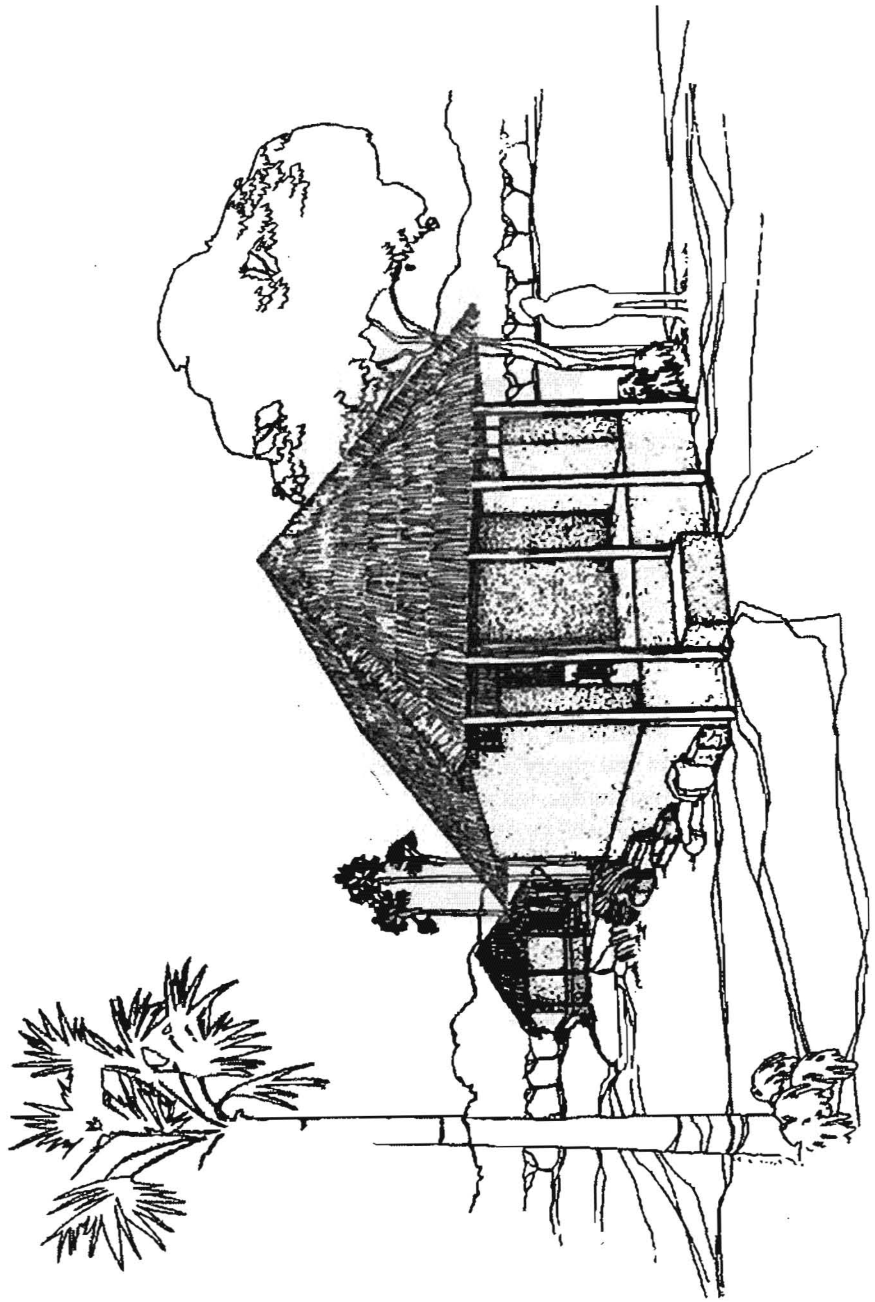


Figure 5-2 An architect's reconstruction of the domicile for Household 2 (Structure 2) and the bodega (Structure 7) behind it.

a horizontal beam. The doorway is 55 centimeters wide and 1.5 meters high, very similar to most doorways at Ceren. Why doorways are so low, and consistently low, is unclear. Certainly most people would have had to duck while going through the doorways because 1.5 meters is only about 5 feet high. The sides of the doorway were enlarged or reinforced, creating a pilaster effect, and a cornice along the top of the entire wall. The mudded bajareque walls were 1.75 meters high above the floor, or 2.40 meters above the surrounding ground surface, more than enough to provide privacy in the inner room. Just inside the partition wall, and parallel to it, was a high shelf that ran the width of the building, and extended beyond the walls to take advantage of storage space under the eves. It was made of horizontal poles. Curiously, the parts extending beyond the walls, under the eves, received special treatment. They were covered with grass and then a thick layer of wet mud. When that dried, it made a very hard overlying shelf well above the outside walkway that was not very accessible. That almost certainly was the objective.

As with Structure 1, the eastern side of the inner, back room had a large adobe bench, filling almost half of the room. The Structure 2 bench was bigger than the Structure 1 bench, measuring 55 centimeters in height, and was about 1.5 by 2.5 meters in width and length. Its most interesting feature was the niche that was built into it when it was constructed (Figure 5-3). It is an opening about one-half meter cubed that was supported on its top by horizontal rods of wood that were mudded over, functioning as small multiple lintels. It is impressive to note that the poles must have decomposed within a few years of the eruption, but the niche held up, even though it was a hollow air space for all those centuries. (Earthen architecture is so misunderstood and underestimated.) The niche contained three polychrome vessels, all evidently involved in food serving. One is a Gualpopa open bowl with a slightly flattened bottom. Another is a Copador tripod bowl. It was upright in the niche, covered by a Copador Polychrome bowl (Figure 5-4) with melon stripe decorations, that was placed upside down just before the eruption. When this bowl was removed from the niche, and cleaned carefully with brushes, the finger swipes of the person who ate from it 1,400 years ago became visible (Figure 5-5). Because forks were invented in Italy only three centuries ago, people used to eat with their fingers, and we found the direct evidence of that. Even today, traditional household members in Central America use their fingers in eating more than they use utensils. We had an emotional response to this discovery, as we felt very close to people because we were finding their dirty dishes. (I did try the visual clue of "upside down dish needs washing" with my children and it did not work. I think it is culturally specific to a time and place far away.)

It is fortunate that we learned years ago not to follow the usual archaeological procedures in artifact processing. At most archaeological sites, the archaeologist, after mapping, describing, and photographing an artifact in its original location, lifts the artifact and sends it to the pottery lab. There someone carefully and thoroughly washes the pottery, and after it is dried and cataloged, the ceramic specialist analyzes it. That would have eliminated the finger swipes. We have learned to gently clean all artifacts with fine brushes before considering washing them with water. At any rate, we found their dirty dishes, and it is my

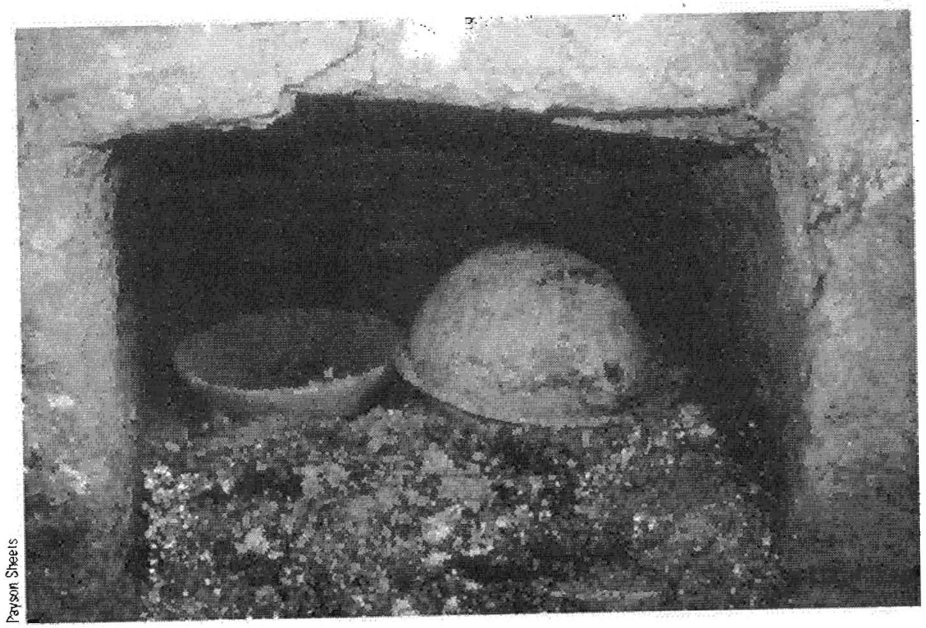


Figure 5-3 The niche in the bench, immediately after it was uncovered. Two pots are rightside up, and one is upside down. To the left is the painted artifact; at first, it was thought to be a codex, but it turned out to be an elaborately painted gourd.

Figure 5-4 The pot that was upside down in the niche, after cleaning. A band of human faces adorns the top, and broad melon stripes decorate the bottom.

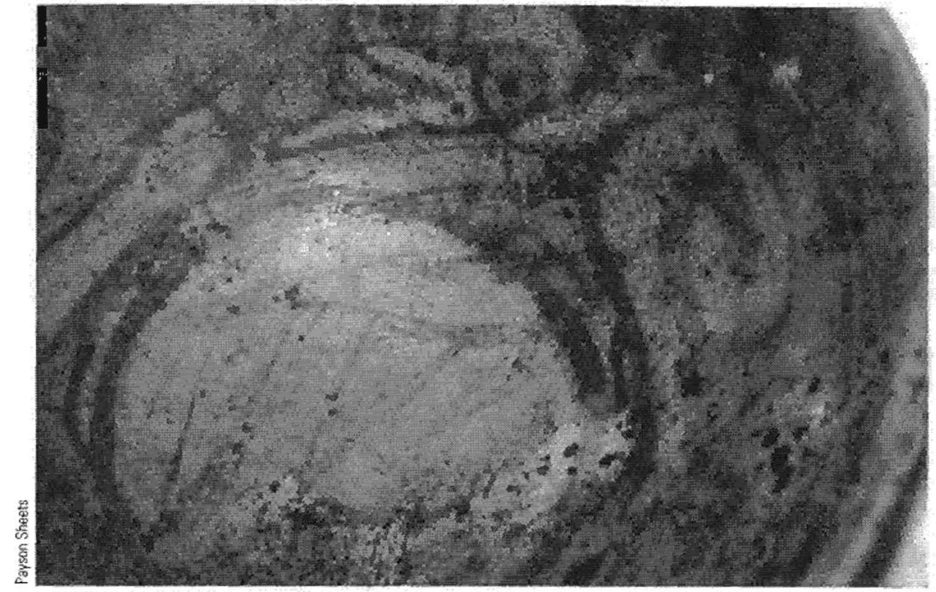


Figure 5-5 The inside of the pot was also polychrome painted. Archaeologists have thought that this type of vessel was used as a food-serving vessel. With the excavation of this pot, there is no doubt about it because the finger swipes of food can still be seen.

intention that their polychrome serving bowl will never be washed. It is on display at the Museo Nacional in San Salvador, and another at the new on-site museum.

The other important item in the niche was a huge number of tiny flecks of paint, partially visible on the left side of Figure 5-3. At first, we thought it might be the remains of a codex. (Jay Leno noticed this and speculated how much the book fines from the library were going to be after 1,400 years!) A codex is a fanfold document that is like a book. It can record religious matters or more mundane items. On a base of deer hide or amate bark paper, both sides of codices were painted and then folded in on themselves multiple times. Archaeologists have, upon occasion, come across places in Maya sites where they thought a codex had been, but they found only some isolated paint flecks, and no painted surface was reconstructable. The area of the niche with the painted item seemed to be in better condition than those finds of paint flecks, so we decided to try to recover the item by a procedure called "block lifting." The painted area was carefully isolated and then the item, along with a section of the adobe floor of the niche, was lifted all together as a block. That evening I called a number of archaeologists, from Los Angeles to Washington D.C., to get advice on how to handle such an item, and who would be the best person to help. Many people agreed that the best person in the United States is Harriet "Rae" Beaubien, of the Conservation Analytical Laboratory, Smithsonian Institution. She was able to treat the fragile artifact in El Salvador and then take it to her laboratory. She has determined that both sides of the organic layer were painted white with kaolinite (a pure clay) and then painted with cinnabar (mercuric sulfide, a strong red color), limonite (an iron oxide), a green pigment with serpentine, and other pigments.

We had thought it most likely was a codex until we found a series of painted gourds, many painted with similar designs to that on the niche artifact, in the kitchen of Household 1 (described in Chapter 4). It is now clear that the niche object was a painted gourd that, when the gourd itself decomposed, the painted surfaces collapsed down onto the flat surface of the niche floor. The gourd probably was used for food serving. It is possible that it was used to ladle food from larger vessels. Now, the fact that mercury is toxic, if ingested in significant quantities, becomes important. Mercuric sulfide is one of the most toxic forms of mercury. However, in small quantities it does little harm. In the future, when we find human bone, we will determine if there are significant amounts of mercury showing up in the bone. It will be interesting to see how successful they were in avoiding the toxicity.

An enigmatic item was suspended from the ceiling in Structure 2. We do not know what it was doing there, and we are puzzled because we found it in some other structures we have excavated at the site. Structures 3 and 4 also had one of these, which only deepens the mystery because they were a public building and a bodega, respectively. In all cases, this item was suspended in the center of the building, probably in an organic container, but we have yet to find definite evidence of the nature of the container. It is a large, about 30 to 50 centimeter diameter, mass of Ilopango volcanic ash mixed with water and short pieces of grass. It was mixed vigorously enough to have included bubbles in it, and it was kept moist. It might have been a cleanser, like Ajax but without the soap, to clean food vessels, floors, walls, and the like. We just do not know. Because Household 2 had so many painted gourds, it is possible they were using this as an abrasive to clean out the inside of the gourds. It would work well for that, as the individual tephra particles are very angular.

No artifacts were found on the bench, but a number of artifacts were found on top of a thin dusting of Unit 1 that had blown onto the bench before they fell. That indicates that they had been stored above the bench, likely on the long shelf that ran above it. Three ceramic vessels were stored there, a globular scraped-slip jar, a smaller scraped-slip jar, and an incensario that was used in family ritual. The bench was kept clear for family use.

The floor and roof of the south (inner) room were also kept quite clean, cleaner than the analogous inner room of Structure 1. That contrasts with the north room, where a lot of obsidian was stored high. Two prismatic blades (Figure 5-6) were kept in the north room thatch, in accessible locations near the doorway. One was complete and barely used. The other blade was broken, and had moderate use wear along with some organic residues. A large stemmed macroblade was also kept in the roofing and was in very good condition. It is a visually impressive artifact that uses lots of obsidian and, therefore, had a high intrinsic value. It is possible that it was used as a large knife, for cutting tougher materials than those that can be cut with the more fragile prismatic blades. One edge was more used than the other. The stemmed portion may have been shaped to hold onto it by hand, as there is no evidence that it was hafted to a handle.

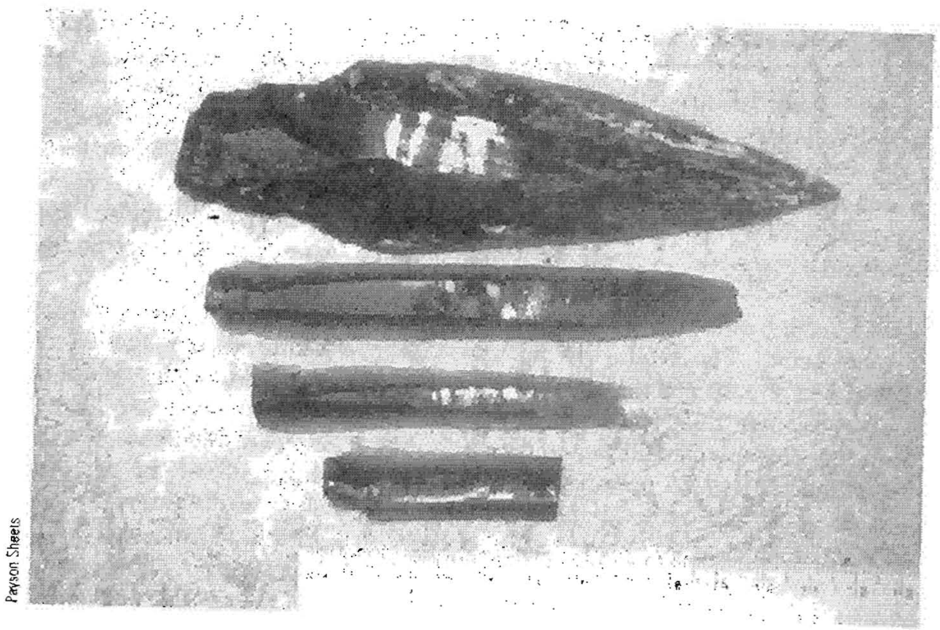


Figure 5-6 Four obsidian artifacts that were stored in the roof thatch of Structure 2. At the top is a stemmed macroblade apparently used, hand-held, as a knife. The others are prismatic blades; the longest is complete and the other two are partial blades. They remain extremely sharp.

A small side scraper was found on top of Column D, with no use wear visible. It apparently had been resharpened just before the eruption.

Along with most archaeologists, I had assumed the main reason for people to discard an obsidian prismatic blade would be that it became too dull. Wrong. As I examined the discarded blades in the trash deposit (Figure 5-1), it was clear the main reason for discard is that they broke into segments that were too awkward to hold. Most of the discarded segments were short but still sharp.

The north room also had a Cashal cream storage vessel stored up in roofing. The only artifact that was in direct floor contact was a series of small poles that were lashed together with string. We found thirty-one holes, and cast them with dental plaster. It apparently was a portable fence. A very similar one was found on the floor, by the front door, of the Household 2 storehouse (Structure 7). Two portable pole fences were found under the eaves of Structure 4, also a storehouse, but their functions in any of these structures are unknown. They could have been used as pens for small animals.

We found some interesting things to the southwest of Structure 2, just outside the walls. They may have been stored on the relatively inaccessible shelf. Two donut stones were stored up high, under the eaves, and fell during Units 3 and 4 times of the eruption. One had organic material caked on it and in the perforation. This incrustation taught us that we would be incorrect if we used any of the three common interpretations that archaeologists are using: a club head, a scepter, or as a digging stick weight. It also had a short hardwood stick projecting out of it, and the perforation inside it had worn asymmetrically. All these indicated that the donut stone was a perforated mortar. Evidently it was used to grind small amounts of food, perhaps nuts, with the ground portion falling through the perforation to be caught and collected below. A few meters beyond the edge of the roof was a trash area with discarded potsherds. With them were found a tooth of a carnivore, probably a domesticated dog, and a freshwater snail locally called a "jute." As mentioned in Chapter 3, this indicates that the nearby river was not polluted, in unfortunate contrast with contemporary conditions.

The area west of the structure was used for storage under the eaves, and for a small hearth. The hearth was a surprise, as it was immediately against the platform of the structure. In fact, the platform edge provided the third point of support because there were only two stones of the usual three-stone hearth. There was some charcoal accumulation at the bottom, and some oxidation of the surface below the fire and along the vertical surface of the platform, but both charcoal and oxidation were minimal, indicating very little use. People must have watched this fire carefully because if it got out of control it could easily catch the thatch roof on fire. No vessel was found on top of the hearth, as with the hearth in the kitchen of Household 1. The hearth was built in an area that was used to store adobe bricks. The sun-dried adobe bricks were of equal widths and thicknesses but of two lengths, one about 55 centimeters long and the other about 95 centimeters long. One curious aspect of this is that we have yet to find adobe bricks used in construction at the Ceren site, yet they were storing them under the eaves, out of the rain. Adobe brick construction was common at the site of San Andres, the major site dominating the valley at the time.

A medium-sized donut stone was stored high, above the adobe bricks, but fell early in Unit 3 deposition, and broke when it landed. It was stored near a fine sandstone whetstone, which similarly was dislodged and fell under the eaves. These artifacts probably were stored up on the relatively inaccessible shelf, indicating that their owner was trying to keep them away from casual manipulation. The closest natural outcrop of sandstone is about 40 kilometers north, requiring some significant human transport. It likely was used to resharpen jade celts. The shapes of the ground areas on the whetstone match the shapes of celt bits.

In general, the domicile of Household 2 was significantly larger, and better constructed than the domicile of Household 1. Victor Manuel Murcia (personal communication 1995) estimated it would have taken about sixty-two person days to build Structure 2, and it would have taken about forty to build Structure 1. Structure 2 also had floors that were kept more clear of artifacts, and it had fewer craft areas.

THE BODEGA (STOREHOUSE; STRUCTURE 7)

Structure 7 (Figure 5-7) is the bodega for Household 2. It is only 1.2 meters to the southwest of the domicile, and their thatch roofs almost touched each other. We still have not found the kitchen to this household; it likely is to the west, but we really don't know.

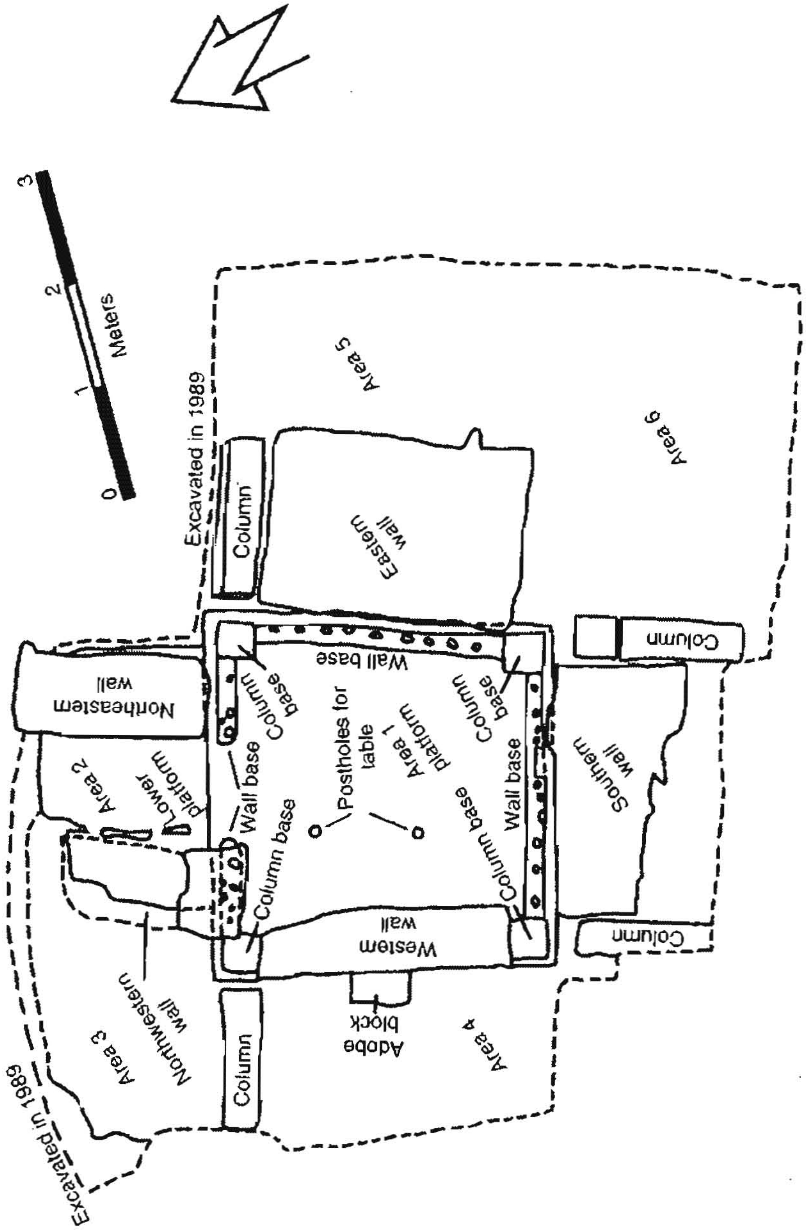


Figure 5-7 Map of Structure 7, the storehouse (bodega) for Household 2. All bajareque walls and all columns fell during the eruption when Unit 3 was deposited. It was loaded with pottery vessels, most of which were being stored off the floor, suspended by ropes or on shelves. Area 3 is where the maize cobs were tossed after someone ate maize.

