Cihuatán, El Salvador:

A Study in Intrasite Variability

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With the Assistance of:
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Publications in Anthropology
NO. 35

In Memory of

Thomas Michael Kelley

Plate 1. Mapa del Curato de S. Salvador

Made in connection with Arzobispo Cortes y Larraz's 1768-1770 visit to the Diocese of Guatemala (Archivos General de Indias, Mapas y planos, Audiencia de Guatemala, 86).

1. Ciudad del San Salvador
4. Pueblo de Apopa
7. Pueblo de Guazapa
28. Hacienda San Diego

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PREFACE AND ACKNOWLEDGEMENTS

Preface

The last decade or two in Mesoamerican studies has seen the emergence of somewhat different directions of inquiry for archaeological field projects. Greater emphasis is now placed on nonelite sectors of major sites; sampling designs reflect the broader concern of the archaeological community with problems of representativeness; spatial patterning of archaeological materials is of interest both within individual sites and within regions; sources of raw materials and their allocation are routinely considered, as are problems of production and exchange.

The goals of the 1979 Cihuatán project can be seen as sharing some of the methodological concerns and problem orientations in contemporary archaeology. We selected as our basic goal the investigation of intrasite variability at the large Postclassic site of Cihuatán in El Salvador. This basic goal was appropriate for the site in question because of Cihuatán's large areal extent and apparent short period of occupation. Given the history of previous work at the site, we felt it reasonable to orient our field project toward nonelite sectors of Cihuatán. Our initial plan was to design a sampling strategy to guide survey and field work. We had to change our strategies about the archaeological field work, and the sampling design we had intended to pursue had to be abandoned (see Chapter 2). Nonetheless, by adding the information we obtained to that previously acquired by other investigators, we are able to make a modest contribution to the central goal of understanding intrasite variability at Cihuatán.

We had other preconceived ideas beyond the core problem orientation which can be regarded as methodological guidelines. Two deserve mention here. The first was our conviction that an interdisciplinary approach would be the most satisfactory. Second, we would attempt to analyze such materials as were recovered during field work as completely as possible. The interdisciplinary approach was translated into having three botanists, a statistician, and an engineer join the archaeological party in the field. As a methodological footnote, only one botanist was included in the initial project proposal; that botanist made an argument that a classic fault with interdisciplinary projects has been that only one member of cooperating minority disciplines is included, thereby precluding on-going peer review from within the minority discipline as the project progresses. This seemed a sound argument, and the granting agency allowed us to modify our proposed arrangements. With the wisdom of hindsight, we now realize that a major omission from our interdisciplinary team was a geologist-mineralogist.

The second methodological preconception of wanting to control and to exploit our data base as fully as possible had a number of consequences. Archaeological field work was done with small crews of workers under close supervision. Artifacts were analyzed in a number of alternative frameworks (cf. Chapters

3,4 and 5). However, since we were unable to analyze all excavated materials in the field and only a limited portion of the collections could be exported for study purposes, this goal was not fully met.

The end result of our endeavours as presented in this monograph is not to be regarded as the final statement on Cihuatán. Rather it is a modest addition to the cumulative process of better understanding this one site and its position in the southern Mesoamerican periphery.

Acknowledgements

A University of Calgary project at Cihuatán in 1979 was the direct result of Karen Bruhns' invitation to cooperate in investigating this site. Her enthusiastic recounting of the problem-oriented research potentials caught our interest. Our first acknowledgement, therefore, must be to Dr. Bruhns who planted the seed and who went to considerable effort to help us get settled at Cihuatán and to share her knowledge about the site with us. The Social Sciences and Humanities Research Council of Canada provided two generous grants (one for field work and one for subsequent analysis) which allowed the project to be undertaken. Permission to do the field work was issued by the Ministerio de Educación and the Administración del Patrimonio Cultural of El Salvador. Alfredo Ortiz, then Director, Dr. Stanley Boggs, Chief Archaeologist, and Mario Inclán, the APC legal advisor, extended many courtesies and aided the project in material ways, including allowing us full use of all facilities at Cihuatán. Patrimonio Cultural also gave permission for collections to leave El Salvador for study purposes. At the time of the project, William Fowler was the archaeologist in charge of Cihuatán for Patrimonio Cultural. Later, he resumed his status as graduate student at the University of Calgary and later still he completed his degree and moved on to pursue his career. In all roles he made substantial contributions to the project.

Robert A. Simms, Instituto Geográfico Nacional, San Salvador, provided us with maps of the area as well as useful information.

The botanists in our crew consulted and received valuable aid from Dr. Jorge Lagos, Facultad de Farmacia y Facultad de Ciencias Agronomicas, Universidad Nacional de El Salvador; from Vilma Ethel de Castro, Facultad de Ciecias Agronomicas; and from Victor Hellebuyck, Head, and Rosa Nohemy Tobar de Sahueron, Museo de Historia Natural de El Salvador.

Doña Adelita Prieto Mira owns the Hacienda de San Dieguito on which the Cerro de San Dieguito is located. She gave permission for the excavations, allowed the botanists to study her woodlot and provided the botanists with a great deal of ethnobotanical information, as did José Maria Peralta.

At Cihuatán, we relied on and personally enjoyed our acquaintance with the families who then lived at the site and cared for it under the auspices of the Patrimonio Cultural. Sr. Dolores Garcia was the head guardian; he, his wife Paola, and their children interacted with us in several capacities on a daily basis, as did Sr. Gregorio Quijano Perez, Maria Julia Quijano de Garcia, and Jubita Garcia. Dolores Garcia and Gregorio Quijano Perez provided useful ethnobotanical information. Paola Garcia, Maria Julia Quijano de Garcia and Jubita Garcia washed sherds, numbered artifacts and performed numerous other services. The more than 30 workmen, all previously trained by Fowler, knew their jobs and the site.

The University of Calgary contributed equipment, facilities and computer time for analytical procedures. Some of the drafting was done by Claire Minchin and Mark Samber. Figures were drawn by Claire Allum, Catherine Ringer Driver and Sharon Thorpe. Photographs of selected artifacts not allowed to leave El Salvador were provided by the David J. Guzmán Museum; Barry MacDonnell did artifact photography and prepared the plates. The manuscript was typed by Ornella Cavaliere, Anima Islam, Lois Morris, and Gail Matis. Lesley Nicholls, in cooperation with the trust officers of the University of Calgary Controller's office, expedited the rather complicated expenditure of grant funds in El Salvador. Trevor Groves loaned a vehicle for the lengthy trip to El Salvador and carried out experiments in temperature and acoustical sub-surface mapping at Cihuatán. Andreas Graspointner undertook a mercy mission that pulled us through the end of a difficult field season. Dennis Kelley and Megan Kelley measured and weighed the obsidian. Carol Krol, Mario Aliphat, Judy Sterner and Lynn Howard did ceramic coding in Calgary.

Plate 1 is reproduced from Mapas y Planos, Audiencia de Guatemala, Archivo General de Indias, Sevilla. The accompanying documentation to the map comes from Legajo 948, Audiencia de Guatemala, AGI. This and other information from the AGI is used with their permission. My own work in the Seville Archives in 1980-81 was aided by Larry Feldman and Janine Gasco.

The 1979 field project was conceived from the beginning as a cooperative venture. During the field season, those project members present in El Salvador discussed at some length the ways in which the final report might be structured. A consensus was reached in favor of an integrated report rather than one in which different chapters were written by different people. This has both positive and negative consequences for project members. On the one hand, the spirit of the research is translated into an integrated report. On the other, the work of individuals becomes submerged and their contributions more difficult to identify and cite on c.v.'s.

In an effort to clarify the contributions of

as well as to acknowledge those contributions, the roles played by the several project members will be identified here.

All archaeological crew chiefs (Mario Aliphat, Jack Brogan and Douglas Brethauer) kept field notebooks and photographic records which are the property of the project and which are deposited at the University of Calgary. All three crew chiefs were involved in the excavation of San Dieguito Structure 15-1; Brogan and Brethauer excavated Structure 15-2; Brethauer was in charge of Structure 12-51; Aliphat was in charge of Structure 12-1. Brethauer prepared a report on domestic architecture (Structures 15-1, 15-2 and 12-51) before we left the field; Aliphat prepared a report on Structure 12-1. Harry F. Reed III was in charge of surveying and mapping; his maps were prepared in El Salvador. Charles Miksicek was in charge of flotation; Annita Harlan and Willard Van Asdall conducted ecological studies. Copies of the field reports, field records and the maps were placed on file with the Department of Archaeology, David J. Guzmán Museum, San Salvador before we left El Salvador in 1979. All of the notes, photographic records, maps and reports (including the more comprehensive botanical reports prepared later by Harlan, and Van Asdall) have contributed directly to this final monograph.