The architecture of Structure 7 is described here in order of construction. First, a larger-than-usual clay mound was constructed for drainage of rainwater away from the building. The subplatform mound of Structure 7 extends more than a meter from the platform walls. At least on the north side, this provided an ample roofed household activity area that was used for eating corn on the cob just before the eruption struck. We found their recently nibbled corncobs left on and beside the porch. After building the mound, a square platform of solid adobe was constructed, slightly larger than 3 by 3 meters, and about a meter above the surrounding terrain. This is considerably more substantial than Structure 6, the bodega for Household 1.

A large porch was added to the north side, of 3.5 square meters. The exposed portions of the mound, the platform, and the porch were fired, perhaps before the adobe columns were mounted in the corners. The columns are about 1.55 meters high, and most bajareque walls are about the same height. The vertical poles in the bajareque walls penetrated well into the platform, to supply strength to the walls in addition to their being anchored above with the roof.

The northern bajareque wall, with the entrance doorway, was built taller than the other walls, and measures 1.67 meters in height. Handles salvaged from broken pottery vessels were mounted inside the doorway wall to secure the front door. The front door was made of vertical poles lashed together with twine. The poles rested on the lower surface of the porch, and some went into sockets of small postholes, to further secure the front door. Thus, when tied shut, the front door was relatively substantial.

The vertical poles from the bajareque walls continued upward and supported the roof, assisted by large posts set into and north of the porch. Pieces of twine were the lashing connecting vertical and horizontal members of the roof. The excavated thatch was 5–10 centimeters thick; the degree of thinning caused by the fire and the tephra overburden is unknown. The thatch roof was extensive: it covered some 27 square meters outside the walls in addition to covering 10 square meters inside the walls. The amount of grass used in re-thatching roofs at Ceren must have been tremendous. We do know that some palm trees grew in a line a few meters to the west of Structure 7 because we found their hollow cavities in the volcanic ash, but we have yet to find a roof where they were used for thatch.

We found an adobe "step" on the west side, abutting the platform, but above it is a bajareque wall with no doorway. We believe the building originally opened to the west, but was later remodeled to open north, and the step was thus converted to a sitting bench.

Inside the walls, a wooden shelf of multiple horizontal poles was constructed on the western side of the room, supported by large wooden posts. It was at least a square meter, and probably double that size. A rolled-up mat was stored on its north end.

Structure 7 suffered more structural damage from the eruption than any other bajareque structure yet excavated, as all walls and all columns fell. (As we will see in Chapter 6, Structures 3 and 9, with solid adobe walls, suffered no wall collapses at all.) Unit 1 packed on the roof of Structure 7 and onto exposed surfaces, and a little blew into the building. Unit 2 lava bombs, which were hotter than 575 degrees Celsius, set fire to the roof. Unit 3 continued to burden the roof until the combined effects of weakening by fire and overburdening by tephra resulted in collapse.

In bajareque buildings at Ceren, the principal structural resistance to stress from wind, earthquake, and so forth, is in the interconnectedness of bajareque wall poles being tied to roofing members. Walls and columns were not structurally interconnected, but rather were only abutting, with their junctures smoothed over with clay surfacing. Therefore, the failure of the Structure 7 roof left the walls and columns vulnerable, and they all collapsed shortly after the roof fell.

The nature and density of internal artifacts indicate this was a bodega. A series of five empty large storage jars lined the back wall and were in direct floor contact. Most are Guazapa scraped-slip vessels. It is unusual to have so many empty large jars, and we now think they were used to provide water for the sauna to the south. In addition to these, one medium-sized and two large pots were placed on the floor. They were storing various kinds of seeds.

A surprisingly large number of artifacts were suspended from the roof inside the bodega. Most ceramic vessels were suspended rather than resting on the floor. As archaeologists, we had no reason to suspect this from previously gathered data at other sites, and this requires attempts at explanation. A couple of practical reasons are (1) rodent and insect pests would have more trouble getting to something suspended from the ceiling than sitting on the floor, and (2) efficiency in utilization of space. If all of the artifacts we found stored with the roof were placed on the floor, the interior of this bodega would be too crowded to be very useable.

A cache of five miniature pottery vessels (Figure 5-8), seven jade beads, two other beads, and six shell fragments were found in Unit 3, in the southwest corner. They had been stored high in that back corner of the bodega in an organic container, probably of gourd but possibly of hide, and fell with the roof. Most of the jade beads were biconically drilled (from both sides), but two were cylindrically drilled, a relatively unusual way of perforating beads. They are 1.4 to 1.7 centimeters in diameter. The other two beads were of shell and of a dense gray stone. A shell pendant, carved in the shape of a 5-pointed star, was found nearby. It is possible the nine beads and the pendant were a necklace, but no string was found. These are luxury goods, and with the architecture, indicate a higher degree of wealth than that in Household 1.

All five miniature pots in this container contained red paint, and all were decorated. The pigment is mercuric sulfide (HgS), and it is so pure that some kind of refining may have occurred. The hues vary slightly, offering the artist using them as paint a fascinating range of reds. One of the miniatures had a face on one side and a coiled tail on the other, a common Maya motif. The miniature pots are so identical at the mouth that they probably were made on a mold. I think the paint in them was liquid when the eruption struck, because of the flat surface it achieved after it fell in the pots, but Brian McKee thinks it could have been dry. The only artifacts we have found at the site that were painted with cinnabar are gourds, and it appears that the part-time occupational specialization of this household was painting gourd vessels for their own use and especially for exchange in the village and valley.

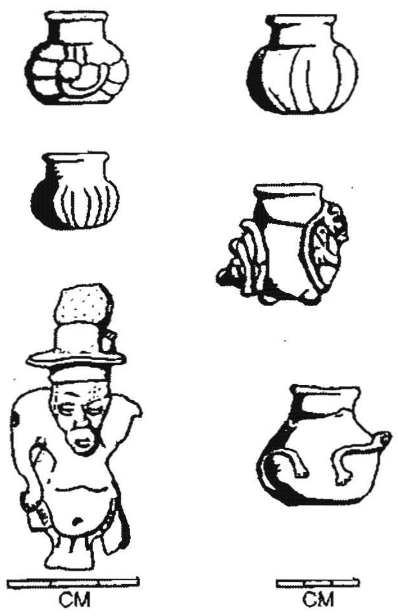


Figure 5-8 Five miniature fired clay pots, used to store different hues of red paint made of cinnabar (mercuric sulfide). Each is uniquely decorated but of precisely the same size at the top. The one in the middle on the right may be the Maya God N emerging from a shell. The Maya associate God N with scribes and art. The tiny bone figurine was kept near the paint pots.

Nine other ceramic vessels or partial vessels were stored high inside the bodega, two probably on the shelf and the others connected with roofing. These include a polychrome tripod plate, a polychrome bowl with three clearly male monkeys cavorting around its surface, two medium sized jars, and two dishes.

A greenstone celt was found inside one of the large storage vessels lining the south wall. It was with Unit 3 tephra inside the pot, as both had fallen into the pot during the third phase of the eruption. The celt was well made and highly polished at the bit end from manufacture and from use. There was no evidence that it had been hafted to a handle. In fact, none of the jade axes showed evidence of being hafted—yet another surprise from Ceren.

Five prismatic blades that had yet to be put into use were stored together in roofing thatch at the southern edge of the structure. The thatch roof probably was too high toward the center of the structure to reach the thatch conveniently.

All roofs excavated so far at Ceren have small rodents, but bodegas are becoming known for having more than most. This bodega roof had five. As our Salvadoran workers noted, some things change with time and some things do not. They have to take anti-rodent precautions today that are similar to those their ancestors at Ceren took.

A carved bone figurine (Figure 5-8), in the form of an older man with a tall, broad-brimmed hat, was found in very good condition. It was stored high, perhaps with roofing, and fell into a pot. It was an heirloom, well-polished by handling, with very smoothed breaks where the legs and an arm had been missing for a long time. Another important organic item is a palm nutshell perforated by a wooden stick, forming a spindle and spindle whorl. As with so many organic artifacts found at Ceren, this would not be preserved at most archaeological sites.

The porch had no floor contact artifacts, so it apparently was used a lot by household members, probably for varied tasks and activities. The adobe surfaces showed the effects of use; they were quite eroded. Although the surface was kept clean, there were quite a few elevated items, including a large sherd for storage of some unknown substance in the rafters, 2 polychrome bowls, sherds, a prismatic blade and a macroblade of obsidian, some paint, two deer bones, and a "hemisphere of wood ash."

Lumps or hemispheres of wood ash are common in bodegas. The wood ash remains from cooking fires would be gathered up and placed in gourds, and stored. The most likely use is in soaking maize kernels before grinding them, often overnight, as is still done in traditional households in Central America. Stored maize kernels are too hard to grind, and thus need soaking. The objective is to soften the shell of the kernel. In areas with limestone (calcium carbonate) available, burned limestone (calcium oxide in water) is preferred, but wood ash is a viable substitute. It is not unusual for a bodega at Ceren to have a dozen hemispheres of wood ash.

Northwest of the structure were some sherds and dull obsidian blades that were discarded trash, a fragment of a bone needle, and some maize cobs. Although they sound mundane, the maize cobs were exciting to encounter because they really add that human touch. Someone had a taste for maize on the cob, probably freshly picked from the recently matured corn plants just a few meters to the west. The maize cobs, now preserved by dental plaster, apparently were tossed there by people eating while seated on the porch. This may have happened right before the emergency began, and there was no time to tidy up the area before they had to flee.

Immediately west of the structure, under the eaves and outside the walls, were two bowls, part of an obsidian macroblade, two manos, and two hemispheres of wood ash. All of these were stored high and fell when the roof collapsed early in Unit 3.

THE MILPA (MAIZE FIELD)

A milpa (maize field) was found south of Structure 7 and east of Structure 9 (Figure 5-9), and we now know it extends the full length of the east side of the household. The agricultural field began one meter east of the eastern edge of the thatch roof of Structure 9. That provided a one-meter wide outside pathway between the roof edge and the field, and it was well packed down. We encountered the maize plants as hollow cavities, preserved as casts by the Units 1 and 3 fine-grained base surge tephra units. The Unit 2 tephra, being largely airfall and coarse, unfortunately did not preserve the maize stalks. Eight ridges were excavated, within the 3 by 6 meters of milpa exposed (Figure 5-1), and later work has found some 30 more ridges to the north. The ridges are aligned to the overarching site alignment, 30 degrees south of east, evidently a reference to the water of the river, and the wish for water from rain. The ridges themselves are 10 to 20 centimeters high, and are about 80 centimeters apart. Usually there are multiple sproutings per planting location, with three to four plants being common, but the range is one to five. Most plant clusters, but not all, had small

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Figure 5-9 Three rows of maize plants found in the milpa south of Structure 7 and east of Structure 9. The maize plants are mature, and many have the stalks doubled over, with ears of maize still attached. This is a storage technique still used in Central America for milpas close to the house. Multiple grains were planted per locality, and most localities had two to five plants that grew and matured. The ridges on which the planting was done can be seen continuing back into the unexcavated part of the milpa.

mounds of soil built up around them, as was found in the Household 1 milpa (Zier 1983). The ears had matured, and the stalks were bent over, so the corn could dry in the field before being harvested.

SUMMARY

Of the two domiciles excavated at Ceren so far, the domicile of Household 2 (Structure 2) was better constructed. It was kept more clear of artifacts. It had a niche in the bench that contained food-serving vessels. One of the vessels had what archaeologists love to encounter, the "smoking gun" that indicates unequivocally the function of an item in a past society. The finger swipes in food remains in the polychrome bowl show, beyond a reasonable doubt the function of that vessel. The family's cutting tools were neatly kept up in the thatch roof by the entrance to the structure, much as the Machiguenga natives in the Peruvian Amazon rainforest routinely stick their machetes up into the thatch roofs above the doorways to their houses when they enter (Allen Johnson, personal communication 1990).

The Household 2 bodega was built on a much more substantial subplatform mound and platform than that of Household 1. Its walls were much more solid, and were anchored with adobe columns. Both bodegas were well stocked with ceramic storage vessels with abundant seeds. Some of the large pots may have been used to supply the sauna with water (see Chapter 6). This bodega had a sizable porch on its north side, and that was the place where people sat, ate maize on the cob, and threw it over to the west, just before the eruption struck. New obsidian blades were kept in the thatch near the back wall of the bodega. A temporary cache of valuables had been tucked in the back right corner of the bodega. This cache consisted of five miniature paint pots, beads of jade and other materials, a shell pendant, a bone figurine, and other items. That such a valuable cluster of artifacts was left behind is silent but eloquent testimony to the emergency nature of village abandonment.

We have yet to excavate the kitchen of Household 1, and they might have had other specialized buildings. It appears that there was a service relationship between Household 2 and the sauna (Structure 9), with the household providing water and firewood, and likely doing construction and maintenance of the building. Some of the household's wealth, seen in architecture and artifacts, must have derived from villagers using the sauna. Household 2 was wealthier than Household 1, but not hugely so.

6/Other Structures at Ceren

In the previous two chapters, we looked at the two households at Ceren where we have two or more buildings excavated, and thus can get some idea about the activities within households. Here we look at some other important structures in the village, including Structure 4, the bodega of another household. We also look at a public building (Structure 3) facing a large plaza, and we examine the sauna (Structure 9) that was serviced by Household 2. Household 3 is known by only by a small section of their kitchen, located 10 meters northwest of Structure 4. About all we know is that it was circular, and they used a stack of rocks to elevate their metate instead of wooden horquetas.

THE BODEGA FOR HOUSEHOLD 4 (STOREHOUSE; STRUCTURE 4)

Andrea Gerstle (1990, Gerstle and Sheets 2002) excavated the bodega (Structure 4) of Household 4 (Figure 6-1). Although it is not necessary to present the amount of time it took to detect and excavate all structures, Structure 4 will be so documented as an example. It was first detected as a geophysical anomaly in 1979 and checked again in 1980 and 1989, using resistivity and ground-penetrating radar (Conyers and Spetzler 2002, Loker 1983, Spetzler and Tucker 1989). Its excavation was delayed by complex land ownership negotiations, and it was decided that Structure 3, some 15 meters east, would be excavated first because it was more accessible. Because of overpopulation of the country, land ownership is a very sensitive topic, and archaeologists must be very careful and respectful. Whenever we wish to walk a field in cultivation, to check for prehistoric remains, we talk first with the landowner or the person leasing the land. Rarely do we have trouble obtaining permission to survey or excavate, once we make clear what we want to do, and why.[6] We pay landowners for any damage done to crops, and we backfill excavated areas as a routine procedure.

At Ceren, our access complexities began in the late 1970s when El Salvador began some agrarian reforms that, at least in the early days of the program, really did benefit many rural farmers. The area that includes the Ceren site became a

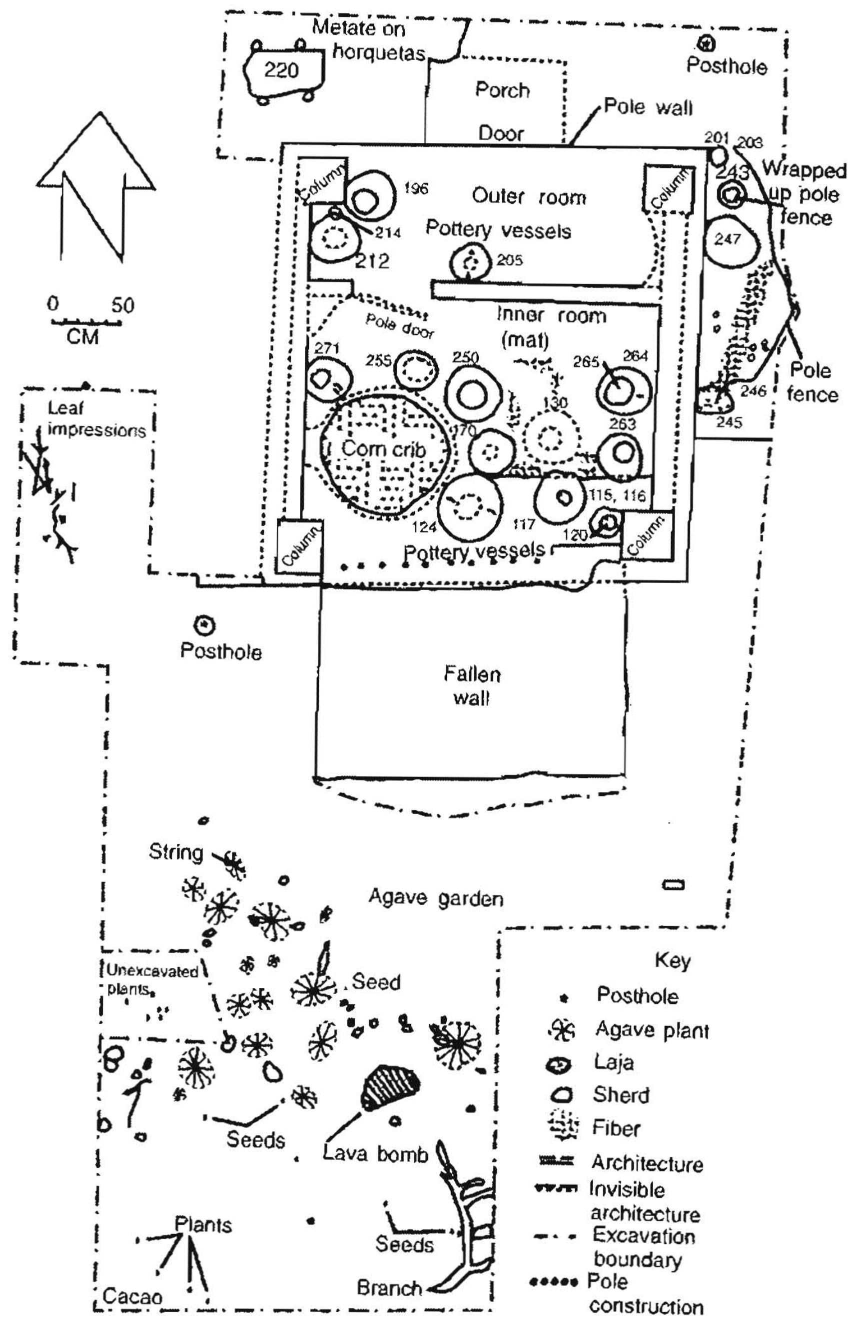

Figure 6-1 Map of Structure 4, the bodega for Household 4, showing architecture and artifacts.

part of that program, and farmers were allowed to lease the land for a few years while they learned modern agricultural techniques. Eventually they could purchase the land at a reduced price and, for the first time in their lives, actually own land from which they could support their families.

A local peasant named Salvador Quintanilla began leasing Lot 189A, the present surface that is 5 meters above what we now know is the Ceren site. When we first came to the site, in 1978, he exhibited quite an interest in our findings. When we returned in 1979 with the radar, he was instrumental in obtaining an oxcart, two oxen, and he served as the ox cart driver. He has since become a close friend and trained archaeological worker. He also routinely takes people from San Salvador, contestants for the Miss America pageant, the United Nations, the Organization of American States, and other organizations, on tours of the site. It has been immensely complex to find land of equal or greater value to substitute for his Lot 189A. Finally, a very fertile plot was found, and he is now the owner of it. Fortunately, he continues to be a valued worker when we are conducting field research because his knowledge, experience, and enthusiasm for archaeology have grown. Because of his changing ownership from one lot to the other, we had to restructure our research program.

The excavations of Operation 4 began in mid-July and continued until mid-December of 1990. That the excavations took five months, with an excellent crew averaging eight Salvadorans, is indicative of conditions very different from the usual housemound in Mesoamerica. Had this bodega been abandoned in the usual fashion, with people taking away the usable vessels, food, and other items, and people still living in the area having scavenged other items including architecture, there would have been very little remaining a year after they left. After that, the tropical sun and rains would cause further deterioration, aided by flora and fauna. An archaeologist, with the same size and training of a crew, would be able to excavate such a building in a week or two. That it took so long to excavate is indicative of preservation conditions at Ceren. Excavations began with three 2 by 2 meter test pits that successfully located and determined the orientation of Structure 4.

A duralite roofing module was constructed above the area to protect the structure from rain, sun, dust, and wind. The duralite modules, each covering 7 by 7 meters, were our salvation. They were roofing a school in San Salvador, but the big 1986 earthquake destroyed the walls and inside of the school. The roof largely survived and was salvaged. Later, international aid replaced the entire school, so the government donated 20 roof modules for our use. The good architectural preservation of the site requires us to erect protective roofing over all prehistoric structures before excavating them.

Early in the excavations, in the top layers of volcanic ash well above the Ceren site structures, a Postclassic midden (trash deposit) was found. It was buried in tephra layers from the Boqueron eruption, deposited well after the Loma Caldera eruption (see Figure 1-4). The midden is from people living in the area a few centuries after the Ceren site was occupied and entombed below the Loma Caldera tephra, and it is almost certain that they had no idea what lay a few meters below them. Boqueron, the main crater of San Salvador Volcano, erupted explosively sometime between AD 800 and 1200, and deposited a pasty wet blanket of volcanic ash over adjoining portions of the Zapotitan Valley. Although the Boqueron tephra was not intact over large areas of Operation 4 within the site, it was in situ in a few places. The artifacts apparently were from the soil developed on top of the tephra. A considerable amount of ceramics and obsidian was recovered. The obsidian was from a small workshop where they were making blades to serve as cutting implements.