Laboratory processing of artifacts at Cihuatán was supervised by Laurie Nock. As is described elsewhere, the descriptive notes on the collections are used as one line of evidence for, particularly, the ceramic analysis (see Chapter 3). Subsequent analysis of those collections loaned to the University of Calgary was conducted under the supervision of Kelley.

Michael R. Williams has assisted the project at every step of the way from pre-season planning to final manuscript preparation. His computer analysis of ceramic data forms the basis for part of the ceramic analysis (especially Chapter 4); he accompanied us to El Salvador to assist in on site implementation of our proposed sampling programs (see Chapter 2), and he helped in the final preparation of the manuscript using the Xerox Desktop Publishing Series; Ventura Publisher Edition. Peter Shinnie read the mannuscript and offered helpful suggestions.

William Fowler supervised the lithic analysis, and his report is only slightly revised in Chapter 6 of this monograph. Petrographic analysis of sherds was carried out by Mavis Stout. The discussion of those results in Chapter 5 is Kelley's; it was, however, carefully reviewed with Stout. David Harvey undertook X-ray diffraction of a sample of ceramics (see Chapter 5). The results of neutron activation of obsidian by Helen Michel and Frank Asaro of the Berkeley Lawrence Laboratory are fully reported in Fowler et al (1987). Joseph Michels of Mohlab did the obsidian hydration.

Payson Sheets offered many helpful suggestions for improving the manuscript. Anonymous reviewers also made useful comments.

Those individuals identified under the rubric of "With the Assistance of:" are those who presented subtantial project reports that have been largely incorporated into this monograph.

It is hoped that this method of identifying contributions of participants adequately reflects the realities of my responsibilities as project director and actual writer of the monograph while identifying the substantial contributions of other project members and analysts. The success of the project is due to the cooperative spirit that prevailed. I take this opportunity to express my deep appreciation to all institutions, agencies and individuals involved.

I also want to thank my family for their patience and support.

Publication has been made possible, in part, by a grant from the Endowment Fund of the University of Calgary

JHK
January 1988

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CHAPTER 1

CIHUATÁN AND THE SOUTHERN MESOAMERICAN PERIPHERY

This monograph, and the research behind it, is aimed at better understanding Cihuatán as it functioned during the Early Postclassic, and as it related to its social and natural environment. Given the scale of our research base and the nature of prior knowledge about the site and region, this site-specific focus is, we believe, fully justified. Our goal of carrying out a study of intrasite variability was not fully realized and we cannot claim to have carried out such a study for a site that is not even completely mapped. However, we can present the results of our own research, summarize available data and make some cautious and tentative inferences about the nature of Cihuatán society.

One consequence of our somewhat introverted focus is that we pay less attention to more traditional concerns of culture history, linguistic affinity and ethnic identify than do many contemporary and recent works. However, we cannot completely avoid these topics if Cihuatán is to be seen as more than a dusty site sitting in not-so-splendid isolation on the Mesoamerican scene. One question of particular significance for southern periphery studies concerns population continuities and discontinuities. Cihuatán offers an interesting case study in this regard.

Research in El Salvador and the Southern Mesoamerican Periphery

The archaeology of the southern Mesoamerican periphery has lagged behind that of core areas of Mesoamerica. The history of research is such that the data base for the periphery is sparse; culture history is still of fundamental concern to investigators who feel, reasonably enough, that they need a reliable framework within which to evaluate problems that elsewhere have moved to more routine arenas of discussion. The state of knowledge for one geographical area was recently described in the following terms by Paul Healy:

> The questions are almost endless, the data insufficient, and the many voids intolerable. To use the terms of a recent evaluation of the history of New World archaeology, we can only conclude that Honduras archaeology is operating in the Classificatory-Historical period of development, 20 or more years behind work being done elsewhere in the Americas (1984:160).

The situation is nowhere as bleak as it was even 20 years ago, however, when short-term

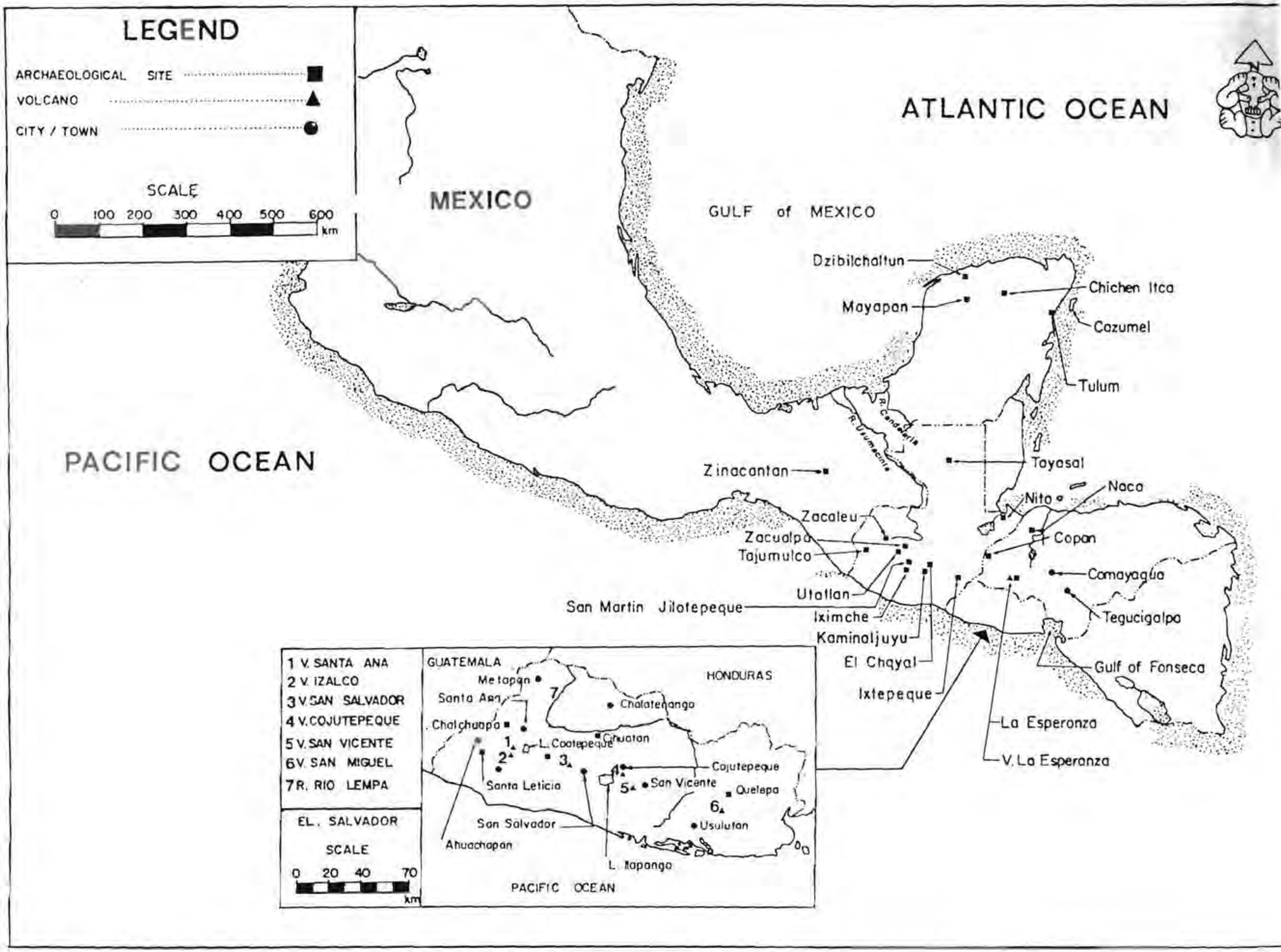


Figure 1. Map of Southern Mesoamerica

projects - often little more than visits to sites - were the rule, and the artifacts observed in private collections formed the basis for inferences about the nature and dimensions of cultural areas (for examples of trying to make sense of prehistory on the basis of such a data base, see Lothrop 1927 and 1939; Larde 1926a and 1926b; Boggs 1949 and 1976). Like so much of Latin American archaeology, the major part of the research was conducted from foreign institutions in an expeditionary fashion. In El Salvador, Stanley Boggs, unusual in being a resident in that country and in not being an expeditionary archaeologist, was especially influential in crystallizing knowledge about Salvadoran archaeology from the 1940s to the present.

Although none would claim the archaeology of El Salvador is well known, several major projects mounted since the late 1960s have moved us some distance from the very preliminary outlines of culture history that prevailed for so long. Noteworthy are the Chalchuapa (Sharer 1974; and Sharer, ed. 1978) and Quelepa (Andrews V 1976) projects which Sheets credits with adding "more substantive information on Salvadoran prehistory than all previously published research had contributed in total" (1984:110). The Santa Leticia (Demarest 1980), Cerrón Grande (Fowler 1976; Fowler and Earnest 1985), and Zapotitán Basin (Sheets, ed., 1983) projects have further extended our understanding of Salvadoran prehistory. Elsewhere on the Southern periphery, even more impressive "quantum advances" have occurred in Honduras (Robinson 1987; Henderson 1987).

The problem of defining the boundary between the Mesoamerican and Central American or Intermediate areas has concerned many archaeologists (cf. Lothrop 1939; Thompson 1970); it is generally conceded that most of western El Salvador and western Honduras were part of "real" Mesoamerica (Linares 1979:25). For some, the dividing line between "real" Mesoamerican and other allegiances was set, for El Salvador, at the Lempa River (cf. Longyear 1966). With more research, this boundary has been shown to be considerably more permeable than previously thought (Andrews V 1977:114).

The core-periphery dichotomy which permeates thinking about both cores and peripheries (but especially the latter) is useful only at rather early periods in the accumulation of archaeological knowledge about particular areas. As Earnest and Demarest argue:

> We now know that there are many different cores and many different kinds of peripheries...what we find in southeastern Mesoamerica is a variety of contact possibilities with different complex Mesoamerican societies interacting with the different "peripheral" areas. In each case the nature and intensity of relations is defined by nearly unique combinations of local ecologically based evolutionary processes with variable external needs. If anything characterizes the Southeastern periphery, it is the boundless nature of interactional possibilities (1987:224).

The Postclassic Period

Just as the southern periphery has lagged behind other parts of Mesoamerica in archaeological research, the Postclassic period is the most poorly known period in the Mesoamerican sequence between the Formative and historic periods. How the period is defined depends in part on chronological considerations. However defined, Mesoamerican archaeologists tend to regard it rather as Peter White (1977) says many prehistorians regard the Stone Age cultures of Sunda and Sahul: i.e. as "crude, colourless and unenterprising". Except that, in the Mesoamerican case, the terms usually used are more likely to be "decline, decadence, and depopulation" (Chase and Rice, eds., 1985:1).

Postclassic sites tend to lack the impressive monumental architecture of Classic period sites, and this, as much as anything, may be why archaeologists were so slow to turn their attention to this period. Postclassic period arts and crafts are seen as lacking the artistic merit of earlier work. The Postclassic period provides many experiments in statehood, however, as well as examples of thriving commerce and a great variety of exchange systems which are of theoretical interest to contemporary archaeology. The general neglect of this period is rendered even more incomprehensible in the light of the extensive and rich documentation that exists for the contact period.

Archaeologists now tend to see more continuity between the Classic and Postclassic periods than was formerly the case (cf. Henderson 1981:202; Webb 1978). Major disruptions occurred at the end of the Classic period in Mesoamerican and to some extent along its southern periphery. While some regions show discontinuities at approximately the Classic/Postclassic boundary, others such as the Naco Valley do not (Urban 1986). Trade and commercialism, secularism, and militarism have long been recognized as being characteristic of this period (Holden 1957).

At a 1979 symposium, several themes were identified as characterizing recent Lowland Maya Postclassic studies. "Replacing the earlier view of a declining society, these new themes underscore the strength and complexity of Postclassic culture" (Chase and Rice 1985:5). In their introduction to the volume, Chase and Rice (ibid:5-8) identify several of these new themes which can be briefly summarized as follows:

1. Most important is the element of long distance trade as documented ethnohistorically and archaeologically. Much of the trade was coastal (cf. Sabloff and Rathje 1975). Early Spanish accounts tell of meeting large, heavily loaded canoes off the east coast of Yucatan.
2. In some areas a shift to coastal/riverine settlement patterns occurred, apparently in response to the increased importance of trade. The abandonment of Quirigua and founding of Nito probably reflects the importance of the new sea trade routes (Sharer 1985:252). Some scholars see major river valley routes into the highlands of Guatemala as playing a major role in the intrusion of lowland traits into the highlands through invasion or whatever mechanism of contact is postulated (see Sharer 1985 and Brown 1985 for two views).
3. Militarism is seen as perhaps being implicated in the Classic Maya collapse, and certainly as a major factor in the Postclassic.
4. Population movements profoundly affected the entire lowland Maya area, even if it is often difficult to disentangle the evidence of who moved where.

Freidel's "grand synthesis" of the papers presented in the Lowland Maya Postclassic symposium isolates three other themes heralding a "broader evolutionary view of Maya prehistory in which the Southern collapse is a signal event, but by no means is it the last gasp of a civilization" (Freidel 1985:286):

> The first issue is that of continuity and disjunction between indigenous development on the peninsula during the Classic era and the developments following the collapse in the south. In general, these papers tend to seek out continuities in order to place the disjunction in context. A second theme is the role of external groups in developments on the peninsula during the Postclassic. The general inclination of the papers is to regard external influence in light of a more outward-looking indigenous population, but several of the contributors maintain the stance that the lowland Maya were under severe accullurative pressures of an involuntary nature. Third, there is a trend toward viewing the peninsula during the

> Postclassic as a heterogeneous mosaic of sociocultural organizations rather than as a relatively homogeneous territorial block undergoing sequential cultural expressions (ibid:285-286).

Although Freidel's remarks are directed toward the peninsula, these themes are echoed in the southern periphery.

The Language Question

The historical distribution of languages along the southern periphery is sufficiently complex to raise tantalizing questions about prehistoric language distributions and the relationships between cultural orientation, population continuities and discontinuities, language and ethnic affiliation. Interest in such problems is particularly acute because this is the geographical area in which Mesoamerican languages meet Central American ones, and languages presumed to have spread from Central Mexico are interspersed with Mayan. Various linguistic reconstructions have been proposed for western El Salvador. Sharer (1974) once argued that the core population of western El Salvador was Maya or Maya related in speech and culture throughout much of prehistory; Sheets (1984:88), however, feels that the earliest inhabitants of Chalchuapa may have spoken Mixe-Zoque; in this he follows suggestions made by William Fowler. Eastern El Salvador is seen as having a core population of Lenca or Lenca related peoples (Andrews V 1977).

Although reconstructions such as these are controversial, they set forth what would otherwise be implicit premises. They also serve to order hypotheses about cultural dynamics over time in ways that are extremely useful as long as the framework created does not override the consideration of alternatives as merited. The picture of language distributions was quite complex in the southern periphery at the time of the conquest, and there is no compelling reason to think it was vastly simplified in earlier centuries (cf. Feldman 1977).

At the dawn of history, western El Salvador was largely occupied by Pipil speakers with enclaves of Pokom Maya speakers in the vicinity of Chalchuapa and Ahuachapan; there were possibly also Pokom Maya speakers around Atiquizaya (Thompson 1970; Fowler 1981:498-508). Lothrop (1939) indicates Chorti speakers living in the vicinity of Chalatenango, north of the Rio Lempa. Miles felt the Pokom language distributions of the contact period were best interpreted as contracted remnants of the former population; she says: "It appears quite unnecessary to search for another Maya people as inhabitants of Classic Tazumal, Aguachapan, San Andres, and Asuncion Mita" (Miles 1957:754). Sharer (1974:173), on the other hand, suggests that the Pokom Maya may have arrived in Chalchuapa in the Late Postclassic.In general, the Pokom Maya distribution now tends to be interpreted as a later dispersion. Archaeologists working in the region appear to feel that western El Salvador Classic period inhabitants were most likely to be Chorti or Chorti-related speaking (cf. Fowler and Earnest 1985:24; Sheets 1986:233 and 236). These, then, would be the people who moved into the area as it recovered from the long-term deleterious effects of the Ilopango eruption of about the mid-third century A.D. (cf. Sheets 1979a:525-564;1986), and the dominant populations resident in western El Salvador when the Pipil arrived. Baudez (1986:335) challenges this view, and Sharer (1986:344) has become much more cautious about ancient ethnic identification.