By mid-August 1990, three bajareque wall tops and four adobe column tops were uncovered. It was immediately clear that this bajareque structure was in better condition than most at the site. Most bajareque walls at Ceren were vulnerable to collapse or partial collapse after the roofs burned and collapsed, and most bajareque structures had some or most of their walls collapse. For example, all walls and all columns of Structure 7 collapsed; Structures 1, 10, and 12 each had one wall collapse; and Structure 2 had one wall partially collapse. Only the south wall of Structure 4 collapsed, so the excellent architectural preservation provided an opportunity for conservation of walls before their being excavated. This may be a first in archaeology, doing architectural conservation of walls before excavating them. While the tephra layers were still in place on both sides of the walls, Victor Manuel Murcia and the architectural conservation team investigated each vertical hole where a pole had been placed in the wall. Most penetrated some 20 centimeters into the platform, and some went more than 30 centimeters. The hole where the rod had been was measured for diameter and length and a match in diameter and length was obtained. The contemporary varas were slid gently down into the holes and solidified before continuing the excavations. We thus reinforced the walls in the same way they were reinforced by Ceren's original residents before the Loma Caldera eruption, so they can now sustain wind stress and earthquakes. They would be very fragile without this reinforcement. It would be a crime to abruptly take these 1,400-year-old structures into the present, but give them a very short future, by inadequate conservation.

Structure 4 was constructed over a substructure mound. The formal platform, built on top of the mound, measures 3.2 by 3.25 meters, and averages 70 centimeters in height. The top surface slopes slightly down from the northeast corner, reflecting the slope of the general topography. The slope is so slight, just a few centimeters, that it is only detectable with instruments, and it is likely that the household members were unaware of it. The platform top and edges were resurfaced by a fine clay mixture, generally less than 1 centimeter in thickness, to make a very smooth floor. The entire platform was allowed to dry and then was fired, to create a massive fired brick block.

Four solid earthen columns were mounted at the structure's corners, inset a few centimeters. Each column was 35 centimeters in length and width, and 1.4 to 1.45 meters in height. All tops were modified to support north-to-south horizontal roof beams; clay was packed around the beams to structurally affix them to the columns and likely to the vertical poles exiting the bajareque walls. The beams run adjacent to, and inside of, the tops of the two bajareque walls. The beams were daubed with mud, forming a kind of internal rounded cornice. This extra reinforcement contributed to the building's strength and resistance to the buffeting from the eruption.

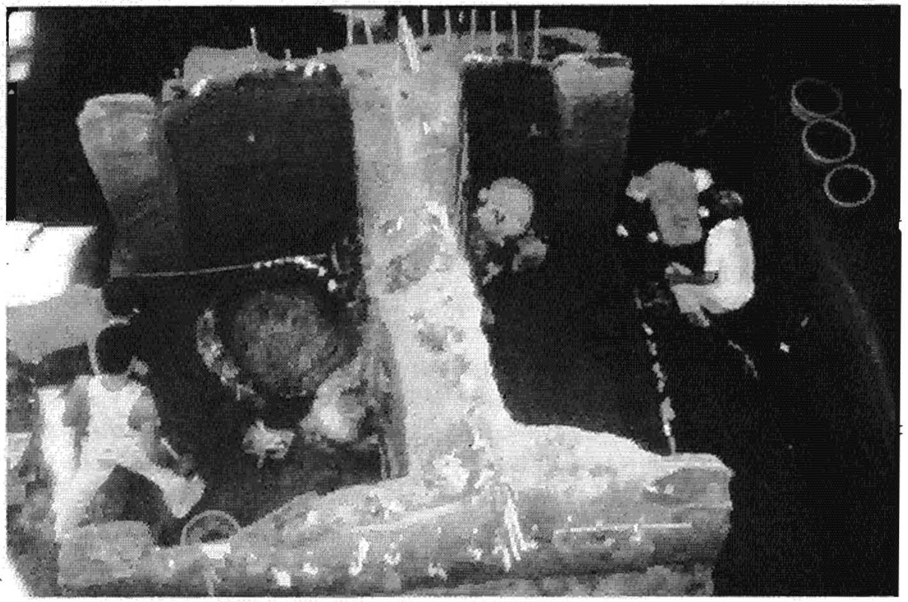

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Figure 6-2 Structure 4, largely excavated. The front (north) room is on the right, and the inner (south) room is on the left, with the circular maize crib visible. The walls have been consolidated with new rods to reinforce them. Two pots that fell from a high shelf can be seen at the far side of the front room. A metate just outside the structure, but under the eaves, can be seen at the upper right.

The bajareque walls are 10 to 13 centimeters thick, with 2-centimeter diameter poles every 15 to 20 centimeters extending up above the clay-daubed portions of the walls, to assist in roof support. Only the south wall collapsed, during the beginnings of Unit 3 emplacement. There is no evidence that it had additional reinforcement by a horizontal beam at the top. The internal dividing wall did have a horizontal beam at its top, and it survived the eruption's turbulence. The wall was perforated by a doorway 60 centimeters wide that is offset to the west. Clay was packed around the beam to form a squared cornice along the wall's north face. The effect is something like the upper cornice in the partition wall of Structure 2. So, it appears clear that the additional reinforcement by a horizontal beam at the top of the mudded part of the bajareque wall made a difference in resistance to the lateral blasts of the eruption. The walls that had it did not collapse and the wall that did not have it collapsed when the roof failed.

The internal wall created two rooms (Figure 6-2), the north and the south. The north room is small, about 1 by 2.7 meters. Most of its artifacts were on a high shelf made of horizontal poles tied together with two-ply string. The shelf was surfaced with a thin layer of clay mixed with grass to create the top surface. The shelf evidently ran from the western to the eastern horizontal roof beam; one would have to duck under it and the wooden lintel of the doorway to enter the back room. The internal doorway had a wooden door consisting of two rows of vertical poles tied together with two-ply twine in pairs. When people wanted to close off the inner south room, they must have tied the door to the vessel handles that

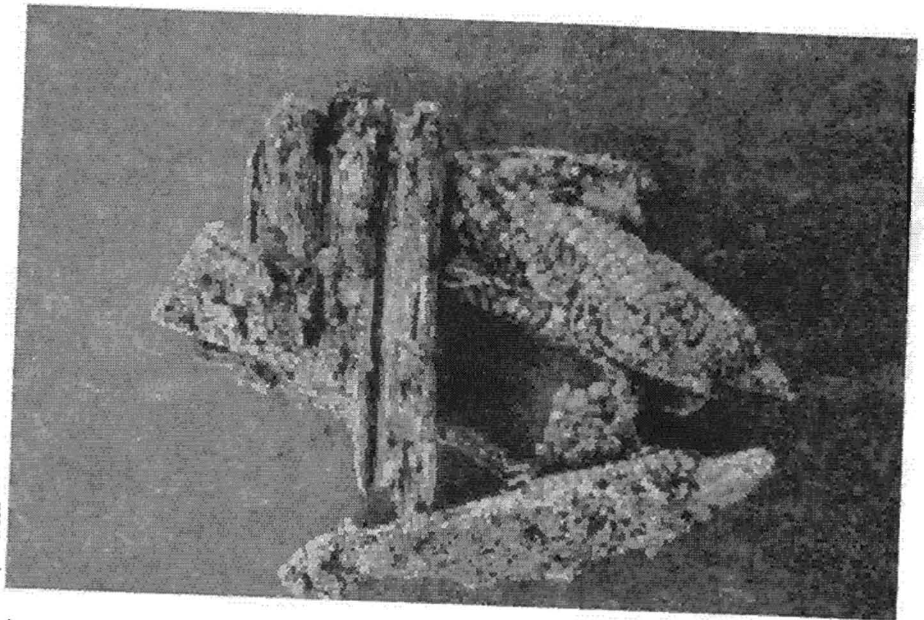

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Figure 6-3 Parts of the vertical poles of the maize crib and ears of maize inside. These were preserved as hollow spaces in the volcanic ash, as the organic material decomposed after the eruption. We poured dental plaster in the cavity, and then excavated the volcanic ash away from the set plaster.

were embedded into the south side of the doorjambs. This door also was closed at the time of the eruption, as with most other doors found at the site so far.

A bodega does not need two rooms. This is quite a bit "over the top" for a bodega, and we suspect it originally was built as a domicile, and later converted to storage. If we are correct, then a part of the conversion was removal of the earthen bench in the back room. And, if we are correct, that could explain why some of its former functioning continued, as someone had just consumed a meal in the inner room, but the dishes had not been washed.

The south room measures 1.8 by 2.6 meters. It had six jar handles mounted into its walls, four for tying the door, as mentioned above, and two to suspend things that we do not understand.

The most prominent internal feature of the south room is a circular maize crib (Figure 6-3) with a maximum diameter of 1 meter. It was made of small (1 centimeter diameter) poles extending upward over a half meter, tied in pairs, and full of corn on the cob that had been husked. At the base of the crib, on top of the earthen floor, leaves were placed in various layers, perpendicular to each other, in part to form a moisture barrier between the maize and the clay floor. Or, probably more importantly, the organic layers separated food from the earthen surface. (The only place where beans were placed directly on an earthen floor is in Structure 12, and they apparently were not food there, but functioned for divination.) A similar multilayering of leaves separated the pile of beans from the floor of the kitchen in Household 1. The crib held at least a half cubic meter of maize, and we found a mouse that had been helping itself to the contents and was killed by the eruption.

The roof of the building was supported by a series of vertical, horizontal, and sloping members, with grass thatch on top. It is estimated to have covered some 26 square meters in total (4.5 by 5.8 meters), of which 7.4 square meters are inside the walls. Almost 70 percent of the area roofed by the grass thatch was outside the walls.

Most bajareque structures at Ceren have more roofed area outside the walls than inside, but usually not quite so high a ratio of outside-to-inside as Structure 4. A few structures are at the opposite end of the spectrum, where the thatch roof extends only a short distance beyond the walls. All of those are the special buildings discussed later: Structures 12, 9, and 11. Structure 9 apparently is a sweat-bath, and its thatch roof protected it from the elements but did not extend far beyond its walls. Structure 12 was a very special building, evidently the location where a shaman practiced, and its roof barely extended past the walls. The roof of Structure 11 was very thin and extended only a short distance past the thatch walls; it was constructed with ventilation in mind, because of the hearth within and the need to let smoke escape. It had no earthen walls that could be damaged by the rains.

A large solid adobe step was located on the north side of Structure 4, which was later incorporated into a raised floor area just outside the north wall, as part of an expansion and remodeling. That elevated extramural surface extends around the northeast corner of the building. A metate elevated on its horquetas was found at the northwest corner, under the eaves. The grinding surface was about 60 centimeters above the floor, notably higher than the mounted metates of Operation 1. The woman who was the principal food grinder of Household 4 apparently was taller than her counterpart in Household 1. The metate's matching mano has yet to be found. Lentz and Ramirez-Sosa (2002) conducted an analysis of the organic residue left on the metate, and it turned out to be cottonseeds. They must have been ground for their oil, used in cooking, or as a base for paint, or both.

The artifacts, portable features, and organic items preserved in Structure 4 clearly indicate its function as a bodega. What is interesting is that it was a bodega and more because it also was an active craft area focusing on processing agave leaves into twine, with some painting, and eating. We begin the detailed consideration of the artifacts in the north room, followed by the south room, and then other areas near the building. Some of the artifacts in the north room were found on the floor, but most were stored high on the elevated shelf. Three pots were found on the floor, on the west side, one of which contained cacao. The floor's east side was free of artifacts. A red paint splotch on the floor evidently was a paint spill that largely had been cleaned up, but some penetrated down into the adobe surface.

The bulk of the north room artifacts were associated with the shelf; most were sitting on top of the shelf but some may have been suspended below it, some could have been suspended above it, and some were in the thatch roof above it. Ten pots were with the shelf, including a ladle incensario, two polychrome bowls, two polychrome tripod bowls, four scraped-slip jars, and an open mouthed bowl. One jar was full of cacao seeds and another held a yet-to-be identified organic material. The shelf also held a piece of a finely woven cotton cloth, a bone needle, a possible bone awl, and some pigment. A few pieces of laja, that were thermally fractured when the roof caught fire, may have functioned as caps to vessels. Many chilies, apparently stored dried in hanging bunches, were scattered in the north room. They probably were tied to rafters. One obsidian blade was stored in the roofing thatch. It broke during the eruption and roof collapse and the two pieces were 50 centimeters from each other, indicating turbulence and item displacement.

A few items fell just north of the north room but probably were inside it before the eruption. They include a scraped-slip jar that was on the shelf or suspended from the roofing, and two obsidian prismatic blades that were in the thatch. Fourteen hemispheres of wood ash were found in the north room, just beyond the room, or around the northeast corner of the building. They are generally or approximately hemispherical, as wood ash was collected from the hearth and placed in a spherical organic container, which must have been a gourd, until it was about half full. Most are between 8 and 14 centimeters in diameter. They seem to be common bodega items because a dozen were also found in the Household 2 bodega. Why none were found in the Household 1 bodega is unknown, and curious. The wood ash probably was added to soaking maize kernels, to soften the shells before grinding, as mentioned in the previous chapter. They would have had to collect wood ash into these gourds, of which the fire had completely gone out. Even a single ember burning could catch the thatch roof on fire and burn the structure down. Although this may seem obvious, a friend of mine in Boulder burned his house down by putting wood ash from his fireplace outside his house, on a windy winter day. A hot coal blew into the woodpile and ignited the wood and then the house.

Much of the floor area of the south room is covered by a woven mat, measuring some 1.3 by 1.5 meters, with five jars placed around its margins. It probably was placed on the floor to make sitting on the floor more comfortable. We are used to living in a world with furniture, but it was their custom to squat or to sit on architecture: floors, benches, porches, and the like.

The south room contained numerous artifacts, some on the floor and some elevated. Twelve ceramic vessels were on the floor, of which nine were Guazapa scraped-slip utility vessels. Six of them had no identifiable contents, but a rodent did get into one. Of the three with recognizable contents, two contained cacao seeds, as identified in the field. One of them had a mixture of cacao and another small round seed and nut shells, and the pot apparently was covered with a layer of fine cotton cloth woven as a cheesecloth or gauze. The rodent found inside that vessel is evidence that the cloth was not sufficient to keep intruders out. One other vessel contained a pointed deer antler tool that could have served as a maize husker and grain remover, as still is done in many areas of rural Central America today.

Another floor-contact vessel was a polychrome cylinder vessel that apparently held a liquid, indicated by the yellowish stain at the bottom. The yellowish color may be an indication that it was a water-and-maize drink, perhaps chicha, the fermented maize beer. The cylinder vessel had two identical nested polychrome bowls placed upside down on top of it, to cap it. The bowl in contact with the vase retained the finger swipes of food from the last person to use it as a serving vessel. One can almost picture the person sitting on the mat, drinking from the cylinder vessel and using fingers to swipe out the food from the bowl. All the food from the bowl was consumed, but not all the liquid drunk, when the eruption began as the last supper ended. This is strikingly similar to the polychrome serving bowl with finger swipes found in the niche of Structure 2. The difference is that Structure 2 is a domicile and Structure 4 is a bodega.

Quite a few items were stored high in the south room, and they include a polychrome bowl, four lajas (including three unmodified and one shaped by percussion flaking), bunches of chile seeds, a celt (possibly hafted), a bone needle (in thatch), and two organic containers. Both the organic containers apparently were gourds. One was not painted and contained seeds, and the other was a small gourd disk that was painted red but had no contents.

The prepared floor to the east of Structure 4 was loaded with delicate and complicated organic items. The only ceramic vessel was at the north end. It is a polychrome cylinder vase found right at the northeast corner of the building. Just south of it was a 35-centimeter diameter basket containing beans. The basket was resting on two laja stones, likely to retard capillary groundwater from affecting seed storage. The basket was coiled on the bottom and supported by small diameter vertical poles around the periphery.

Two portable pole fences were found along the east side of Structure 4, under the eaves. One was opened up and leaning against the east wall of the building, and the other was tightly coiled up and tied in a bundle. Both were made of small poles that were tied together in pairs, using agave fiber two-ply twine. The height of both fences is unknown because only the bottom portion was preserved. The extended fence was 2.9 meters long, but at the time of the eruption only 2.1 meters was stretched out straight. The remainder was coiled up at one end. The coil was around a pair of larger sticks that leaned against the edge of the building and formed the end of the fence. Another fence roll apparently was not being used because it was carefully wrapped up in a bundle of leaves and tied with a string in a loop knot to form a tidy bundle, and left near the other bin. I have only vague speculative ideas about how these fences may have been used.

A few things had been stored above the floor in this area just outside the eastern wall. Already mentioned are the three hemispheres of wood ash that were found near the northeast corner of the building. It is almost certain that the wood ash was stored in gourds, but the gourds disappear to virtually nothing unless extraordinary conditions assist their preservation.

Many carbonized beans were found above the basket mentioned above. They were covered with roof thatch, and had come down with the roof. Some string was found below the beans, and may have been part of a net bag that was suspending the beans immediately below the thatch roof before the eruption. These had been stored for almost a year, as beans are planted about the time of the first maize harvest.

Three pairs of sticks were found outside the northeast corner of the building, under the eves, and another pair just inside the north room. All were about 20 centimeters long and 3 to 4 centimeters in diameter. They probably were used

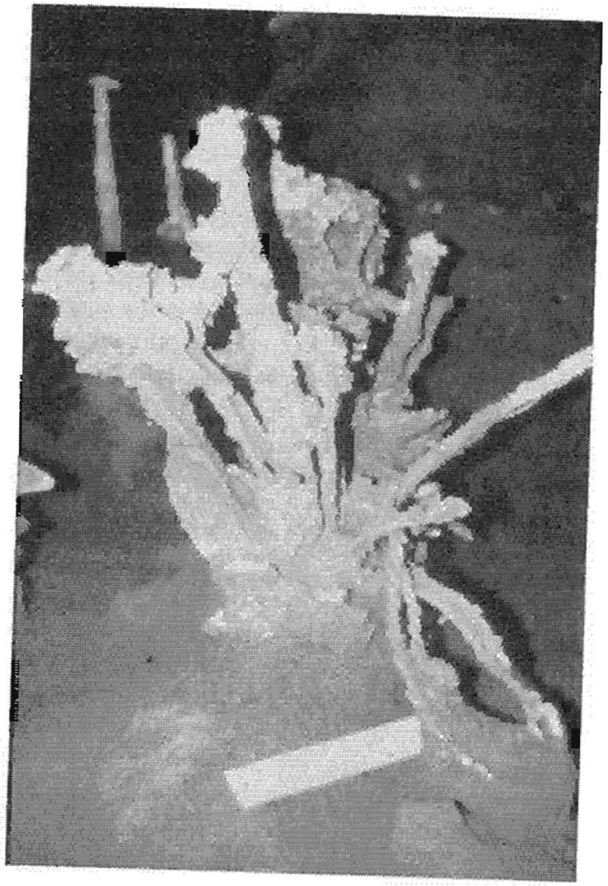
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Figure 6-4 An agave ("maguey") plant in the garden south of Structure 4, with two other plants in the background. As with the maize, this was preserved as a hollow cast in the volcanic ash; we filled the void with dental plaster and then excavated the ash away. The agave leaves were used to make twine and rope, and a piece of rope was tossed onto the leaf at the lower right. It loops over a leaf.

for de-pulping agave leaves, by tying one end of the pair to a pole and squeezing the other end together as the leaf is pulled between the sticks. The wet pulp drips to the ground as the fibers are liberated. The extensive cracking of the clay floor in a 1-meter radius around the post at the northeast corner of the building tells us where the de-pulping was done.

Only a small area was excavated to the west of the structure. Some sherds were associated with seeds that were field identified as pipian. The sherds probably were from a jar that was resting on the west wall or hanging from the roof just outside the structure, and the seeds probably were inside it. There were no floor-contact complete artifacts; this area apparently was kept clean as a walkway.

A zone to the south of the structure was kept clear of artifacts and plants. About 2.5 meters south of the building was an agave ("maguey") garden (Figure 6-4) consisting of some 18 plants. They continue into the unexcavated area to the west and east, where testpits have confirmed their continuation. More than 70 agave plants were growing, which could supply all the fiber needs of about a dozen households. This could be the sole source of agave fiber for the village. All plants have tall central stalks or inflorescences, long leaves, and places where leaves are missing. Those missing leaves were cut off and taken to the other side of the building where they were de-pulped and then processed into fiber for string, twine, and rope. One plant close to the structure had two pieces of two-ply twine draped over a leaf (Figure 6-4); it could have been thrown out as trash or blown against the plant during the early stages of the eruption. It represents the full cycle of growing the plant, removing the leaves, de-pulping, making twine, and then ending its use.

Other plants were growing in the garden. One is field identified as a guayaba tree, and dozens of guayaba fruits were found on the ground nearby. A cacao tree was growing in the area south of the agave garden. About two-dozen sherds, clearly trash, were found in the garden area. One was lodged in the juncture between two agave leaves. Many large branches had been blown off trees to the west of the structure by the eruption and had landed in the garden.

In summary, Structure 4's principal function was as a bodega. An impressive range of grain storage techniques was employed, including drying and hanging, storage in pottery vessels, storage in a permanent crib, and storage in suspended net bags and floor-contact baskets. As with the other bodegas, less than half of the fired clay vessels were directly placed on the floor. The others were on the big high shelf of the north room, on wall tops, up with the rafters, or suspended from roof beams with rope. The garden of agave plants was supplying raw material for cordage on a regular basis, and the craft area was at the northeast corner of the building. The excavated evidence shows a great demand for cordage to fasten roofing members, to make walls and shelves and doors, to suspend pots and hang a variety of seeds and organic containers, and to make grain storage facilities. A wide variety of grains was being stored, including maize, beans, cacao, cotton, guayaba, pipian, and chilies. Future work needs to be done to set the structure into a functioning household complex because the domicile, kitchen, and other possible buildings remain unexcavated.

THE PUBLIC BUILDING (STRUCTURE 3)

Andrea Gerstle (1989, 2002) was the field supervisor for the excavations of Structure 3, the largest building yet excavated at the Ceren site (Figure 6-5). It is 8 meters long, 5 meters wide, and is more than 3.5 meters tall at the rear. Despite the size of the structure, and the massiveness of its solid adobe walls, it had a striking lack of artifacts. The disparity of architectural size and artifact frequency can be expressed by the fact that many structures with less than one-quarter of the floor space of Structure 3 had more than ten times the artifacts. This disparity is explained by Structure 3 being a public building, not lived in, and used only for special purposes. We think a main use was resolving disputes. As with most other buildings, it was oriented 30 degrees east of magnetic north.