The Pipil Question

Since Cihuatán has been seen as a Pipil settlement (Fowler 1981), the Pipil question needs to be reviewed. It is generally agreed that the movement of Mexican people, culture and/or languages out of central Mexico to the south and southeast occurred over a long period of time, as the following brief sampling of some examples will attest. The ties between Teotihuacan and Kaminaljuyu during the Classic Period are well known (see Kaufman 1976 for a discussion of archaeological and linguistic correlations). As well, the Classic period Cotzumalhuapa culture centered in the Pacific slopes of Guatemala was Mexican-related. Parsons, who excavated Bilbao, refuses to designate the language spoken at that site as Pipil, arguing that:

> ...continuing to call this prehistoric culture Pipil on the basis of traditional definitions is tantamount to the problems of naming Preclassic Olmec culture after the protohistoric Olmec speakers living in that region. We would prefer to leave the question of the linguistic attribution of the Classic Cotzumahualpan people open. We decidedly do not affiliate them with the Postclassic Pipiles ... If ... new linguistic evidence is able to demonstrate that such Classic-period Mexican cultures as Teotihuacan utilized the Nahuat tongue (and this idea is becoming increasingly popular) then we will have no objection to also calling the Cotzumalhuapan culture Pipil ... (Parsons 1969:150).

Although the idea that the language spoken at Teotihuacan was indeed a Nahuat one is advocated by many, a group of linguists have recently favored the idea that either a Totonacan related language or, less likely, a Mixe-Zoque language was spoken there (Justeson et al. 1985: 68 and 72). Nevertheless, Cotzumalhuapan represents a Mexican penetration of some sort into the fertile Pacific slopes during this period, and it seems they sought control of the agricultural resources of the area.

Looking at the situation from the other end of the continuum, investigations at the site of Tula, Hidalgo, produced a cache of Plumbate pottery, a tripod bowl and several goblets of Papagayo pottery (Diehl, Lomas and Wynn 1974). The Papagayo pieces are believed to be from Central America. Diehl and Benfer (1975:123) suggest a Nicaraguan or Costa Rican origin for the Papagayo pieces, while Diehl (1983:89) notes in a later statement that a Central American archaeologist suggested they were made in eastern Honduras.

During the protohistoric period in highland Guatemala, the formation of the Quiche empire shows a pattern of Mexican (Toltec) elite taking over a Maya area through conquest. Fox (1978) outlines a scenario of Epigonal Toltecs from the Gulf Coast penetrating the highlands following the fall of Chichen Itza. Some 13 of these Mexicanized groups are said to have settled among the Quiche Maya. They married local women and lost their Gulf Coast language. The Quiche became the most successful of these militaristically expansionist groups. The Quiche case is most superbly documented from both ethnohistoric and archaeological perspectives, and it stands as a classic case of evaluating the archaeological evidence in the light of ethnohistoric documentation in a case study of state formation (Carmack 1968; 1973; 1981; Fox 1978; 1980).

The Mexicanized Gulf Coast groups are known to have been deeply involved in long distance trade relations. Postclassic period coastal shipping was routed around the peninsula of Yucatan and down the east coast of Central America. Improved water transport is seen as playing a major role in defining the nature of Postclassic societies. Overland trade was also extensive, as is indicated by the sixteenth century relationships between Acalan and Nito (see Scholes and Roys 1948; Henderson 1976; 1977; 1979). The brother of the ruler of Acalan (near the Gulf Coast) was in charge of the Acalan merchant's barrio in Nito (on the Caribbean). In 1524-25, Cortes was given maps of the land route to Honduras by the merchants of Tabasco, Xicalango and Acalan

(Scholes and Roys 1948:20). Some of these Mexicanized merchant enclaves in the southern periphery may have spoken a Nahuat language and might be called Pipil (see Henderson 1979: 369-370 for a discussion of the situation at Naco). It should be remembered that Malinche was a Maya who also spoke Nahuat.

In western El Salvador, the introduction of Nahuat did not occur in a single sweeping invasion. Rather, multiple events and complex histories of the interaction of Nahuat speakers with previously established populations are believed to be behind the 16th century "sea" of Pipil speakers. As we shall argue, a number of different patterns of accommodation between the "old" and "new" populations can be suggested on the basis of the archaeological evidence.

Culture History in Western El Salvador

Sheets (1984) offers an excellent summary of Salvadoran archaeology as known at the present time. The following brief discussion, intended only to orient the reader unfamiliar with the Salvadoran sequence, relies heavily on Sheets summary. The backbone of the western El Salvador culture historical sequence is the very important site of Chalchuapa (cf. Sharer, ed., 1978; Sharer 1974).

The earliest evidence of sedentary agriculturalists dates from 1200 B.C. and is found at Chalchuapa. Sheets attributes the selection of this locale by early farmers to its favorable water supply, fertile valley, and also to the fact that it is exactly half way between the Ixtepeque obsidian source and the Pacific coast. Throughout the Preclassic, Chalchuapa continued to grow and prosper as a chiefdom or ranked society under sustained external influence from the Olmec. Sheets (1984:90) feels that the obsidian from the Olmec site of San Lorenzo probably was routed through Chalchuapa in the Middle Preclassic.

Chalchuapa in the Early Classic is described by Sheets as:

> a major residential, economic, and ritual center in the southeast Maya highlands. The central zone alone was 2 km in length, composed of numerous 15-m-high pyramids...separated by formal plazas and surrounded by habitation areas of the elite, artisans, and agriculturalists. Obsidian was traded in large quantities from Ixtepeque and manufactured by craft specialists into numerous kinds of tools. Monuments, some with elaborate sculpture and calendric dates, were carved and erected in the ritual zones. Elaborately decorated ceramics were manufactured, commonly using Usulutan decoration combined with the mammiform tetrapod vessel form (Sheets 1979a:535).

The number of sites known for the Late Preclassic and Early Classic is much greater than for the previous period. Aside from an ongoing population at Chalchuapa, the sites of Santa Leticia (Demarest 1986) and Quelepa (Andrews V 1976) were both founded in this period. This was a time of high population density at lower elevations. The whole of El Salvador is culturally more homogeneous during these centuries than at any other time - at least until the eruption in the mid third century A.D. of Ilopango which apparently caused the abandonment of much of western and central El Salvador for varying lengths of time (Sheets 1984:94; 1979a; 1986).

During the Classic period, regions recovering from the effects of the Ilopango eruption seem to have been repopulated by Chorti (?) Maya - probably from the north, and perhaps from the vicinity of Copan and Quirigua, judging from similarities in the ceramics between the two areas. In the west, Chalchuapa is "much reduced in population, ritual construction and general vitality" (Sheets 1984:104). In the east, Quelepa shows more influences from the Intermediate Zone and exhibits a major building period which seems to be parallelled at the little known site of Tehuacan.

By the beginning of the Postclassic, then, El Salvador had a long history of agriculturally based ranked societies of varying degrees of complexity. All archaeological reconstructions indicate a complicated picture of external relations and population dynamics. Some population movements occurred in response to natural disasters and the subsequent process of natural recovery which again allowed access to and exploitation of natural resources.

The Postclassic is the least understood of any of the agriculturally based periods in El Salvador. Population movements appear to abound. At the end of the period, we encounter the documented "sea" of Pipiles in much of central and western El Salvador, enclaves of Maya speakers, and the Lenca in the east.

External relations shift markedly during the Postclassic. Earliest to show new influences from the Gulf Coast is the eastern site of Quelepa. In this context of Gulf Coast relationships to El Salvador, it is worth remembering that Parsons (1978) proposed delimiting the Peripheral Coastal Lowlands as a third area on an equal footing with the Mexican and Maya areas. The Peripheral Coastal Lowlands stretch from the Veracruz coast, across the low-lying Isthmus of Tehuantepec, and down the Pacific coast of Guatemala and El Salvador. From the perspective of El Salvador, the most compelling evidence for close relationships across the Peripheral Coastal Lowlands occurs in the Preclassic (Olmec) period and in very Late Classic/Postclassic times.

Specific relationships to the Veracruz area have been argued by Boggs (1972; 1973) for the wheeled figurines that appear first at Quelepa, as do Veracruz yokes, *palmas*, an *hacha* and other distinctive items (Andrews V 1976:154, 155, 169-174, 183-186). Mexican traits found at sites occupied in the Early Postclassic include life size Xipe Totec ceramic figures, *talud-tablero* architecture, Chac Mools, Plumbate pottery, stylistic resemblances to Mixteca-Puebla pottery and other items. Considerable variation is seen in how pervasive these Mexican traits are in different regions of El Salvador, as well as in the strength of indications of continuity or discontinuity of site occupation across the Classic-Postclassic temporal boundary.

From the meager information available, we can speculate that the groups broadly known as Pipil (some of whom might more appropriately be called the Tajinized-Teotihuacan-Pipil, following Borhegyi [1965]), began entering El Salvador in the Late Classic period. The earliest extant evidence of their presence is in the eastern part of the country; a sea route is suggested to account for the absence of a similar complex of traits in intervening areas (Boggs 1973).

Even more profound changes are usually seen as characterizing the Late Postclassic. Population reduction, the continued withering of previously active centers (i.e. Chalchuapa), or the actual abandonment of major sites such as Cihuatán and Santa María, seem to indicate major demographic shifts, although it must be admitted that we know very little about this period, and El Salvador has no excavated equivalent of Naco in Honduras, for example, that falls in this period.

For a continuation of this speculative culture history into the early historic period, the reader is referred to Fowler's (1981 and 1987) excellent reviews of the historical documents and ethnohistorical inferences.

Culture History of the Paraíso or Central Basin

Since Cihuatán is located at the margin of the Paraíso Basin, the culture history of the basin brings us closer to the setting in which Cihuatán flourished in the Early Postclassic.

Contrary to earlier expectations that Paraíso Basin cultural developments would be closely related to those of the volcanic highlands, the current view is that the Paraíso Basin inhabitants were not "full participants in the main stream developments which occurred along the volcanic axis and coastal plain" during the Preclassic (Earnest and Demarest 1987:217). Rather, the early cultures appear to have developed a "high degree of self-sufficiency firmly based in the distinctive environment of the basin" (ibid).

The Cerrón Grande Archaeological Salvage Project, carried out in conjunction with the construction of Cerrón Grande dam on the Lempa River in the early 1970s, provided a great deal of information about the cultural sequence in this sector of the Basin. The following information is primarily drawn from Fowler (1976), Fowler and Earnest (1985) and Earnest and Demarest (1987). Dates given for each phase are as suggested by those authors.

The nature of occupation in the basin during the Early to Middle - Preclassic Bagazo phase (ca. 1000-650 B.C.) is unclear. A few eroded sherds showing some resemblances to the contemporary pottery in the Chalchuapa sequence provide the presently available evidence. Fowler and Ernest (1985: 22-23) note that most of the land surfaces from this period are probably deeply buried; nevertheless, it is felt that the area was occupied by a substantial Preclassic population (Earnest and Demarest 1987:215).

In the Middle Preclassic Concepción Phase (ca. 650-400 B.C.), ceramic ties are again noted to the better known Chalchuapa sequence. Interestingly enough, the two regions differ in the importance of obsidian working. Obsidian was already the major raw material in the Chalchuapa lithic industry, as it remained. In the Paraíso Basin, on the basis of the limited evidence available, the Concepción phase lithic industry is characterized by only 20% obsidian, with locally available igneous and cryptocrystalline materials making up the bulk of the industry. Earnest and Demarest describe the Paraíso Basin assemblage up to this point in time as "conservative, if not archaic" (1987:219), contrasting these developments with the rapid development and evolution of societies to the east and west.

The Late Preclassic Dulce Nombre phase (ca. 400 B.C. - 250 A.D.) is known from several sites. Fowler and Earnest see the ceramic complex as showing tenuous relationships to contemporary sites of the southeast highlands, but by and large they are impressed with the conservative nature of the ceramics; many of the types and modes are retained from the preceding phase in the Paraíso Basin (Fowler and Earnest 1985:23). Similarly, the lithic industry shows strong ties to that of the preceding Concepción phase (ibid). A ridged field is known from the site of Río Grande. The Los Flores site is regarded as the ritual/administrative center of a considerable Late Preclassic population in the basin. Fowler and Earnest believe that Preclassic sites were limited to the floodplain in order to exploit the fertile soils and the riverine resources. Swampland would have provided a useful microecological niche, and one site is located next to a swampy backwater. The uplands, they argue, would have been exploited for lithic materials, animal procurement, wood and other resources. Sites of the Dulce Nombre phase lie under a thick layer of volcanic ash from the Ilopango eruption. As was the case for earlier phases of the Preclassic, the Paraíso Basin can still be seen as conservative and static relative to regions lying on either side. Little social differentiation existed (Earnest and Demerest 1987:220).

The Ilopango volcano lies some 45 km to the south of the Basin, and, as Sheets has described, the eruptive plume was blown primarily to the north and west (Sheets 1984:94). Sheets identifies three zones of differential impact: (1) a zone of lethal damage, (2) a zone of ecological impact in which humans might have survived the ash fall, but their technology was incapable of coping with the changed environmental conditions, and (3) a zone of significant impact in which an agricultural way of life could continue with certain adaptations (Sheets 1979:525-526). The area within the second zone, perhaps some 8000 km^2, would have lost population through out-migration. Sheets suggests a "conservative" estimate of 320,000 people displaced by the eruption (ibid). Among them, presumably, would have been all or most of the people of the Paraíso Basin, where the ash fall was too heavy to allow continued farming of the bottom land. Fowler and Earnest suggest that the uplands were less affected, and any population remaining in the Basin would have had the option of retreating to that environmental zone and, presumably, accepting a changed life style. There is no evidence, however, that this sort of adaptation was attempted.

Fowler and Earnest (1985:24) have a named phase that covers the time of the Early Classic - i.e., the time following the Ilopango eruption. They see a very sparse population in the Basin at this time, and indeed only one site is known to pertain to this Early Classic Ejotal phase (ca. 250-400 A.D.). The first known reoccupation is found, significantly enough, in the floodplain on a point bar formed by the river cutting through the sterile deposits and creating a small environment in which agriculture could once again be practiced. Artifacts from this site are said, on the one hand, to show strong continuity to the preceding phases, and on the other, to show affinities to Quelepa. Quelepa is regarded as having become much more important in the southern periphery as a result of the devastation of so much western El Salvador; its own relationships during this period show strong ties to Central America, and it is assumed that Quelepans turned their attention to the east and south when the western Salvadoran ties were destroyed or weakened (Sheets 1984:103-104).

Major repopulation of the Basin occurred in the Middle to Late Classic Fogón phase (ca. 400-900 A.D.). Fowler and Earnest suggest that a reasonable reconstruction of the sequence of repopulation would see population first returning to the Lempa floodplain, followed by movement into the major tributaries. The land-use patterns of the Fogón phase differ markedly from earlier times, perhaps partly in response to higher population densities, since this was the period of peak population in the Basin. Fogón phase people made extensive use of the upper terraces which were above the Ilopango alluvium. These authors see these immigrants as Chorti or Chorti-related Maya speakers.

The spread of the Chorti (or related) people into these regions may have been due to population pressure in their homelands and the availability of the recovering agricultural land. In all likelihood, the motives were complex, and Sheets has suggested that their southwest movement was related to maintaining control over the obsidian sources and routes threatened by the Teotihuacanos at Kaminaljuyu (1984: 109; see also Sheets 1986:236).

Ten known sites may be assigned to the Fogón phase within the Paraíso Basin; as well, the site of San Francisco in the south of the Basin may belong here. Ceramics most closely resemble those of Middle to Late Classic Copan and the contemporary complexes at Chalchuapa. Larger sites are characterized by plazuela groups at the center of tightly nucleated settlements (Fowler and Earnest 1985:25). Ballcourts with open ends are found in the centers. A hierarchy of settlement components ranging from civic-religious centers to small isolated farmsteads with little or no platform mound construction is indicated.

The Early Postclassic period, to which Cihuatán belongs, is assigned to the Guazapa phase (ca. 900-1200 A.D.). Fowler (1976 and

1981) and Fowler and Earnest (1985) see a complete break between the preceding Fogón phase and the Guazapa phase. This apparent discontinuity in the basin sequence, plus ethnohistorical and other evidence, leads these authors to infer that the Paraíso Basin experienced a massive Mexican intrusion (see also Earnest and Demarest 1987: Table 1:218). Mexican traits derive from both the Mexican highlands and the Gulf coast. Bruhns (1986:308) suggests "an immigrant elite, perhaps from Veracruz" entered the basin at this time. These movements are part of the events happening across the entire southern periphery which was undergoing severe populations displacements. Healy (1984:184) sees the period after 1000 A.D. as being characterized by a considerable population drop and widespread abandonment of sites in western and central Honduras.

During the Guazapa phase, the entire suite of microenvironments in the Paraíso Basin was used, although the lower reaches of the floodplain continued to be sparsely occupied. Cihuatán, the largest site of the period, is located in the upland environment which was occupied for the first time. As Fowler and Earnest remark, "it does not seem fortuitous that access to the heart of the Basin could have been controlled on the west from Cihuatán and on the east from Santa Maria" (1985:30).