First, we will look at the structure's adobe architecture with its thatch roof. Then we will look at the artifacts found inside it and near it. Finally, we will try to look at the structure and its artifacts within the functioning site.

Our first suspicion that there might be a structure at this location emerged during the geophysical survey at that area, using ground-penetrating radar and resistivity in 1979 and later re-checked by resistivity in 1989. A quite pronounced

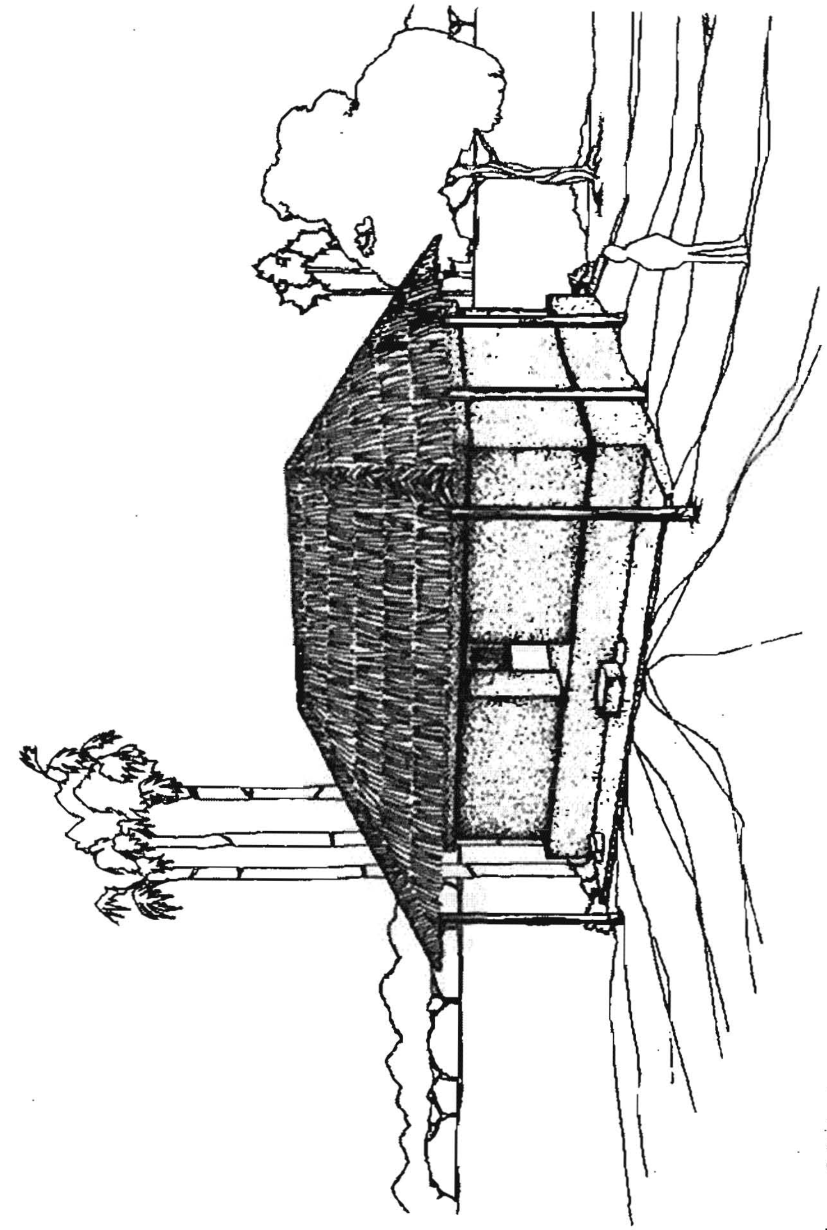

Figure 6-5 Architectural reconstruction of Structure 3, a communal building for the site, or at least for the neighborhood. Note the ample porch and the bench inside the front door. The walls were of thick, solid adobe, and the roof was supported by poles that were not incorporated in the walls.

M-shaped anomaly showed up in the resistivity data, indicating an increase in resistance as one approaches the structure, dropping dramatically, rising again, and then finally flattening out to join the background reading of the site. I am tempted to interpret this as an increase in resistance as the moisture decreases near the building because the tephra layers are sloping away and thus they shed moisture. Certainly, a decrease in moisture results in increased resistance. And, it is tempting to see the building itself as trapping some moisture, and conducting electricity more readily through the fired clay platform, thus creating the strong dip in resistivity in the middle of the "M." However compelling this logic seems, we are not confident that we understand all the variables that are being measured in our resistivity traverses, and the subsurface electrical properties may be more complicated.

The anomaly in the radar imagery that was later confirmed as Structure 3 showed up as a large bulging of tephra layers above the building, and a strong reflector that we now know as the floor of the building. That was seen in the rough imagery, without having to digitize and clean it up. The combination of the resistivity and radar anomalies indicated to us, with no question, that this was an anomaly that needed investigation. The drill rig was placed above the anomaly, and a sample was removed of subplatform mound construction with Ilopango volcanic ash below it, and the clay-laden Preclassic soil below that. This inverted stratigraphy, as with Structure 2, was taken as confirming a cultural anomaly, that is, a buried structure. With excavations, that turned out to be accurate.

Construction began by creating a sizeable mound of clay, measuring perhaps 8 by 10 meters. The platform itself, with its vertical sides, flat top, and right angles, is an impressive construction that measures 8.2 meters long and 5.35 meters wide, with an average height of about 1.2 meters. The platform was allowed to dry and then was fired. As with most buildings at Ceren, the platform surface becomes the floor of the building. One rectangular area of floor settling was noted, along the central axis and toward the rear (west) of the building. It probably is a subsurface feature such as a tomb or cache. It was not possible to excavate it, given the strong conservation ethic under which we are operating. I doubt that it ever will be excavated. Architectural conservation is paramount, so when we excavate the volcanic ash away from a floor, step, wall, cornfield, or other element of the Classic period landscape just before the eruption, we can go no farther. This is frustrating for us as archaeologists because we are missing an important aspect of their activities, subfloor caches and burials. Also, we often leave sloping baulks of volcanic ash inside and outside of walls, or in doorways, to act as reinforcements where the architecture appears to be too fragile to excavate it. This also is frustrating because we must leave some artifacts in situ or undetected, and we cannot fully record all features of walls, floors, and doorways. However, we must operate within the strictures of architectural conservation. In a very real way, the good news is the bad news. The preservation is so good that it necessitates unusual procedures that get in the way of the recovery of some data, but we agree with this important compromise.

The rooms are defined by five walls, four of which cap the peripheries of the platform, and one is the internal dividing wall. All walls were of solid adobe. Because we do not excavate inside of walls, we know little about the details of construction, but we can say that the walls evidently were made by the puddled

adobe technique, rather than adobe bricks. The way puddle adobe is done today is by erecting forms of wood on either side of a segment, and wet adobe (clay, earth, and volcanic ash) mixed with grass is packed inside. When the segment dried enough to hold its shape, the wooden forms were moved upward and another segment was packed in on top of the earlier one, until the desired height of wall was reached. We do not know if wooden forms were used in ancient Ceren, or perhaps they patiently hand-formed each segment. We found no evidence that the walls were fired like the platform. After the walls were constructed, they were smoothed and then finished by the application of a layer of fine clay that varied in thickness from a few millimeters to a few centimeters, depending on the irregularities it was covering. The result was exceptionally flat straight walls, and a visually impressive building. That impressiveness probably was intended, as in all cultures when people build a structure in which disputes are resolved, they build in monumentality. They sacrificed earthquake resistance, but they may have reasoned that people are inside the building only for a short time, in contrast to the very earthquake resistant bajareque architecture of their household buildings. (When I gave President of El Salvador Cristiani and his family a tour of the site, he commented how some things don't change and lamented the hazardous nature of much public construction today!)

All walls extended about two meters above the platform. The western (front) wall was somewhat accentuated in height, as is fairly common at Ceren. It measures 2.1 meters high, whereas the other walls are between 1.8 and 2.0 meters. The interior wall is shorter, at 1.8 meters. The outer walls are thicker, generally thicker than .5 meter, whereas the interior wall is 38 centimeters thick.

A prominent cornice was constructed at the top of the four outside walls, encircling the entire structure. We can think of no utilitarian purpose for the cornice, so we have concluded that it is decorative and was probably placed on the building for aesthetic purposes. The cornice was quite large, being 30 to 32 centimeters in height, and projecting from the building consistently 8 centimeters from the wall. We were surprised to learn that it was not built on sticks that would reinforce it by interconnecting it with the wall, but was held up only by the adhesiveness of the clay. It probably held up well under normal circumstances, but we found a number of places where the buffeting and turbulence of 50 to 200 kilometer per hour blasts from the nearby steam explosions dislodged large pieces. Even the interior partition wall had a cornice along its western side. It projected out the same distance, but was not as tall as the exterior cornice because it was 24 centimeters high. In both cases where walls were penetrated by doorways, the cornices continued uninterrupted above them as parts of the lintels.

The front doorway (Figure 6-6) is the same height as all doorways so far found at Ceren (except Structure 12), 1.5 meters high. It is the widest doorway found so far, at 1.10 meters. The inner doorway is the same height, but is more constricted at .78 meters, only slightly wider than the average household doorway at Ceren. We left the volcanic ash in both doorways because the wooden internal support for each adobe lintel has long since decomposed, and the adobe lintels would soon collapse if not supported from below. Also, the layers of volcanic ash in the doorways provide mute stratigraphic testimony to the phases of volcanic eruptions that entombed the site.

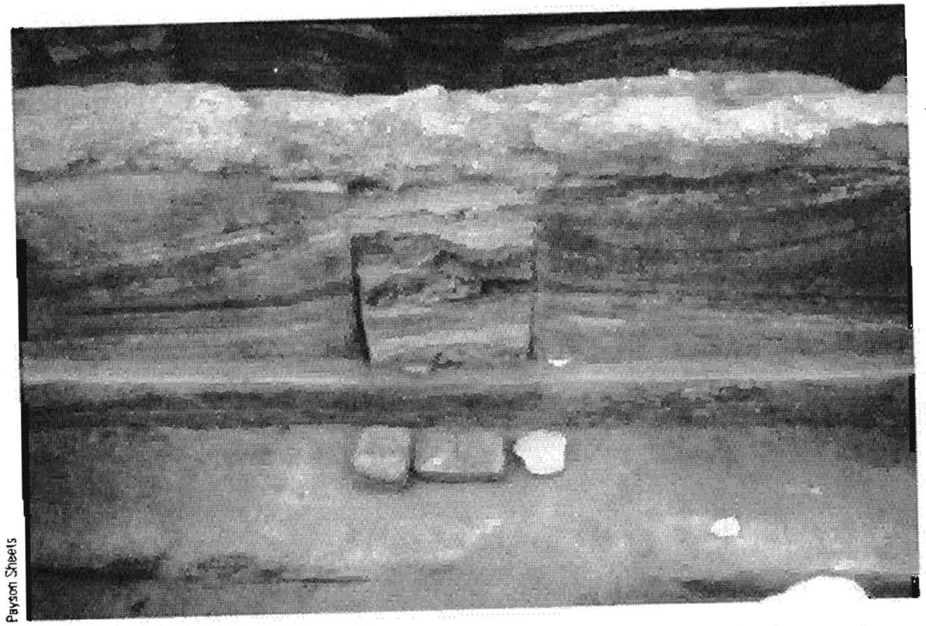

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Figure 6-6 The front door of Structure 3, with the volcanic ash left in the doorway to support the fragile adobe lintel. The "staining" effects of the ash layers can be seen on the adobe wall. A cornice ran around the entire building at the top of the wall. An adobe brick was used as a step up into the front room. The ample porch can be seen in the foreground, with some abrasion from foot traffic to the lower right of the adobe brick.

Immediately inside both the front doorway and the inside doorway were sets of four reused vessel handles, mounted vertically in the walls as ties. Thus, the door could be secured at four points. No direct evidence of either door was found; they likely were made of wooden poles tied with agave twine like the doors of household buildings.

The front room had no other ceramic handles built into the walls other than the four with the doorway. However, the inner room had four additional handles in two corners, which could have been used for suspending dividers or other things.

One thing that impressed me was their confidence in construction. They built an adobe column base on top of the front wall and on the center of the adobe lintel above the main front door. This low, rectangular block of adobe was evidently built to support a vertical post that would assist in supporting the roof. It would have received weight from the roof, and movement during a windstorm, yet it was mounted above an architectural weak point, the middle of the wide doorway. I think that can only be interpreted as confidence that the adobe lintel could hold much more than its own weight.

Four niches were constructed in the walls, two in the front wall and two in the back wall. The niches were very similar in size, varying only slightly from the average of 47 centimeters wide, 28 centimeters high, and 31 centimeters deep. The niche roofs were supported by horizontal poles laid into the wall, like

the niche in the Structure 2 bench. The niche was surfaced by a fine mixture of clay. Only the northeastern niche contained an artifact, a deer bone tool that broke when the roof of the niche fell in sometime after the eruption. It had a spatulate shape, looking very much like a guitar pick, but its use is unknown and I certainly am not suggesting such a function.

The front (eastern) room had two very large solid adobe benches built into it, which took up most of the floor area of the room. After the benches were built, only 27 percent of the internal space of the room was left as floor, and that had to function as a corridor connecting the front door with the door in the internal partition wall. Each bench is notably larger than any of the benches found in domiciles, which occupy less than half of the areas of their rooms. Also, domicile benches are always in the back, innermost room, in contrast to these two benches. These architectural differences, when combined with the artifactual differences, indicate that these benches served different functions than those in domiciles. After finishing the discussion of architecture and artifacts, we will come back to the use of these benches.

A long porch was constructed along the front of the building. It is only slightly shorter than the building, measuring 7.88 meters, and it averaged 1.1 meters in width. It apparently was built after the structure, as a later addition or remodeling. At three places along the edges of the terrace, erosion from foot traffic was discovered. These traces varied in intensity, and they give us direct evidence of where people walked in and out of the building. The most foot traffic exited the building and headed slightly to the left, toward the east. Or, people came from the east and reversed the flow along this route. The second most traveled route exited the doorway and headed sharp left, hugged the front wall, and slipped down around the corner and headed west. The least traveled route headed sharp right out the door, slipped around the corner of the building, and headed west. These traces of foot traffic are arrows for us, pointing to where people went as they left the building. As archaeologists, we are interested in the pattern of human movement within the site. Future seasons of work will follow their footsteps to the places east and west of the structure.

The step up from the porch to the floor was a sizeable one, and it was facilitated by someone placing an adobe brick along the platform edge just below the doorway as a step. This is the closest we have come to finding an adobe brick being used in architecture at the site to date, even though adobe bricks were found in storage, under the eves of Structure 2. The brick measures 67 by 35 by 11 centimeters, and had cracked during use, before the eruption. It helped a bit, in stepping up from the brick onto the floor, but more than a half-meter remained to get up to the floor. I wonder why adobe bricks were used in such huge numbers at the elite site of San Andres and not at Ceren.

It seems ironic that the largest roof excavated so far, built to protect the largest building we have found so far, structurally was the most independent of that earthen structure found to date. Most buildings have bajareque walls that have their principal reinforcing members, the vertical poles, firmly tied in with the roofing members, providing strong interconnections. In contrast, the roof of Structure 3 was largely independent of it, being supported by tall poles sunk into postholes outside its walls. It was also supported by some vertical poles resting on top of the solid adobe walls, but not penetrating down into them. There were two of these clay post supports on top of adobe walls, one in the middle of the eastern wall and one on top of the western wall. In addition to these, five other clay pedestals were found beyond the building that probably were vertical post supports. Also, one large cobble and two lajas were on the northern part of the porch, probably for roof pole support. The lajas were built into the adobe surface during construction. Thus, the primary support for the roof was provided by posts anchored in postholes and by posts on adobe pedestals, with ancillary support by posts resting on the adobe walls. In not a single place was there evidence of a building-roof structural connection, despite the large size of both.

The roof itself was primarily of grass thatch, with some palm. The peak of the roof, not surprisingly, ran along the long axis, above the internal partition wall. The dimensions of the roof are unknown, as the edge of the roof has been found only on the eastern edge. The roof measures more than 11 by 8 meters, but how much more is unknown, as some of the outer edges have yet to be excavated. Thus, the roof covered over 90 square meters, of which 40 square meters consisted of walls and the area inside the walls. Again, more space was covered outside the walls than inside.

A few lajas were placed on top of the thatch roof, on the west side of the building. They fell with the collapse of the roof, and they were thermally fractured by the burning of the roof. Why they were on the roof is unclear. The only reason I can think of is perhaps they were weighing down a section of roof that was considered prone to wind damage.

A complex framework of posts and beams supported the thatch roof. The larger wooden members were as much as 13 centimeters in diameter, and the smaller ones were as small as 3 centimeters in diameter.

Given the size and complexity of the structure, it initially was a surprise to us to find so few artifacts inside. That was particularly perplexing given the direct evidence of many people entering and exiting the building, in the form of porch erosion. Only three artifacts were found in the front room, two pots and the bone tool in the niche described earlier. The pot found on the southern bench is the largest vessel found at the site to date. It is a Guazapa scraped-slip vessel that is more than 60 centimeters high and 65 centimeters in diameter, with a large open mouth. Clearly, it was not for cooking, grain storage, or hauling anything. It probably was for keeping and dispensing a liquid, and dispensing a lot of it, given the size of the vessel. Not far away was the only other ceramic vessel found in the building, a large Copador melon stripe polychrome bowl. It was resting on top of the inner partition wall above the same bench. It could have been used to dip the liquid out of the big vessel and dispense it. The Copador vessel broke during the eruption and deposition of the volcanic ash. Most of it stayed on top of the wall, but some sherds fell onto the bench.

Only two artifacts were found in the inner, back room. The only one that was in floor contact was a donut stone in the northwest corner of the room. It was resting on its edge, at a slight tilt, much like the two in Structure 6. It probably had a stick in the hole, which held it in that position while the tephra accumulated, and then it decomposed in the years after the eruption. We could find no evidence of that stick. The donut stone was not decorated, but it was very well formed. It had been used extensively, judging by the use wear in the perforation. It probably was used as a perforated mortar, judging from a black organic residue still adhering to the artifact. It is particularly visible on the inside of the perforation and a little bit of the top. If a stick was holding it in position, and it was a mortar, then the stick would be the pestle. As with the other donut stone found on the porch (see later), it was undecorated but very well formed.

The other artifact from the back room is barely an artifact. It is a very large stone, almost the size of a basketball, that had its corners pecked smooth by a hammerstone. Surprisingly, it was not found on the floor, but it had been stored up high, either on a wall top or in the rafters. We do not know why this stone was so shaped, or why it was stored up high. It crashed down early in the eruption, before Unit 3 was completely deposited.

As with two other household structures at Ceren, this building also had an organic container holding the Ilopango ash-water-grass mixture suspended in the middle of the back room.

Some incised designs, or graffiti, were found on the south wall of the inner room. They are a series of lines and punctations. We have puzzled over them for quite some time but have not reached a consensus as to what they depict. One thing I have learned, over the years, is to be careful in interpretations of ambiguous things. Often the interpretation tells more about the interpreter than the item being interpreted. Hence, I have enjoyed other people's interpretations that run the gamut from sexual to religious, from maps of where the gold is buried to scenes of war. They could also be nothing more than the scribblings of a bored child. Certainly none of us ever scribbled on walls in our houses when we were young (yeah, right!), but it may have happened in prehistory.

A few other artifacts were found on the porch. Two were in contact with the adobe porch surface immediately outside the front door. A Guazapa scraped-slip storage jar was found resting against the edge of the platform, to the south of the front door. It had seen quite a bit of use before the eruption, as its top and two handles had been broken off, and its bottom was heavily abraded. It was still in use right before the eruption, however. Near it was a donut stone, resting on the porch and the platform. Given its position, it probably did not have a stick in it at the time of the eruption. The donut stone was a relatively small one, with significant use wear and a little organic residue in the hole. This specimen likely was used as a portable perforated mortar. Grinding hard organic materials such as nuts was important at this public building, but in what context, and why, are not known.

A Guazapa scraped-slip vessel was found on the southeast corner of the porch, in highly fragmented condition. It probably fell from the roofing and shattered. It is one of the few, perhaps the only, vessel that has been found in the site to date that fell before any detectable volcanic ash had dusted the surface. Also, a large sherd apparently had been tucked above and just outside the main door, within the roofing, and fell during the early stages of the eruption.

Those are the only artifacts found in the two rooms or the porch. Around the outsides of the building were some scattered small sherds that were clearly discarded as trash, but not very many. It was maintained as a remarkably clean building.

A number of artifact categories are notable for their absence. Not a single piece of obsidian was in or around the structure. The usual pattern of people placing their obsidian knives or scrapers in the thatch of the porch or just inside above the doorway was not practiced here. All the cutting and scraping functions so common in household buildings were not done here. There were no manos or metates, no celts, no hematite lumps, no painted gourds, and no baskets. The usual suite of household ceramics is largely missing.

So, how did Structure 3 function within the community? It was not a part of a household, but the abrasion on the porch indicates that it was used a lot by local residents. Architecturally it is the only building found at Ceren so far that could have held dozens of people, probably the entire village, in its two ample interior rooms and the broad porch. Also, it has the widest doorway found to date at Ceren. The area east of the porch was a hard packed open area that served as a plaza for the building. It has two very large benches in its front room, one of which has a big pot probably for dispensing liquids. By Maya standards, large benches in front rooms of larger-than-usual buildings in a community are seats of authority. I think this is the clue to function of the building, that people would sit on the big benches and make decisions for the community. It is likely that the village elders would listen to disputes, resolve them, and help "seal the deal" with liquid dispensed from the large pot on the south bench. The polychrome bowl on the wall top nearby may have been for dishing it out. The building has a monumentality to it that puts it apart from the household structures, and substantiates it as a locus of power.

THE SAUNA (STRUCTURE 9)

Just 7 meters south of the bodega of Household 2, we found a sauna. The ancient Maya used saunas for physical and spiritual cleansing, and they are still so used by traditional Maya today. Saunas are often found in the big Classic period Maya cities such as Tikal, made out of limestone masonry, and located in elite sections of those cities. This is the first well-preserved earthen sauna found in Mesoamerica, and it is in a commoner setting. It compares favorably in size with the masonry ones, and it could seat some ten people inside.

Structure 9 (Figure 6-7) is the third building in Operation 2 to be excavated. It was excavated under the field supervision of Brian McKee (1990b, 2002b). The first two structures are the domicile and the storeroom of Household 2, and it appears the household supported the use of the sauna. The household maintained an unusual number of pottery vessels that could have provided water for sauna users. They used water to pour over the rocks to create steam inside, and they could have rinsed off after exiting the sauna.

The first suspicion that there might be a structure at that location occurred when tephra layers were being removed, one after another, and Units 10 and 11 were noted to be bulging upward. As tephra layers were removed down to Unit 8, the bulging became more pronounced. Sure enough, when Units 5 and 4 were removed, the corners of the adobe structure were encountered. However, we are talking of the excavations sequence, from the top down, and we usually document buildings from the bottom up, in the sequence of construction.

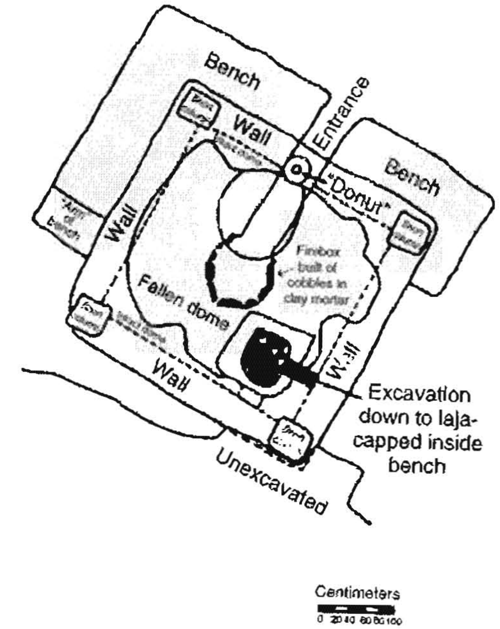

Figure 6-7 Map of Structure 9, the probable sauna. A thatch roof protected the earthen dome from rain and sun.

The building was built on top of a sizable clay substructure, larger than most. Then, a substantial platform was built of clay, measuring 3.8 by 3.8 meters, rising a half meter above the original ground surface. Instead of having an adobe top like all other known platforms at the site, the top of this platform was made of laja stones laid in a clay mortar, at least in the southeastern area. This surface forms the floor, or better stated the seating surface, inside the structure. A seating surface of laja stones would be more practical than an earthen surface in a sauna where people are perspiring. A 1- to 2-centimeters thick surfacing of volcanic ash from the Ilopango eruption covered the laja floor. The building is oriented 30 degrees east of magnetic north, like most structures at the Ceren site.

Short, thick walls of solid adobe were constructed on top of the platform. They are a meter high and some 35 to 40 centimeters thick. The walls are capped by a large cornice. The cornice was 27 centimeters high and 7 centimeters thick, and thus is only slightly smaller than the cornice on Structure 3. The corners of the structure have short column bases of adobe. Those square column bases provided support for horizontal beams that supported a thatch roof.

So, the building had two roofs, one of adobe and one of thatch. The roof that was built directly into the building was an architectural masterpiece, an impressive bajareque dome (Figure 6-8) rising some three-quarters of a meter in the middle. It was internally reinforced by sticks 1.5 to 2 centimeters in diameter every 20 centimeters. It was somewhat thicker than many bajareque walls at the site, being 10 to 15 centimeters thick. The domed roof of clay was a significant engineering accomplishment, and a big surprise to us as Mesoamerican archaeologists because we had no idea that they had this technical sophistication. The underside became thickly coated with black soot from the burning of a lot of

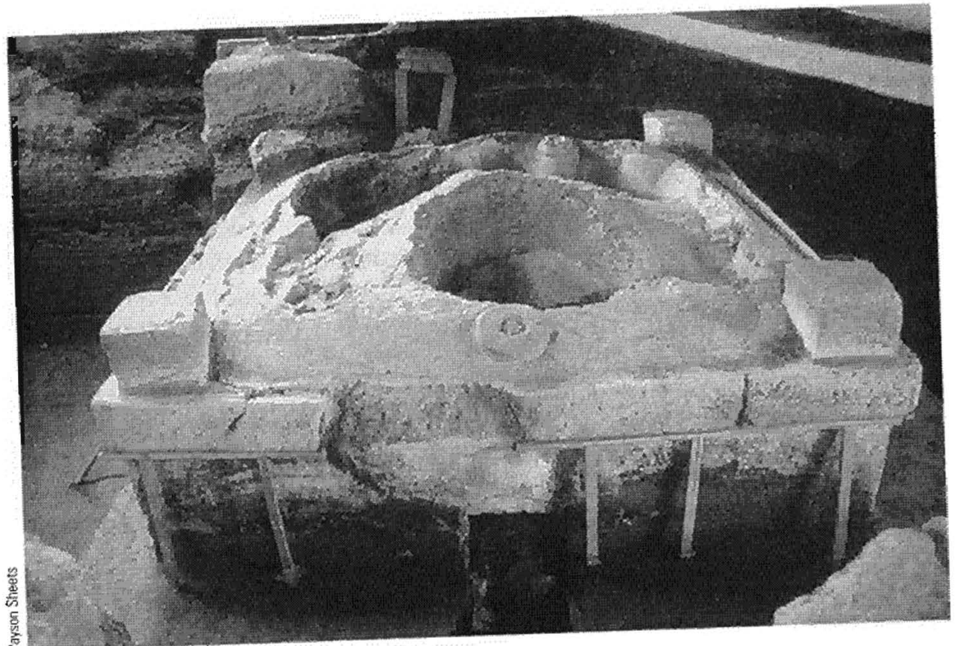

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Figure 6-8 Structure 9, looking south. The bajareque adobe dome was destroyed in two areas by lava bombs. The dome originally was protected by a thatch roof supported on roof beams resting on the four short adobe columns.

wood. Above the domed roof was a thin roof of thatch, surely to protect it from rain and sun. The distance between the earthen and the thatch roof was short, probably less than a meter.

The outer periphery of the dome is still in its original position. The majority of the dome has dropped down a bit, but generally retains its original shape. The preservation of this marvel is so good that we decided we should not excavate through it. It must be preserved for posterity. However, as archaeologists we wanted to excavate below it to see what the floor is like and search for artifacts that can reveal the building's function. Unfortunately, a lava bomb blasted one corner of the bajareque dome into tiny fragments. However, this damage did provide an opportunity to excavate a small test pit down to the interior floor, providing a glimpse inside. A sizable firebox was built of river cobbles set in clay mortar in the center of the structure. Its chamber is about 80 centimeters in diameter and 80 centimeters high, with walls sloping inward toward the top. Its outside diameter is estimated at about 1.75 meters. Thus, it occupies a significant amount of the interior space, almost one-third of the floor space. The clay mortar between the stones was oxidized bright orange by intense fires. The firebox chamber was reached by a narrow doorway low on the structure's north side. The entry was only 50 centimeters wide and 80 centimeters high, with two beams covered with adobe to form the lintel. This is barely enough room for an average-sized adult to crawl through, so there was a strong selection against the corpulent, at least at this entrance. The water poured on the firebox, that did not

turn to steam, ran out the north entryway of the building, west along the building edge, then south away from the building. There was no evidence of a door, but it is likely they had some way of closing the entrance after people crawled in, to keep the steam and heat inside.

Above the entryway, on the outermost edge of the sloping dome, is an adobe "donut." This feature was carefully built into the structure. It is a circular flattened ring or disk of clay with an outside diameter of 35 centimeters and an inside hole 10 centimeters in diameter. The hole was plugged with an irregular adobe chunk. With the plug removed it would have provided ventilation, and thus could have assisted in regulating the internal temperature, and let the smoke out of the interior before people entered.

An extensive and rather elegant bench encircles the structure's north end, wrapping around to continue along both the eastern and western walls. It has a short gap along the north side for the entrance into the firebox. The bench is more ample on the west side, even with a triangular arm or bench termination at its southwest corner. It certainly looks like a bench designed for reclining or resting after exiting the sauna. A few meters farther west were a set of stone seats, where someone could sit on a flat rock and lean back against a sloping laja. The seats were concentric, facing toward the entrance to the sauna. They could have been used for rituals before or after sauna use, or both.

Although the building is sizable in plan view, the adobe roof is by far the lowest roof found at the site to date, and the interior space is constricted by the presence of the large firebox in the center. Around the edges of the room, there is only about 1.2 meters of headroom, and in the center, the distance from the floor to the dome surface would have been about 2 meters. One would enter by crawling in the low northern entrance, and then crawl up onto the seating surface. There is room to sit but not to stand up anywhere inside the sauna.

Along the east side of the structure, a zone about 3 meters wide was maintained clear of artifacts and plants. The thatch roof extended over about a meter and a half of that zone, leaving another 1.5 meters of open walkway. Both the area under the thatch and beyond were well compacted by significant foot traffic. Beyond that was a maize milpa (see Figure 5-9). The milpa was not compacted by significant foot traffic. Apparently, they had learned how compaction inhibits plant growth. As with most planted species we find at the site, the maize plants were encountered as hollow tephra casts around plants that had decomposed. As with the milpa of Household 1, microtopographic slope management procedures were followed, by constructing soil ridges and planting on them. The maize was planted, with multiple sproutings per locality. The "wavelength," from ridge top to ridge top, was about 80 centimeters. The ridges run parallel to the northern and southern walls, and thus follow the spatial organization of the site. This certainly was a well-ordered landscape, with the buildings and the maize plants all lined up in the proper water-associated direction. In addition to the ridges, additional mounding of the soil often was done around the maize stalk clusters, perhaps to decrease the chances of wind throw.

The area to the west of Structure 9 was very different from that to the east. The entire area was clay-covered as a deliberate finished surface, including the area with the stone seats. A steep dip or ditch runs from the structure's southwest corner toward the southwest, and it is loaded with discarded broken artifacts. It contains many sherds and some chipped and ground stone artifacts. This is general domestic trash from used and broken pots, broken but generally still sharp obsidian knives, and other discarded junk, probably just from Household 2. It also contains maize cobs without the kernels, leaves, and tree branches. This looks like the edge of a trash disposal pit. It will be excavated stratigraphically, some time in the future, to get a window on the past of the Ceren site. To date, all we have excavated existed at the instant of the eruption.

In summary, Structure 9 clearly was designed as a sauna. It could have been used by members of any household, or by groups based on gender, age grade, or other criteria. It is an elegant and elaborate structure, with its surrounding bench and arm, a well-made cornice running around the entire building, a very impressive dome with four adobe column bases at its corners, a domed firebox with a sunken floor and accessway, a protective thatch roof, stone seats, and prepared surroundings. Not a single artifact was found inside or nearby outside. Household 2 likely profited from maintaining the sauna for village use, as people would exchange crafts or commodities for the privilege of taking a sauna.

SUMMARY

In this chapter we examined three structures, each of which informs us about aspects of life in ancient Ceren. Structure 4, the bodega for Household 4, had much the same contents as did the other bodegas. It also stored some unusual items, including cacao in vessels, and tools to depulp agave leaves for fiber. It had cotton cloth as well as cotton seeds ground on a metate. The building apparently was remodeled from a domicile to a bodega, and that may have been a reason why someone had consumed a meal inside but not yet washed the dishes. They may have gone to Structure 12 for the deer-maize harvest ceremonies right after dinner, but never returned because of the emergency evacuation. Near the structure the household grew over 70 agave plants, chili bushes, cacao and some fruit trees.

Structures 3 and 9 had massive solid adobe walls, and were public buildings. Structure 3 had large benches in its front room, probably serving as seats of authority, where the village elders may have resolved disputes. Its ample porch faced onto the civic plaza. We have confirmed but not yet excavated another solid-walled building bordering the plaza on the south, and two strong anomalies on the east edge of the plaza probably are buildings as well.

Structure 9 was a community sauna maintained by Household 2. If recent Maya use of saunas applies to it, both physical and spiritual cleansing were done by people of all ages and both genders. It had a long exterior bench attached to it, and a series of stone seats with backs nearby. People likely prepared themselves for the sauna, and rinsed themselves with fresh water after exiting from the sauna, in those places.

7/The Religious Complex

Here we look at a pair of buildings that were dedicated to contacting the supernatural domain. Before getting into them in detail, I need to mention that to call these religious should not imply that other buildings were not religious in one way or another. In fact, the Maya and other Mesoamerican peoples could not imagine an inanimate building, artifact, river, or mountain. Everything had a spirit, some stronger than others, and a result of this belief, they had a strong respect for nature. All household buildings except Structure 5 had incense burners, which were used to contact the supernatural domain.

But these two buildings functioned primarily to exclusively for religious purposes, so that is why I isolated them for special consideration here. As the Maya so often preferred, they were built on the highest spot in the site, and they are on the east side, closest to the water of the river. They are the only two buildings to not follow the 30 degrees east of north orientation, probably to indicate their specialness. They share some other features, in contrast to all other buildings excavated so far. They both were painted white, with a mixture of fine white Ilopango volcanic ash mixed with some organic binder. They both had some red painted decorations on their walls. They both had progressively higher floors as one moved from the secular outside to the innermost room, a deeply Maya characteristic of sacred architecture. And both had architectural features that deliberately deviated from the massiveness of public construction (Structure 3) and from the durability and practicality of household architecture.

BUILT FOR DIVINATION (SHAMANISM; STRUCTURE 12)

Structure 12 (Figure 7-1) was excavated during December of 1990 and January of 1991 (Sheets and Sheets 1990), and in 1992 (Simmons and Sheets 2002). It does have features found at many other structures at Ceren, including solid columns, bajareque walls, a large fired clay platform, a thatch roof, and some artifacts that were "up," that is, on wall or column tops. However, the differences outweigh the similarities. Besides being one of only two buildings excavated at Ceren that was painted white inside and out, with some red painted decoration, it is the only

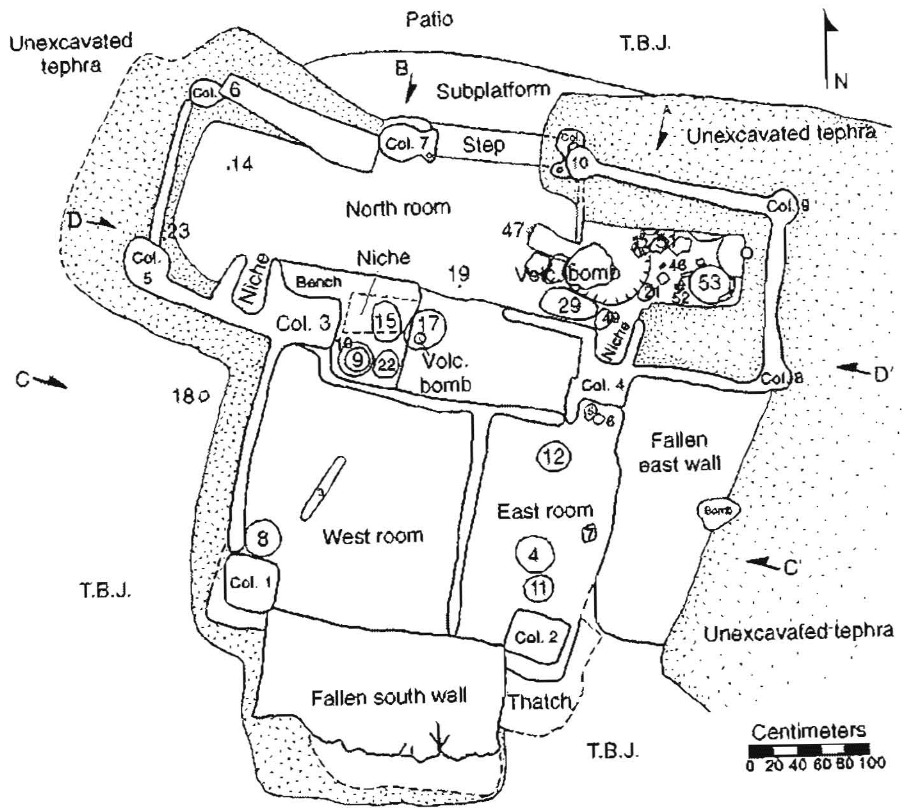

Figure 7-1 Map of Structure 12, architecture and artifacts.

bajareque structure with no artifacts stored in roofing thatch. It is the only one to have a window, and it actually has two. It is the only one to have vertical niches, and it has six of them. Vertical niches are spaces that are enclosed on three sides; because most are associated with columns, the space is vertical.

Structure 12 is the only one to have a broad spreading enclosure in front, enclosed with bajareque walls and columns, to form what we call the north room. It is the only one where access to the inner room was made very complex by many changes of direction, barrier walls, a low beam, a double pole door, an entry so small one needed to crawl through, and five changes in floor level from outside to the back room. It is the only one with an orientation 15 degrees east of north. It has more columns than any other structure; most structures have four columns, yet it has ten. It is the only one with round cornices on the platform. It is the only one with Ilopango tephra in the core of a wall.

The artifacts in Structure 12 do not represent a functional assemblage in the way that the bodega assemblages from Structures 4, 6, and 7 indicate storage, or the household domestic assemblages indicate living areas as in Structures 1 and 2. Rather, the artifacts in this structure may have been brought individually and left, as offerings or payment for services rendered. Many had seen considerable use.

The term *heirloom* might apply to some. Others are quite functional, such as "chicha" pots and a deer antler tine. And some were pretty well used up, as exemplified by an obsidian blade. The artifacts are not elegant. Many seem to have been carefully placed, such as a pot gently placed on oliva shells, and a mano on a layer of wood ash.

This evidently was a structure where a shaman practiced. Strictly speaking, *shamanism* is defined for Siberian religious specialists, but the term is broadening and is almost synonymous with divination. Our most direct clues that divination was taking place in the building were the three piles of items that are cast on the floor so their patterns can be "read" and the future foretold. Two were piles of beans that were right on the earthen floor (and thus, by Ceren standards, not food). The other was a collection of minerals kept on top of an inner partition wall. Beginning 500 years ago, the Spanish spent centuries trying to eradicate shamanism, as it was considered the work of the devil. They did not eliminate it, but drove it "underground" and a diviner today would not dare build a building that overtly advertises the craft.

While we were beginning to excavate the diviner's building, a friend of mine in San Salvador went on vacation and loaned me his cell phone for a month. We all knew it would not work in the Ceren area because it works on line-of-sight transmission, but it worked fine while I was in the capital. At one point, at the site, I was fiddling with it and kept receiving "out of zone of service" messages, as expected. However, as I walked over to this building and tried it once more, I was shocked to get a dial tone. I was sure that was a malfunction, but to try it I dialed the number of a biologist in San Salvador, and to my astonishment she answered. She was worried about me because I was mumbling incoherent things. All of us from the United States were flabbergasted, but all the local Salvadorans were quite comfortable with this. They said this building has been a center of communication for centuries, so of course the cell phone would work there. We sometimes live in different worlds.

Structure 12 was built on top of an informal clay mound, as with most buildings at the site. Formal construction began with the half-meter high platform that measures 3.2 by 3.7 meters. Rounded cornices decorate all edges of the platform. Four columns were inset slightly from the platform corners, and bajareque walls were constructed to link them. The east, south, and west walls ran straight and directly connected to the columns. However, the north wall did not directly connect the two columns on the north side of the platform. The wall was inset to the south, creating two vertical niches to the south of columns 3 and 4. Because earthen columns received such special treatment, they probably had a richness of meaning that is largely lost to us. They may signify connectivity between the ground and the sky, but we must admit that much of their significance eludes our understanding.

All surfaces of the walls, columns, and platforms were painted white, using a mixture of white tephra from the Ilopango eruption and a binder. Tephra from Ilopango was also used as a core for bajareque wall construction in the north room. The result is a "sandwich" of unconsolidated volcanic ash between layers of clay surfacing. That resulted in a much weaker wall than one with good quality clay-laden adobe. There may have been some kind of symbolic importance

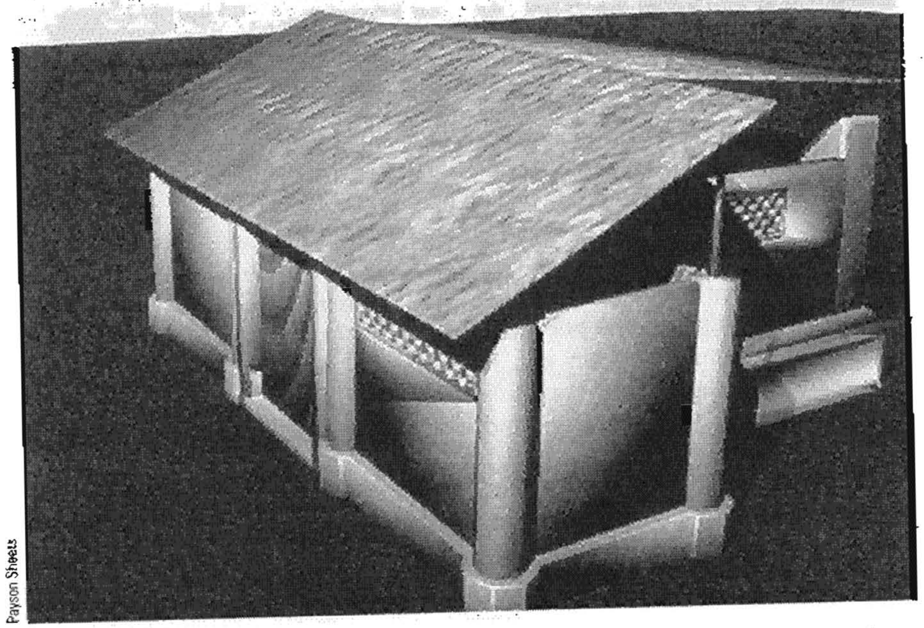

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Figure 7-2 Electronic (computer) reconstruction of Structure 12. People apparently would approach the building, often with an offering and communicate with the shaman through the lattice window. Then, as the shaman was doing the divination, the client would walk around to the back of the building to receive the results through the other lattice window. The building was exclusively for divination, and nobody lived inside.

of using the white volcanic ash from the big Ilopango eruption that occurred centuries earlier. And people deliberately sacrificed earthquake resistance in this overtly religious structure, vaguely analogous to what they did in Structure 3, their big public building.

The north room was created by erecting the round columns and connecting them with the "sandwich" bajareque walls. The north room wall has six earthen columns, circular in section, at each of its corners, for a total of ten columns in the building. A lattice window was built into the west side of the north wall (Figure 7-2), and we believe people would approach the building and communicate their divining needs to the shaman inside here. They often left offerings on top of the wall or column, or on the lintel above the door, which we found. They include two spindle whorls (for making cotton thread) and a carved greenstone disk, and a few obsidian artifacts. Then when the divination was in process inside the building, the client would walk around to the back of the building to receive the results, through the other window.