The Guazapa phase cultural traits are very homogeneous over the Basin, showing little variation (Fowler and Earnest 1985). The ceramic complex shows affinities to the Tula-Mazapan and Mixteca-Puebla ceramic horizons. Obsidian blade production dominates the chipped stone complex; the obsidian at Cihuatán comes from Ixtepeque, El Chayal and San Martín Jilotepeque (Río Pixcayá) (Fowler et al 1987). At both Cihuatán and Santa María, and perhaps in other Guazapa phase sites, *talud-tablero* construction occurs on presumed public buildings; I-shaped ball courts and T-shaped platform mounds are known. The Cerrón Grande survey gives evidence of a settlement hierarchy which includes the two main centers, smaller villages, hamlets and farmsteads. Both Cihuatán and Santa María have a central zone where elite residences, pyramids, ball courts, walled enclosures, and platform mounds that held small temples are located. Beyond the center, at both sites, the smaller platform mounds of the nonelite residences are dispersed around the surrounding landscape over quite a large area (an estimated 375 hectares at Cihuatán and ca. 360 hectares at Santa María). Both sites are said to have been burned and destroyed with some violence.

Evidence for Late Postclassic occupation of the Basin is problematic; however, Fowler and Earnest feel that it is unlikely the basin would have been completely abandoned. They provide a phase name to cover this period, the Hediondo phase (ca. 1200-1524 A.D.). Marihua Red-on-Buff, which Haberland (1974) has seen as a Postclassic marker, probably falls after 1200 A.D.; it has been found at the sites of San Francisco and El Mico. What has been called Marihua Red-on-Buff has been found at Cihuatán, but it is not entirely clear that this is the same as Haberland's type; Tamoa Red-on-Buff as described by Fowler (1981) is definitely not the same as Marihua Red-on-Buff.

The Paraíso Basin is not alone in showing reduced population during the Late Postclassic. This period is represented by only five sites in the Zapotitán Basin survey, and Chalchuapa is greatly reduced in size.

A Comment on Chronology of the Postclassic

Concepts about how the Postclassic is to be dated derive from a number of sources. It is, first of all, something that temporally follows the

Classic period, and, in the Peten, it therefore follows the southern Maya collapse of approximately 10.3.0.0.0. in the long count (Chase and Chase 1985:10). One important factor, therefore, is the correlation between Mayan and Christian calendars selected as a basis for establishing a base date. Correlations vary rather dramatically, with the most recent Kelley correlation placing events some 216 years later than the Thompson correlation that tends to be favored by archaeologists at the present time (see Kelley 1984; Thompson 1950). A suite of other possibilities exists. Selection of a correlation is of fundamental importance to chronological interpretation because it establishes expectations about what dates to expect and to accept from other dating techniques that might be applied.

Other problems associated with chronological measurements of the Postclassic include interpreting dates obtained from various chronometric techniques, the scarcity of such dates to interpret, the scarcity of good stratigraphic sequences, and the over-reliance

Table 1

Sample Number	Excavated by	Provenience[1]	Sample Material	Uncorrected Date
ELSx-12a[2]	G. E. Hernandez	P-13A at 2 m BS (WCC)[3]	Charred Wood	1155±50BP
ELSx-12b	"	"	"	1010±86BP
ELS-31	"	P-6A[4] Trench 2 Structure 2	Charred Wood	1028±92BP
ELS-35	Fowler	Structure A-1 Santa María	Charred Roof Beam	940±86BP
ELS-42	Hernandez	P-6A (WCC) (sub-construction)	Charred Wood	1230±84BP
S-1881	1979 Project	San Dieguito "Oven" by Structure 12-1 from interior of feature	Charred Wood	165±65BP
S-1882	1979 Project	San Dieguito Structure 12-1 fill	Charred Wood	805±190BP
S-1965	Fowler	Southeast Patio Complex (WCC) 78-II 33 Unit 52 E22 (1.15m BS)	Burned Post	1355±230BP
S-1966	Fowler	Southeast Patio Complex (WCC) 78-II 33 Unit S2 E28 (45 cm BS)	Charred Post	430±70BP
S-1967	1979 Project	San Dieguito 12-1 fill	Charred Wood	980±80BP
S-1968	1979 Project	San Dieguito 15-1 Unit 2N6E inside foundation wall (20-30 cm)	Charred Wood and Fruit Pit[5]	2960±205BP
Beta-4411	1979Project	SanDieguito "Oven" near Structure 12-1. From interior of feature.	Charcoal	400±90BP

ELS - Radiocarbon Laboratories, National University of El Salvador
S - Saskatchewan Research Council
Beta - Beta Analytic, Inc.

1. Provenience is Cihuatan unless otherwise noted.
2. ElSx-a and ElSx-b are two determinations run on the same sample.
3. P-13-A is a structure incorporated in the east range of the west ballcourt.
4. P-6 is a structure between the main pyramid (P-7) and the east ball court
5. The fruit pit in sample S-1968 was tentatively identified as such by Mario Aliphat.