That second window is in the west wall (Figure 7-2) and someone hearing the result would have to look up. The diviner had stepped up to successively higher floors in moving to the back innermost room, as the client walked slightly downhill from front to back. The window is 39 cm high and 86 cm long, apparently

made of five sticks slanting right-to-left and five slanting the other direction, in a wooden frame. The sticks and the frame were covered with adobe, smoothed, and painted white, resulting in a lattice window and a rounded molding. The lattice pattern may have had symbolic importance, because the hair on the heads of people I think are diviners depicted on polychrome pottery had the same design.

Many artifacts can be used by males and females, as recorded in southern Mesoamerican ethnographies and as one can see in traditional communities in the area. However, some artifacts are quite strongly associated with ideal gender activities, such as those used by males engaging in agricultural field planting, weeding, and harvesting. Strongly female-associated artifacts are spindle whorls and food grinding artifacts, both of which were found as offerings at Structure 12. There were no male-associated artifacts found anywhere in or near the building. That has led us to conclude that the diviner probably was a woman. Therefore, I will use the female pronoun for the rest of this section, and state that given the closeness of association of Household 1 in supporting and maintaining Structures 10 and 12, it is possible that she was a member of this household.

The shaman entered the building by detaching the double-pole thick front door and crawling in. I do mean crawl because it was less than a meter from the floor to the lintel. The inside walls of the north room were painted red, with a broad horizontal band with vegetative designs, apparently leaves, emerging from it. Once inside the north room, she had to her left a large number of items she evidently had received as payment for services rendered. They included at least five pottery vessels, one of which was full of corn kernels. A large lava bomb landed in this area and did a lot of destruction to artifacts and the floor of the building.

Her first step up from the north room was onto the floor by the bench. In the niche that is under the bench were some special artifacts that likely were part of her "supernatural tool kit" that assisted her contacting spirits and deities (Figure 7-3). Diviners today often pick up an item that catches their eye, at a time and place where they had a particularly successful contact. We think that was also happening at Ceren, and explains why some of the artifacts don't make sense in a practical, utilitarian way. The niche artifacts included a small pile of beans, a deer antler with holes for insertion of feathers, shell fragments, an animal head ceramic figurine, a human female figurine, and a ceramic ring. On top of the bench, she stored a collection of five pots, all empty as far as we could tell. As she stepped up with the niche on her right, she also was stepping past the mineral collection she had placed on top of the wall to her left.

As she continued into the building, she would duck under the low lintel and through the narrow doorway into the east room. The lintel was unusually low for Ceren, barely over a meter. She stored her own personal set of matching pottery vessels in this room, two of which are a very close match to "chicha pots" in El Salvador today, which hold fermented maize beer. One pot was gently placed on top of four oliva shell beads. She also stored her other pile of beans on this floor, presumably used in divination.

Inside the building, her final step up into the innermost room was again through a very narrow and low doorway, into what we call the west room. This is the largest room in the building, and the floor was kept more clear of artifacts

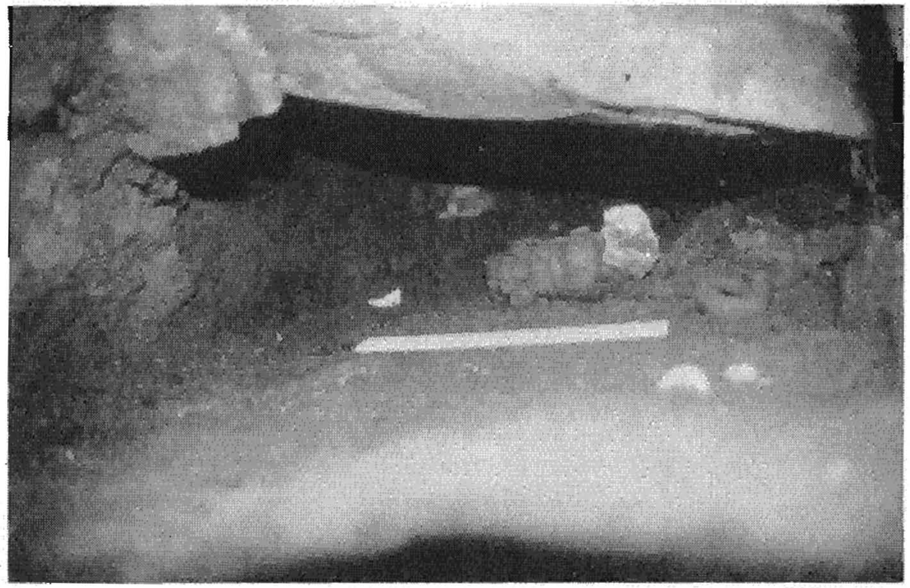

Figure 7-3 Looking into the niche in the north room bench, under the large laja that forms the roof (top of photo). To the right of the scale, which is 15 centimeters long, is a ceramic ring, and above the scale is a female figurine made of fired clay. Just beyond the figurine is a part of the inner skull bone of a deer; the antler tine is attached but cannot be seen because it is behind the figurine. We believe this was the shaman's supernatural "tool kit."

than elsewhere, probably so casting the beans or minerals could be done more effectively. The only artifact in the room was a large empty vessel in the corner. After interpreting the pattern she saw on the floor, she would communicate the results through the lattice window to her client waiting below.

A feature that only Structure 12 has is a series of four vertical niches, vertical enclosed spaces on the north and south of the two principal columns of the building. The bottom of the niches had seen considerable use, as they were use-polished and darkened by organic spills. One had a layer of wood ash placed in it, with a small mano on top of it. Another had a small painted gourd in it, that fell out onto the floor during the turbulence of the eruption. I wish we understood the meaning and the rituals associated with columns and these vertical niches.

In summary, Structure 12 is highly unusual architecturally and artifactually. Most buildings at Ceren have most of their artifacts in elevated storage, suspended from the ceilings or on elevated shelves, but Structure 12 had none. All walls and columns were painted white, and some were then painted red. The building does not follow the standard 30 degree east of north orientation of the site. The principal inner room is difficult to access. The floor levels are quite variable, and doorways are narrow and low. There are numerous vertical niches associated with columns. The artifacts are individually placed, and some seem to have been in people's possession for some time. It is the only building excavated to date with a lattice window, and it has two. The structure evidently was built for a single purpose: to house the practice of shamanism. It is not the

dwelling of a shaman. The shamanic tradition continues in Central America, and it is a rare town that does not have at least one. They are employed to predict the future, determine the best days to go to market, get the spirits on one's side, or assist in curing illnesses. Based on gender associations of artifacts brought to the building, we believe the diviner was a woman.

THE VILLAGE CEREMONIAL CENTER (STRUCTURE 10)

Structure 10 is the other building in the religious complex maintained by Household 1. It is exactly half way between Household 1 and Structure 12. It was used for village ceremonies, which included feasting and performances. Between the ceremonies, it was used to store festival paraphernalia such as masks. In contrast to shamanism, which dealt with one person at a time, this building supported rituals that involved many households. Based on all the materials in it, the entire village may have participated. The eruption interrupted the ritual before it was even half completed, based on the amount of food yet to be dispensed from inside. Linda Brown and Andrea Gerstle (2002) provide a detailed description and interpretation of the architecture, artifacts, and activity areas.

Structure 10 (Figure 7-4) shares some similarities with Structure 12, in that both have quite sizeable enclosure rooms/corridors added on to the fronts of two-room main buildings, they divorced themselves from the usual 30 degree orientation, they had successively higher floors as one moves inward, they had unusual numbers of earthen columns with special properties, and their walls were painted white with some red decoration.

This section is organized as one would move into the entrance, through the two corridors, and then into the main structure. The basic construction is familiar, with a large mound for drainage corresponding to the dripline and, of course, the total roofed area of about 53 square meters. The entrance (Figure 7-5) is at the northeast corner, which had a pole door that could close it off. Someone who opened the door and stepped up would be entering the north corridor, a long (4.5 meters) and narrow (2 meters) space dedicated to food processing. There are stone hearths at both ends of the corridor, indicating a lot more than household cooking was going on when a festival was in process. A large jar cooking maize was still on top of Hearth 1, and was left there as the eruption began in earnest and people evacuated the festival area. The discarded shelled corncobs lay nearby. A metate mounted on horquetas was at the east end, with the person doing the grinding facing west, toward Household 1. A large open-mouthed jar was placed below the lower western end of the metate, to catch the ground maize. Three large utilitarian jars lined the north wall. Elevated storage was provided by a wooden shelf that extended from inside the building over the middle of the corridor, and held two corn huskers (one an antler tine and the other a deer long bone), an obsidian prismatic blade, and six ceramic vessels. The vessels ranged from common utilitarian vessels to a shoe-shaped jar and an elegantly decorated tripod plate probably for serving tamales.

Passing from the north to the east corridor was moving into a more spacious area as well as into a space that functioned differently. The east corridor was 8 by 2.3 meters and was dedicated to serving food and drink to ceremony participants

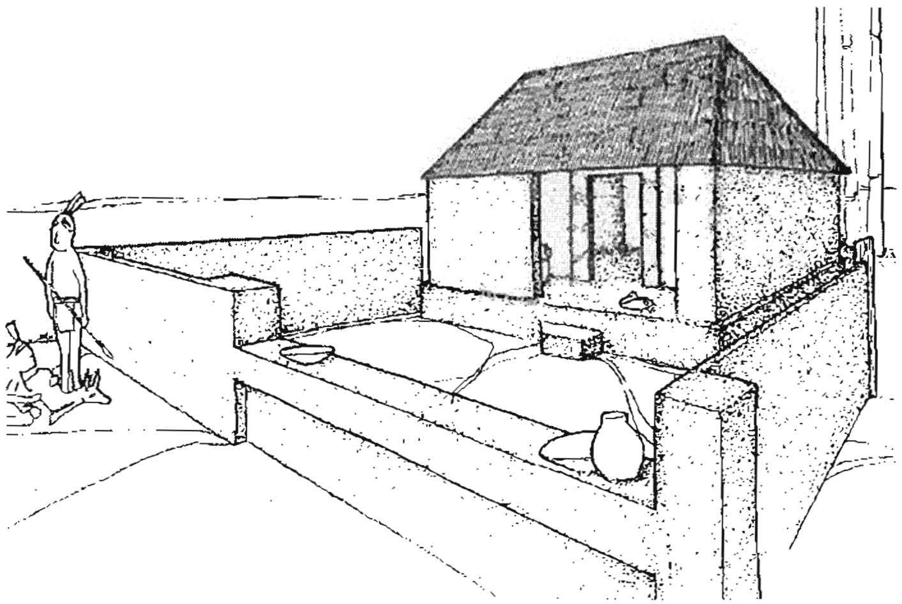

Figure 7-4 Drawing of Structure 10, the building for village ceremonies. The entrance is at the back right, up a corridor to the enclosure at the front. A step leads up into the building proper, with two rooms. The thatch actually extended over the entire building, but is "pulled back" here so you can see into the building.

and observers over the half-height wall. The clay plaza was particularly flat and hard-packed by people walking on it and approaching the half-height wall to be served. A secondary function of the east corridor was vessel and food storage, with fourteen pots and a painted gourd in the area. They stored a lot of corn, beans, and squash seeds here. The vessel and food storage apparently continues under the south end of the corridor, under the fallen walls, but we did not excavate the area because of the importance of those walls. The walls of the corridor as well as a wall of the main structure fell over this end of the corridor. Artifacts in elevated storage in this area, in thatch, on wall tops, and on roof beams included two obsidian blades, a jade axe, four donut stones, five deer bone artifacts, a spindle whorl, and an enigmatic painted organic cylinder.

The columns at the corners of the walls of the corridors have a curious attribute: they taper upward (Figure 7-6). They are thicker at the top! Thus, they are more vulnerable to earthquake toppling than are other columns at the site. They would not topple inward because they are blocked by the walls, but they would easily topple outward. For some reason, perhaps not too different from the reason for constructing the very fragile "tephra sandwich" walls of Structure 12, these columns were metastable. We also don't understand why they mounted a large laja stone into the tops of each column, and then largely mudded them over.

A trapezoidal-shaped adobe step provided access up into the east room of the main structure. The east room measures 3.3 by 1.3 meters. East is the most sacred direction of the Maya, and east is emphasized in this building by two

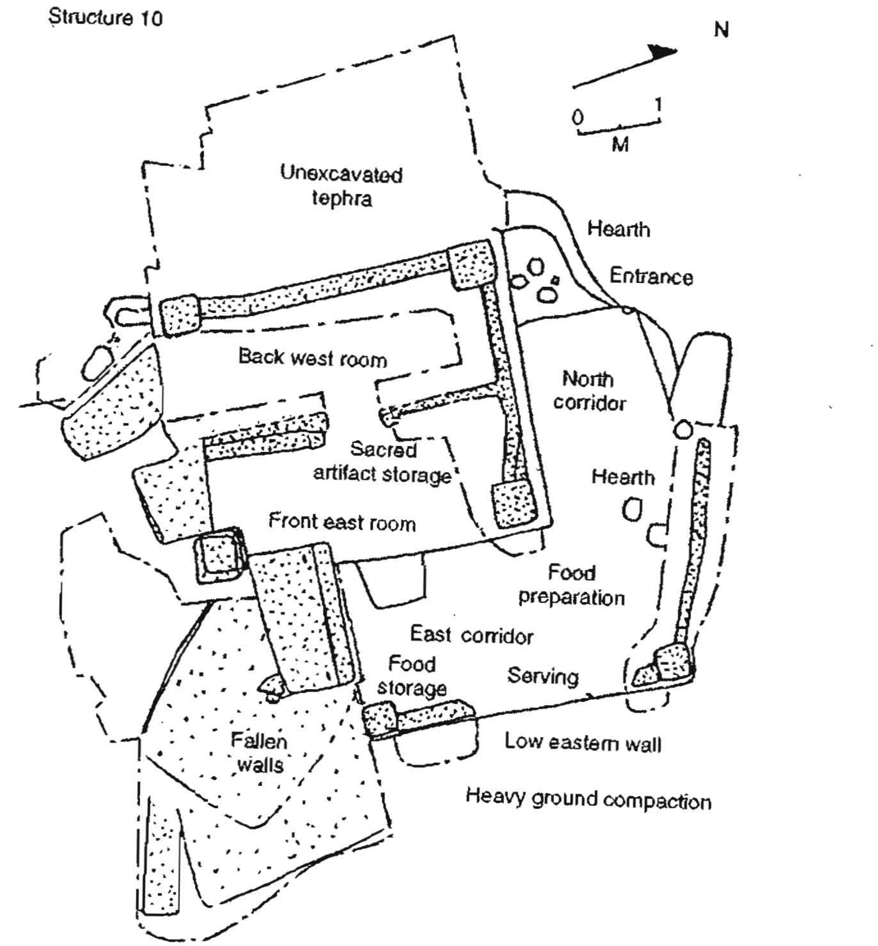

Figure 7-5 Plan drawing of Structure 10. The entrance is at the upper right, past a hearth and into the north corridor. That area was used for food preparation, and the east end of the east corridor was used for food serving, across a half-height wall. Food storage was to the south of there and extends under the fallen walls. The east room of the structure proper was used for sacred artifact storage. The west room was also used for storage.

things, this east room stored the most sacred artifacts, and this east room is the only one with red paint in the building. The eastern face of the dividing wall was painted red, along with the pilasters that emphasized the door jam, and the horizontal cornices that ran around the room at the top of the walls. Along the top of the dividing wall ran an elevated shelf made of poles; this is the same shelf that extended past the wall over the northern corridor and provided elevated storage space there. On the shelf was probably the most sacred artifact of all in the building, and maybe of the village: a painted deer skull headdress. The headdress included the antlers but not the lower jaw, and it was painted red with some

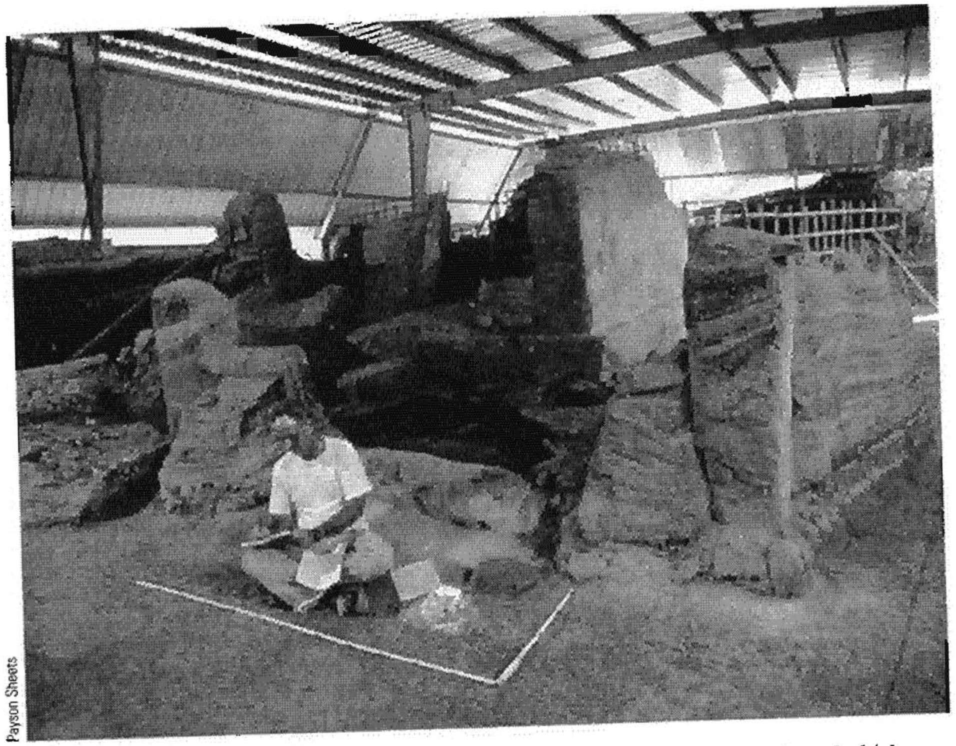

Figure 7-6 Photograph of Structure 10 under its large protective roof. Household 1 lived in the background, to the right. The original volcanic ash has been left along the wall to help support it. Note that the columns visible to my right and to my left are both tapering upward, in defiance of earthquake resistance.

blue and possible white paint. It still had some one-ply agave string around the base of the antlers that probably was used to tie it onto the head of a celebrant. Next to it was an unusual wide-mouthed jar with a basket-style handle decorated with two human faces. Traditional Maya today revere the deer as symbolic of the vitality and fertility of nature, particularly focused on maize and the first harvest. The ancient and contemporary Maya link as analogs the germination of corn with human birth, growth to maturity, and death. But the spirit of the human does not die when the body dies, just as the seed corn stored in the dry season seems dead but comes back to life when planted and it germinates.

Also on the elevated shelf, by the deer skull headdress, were elements that Brown and Gerstle (2002, 99) interpret as elements of ceremonial costumes for ritual performances, including large tubular bone beads, variously shaped other deer bone artifacts, a shaped scapula from a young white-tailed deer, two prismatic blades, and a jade axe. One of the prismatic blades was tested for organic residue and tested positive for human hemoglobin. It likely was used in bloodletting during the ceremonies. That would link red human blood with the red achiote pigment (see later) and the red painting of the east room. As Brown and Gerstle (2002, 103) argue, this complex is fundamental in Maya conceptions of the nature of reality, with east being the birthing and most important of the

cardinal directions, and the color symbolism of the directions date back to the Early Classic period in other Maya sites in the lowlands. The Maya used, and still do use, the male deer as access to the supernatural domain to keep the rains coming so crops can mature. Because this complex is very Maya but largely lacking in Lenca or Xinca groups, we take this as evidence that the ancient Cerenians were ethnically more Maya than any other group.

On the floor below the east room shelf were more special vessels. The most notable was a large painted jar with a modeled caiman face at the top, resting on a fiber ring. Fiber rings are large donut-shaped rings of twisted grass or vines that keep round-bottomed pots from tipping, and are used for frequently used pots. The way of supporting pots in less active use is with stone pot rests as described in the Chapter 4, "The Ceren Site: Household 1." The big jar was full of achiote (*Bixa orellana*) seeds. Achiote is the seed of a local tree that provides a brilliant red color that is used regularly in traditional Maya as symbolic of human blood, and the sacrifice that people must do to meet their obligations in their sacred covenant with the supernatural domain. Adjacent to that large jar was a smaller jar full of squash seeds (*Cucurbita* sp.) that were essentially unchanged over all the centuries.

The back room, on the west side of the main building, stored mundane objects, probably "the other side of the Maya coin" that west was not as important as east. On the floor were two large utilitarian jars that contained beans. In elevated storage were another deer scapula and a painted pottery bowl.

The area outside Structure 10, to the north and to the east, was kept clean for ritual performances. Its hard packed clay was flat and swept clear of broken pottery and other bits of trash, and it was maintained clear of vegetation. This is reminiscent of the Chorti Maya, who considered the land around ceremonial houses to also be sacred and maintained them clean of artifacts and vegetation by the community (Wisdom 1940, 426) for ceremonies.

SUMMARY

Structures 10 and 12 formed a religious complex to the east of Household 1, at the highest point in the village, and overlooking the river. Both buildings did not align to the 30 degrees east of north orientation of the rest of Ceren, and both had successively higher floors as one went from outside to the innermost room. Both had white painted walls and red decoration in one of the rooms. Both had architectural aspects that were fragile but religiously important. A number or lines of evidence indicate that Household 1 maintained the buildings and their functioning, including the fact that the dominant "recipe" of clay and tempering material for making the pottery of the household also dominated in the religious buildings (Beaudry-Corbett 2002). Also, the household was curious in that it had no corn husker, but two were found in Structure 10. It appears that the household had loaned its huskers for temporary ceremonial use in that building. And the abundance of five metates in Household 5 is striking, in that most households have only one or perhaps two, is interpreted as their gearing up for major maize grinding during ceremonies, particularly that for the first maize harvest and deer fertility rituals. One well-used metate on the floor of the kitchen of Household 1 was their everyday grinder, and the four horqueta-mounted metates were for special occasions.

The richness of Ceren village religion is instructive for us. As archaeologists, we have gotten used to the "top-down" view of Mesoamerican religion, where elites conducting ceremonies at their pyramids are seen as controlling ritual for their societies. Cerenians were burning copal incense in every household building to contact the supernatural. And they had a building dedicated to producing village rituals associated with the maize harvest, fertility, and cyclicity. They also had a building dedicated to divination, where they could alleviate anxieties about the future on an individual basis.

8/Summary and Conclusions: The Site in Perspective

The objective of our research at Ceren is to understand commoner household and village life on the southern periphery of the Maya area, during the middle of the Classic period. Located in a volcanically and tectonically active area of the monsoon tropics, the site has taught us much about how people adapted to their environment, and thrived. Certainly, adapting physically to their environment involved developing suitable agricultural practices as well as earthquake resistant architecture. It also involved understanding how to make or obtain storage and cooking vessels, serving vessels, cutting implements, and grinding tools. These kinds of things could generally be considered ancient economics. Our interest is also in different kinds of environments, such as the social environment within the community and within the valley, and beyond. We also want to understand politics and power relationships, in the village and the valley. And we do not want to neglect the religious domain because belief and ritual permeated household, village, and regional life. I think we have made good progress in all these domains, but it is important to realize only a small fraction of the village has been excavated, and future research is sure to change and improve our understandings in all these domains. Multidisciplinary research by dedicated scholars over the years has been necessary to understand Ceren. Had we only done archaeology, we would have misunderstood so much, completely missed a lot more, and only shed light on a few aspects of life there 1,400 years ago.

GEOLOGY-VOLCANOLOGY

Before the eruption of the Loma Caldera volcanic vent, the Ceren village was in an idyllic setting alongside a fresh water river draining the fertile Zapotitan Valley of what is now El Salvador. Unbeknownst to the villagers, an ominous hot magma was gradually working its way upward, only 600 meters north of the village. When the magma first contacted water of the river, and the vent began to open, a mild earthquake and a horrendous shrieking of a steam emission warned villagers, many (all?) of whom were involved in a deer-fertility-maize harvest festival at their community ceremonial building. They headed south. If some took shelter in buildings from the first blast of volcanic ash to hit the village, they could have survived its scalding cloud, and perhaps escaped before the second unit arrived. The second unit involved lava bombs hotter than 575 degree Celsius, that punctured thatch roofs setting them all on fire. Everyone had fled the village, as far as we can tell, by this time. Not surprisingly, they left virtually all their material possessions behind. We regret what happened to their lives, but we do appreciate the opportunity to open the first clear window on commoner life in this area at this time. The tephra accumulated to 5 meters above all the buildings and fields and trees, entombing them as a time capsule from the Classic past.

GEOPHYSICAL EXPLORATION

A wide range of geophysical instruments has been employed at Ceren. The two that have provided us with the best results, because of the particular conditions there, are resistivity and ground-penetrating radar. Resistivity is a relatively simple instrument that pushes an electromagnetic arc down into the ground and measures the ground's resistance to it. We find that buried buildings create a spot of decreased resistance, actually an M-shaped anomaly, and many buried buildings have been detected and later confirmed by excavations by this technique. Ground-penetrating radar is more complex because antennas are chosen for depth and resolution, and tephra layers and other geological features as well as buildings and plazas create radar reflections that need expert interpretation. I cannot imagine how the Ceren project would have operated without geophysics. We have now excavated a dozen buildings discovered by these instruments, and at least another two dozen await testing and excavation. That figure is very conservative, and I suspect there are more than 30 more structures to be investigated. And, of course, this does not even mention the plazas, agricultural fields, and other features that make the Ceren site so informative.

BIOLOGY

The abundance of plant remains is almost staggering at Ceren. The corn plants are preserved in the fields, bent over at the end of the growing season, as the first stage of drying. This indicates the eruption occurred in the middle of the rainy season, August in a normal year. In one place beans were planted, and that would have followed in most maize fields had the eruption not occurred. Households also maintained kitchen gardens with root crops and other useful plants. Stored in buildings were corn, beans, squash, chilies, cacao, cotton, avocados, nance, guayaba, gourds, and other species. Striking for their absence in the diet were ramon and palm nuts. A local grass was favored for thatching roofs, to the almost complete exclusion of palm. That grass is approaching extinction in El Salvador today because of intensive agriculture, grazing, and the introduction of Old World grasses. One household grew specialty crops, including maguey (agave), cacao, guayaba, and processed the agave leaves into fiber that could have met the village's needs on a sustained basis.

THE VILLAGE ORIENTATION

For many years, we have puzzled over why commoners went to so much effort to align their household buildings and their fields to about 30 degrees east of north. Our speculations ran the gamut of possibilities, but it is not until recently that we think we have the answer: the river adjacent to the site runs 30 degrees east of north. The practical and religious importance of water to ancient Mesoamericans is towering, and it looks like the community was positioning itself to better receive rainwater.

THE HOUSEHOLDS OF CEREN

I think the similarities among the households at Ceren are as important as their differences. The result of both is the rich fabric of social interaction and continuity of culture in the village.

The architectural similarities among households are many, including the very Maya pattern of constructing different buildings for particular functions. Household walls of bajareque, doubly reinforced for earthquake resistance, also supported the grass thatch roofs. Earthen columns, if they fell in an earthquake, could only fall outward, thus not endangering anyone inside. Most household buildings had ample eves, resulting in more roofed space outside the walls than inside. Those covered areas provided spacious craft and activity areas sheltered from the sun and the rain. The domiciles are always the most important and substantial of the household buildings, opening to the north, with two rooms. The more private room in the back has a bench for daytime activities that is converted in the evening to sleeping with mats on top. Both domiciles and storehouses are square to rectangular in plan, and they open into a patio. Kitchens are detached, for practical reasons, and they are circular. All three types of buildings were subdivided into storage and activity areas. A kitchen garden receives close attention, where a variety of crops are grown, including medicinal and root crops. Households have impressive inventories of ceramic vessels, around 70, supplemented by a dozen or more gourds storing wood ash, along with some painted gourds and baskets. Surrounding each household are cornfields; the eruption caught most cornfields at the point of the first harvest, in August, when the stalks are bent to begin drying and temporary storage in the field. In a good year, with better-than-average precipitation, a household could grow all the maize needed for the year from the surrounding fields. However, in an average or below average year, supplemental production would have been necessary from fields outside the village. Thus, Ceren households did both infield and outfield cultivation. So, it appears that Ceren households were self-sufficient in architecture and basic food production.

Each household could conceivably produce all of its pottery and other storage vessels, all its grinding tools, and all its specialty foods. One could conceive of such a situation, where each household existed in material isolation from others. What a dull society. Such certainly was not the situation at Ceren, however. Each household had at least one commodity that was produced in amounts well beyond its own needs, and the excess was used for exchange with other households. And we should not overemphasize the material exchanges, as they surely took place within a rich context of social process, as discussions about the hot topics of the day, gossip, friendships, and alliances were formed or strengthened. Household 1 produced great numbers of grinding tools, specifically manos, metates, and donut stones. Also, all the spindle whorls found at the site to date come from this household, so their production of cotton thread, and perhaps finished textiles, was another part-time occupational specialization. This household also had a service relationship with the religious complex, maintaining it architecturally and supporting it functionally by loaning corn huskers and producing ground corn for the annual deer-harvest-fertility ceremony.

Household 2's craft specialization was making painted gourds, and the residents' service relationship was in maintaining the functioning of the large sauna just south of their household buildings. Their architecture and artifacts bespoke a greater wealth than Household 1 had. Household 3 is barely known, but Household 4 residents clearly produced specialty crops as their part-time specialization. They grew some 70 agave (maguey) plants for the fiber, and they may have been the only agave producers in the village. They also grew and stored cacao (chocolate), and they processed cottonseeds for the oil. Thus, the part-time production of commodities for exchange supported the integration of the households into a functioning community.

Also, the surplus commodity production as well as surplus food production in a good year provided each household with things that could be exchanged for the elite-provided objects that a household could not obtain on its own. A household that needed obsidian tools, a jade axe, a hematite pigment cylinder or cinnabar paint, shells, polychrome pottery, or other exotic items, could take surplus commodities to the marketplace at nearby San Andres for exchange. Thus, we can see how the elite supported their own needs for food or other items, by making available the long-distance traded exotics to the commoners. But, very importantly, San Andres was not the only place where these elite-provided items were available. We estimate there were at least a dozen such centers in the Zapotitan valley. This means that a commoner household had some choice; commoners could avoid one elite marketplace if they felt the exchange ratio was unacceptable, or if they personally disliked the elite or their agents. I believe the implications of commoners having some choice are huge. Elites did not have total economic power and control. Rather, elites in their various centers in the valley would have to compete for clients, and commoners were not mindless cogs in the productive gears supporting the elite. An arrogant or aggrandizing elite group could become unsupported and isolated quite readily. So, the long-term viability of the Classic period society was characterized by a symbiosis between elite and commoners, negotiated by daily, weekly, or monthly interactions whose scheduling was largely in the hands of the commoners.

As with economics, the political landscape of the valley, as seen through Ceren eyes, was one of partial self-sufficiency in the village. If we are correct that Structure 3 was a public building devoted to resolution of disputes, then many problems and decisions could be made locally. However, there must have been times that local authority was insufficient, and one can envision the need for elite intervention. The big front-room benches with the village elders seated on them may have been insufficient to resolve some problems.

And not to be left out, religion also shows a complex blend of local practice within a valley wide system. Each household building had a copal incense burner for sending messages into the supernatural domain. Even with the extraordinary preservation at Ceren, we must realize that many household religious practices and beliefs are not accessible to us. However, the care with which household buildings and agricultural fields were laid out with reference to the river must be an indication of their positioning themselves spiritually to be recipients of sufficient rainfall for good crop maturation. A community harvest ceremony was taking place at Structure 10, interrupted by the volcanic eruption. That harvest ceremony, focusing on the deer as a symbol of the vitality of nature and the need for human participation in the sacred covenant, involved a blood letting ritual as well as body painting with achiote paint as symbolic of human sacrifice. And individual problem solving by access to the divine was provided at the nearby shaman's building, where the diviner would alleviate people's anxieties about the future. She had better be right in her predictions more often than she was wrong, or people would stop going to her.

ETHNICITY

One of the more difficult challenges in archaeology is determining the ethnicity of the people who lived in a site, particularly in a frontier or multicultural setting. The finding of a few portable objects characteristic of a particular ethnic group in a site is not a reliable indicator of local ethnicity, particularly when they are relatively rare items found within a different technological-artistic tradition. (Think of all the items you own that were made in foreign countries that do not identify your ethnicity.) However, artifacts that are locally made, are abundant, and are sensitive to ethnic differences can provide useful evidence. The building of space and the use of space are two of the best indicators because they are deeply ingrained within a culture. One of the most striking characteristics of built space at Ceren is the construction, by each household group, of a number of functionally specific structures. That is in contrast to so many cultures around the world where a single structure is built, and functionally specific areas are achieved by internal walls and partitions. Two nearby cultures provide ethnographic comparisons and contrasts.

The Lenca (Stone 1948), who have considerable time depth in El Salvador, ethnographically were known to construct a single rectangular building, and then internally subdivide it into spaces for particular uses. The Chorti Maya (Wisdom 1940) construct a number of functionally specific buildings per household. The Chorti are the closest Maya group to the Ceren area, now being located about 100 kilometers to the north. Thus, in architecture and the use of space, the Ceren residents appear to have been more Maya than Lenca. Too little is known about other possible prehistoric peoples, such as the Xinca, to make significant comparisons.

Another important indicator of ethnicity at Ceren, I believe, is the construction of sacred space in the village's ceremonial building. The east room of the main building at Structure 10 was emphasized by being painted white with red details, had a special high shelf running its length, and clearly contained the most important artifacts for rituals. The deer skull headdress, the obsidian blade for bloodletting rituals, and the pot with the bright red achiote pigment, were among the most sacred artifacts in the building and in the village as a whole. They relate more to Maya belief and ritual than to any other known ethnic group in southern Mesoamerica.

Marilyn Beaudry-Corbett, the project ceramicist, has noted that the ceramics at Ceren contain a lot of Copador type pottery, a ceramic sphere that included western El Salvador and extended to the Maya site of Copan, Honduras, and may have originated at that site. However, a close look at style and motifs indicate that it is far from a homogeneous ceramic sphere. Ceren ceramics, including Copador, maintain a decidedly local flavor in how often they employed the melon-stripe decoration on the bottoms of polychrome serving bowls and in the use of "swimming figures" on cylinder vessels. The ceramics show an affiliation with the Maya, but certainly do not indicate that the Ceren residents were thoroughly Maya.

The chipped stone and ground stone artifacts are not as sensitive to ethnicity as are ceramics. The stone artifacts are clearly more a part of the Mesoamerican tradition than the Intermediate Area tradition, the culture area of central and southern Central America. Both industries seem more closely linked with the Maya area than with other cultures, in their sources of raw materials beyond the Zapotitan Valley and their technology.

This does not mean that Ceren residents were Maya in a definitive way. It does mean that they were culturally more Maya than Lenca. So, even if the ancestors of the Ceren residents were not Maya hundreds of years before they lived at Ceren, they had largely acculturated to the Maya way of doing things by AD 600.

SUMMARY

The Ceren site has provided us with a plethora of surprises, which means we are learning things. The quality of life in a commoner village on the southern periphery of the Maya area, 1,400 years ago, was surprisingly high. The Cerens had functionally specific architecture in households that was quite appropriate to their environment. They had ample space for their abundant household goods, and each household was self-sufficient in its buildings and its basic foods. The social fabric was interwoven by each household producing one or a variety of special goods that they used for exchange within the village. Residents also could use their surplus craft or produce to exchange for goods they needed from the elite-controlled trade of exotic and distant commodities. Because the commoners had choice in which elite center to do their exchanges, they set boundaries on the exchange ratios in the elite centers. If an elite group set the exchange ratios too high, or became obnoxious, the commoners could "vote with their feet" and therefore have a corrective effect on errant elite. So much for the traditional view that the elite had all the economic, political, and religious power.

Epilogue/Doing Research, the Inside View

In the previous chapters, I have emphasized Ceren through the methods employed and the results, with interpretations and comparisons. Those, of course, constitute the nature and objectives of doing research. However, what usually gets left out of an archaeological report, whether it is an article in a journal or a full book treatment of a site, are the practicalities of doing that research. The human side of things, the excitement, frustration, fears, fun, dangers, satisfactions, and laughter get left out. However, this epilogue is an opportunity to discuss some of these aspects of doing research in the field in Central America, from a personal perspective. I begin with the logistics of organizing and staffing the project, traveling to El Salvador, and maintaining cooperation with people in that country. Then, we look at difficulties in doing the fieldwork, use of certain instruments, and how we relate to people and the media. Then I talk about our attempts to relate with local people, and our attempts to assist people in need. Finally, we view the Ceren project in relation to others, as we visit them and share research results.

LOGISTICAL COMPLEXITIES IN CONDUCTING INTERNATIONAL RESEARCH

From the previous chapters, one might think that doing archaeology in El Salvador is a matter of cruising into the country, digging up some really neat stuff, checking it out, writing it up, and splitting back to the United States. Not quite. Just getting to the point where you can sink that first spade into the ground takes a lot of effort.

One of the first things that has to be done is to obtain permission from the landowners and the government to do the work. Here it is important to understand a big difference between United States and Latin American culture. In the United States, we are used to doing permissions with written documents, with lawyers and the threat of judicial proceedings to back things up. In Latin America, people generally operate on a much more personal level. Important decisions or agreements are made between people only after they have gotten to know each other sufficiently to have a good sense of them and how they could work together in the future. They need to judge character and form a working relationship, perhaps involving a friendship, before entering into a formal relationship of granting permission. Personally, I prefer their system because it puts more emphasis on confidence and trust right from the beginning, and less on lawyers and the threats of difficult judicial proceedings. Their system invests time and effort early, to try to weed out problems before they occur, and thus generally avoids a lot of complications and hassles later.

What this meant, in my case, is traveling to El Salvador every year or two during the 1970s and 1980s, to maintain friendships and acquaintances, and to meet newly appointed officials and get to know them, and them me. Sometimes I was able to get some funds from the University of Colorado or other sources to do so, and other times I paid for it myself.

Another essential ingredient for a successful field season is the permission of one's university to be gone. This is highly recommended, so when one returns to the university, one's job and office are still available (!). The complexities of leaving for a semester are considerable, as alternate advising for undergraduate and graduate students needs to be set up, substitute faculty to serve on MA thesis and PhD dissertation committees need to be found, and myriad other details. No student should have difficulties because a professor is in the field. The classes that I would have taught need to be taught by someone qualified, and it takes time to find the appropriate person. It is a tremendous burden on the family, as my wife Fran had to quit her job, and my daughters Kayla and Gabi were removed from their schools, home, neighborhood, and friends, for almost a year. Actually, as it turned out, it was one of the most important experiences of their lives, to live in a foreign country and learn the language, customs, and culture.

FUNDING AND STAFFING THE RESEARCH PROJECT

An obvious essential for international archaeological research is adequate funding. We usually spend about $90,000 for a field season of three to six months, with the money supporting international travel, room and board, salaries for Salvadoran workers, vehicle rental, gasoline, equipment and supplies, utilities, insurance, shipping, university overhead, and myriad other costs. Very few agencies, private or public, will entertain a proposal for that amount of money. The most appropriate agency, for the kind of research that we are doing, is the National Science Foundation (NSF) in Washington, D.C., a part of the federal government. The NSF budget is only a fraction of what it should be, if it were to fund even half of the research that is proposed to it. It is highly competitive, and in the round in which we fortunately were funded, 87 percent of the proposals were rejected.

A success rate of only 13 percent is not a cause for optimism. A proposal needs to be outstanding, almost without any flaw or weakness, to be funded. It takes many months to write a proposal that stands a chance of being approved. Many letters and telephone calls are necessary to line up the project people, and to have accurate and minimal costs in the budget. I have learned one thing that really improves a proposal's chances is to have it firmly criticized and then revised before I submit it to NSF for review. One reason for the success of our multidisciplinary research in the field is that we have obtained the participation of some of the finest geophysicists, botanists, volcanologists, and conservators in the United States, but it is not easy for them to leave their intense research and teaching programs to join ours for a few weeks. The students I solicit are the best I can find. I post a notice for all students at University of Colorado to read, allow them time to think and talk it over, and then I select the most qualified. Initially, I look for the most qualified in past excavation experience, abilities to analyze data and write, and abilities in Spanish. I also look for students who are more than archaeological technicians, who can understand and respect the culture of the country, and interact with its people.

TRAVELING TO EL SALVADOR

So, when the statistically unlikely events all coincide—of having permission from landowners, government officials, the university, and funding of the National Science Foundation—we take off for El Salvador. When we are going for two or three months of summer, we usually fly down because time is scarce. That means that we have to rent vehicles within the country, and they are very expensive, 200 to 300 percent more than in the United States. When we are spending more than three months in El Salvador, we rent vehicles from the University of Colorado and drive down. That involves a few complexities, such as legally torching off catalytic converters, getting notarized permissions for all anticipated drivers for crossing frontiers, visas, and other items. The drive is about 3,500 miles, which is quite a distance, but I love the experience. In classes that I teach at the University of Colorado, I talk about the ecological zones of Mexico and Central America, and adaptive traditions that continue today. It is a pleasure to see them, and stop to talk with a traditional agriculturalist about why he is contour ridging, or how his harvest is proceeding. I also enjoy the break from my usual hectic pace of meetings, class preparations, teaching, telephone calls, memoranda, and so forth at the university. None of those exist on the open road. It takes us about a week to do the driving, and we avoid driving at night because of potholes, cattle on the highway, and other hazards that are more readily avoided in daylight.

One has to drive with ten times the alertness that one uses in the United States, because of heavier traffic, more large animals, ox carts, worse roads, and a few dozen other reasons. Accidents must be avoided at all costs, not only because of the obvious problems of injury and property damage. As soon as we cross the border into Mexico, we have entered a different system of justice. Latin America, like most of the non-English speaking world, functions on the Napoleonic code of justice. What this means is that anyone who is suspected of doing something wrong has the responsibility of proving himself or herself innocent. All people involved in a traffic wreck can be jailed until they demonstrate they were not at fault. That is not always easy. And it is always costly in time and funds. Traffic accidents are a hazard to be avoided.

DIFFICULTIES WITHIN EL SALVADOR

Speaking of hazards, El Salvador has had a major hazard in progress for more than a decade, a civil war. The Farabundo Marti National Liberation Front (FMLN) guerillas have been battling government troops since 1979. Before that, in the 1960s and earlier 1970s, there was a legitimate struggle for philosophy and power between opposing factions. Some argued that the best future of the country lay in improving business conditions for production and export of coffee, cotton, sugar, and some manufactured goods. Increased prosperity at the top would lead to a general improvement in wealth and living conditions for the rest of the populace. Others argued that the place to start was the bottom, with improving living and working conditions, and wages, of the poor. It was generally not an armed struggle but, rather, waged on the editorial pages of newspapers, in rallies and demonstrations, and in public debates. However, as the cold war intensified and Nicaragua went Marxist with the Sandinista revolution in 1979, both east and west chose El Salvador as a stage for competition and fighting.

The struggle turned into an armed battle throughout the 1980s as great amounts of arms flowed into the bodegas of both sides. The Salvadoran government received regular shipments of U.S. military equipment and assistance. The guerillas received arms from various sources, including Nicaragua, Cuba, the USSR, direct purchases from international arms merchants, and captured government sources. Thus, winning an argument shifted from logical persuasion to violence, and the country fell into civil war. The war waged through the 1980s and into the 1990s, and the suffering wrought on the Salvadoran people has been immense. The death toll ended up at almost 80,000. That is a high number for any country, but it is particularly devastating for a small country. That is a much higher total number of deaths than the United States suffered in Vietnam. Proportionally, that would be about 2½ million Americans dying in a war, an unthinkable toll, but it does give us some idea of how the suffering caused by the war has affected Salvadorans. That does not take into account the hundreds of thousands of injured and permanently maimed people, and all the families that have lost their lands and homes to the conflict and had to flee to seek refuge in San Salvador or in exile in other countries. The kind of suffering from poverty, malnutrition, and underemployment is more than any country should bear, but on top of that, the Salvadoran people have had to live within a civil war. Most Salvadorans do not care what "ism" is running the central government, whether it be socialism, capitalism, communism, so long as they have a decent job, some liberty, and the ability to feed, clothe, and educate their children.

Unless they are attached to one side or the other, foreigners in El Salvador have not been targets during the war. One has to be careful not to be in the wrong place at the wrong time, as many civilian deaths occur when a firefight breaks out between guerillas and the army. We expend quite an effort to keep well informed about troop movements, latest hot spots, possible guerilla infiltration, and the overt battles being waged.