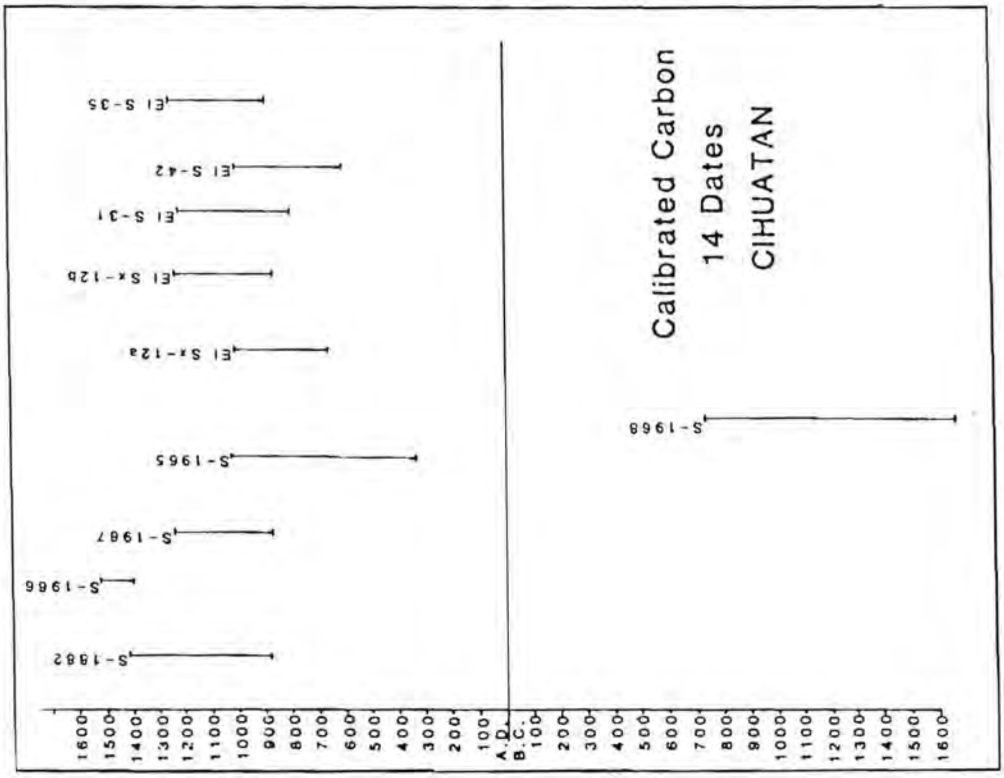


Figure 2. Calibrated Carbon 14 Dates

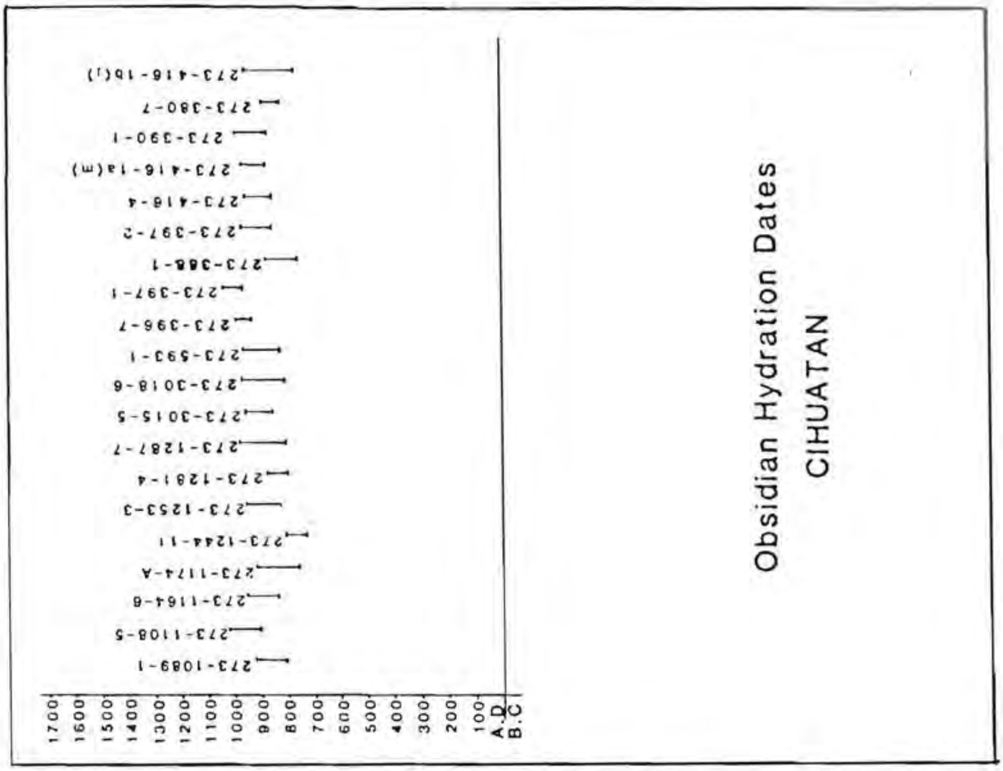


Figure 3. Calibrated Obsidian Hydration Dates

on ceramic cross dating for ceramic complexes that are sometimes not completely described or which embody conservative characteristics that have gone out of style in other regions. There are, as well, many geographical areas for which few or no Postclassic remains are known or dated, and it is thus often some distance between chronological frameworks that might be used as guidelines. The problem of the timing of discontinuities in site occupation between Classic and Postclassic periods presents uncertainties.

Not all Classic period sites were abandoned simultaneously, and some were occupied into early Postclassic times. The transitional period between the Classic and Postclassic is becoming increasingly important to understanding both periods. Some authors explicitly stress the late Classic roots of the Postclassic (Webb 1978), and there is an emerging concensus that there is overlap between terminal Classic and the Early Postclassic in at least some areas (Andrews V and Sabloff 1986; Lincoln 1986). Conceptions about the nature of the Postclassic sociocultural systems also effects chronological perceptions. As Freidel says in speaking of another geographical area, the trend "toward viewing the peninsula during the Postclassic as a heterogeneous mosaic of sociocultural organizations rather than as a relatively homogeneous territorial block undergoing sequential cultural expressions" has caused a "radical reevaluation of temporal schemes" (1985:285-286).

The Chronology of Cihuatán

Everyone who has worked at Cihuatán or concerned themselves with Salvadoran prehistory agrees that the site is Postclassic. Where in the Postclassic it is to be placed has been less clear. Boggs (1972:72-73) once placed Cihuatán in the Período Postclásico Tardio, Las Pampas (a site just to the southeast of Cihuatán) in the Período Postclásico Temprano, and San Francisco in the Período Clásico Tardio. In more recent years, Cihuatán has usually been regarded as Early Postclassic, but the temporal placements of the nearby sites of Las Pampas and San Francisco remain unsettled. Furthermore, Cihuatán and Santa María are usually accepted as contemporaneous single component sites. No evidence of Classic period occupation at either Cihuatán or Santa María has been reported to date. The main pottery type useful for cross-dating is Tohil Plumbate which is more or less omnipresent at Cihuatán, albeit in small quantities. We have, at yet, very little evidence for internal chronology at Cihuatán. Stratigraphic superposition is rare, and the ceramic assemblages from different parts of the site give no strong evidence for internal diversity that might be attributable to chronological factors.

A number of Carbon 14 dates are available for Cihuatán. Some were run in El Salvador on materials collected by Fowler and Hernandez (Fowler 1981:47, 49) and others were run as part of the 1979 Cihuatán research supported by the Social Science and Humanities Research Council of Canada. These included samples from our 1979 excavations in the San Dieguito sector of the site, and earlier excavations – including one sample from Santa María (Table 1). Two Carbon 14 dates from a feature adjacent to the temple Structure 12-1 (Area D) in San Dieguito are described separately in Chapter 2.

All of the dates as given in Figure 2 are calibrated according to the tables in Klein, Lerman, Damon and Ralph (1982). These calibrated dates differ from those given in Fowler (1981:48) for nine of the ten dates reported in Figure 2. Fowler deleted sample S1968 as too early, and we regard it as an outlier, but include it here for the sake of creating a complete record. Fowler averages the nine most reliable dates; using the procedure described by Long and Rippeteau (1974), he arrives at a weighted average of 1037 A.D. The average of the same eight dates using the new calibrated mid-point for each date is 959 A.D.

Fowler (1981-52) then removes samples S-1965 and S-1966 from the average calculations "because of the statistical improbability of their contemporaneity"; the weighted average of the six remaining dates is A.D. 938±40. The mean values of the six dates range from A. D. 742 to 1144. Excluding ELS-42 which dates from a sub-construction level, Fowler (ibid) gives the range of means as A.D. 814 to 1144. Or, if ELSx-12 b is preferred over the other determination on the same sample (ELSx-12a), then the range of means of accepted dates is A.D. 935-1144. Fowler concludes:

> Some of these dates are possible evidence that the occupation of Cihuatán began before and lasted longer than the dates of A.D. 900 to 1200 that I have assigned to the Early Postclassic Guazapa Phase. But since five of the six most acceptable dates fall within this time period, and the sixth (ELS-42) necessarily falls before it, the dating of the phase to approximately A.D. 900-1200 seems most reasonable (Fowler 1981:53).

As we review these dates, we prefer to keep the option open for considering an earlier beginning point for Cihuatán and the Guazapa Phase. In any event, both sets of calculations suggest that Cihuatán, and probably therefore also Santa Maria, may have been occupied in the ninth century, and certainly was during the tenth and eleventh centuries.

Obsidian hydration determinations on materials from Cihuatán have been made by Meighan (1981) and Michels (this report). Meighan ran fifty-five specimens from Cihuatán submitted to his lab by Earl Lubensky and Karen Bruhns; a few of the samples from the presumably contemporaneous site of Santa María were submitted by Stanley Boggs. Meighan presents depth of the obsidian hydration band in microns. Fitting together the "average hydration readings with the C^{14} results for the sites indicates that a hydration rate of 400±50 years per micron will fit all the evidence" (Meighan 1981:146-147). He notes several "uncertainties" about this procedure, including the fact that "we do not know that all obsidian tested is from the same source nor that is was all exposed to the same environmental conditions (particularly temperature). We also do not know what correction factors, if any, apply to the C^{14} dates" (ibid:147). Hydration depths for the Cihuatán specimens range from 2.0 to 3.3 microns. Each investigators' specimens were kept in lots for which the average depth in microns was calculated:

– Bruhns
  (16 specimens; average in microns 2.96),
– Boggs
  (2 specimens; average in microns 2.40),
– Lubensky
  (37 specimens; average in microns 2.54).

Meighan felt Bruhns' specimens might be "a couple of hundred years earlier than the samples from Boggs and Lubensky" (ibid).

Meighan solicited comments from various active field workers about their assessment of the obsidian hydration results from El Salvador which included materials from sites of various ages. Boggs (ibid:194) responded that the Postclassic seemed to be the chief dating problem. Fowler (ibid:148) felt more than one hydration rate must be involved, and Bruhns (ibid:150) noted with interest the apparent clustering of dates from Cihuatán into two temporal spans since on other grounds Cihuatán appears to be a single component site that wasn't in use for very long.

Since the dates reported by Meighan do not include information on sources, and therefore on specific hydration rates, it is impossible to integrate the earlier results with those obtained by J. Michels at Mohlab in conjunction with our

1979 project. The latter determinations (Figure 3) were based on the hydration rates for known sources as determined at the Lawrence Laboratory (cf. Fowler et al 1987). Results of the Mohlab obsidian hydration determinations are shown in the table below.

These dates cluster much more tightly than the Carbon 14 dates. A simple average of these dates is 884 A.D., and this is slightly earlier than the Carbon 14 dates. The overall fit between the two techniques is, however, not unreasonable.