My initial thoughts, as I was planning on continuing our research at Ceren during the civil war, was to quietly enter, do the work, and leave, without getting involved with either of the bellicose factions. But my good friend Victor

Manuel Murcia suggested that might be OK if we were there for a week or two, but rumors would begin to circulate, and they would not be to our advantage. So, following his advice, I invited the leaders of the FMLN guerillas to visit the site, and I gave them the full tour. They loved it, saying "this is the origins of the Salvadoran family," and they said they would do anything to assist our work. Then, on a very different day, I had the leadership of the government "ARENA" party visiting, and they said the same thing—"here is where the Salvadoran family began, our deep roots." They too pledged their full support. So, following Murcia's advice, we ended up the safest people in the whole country.

COOPERATION WITH THE HOST COUNTRY

Some Latin American students have justifiably complained about "academic imperialism" where people arrive from the United States or other developed countries, stay for a while in their country, presumably do good work, often live isolated from natives, return to their country of origin, and publish in their own language. They leave their Latin American host country only with a vague memory that they were there doing something. We have tried to avoid that by doing everything we can to publish first in Spanish in the local country. We involve local students, professors, and scientists as much as possible in the field and laboratory research and in the final publications. We have been training Salvadoran students in field and laboratory procedures, in the hopes that they can go on to earn advanced degrees and become the first Salvadoran archaeologists. It is time that the country has its own archaeologists, instead of having to await the arrival of foreign groups to do research. A Salvadoran student just completed his master's degree at the University of Colorado and should return in a couple years to work on his doctoral degree.

HIGH-TECH APPLICATIONS: FIBER OPTICS

Along with the best geophysicists, volcanologists, and conservators comes the need for the best instruments for their use. We have used state-of-the-art geophysical instruments, with considerable success, especially ground-penetrating radar and resistivity. We are doing remote sensing using Landsat and IKONOS satellites to record moisture, soils, and vegetation variation in the area. We are planning overflights by NASA aircraft to take color infrared photography and use digital sensors to look for buried archaeological and volcanological features.

The Ceren site is very unusual in having cavities in the volcanic ash that often are of extraordinary significance. Unlike most archaeological sites that have no such cavities, the warm moist volcanic ash units packed around organic items, ranging from little corn plants to full size trees, from tiny seeds to large organic containers. After organic decomposition, presumably by fungi and bacteria, the item was preserved as a cast in the ash. We can then mold it using dental plaster or another substance. However, when we find a cavity we must explore it to determine what the item was, and how well the surface of it is preserved. Thus, we need some means of seeing down into dark cavities, often not in a straight line. In searching contemporary technology, we have found that the best instrument available is a fiber optic proctoscope, as mentioned in Chapter 1. Without the proctoscope, we would have to cast blindly and thus waste large amounts of dental plaster on beat up branches of trees blasted by the base surges into the site, and we would not be able to adjust our techniques and materials to individual conditions of preservation. Fiber optics have helped the research at the Ceren site considerably.

THE SITE, THE MEDIA, AND THE SALVADORAN PUBLIC

While planning the 1989 and 1990 field seasons, I had to make a key decision, somewhat like the one mentioned earlier. Would we, as I was initially thinking, keep a low profile, avoid any press coverage, and just go about our business? Or should we be more overt? I asked many trusted friends in El Salvador, and they agreed that we would be much better off being overt and open. The country is small enough, and we were obvious enough, that our living and working quietly could arouse suspicions, and that might be dangerous. So, we decided to be open, and allow the press to visit the site, along with a tremendous variety of other groups, to learn what we were doing, how, and why. This decision did coincide with one ethical issue, and that is that we were receiving taxpayers' dollars to conduct research that was not clandestine in any sense, and thus we have an obligation to share that research with as wide an audience as possible.

We opened the doors to the press, every Thursday, and they came in droves. We quickly realized that we could not satisfy the desires of all the print and broadcast media, so I decided to limit the press to Salvadorans only, and would speak only Spanish to the press, as keeping them informed is more important than audiences outside the country. I had to say no to CNN, NBC, and CBS, much to their surprise. CNN did get clever and hired a local crew, we did it all in Spanish, and then someone at CNN did a voice-over translation into English.

The international diplomatic community in San Salvador became very interested in our research, and they helped out many times. For instance, the Italian ambassador visited the site many times. He arranged for a couple of Italian volcanologists to visit, who had done some research at Pompeii, and they were very impressed. They said that the preservation of organic materials and architectural details is far batter at Ceren than at Pompeii. Other ambassadors and their staffs visited the site frequently.

The U.S. ambassador decided to visit as well, but his visit was not as simple as the others, as he has the tightest and most massive security of any person in the country. The day before his planned visit, he sent Gordon, his chief of security, to case the place. Gordon, a young man with plenty of macho, arrived in a flurry in his big armored car. He jumped out of the car and began marching around looking at the lay of the land and the prehistoric architecture. I spent a couple hours showing him the various excavated structures as well as possible escape routes, paths in and out of the land, and other things related to security. When he returned to his armored car, he was struck by dismay as he looked in through the bulletproof glass and saw the car keys and his machine gun resting on the front seat. In his excitement to see the site, he had inadvertently locked them inside. He broke into a profuse sweat as his macho diminished markedly

and he began trying to break into his armored vehicle. After suppressing guffaws, we tried to help him, but we all failed. Finally, one of our workers slipped his machete between the glass and the rubber molding of the door window, tripped the latch mechanism, and opened the door. We wondered what our worker might be doing in his spare time. The visit of the ambassador did come off without incident the next day.

LOCAL PUBLIC RELATIONS

We are particularly interested in maintaining good relations with people in the town of Joya de Ceren, a community of some 3,000 people just south of the site. At worst, if people from the town turned against us, we could have all kinds of difficulties. In the interest of openness, we gave numerous talks in town to anyone who wished to come, explaining the objectives, the finds, the future, and the implications of the project for them. Occasionally townspeople worried that the excavations would expand southward and require them to abandon their homes. I have promised that we will never excavate in or under the town. One person, Evelin Guadalupe Sanchez, was hired by the government to maintain close and good relations with the townspeople, and she has been very successful. We could not have all people from town to visit, as the site is far too fragile for thousands of people to visit. However, we did decide to invite the school children.

When Evelin suggested we invite the schoolchildren, I agreed immediately because I really enjoy talking with the young and sharing the Ceren site with them. I neglected to ask how many there were, so a few days later, when she told me she had set the visit up for the next week, I was somewhat taken aback by her statement that 800 students were coming. She asked whether I would prefer all 800 at once, or two groups of 400! I chose the latter, as somehow, it seemed a bit more manageable, and we began intensive planning, as the largest group we had had before was 30. When they did arrive, it was clear that they had been well-trained by their teachers. They came into the site single file, in a long line holding hands, and they were the best-behaved group that has ever visited the site. I received more pleasure and satisfaction in giving them a tour than any other group and seeing in them an understanding and a sense of pride in having something of that importance in their own back yard.

We saw, in Chapter 5, how the "hauling ash" program created good will with local residents by loading trucks with volcanic ash excavated at the site and taking it wherever anyone wished. We were able to create a level playing field for the school, as people were tired of playing on a slope that encouraged the ball to roll downhill into the river. We certainly improved a lot of roads and helped a lot of patios. We also used the individual contacts created by the program to allay fears that we would excavate under their houses in town and thus force them to leave.

Some of this could be misinterpreted as indicating that we anticipated having problems with the campesinos (country dwellers) in the area, and I need to clarify that. Salvadoran campesinos are the most generous and honest people I have ever met. The place where people need to be careful with their possessions is in the capital city, San Salvador. I regularly leave cameras, money, portable computers, and other valuables in our vehicle at the site, with the workers, and they have always proven themselves completely trustworthy. I even gave up trying to keep track of the various loans of money that I made to individual workers, as they kept meticulous track and always repaid every cent.

Salvadoran campesinos are generous even to the point of embarrassment. One time we were doing archaeological survey in a very isolated part of the Zapotitan Valley and sat down in the shade of a large tree to eat lunch. A poor family living on the other side of the tree emptied their humble house of all furniture (three chairs and a table) and brought them to us, along with the only three Coca Colas they owned. We thanked them profusely and tried to pay them for the Cokes, but they would not accept any money. Finally, I did get them to accept my Swiss Army knife as a present, but they were very reluctant. It is so unfortunate that people in the capital city, Salvadorans and Americans alike, have such a suspicion of the campesinos, as it is so unwarranted.

Although the campesinos generally are poorly educated, they are far from ignorant. Rarely in the campo does someone go past grade school, and children often drop out of school in the third, fourth, or fifth grades to help the mother in the house or the father in the fields. Campesinos generate a patience and grace that is necessary in a poor third-world country. They can be verbally very articulate and insightful when they trust someone, but are very quiet and circumspect with strangers. I will never forget the statements of Señora Chuz, of Chalchuapa, when we were saying good-bye to her after having lived with her for five months, a number of years ago. We came to like her, and her us, but we had no idea how much until we were leaving. I told her, in my best Spanish, thank you very much, I appreciated all she had done for us, and wished her the best. Then she began to talk. In measured tones, she described how lives are like paths. Paths do not exist as isolated straight lines. Paths cross, and bring experiences and influences together that enrich everyone's lives. When one is open to adventure, open to learning from others, the paths bring new insight into people and distant places. Paths are always dividing, but when one gives to others along the path, and learns from them, then everyone has gained from the experience. Where paths divide, we must make careful choices, informed by what we have learned on the route. Thus, we should live life to the fullest, not by sitting and waiting for things to be brought to us, but by seeking the encounters, the paths coming together, and the paths dividing. And one should never forget that what happens along the path is at least as important as the goal that lies at the end of the path. I must admit that, as a typical male, I shed tears maybe once a decade or two. Boy, that was the time. Her expression of her philosophy of life, done so eloquently and including how much we meant to her, reduced me to tears.

THE CEREN PROJECT AND OTHER RESEARCH PROJECTS

Another thing that we do during field seasons is travel to other sites and share the results of our work with other research teams. A number of years ago we loaded up the Chevy Suburban and headed toward the Maya site of Quirigua, in Guatemala. A group of archaeologists from the University of Pennsylvania was there and they were eager to hear of our work firsthand, and we wished to learn

from them directly. We took photographs, plan drawings, and other information of our research to share with them. We of course took no artifacts, as all artifacts that we excavate can never leave the country, by law. If there is any law that we should respect, it is that one, as the looting of artifacts from sites is atrocious throughout Central America, and many get smuggled out and purchased by wealthy collectors in the United States and Europe. They never see the terrible damage they are subsidizing.

Crossing the border from El Salvador into Guatemala was routine: it was awful. I don't know if there is anything I dread more than a land crossing of a Central American border. It is so much easier to fly in and go through customs and immigration at the airport. At the border, vast numbers of officials (and self-appointed officials) feast on the hapless traveler. Anyone who doubts the adage "power corrupts, and absolute power corrupts absolutely" should go through a border crossing in Central America. Dante, in writing *The Inferno*, omitted Central American border crossings. Perhaps he decided that they were too grim for Hades. As you approach the frontier, you can see drowsy officials coming to life and taking their feet off the desk. The traveler must act with total abject humility and pay all sums that are overtly requested, as even the inkling of displeasure or resistance by the traveler guarantees retaliation. That retaliation for sure involves many more payments of various "fees" and stamps from other "officials," and at worst they will flatly deny permission to cross the frontier. Often, one will be turned back, with orders to go back to their capital city to get a different kind of visa stamped in the passport, or other documents, particularly if that item will take several days to obtain. The traveler must never forget that the border "officials" have total power and authority, and they enjoy using it.

Often, impediments are placed in one's way as a slightly subtle way of requesting a bribe. Rarely does a border official directly ask for a bribe. I was, however, directly approached for bribes recently at a police roadblock in Guatemala. Officially, the police were doing their job stopping about every fourth vehicle and checking to see if their papers were in order, primarily car registration papers, and that the driver had a valid driver's license. We passed their careful scrutiny on both counts. But, before we could leave, the policeman in charge of the checkpoint asked if I could give him a "recuerdo" of the United States. I was a bit surprised, as a "recuerdo" is a little trinket or souvenir that travelers buy when in a distant location, and take home, to remind them of that experience. He clarified his use of the term right away by saying that he would like to have some portraits of American presidents on a few dollar bills, as they would serve very well as "recuerdos" for him. Yep, that left little doubt. He was standing rather firmly between me and the car, so I decided to give him two dollar bills, which I quickly rolled up and passed him. I tried to hop in and drive off before any more "recuerdo" requests arrived, but I was not fast enough. Two others hit me up, and I gave them one each, before zooming off. I feigned ignorance of the other three who were jogging toward me also requesting "recuerdos," and left in a hurry, appreciating having eight cylinders firing at once.

But, back to the border crossings. As mentioned, it is rare that the officials directly solicit bribes. Rather, they set up elaborate complexities and let the traveler suggest that some payments might facilitate the process. I must admit that my stubbornness and my intense displeasure in being forced into these situations generally results in my not paying the fees. Rather, I almost always, in as friendly but as clearly determined a way as I can, continue to discuss my perception that the additional fees may not be appropriate in this particular case. What I have to do is invest a lot of time, patience, and humility to show, in an apparently friendly way, that I do not intend to pay the extra fee, and am willing to spend quite a while to achieve that end. I usually succeed, but I end up adding a lot of time on to border crossings. It often takes us three or four hours, or more, to cross a frontier.

In getting hit with a fee, the important thing to understand is if it is legitimate or not. Some fees, such as for fumigating the vehicle, are legitimate and official, and they give you a receipt for the service (of contaminating all food inside the vehicle with powerful herbicide-insecticides, and causing a chemical stench that lasts for hours). Others are less official, and you certainly do not get and do not ask for a receipt, but they are relatively routine and must be paid without protest. One must be aware of sudden inflations of the fees, and those can be negotiated. It is along the next area of the spectrum that I object: the ad-hock fees that get added on by border officials when they perceive the opportunity. So, I usually fight for principle, and often I win, but in the process lose many hours. I will never calculate the dollars per hour figure, but we are usually able to do both sides of a border within three or four hours and for $50 or so.

But, back to the story of us going to Quirigua. We got to the border and began dealing with the Salvadorans in order to exit the country. We went through the myriad hassles and were ready to enter Guatemala, or rather start entering the myriad hassles to try to enter Guatemala, after a couple hours. During the early part of the process, something that one of our group said irritated a Guatemalan customs official, and he started putting up additional hassles. It got worse and worse, looking virtually impossible for us to get into Guatemala, when my wife and I decided to try our most bold (that is, desperate) move. One of our problems really was our fault, as we had forgotten to get a Guatemalan visa stamped into Kayla's passport. Kayla was only 1 year old at the time, and we realized we had forgotten to get her visa when we got the others the previous week when we all visited the Guatemalan embassy. As we perceived our mistake, he relished it because he had us by the "huevos,"[7] as they say. However, we were very determined to get to Quirigua by nightfall, as we knew the kind of party the Quirigua crew had waiting for us. So, we pulled out the heavy ammunition. As my wife Fran calmly walked out to the car and retrieved a large clear plastic bag with Kayla's dirty diapers inside it, along with a short stack of clean diapers, I began to calmly admit to the official that yes, he was correct, the error was ours, and we were very sorry. What took him aback was my calm following sentence, that, in concordance with their laws, Kayla would not be able to accompany us, and she would have to stay with him and the other officials ("swarthy band of brigands" I thought to myself) at the frontier. Now, they would have to change her diaper thus, they would have to feed her thus, they would have to entertain her thus, so she did not start crying. As Fran came up to the counter with the dirty and clean diapers, she informed them that they would need to wash and dry the dirty diapers soon, as the clean supply would last only a few more hours. We were surprised and pleased that he took us seriously, and he began rapidly scurrying for an alternative solution. Under no circumstances would we actually have left our daughter there alone, even for a second, but he did not know that. Amazing. He came up with the alternative plan surprisingly fast, suggesting that Kayla could go with us, along with her dirty and clean diapers, but her passport would be left with him at the border office. Thus, in a bizarre way, the problem of the passport not having a visa is resolved by the passport staying at the frontier, even though Kayla would be entering the country with neither passport nor visa. We thanked him profusely, suppressed profanations, and headed into Guatemala toward Quirigua.

We barely had breathed a sigh of relief when we came around a bend and were stopped by a military roadblock. We later found out that a prominent businessman had just been kidnapped in Guatemala City, and roadblocks were being set up throughout the country to try to find him and his captors. First, they checked under our luggage in the back to see if there was someone hidden underneath, and poor Chris had the scare of his life when he opened the back door of the suburban and got the muzzle of the M-16 assault rifle inadvertently jammed up his nostril. Things did not get much lighter when they lined us up, counted noses, counted passports, and matched passport photos with individual people. There were seven of us: me, Fran, Kayla, and four CU students. There were six passports. Now we really thought we were in trouble. But, much to our surprise, they ended their inspection by telling us that all was in order and that we could proceed. We lost little time in getting out of there, but we speculated for a long time about what had happened. Did they count Kayla? Did they think that she was too young to have a passport or need one? Did they think that she was somehow covered by mine or Fran's?

Somewhat the worse for wear, we finally did roll into the Quirigua project camp late in the evening. After getting hotel rooms for less than a dollar each (and yes, you do get what you pay for), and a memorable party, most of us hit the rack at the hotel shortly after midnight. Chris and Kevin continued the revelry for another two hours, but found the front door of the hotel locked when they got there. Being thoughtful and considerate (and a bit "under the influence") they decided that they would cause less inconvenience by going around back, climbing over the back wall, and sneaking into the hotel rather than knocking and awaking the manager. That might have worked had they not missed by one property. Unfortunately, they hopped the wrong wall and fell over, on top of a large sleeping pig that awoke with such squawks and hootings that every dog for a three-block radius awoke and began barking. What a commotion. That awoke all people within a four-block radius. And not only that, the maid refused to wash their clothes the next day, they were so smelly and filthy. Such is life in the tropics.

FINAL COMMENTS

We consider ourselves fortunate to have the opportunity to conduct research in El Salvador, particularly at the Ceren site. The site provides us with an unprecedented opportunity to understand what family and village life was like 1,400 years ago, even to the point of knowing just what was growing in their gardens and milpas, where the mice were in their thatch roofs, and which polychrome pots were for food serving. Because all those artifacts are there where the Ceren residents left them, we have the opportunity of answering questions that nobody had even thought to ask before. For instance, we are learning how they looked after their sharp knives: they put them up in the thatch roofs near the doorways or corners of structures. We know quite a lot about what they grew and ate. Their staple was corn, aided by beans, squash, chilies, tomatoes, manioc, achiote, cacao, and various nuts and fruits from nearby trees. Root crops were important, especially "malanga" (Xanthosoma) but also manioc.

Before excavating at the Ceren site, we had no idea of the sophistication and variation in their domestic architecture. We did not know about their bajareque walls, corner columns, lattice windows, strong roofs, lintels, cornices, and the like. We had no idea that they were also making solid adobe "rammed-earth" walls for public buildings, and that they could make earthen domes for saunas. We have only the inklings of why it was important to build fragility into their overtly religious buildings and give them different alignments from the other buildings and fields in the village.

It will take many more seasons of excavations to more fully understand the site in its environment, but great strides have been taken during the past few years. Much of that accomplishment has been because of the dedication of Salvadoran officials and local workers, graduate students from the University of Colorado, and an international team of volcanologists, geophysicists, and biologists. Fortunately, that research is conducted within a strong conservation ethic, to give the site the longest future possible.

On the personal side, we consider ourselves fortunate to have been accepted into the lives of many Salvadoran families. Some of the best friends we have live in humble homes in the Salvadoran countryside, and we wish them the best of good fortune in an uncertain future. The Ceren site has enriched all of our lives.

Endnotes

1. These mean precipitation figures illustrate what I call the "fallacy of the mean." That an average of 1,700 millimeters of rain falls in the area might lead one to conclude that there is abundant moisture for agriculture, but that is not always true. In our culture we pay too much attention to the mean figures and often call them "normal." Thus, we worry about a year that is "below normal" in precipitation, or a child that is "below normal" in classroom achievement. I remember the outrage of a parent who complained that fully half of the tenth grade students were below normal! How could the school district tolerate such poor performance? She seemed to be unaware that about half of the group must be below average because the other half is above average.

2. No, this is not an inadvertent example of gender discrimination. I deliberately use the masculine form because males are the agriculturalists in Central America, in the past and in the present. Of course, if a man is not available to do needed work in the field, others substitute, but we are focusing on cultural standards and expectations here. In fact, many ethnic groups build roles into tradition and religion. The Maya view human life as a close analog to the plant growth cycle, believing that the crops maturing represent the future sustenance of society. Thus, the male plants the seed, both in the agricultural and the reproductive senses. The seed is received and nurtured by mother earth, or the mother of the child. Then, the young plant sprouts and grows to maturation when it produces its own next generation, and then it fades and dies back into the earth from whence it came. Death follows birth, which follows death, in cycle after cycle. Actually, the Maya take this one step farther, and believe that life comes from death, and vice versa, and death is necessary for life. Thus, they unite into a single dynamic concept what we often think of as opposites or mutually exclusive conditions.

3. Local inhabitants claim that the Salvadoran air force was instructed to bomb the crater, to re-initiate the eruptions. There are some doubts about that, however, because the crater is only a kilometer across. Local wags claim that the Salvadoran air force could never hit a target that small (!).

4. The use of a proctoscope has generated a few facetious comments, probably the best (worst?) is the title of a paper purportedly to be presented at some future archaeological professional meetings: "Viewing the Site as a Whole: Proctological Perspectives on Prehistory." In contrast to most professional papers, all potential authors are scurrying for last place in the series of authors.

5. So how can one take the temperature of something that fell hot 1,400 years ago, but cooled within hours or days afterward? Richard Hoblitt (1983) used an ingenious technique called *progressive thermal demagnetization*. The technique is based on the fact that all magma chunks have millions of microscopic iron particles. When the magma is very hot each of the particles is free to move and act like a miniature compass. Each points toward the north magnetic pole. When the chunk of magma cools, the particles become "frozen" in place and continue pointing toward the north magnetic pole. The hotter the magma, the more the particles line up. A tephra particle that was cooler when it landed will have a lower

percentage of particles lining up. Thus, the degree of magnetic alignment is proportional to the temperature. The magma clasts from the Loma Caldera eruption, by this analysis, were above the highest temperature that the technique can measure, 575 degrees Celsius.

6. One time when Kevin Black was leading a survey party, he was stopped by the armed guard of a large plot of land, who rode up on horseback and asked if he had permission. Kevin said no, but that he would like to get it. The guard said it would have to be written, but it was not clear where Kevin should get it. After considerable discussion, Kevin offered to write the letter of permission and sign it, essentially giving himself permission to walk the land, and that was accepted. The guard was told that all permissions must be written, and he had fulfilled his obligation!

7. Translated literally: "eggs."

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Index