OBSIDIAN DATES -- CIHUATÁN, EL SALVADOR

Specimen No.	Hydration Rim	Calendar Date
273-1069-1	2.55u ± 0.06u	873 AD ± 55 yrs
273-1108-5	3.55u ± 0.11u	967 AD ± 62 yrs
273-1164-6	2.53u ± 0.05u	895 AD ± 44 yrs
273-1174-A	2.59u ± 0.07u	840 AD ± 70 yrs
273-1244-11	2.66u ± 0.03u	772 AD ± 29 yrs
273-1253-3	2.53u ± 0.07u	895 AD ± 57 yrs
273-1281-4	3.76u ± 0.05u	845 AD ± 32 yrs
273-1287-7	2.54u ± 0.10u	884 AD ± 85 yrs
273-3015-5	3.65u ± 0.07u	912 AD ± 42 yrs
273-3018-6	3.46u ± 0.12u	884 AD ± 78 yrs
273- 593-1	3.69u ± 0.11u	886 AD ± 65 yrs
273- 396-7	2.44u ± 0.03u	964 AD ± 26 yrs
273- 397-1	3.67u ± 0.06u	898 AD ± 33 yrs
273- 388-1	3.80u ± 0.08u	822 AD ± 48 yrs
273- 397-2	2.51u ± 0.07u	906 AD ± 61 yrs
273- 461-4	2.53u ± 0.06u	895 AD ± 48 yrs
273- 416-1a(m)	3.65u ± 0.05u	912 AD ± 31 yrs
273- 390-1	2.49u ± 0.07u	927 AD ± 60 yrs
273- 380-7	2.58u ± 0.05u	845 AD ± 41 yrs
273- 416-1b(J)	2.57u ± 0.08u	856 AD ± 71 yrs

The results of the two dating techniques do not directly contradict the archaeological evidence that places Cihuatán in the Early Postclassic. However, the problem of correctly dating the transitional period between the Late Classic and the Early Postclassic is evident in

(cf. Andrews V 1976:43). Other Late Classic Period sites may also have overlapped with the Guazapa phase. Since chronometric techniques do not yet provide us with unambiguous dates in the Christian calendar we should perhaps keep an open mind about whether Cihuatán and other Guazapa Phase sites overlap with terminal Classic sites or begin in the transitional period between the Classic and Postclassic (depending in part on the chronology favoured), or whether they postdate major Classic Period sites as is generally assumed. The implications would be somewhat different. As southern periphery and Postclassic chronological sequences are fine tuned, we should be able better to differentiate chronological matters from the cultural mosaic that is beginning to emerge.

Postclassic Themes

Archaeologists working in the southern periphery have been concerned about the effects of the Classic Maya collapse on events to the south. Major movements of population, shifts in the linguistic affiliation of the people of certain areas, realignments of trade and exchange patterns, and changes in architecture and settlement patterns have been studied. As Beaudry notes, there is "growing concern with interrelationships over space rather than a site-centric perspective" (1987:453).

Archaeologists working on the southern periphery have also been concerned with evaluating the evidence for continuities and discontinuities or disjunctions in the archaeological record. With regard to the very late Classic and the early Postclassic, the apparent record of continuities and disjunctions suggests that we are dealing with a number of diverse patterns involving local peoples and in this time period is what are called "Mexican influences". It should perhaps be noted that what is subsumed under such a rubric can have very broad relationships or antecedents in the Mexican sphere. If the Toltec phenomenon was indeed an empire, as has been argued, then that empire could well have incorporated elements from various parts of Mexico into the same social units within and beyond the boundaries of empire. Further, the "Mexican influences" may not be directly derived from the Mexican area, but may be incorporated into Salvadoran culture history from secondary sources. For example, the relationship of the earliest Mexican traits at Quelepa to later manifestations at, say, Cihuatán, have not been seriously studied. Some isolated and perhaps superficial similarities can be seen between Lepa Phase pottery and architecture as illustrated by Andrews (1976) with similar traits found at Cihuatán. I-shaped ball courts occur at both sites, both have ramps, both have wheeled figurines, and the Tecomatal Polychrome illustrated by Andrews in Figure 142-m is very like the white background polychrome bowl illustrated in this report in Plate 4a.

At least four patterns of incorporating Mexican peoples and/or "influences" can be suggested for El Salvador on the basis of presently available archaeological information. These have been touched on above.

1.Quelepa, which shows the earliest major Mexican influence of interest to us here, is interpreted as receiving foreigners in some numbers:

> If only portable objects were involved, such as *palmas*, *hachas*, yokes, flutes, and wheeled figurines, we might suspect trade. If in addition to this we note imposition of totally new architectural styles and patterns of structural arrangement, we then may posit foreign control, presumably by a powerful elite with military backing. When at the same time a new and radically different ceramic complex, derived at least in part from the same foreign area, replaces the old, we are entitled to regard the entering group as more than a small elite (Andrews V 1976:185).

While the late Classic Lepa phase at Quelepa shows a major disjunction with the earlier Shila phase at the same site, nearby Lepa phase sites do not share the Lepa phase artifact assemblage (Sheets 1984:106). Differences in the assemblages of larger and smaller centers within an area are expectable. The major disjunction of cultural traits at the major center of Quelepa suggests that in this case it might be reasonable to postulate a continuation of the older local population at the smaller sites within a new political hierarchy of the San Miguel Valley. The newcomers presumably sought control of rich agricultural lands and of cacao and salt production.

2.Chalchuapa is also regarded as receiving Mexican newcomers, but at a later date than Quelepa -- i.e. during the early Postclassic. One gets the impression that the Mexicanization of Chalchuapa was on a lesser scale than was the case at Quelepa, with a continuation of a larger proportion of the older population within the area and specifically within the town of Chalchuapa itself. Sheets (1984:107) infers that "new people were moving into Chalchuapa." Sharer (1978; 1986:341) stresses continuity across the Classic/Postclassic boundry.

3.The Zapotitán Basin in the early Postclassic exhibits minimal Mexican influences and strong continuities to earlier periods. This appears to represent a very different pattern of response to the enlarging sphere of Mexican influences -- one in which these foreign people and/or influences made a minimal impact on the status quo. This might indicate local political strength, a scarcity of resources of interest to the outsiders, low strategic value of the Zapotitán valley, or a scarcity of foreigners at this particular date. Whatever the reasons, this is a very different pattern from that seen at other late Classic and early Postclassic sites in western El Salvador.

4. The Paraíso Basin in the Early Postclassic appears to show the strongest discontinuity with earlier cultural inventories of any area in El Salvador. Here we have the most extreme form of Mexicanization -- so extreme that a major take over of the Paraíso Basin by outsiders is suggested by Fowler and Earnest (1985). Fowler (1981:16-27) postulates the Nahuat-speaking Pipil invaded the Central Basin and exerted military dominance over the former residents. It would be remarkable if there was actually a total replacement of the late Classic population, but such evidence as is available suggests that even the smaller sites of this period exhibit disjunction from the Classic period sites. The two major sites of Cihuatán and Santa María seem to have built on clean ground, as it were. Cihuatán is located in an ecological- environmental position not previously occupied within the Basin.

If these four examples reflect a gradation in degrees of Mexicanization, they also presumably are the products of a number of different processes of population mobility, acculturation, incorporation into different kinds of social, economic and political units. The end result is a heterogeneous mosaic. Recognition of this fact does not have the same novelty for archaeologists working in the southern periphery as it did for the archaeologists working in the Maya lowlands Postclassic since the heterogeneous nature of the southern periphery has long been recognized, and indeed can be seen as its hallmark.

Archaeologists must evaluate the archaeological evidence for the strength of continuities and disjunctions. Like archaeologists everywhere, those working in the southern periphery must ask whether the identification of such variation in the archaeological record is best interpreted as evidence for population discontinuities or if alternative hypotheses are more appropriate. We are, of course, still a long ways from understanding all of the archaeological analogues for various scales of magnitude and the range of events that might be involved in population mobility, or in sorting out the effects of population mobility from other factors producing variation. Assuming that "foreign" influences might reflect foreigners, the role of those foreigners as traders, tourists or conquerors must be debated. As is so often the case in contemporary archaeology, we find that we need much better chronological control to be able to assess sensibly some of the alternatives that might be considered. Granting all these provisos, it appears that western El Salvador would be an exceptionally nice laboratory to look at the process of "Mexicanization" that ultimately resulted in a "sea" of Pipil speakers at the time of Spanish contact. The processes involved probably can be seen in part as a form of ethnogenesis in the sense of changing the linguistic and ethnic identity of substantial populations. A series of hypotheses could be framed to elucidate the nature of the various processes at work within single time periods and over several hundred years which would be useful in understanding the life cycle of political units at the chiefdom or early state level. However, our purpose in this monograph is to look in greater detail at one site in the Paraíso Basin which belongs to the Early Postclassic. Showing little continuity to the preceding late Classic cultures, it seems to be a good candidate for examining a Mexican or Mexicanized population.

CHAPTER 2

THE SITE OF CIHUATÁN

Cihuatán is located approximately 37 km north of San Salvador. It lies just east of the Troncal del Norte highway which connects San Salvador with the Honduran border; the modern town of Aguilares is some 4 km to the southwest.

The site is quite large; Fowler (1981:32) estimates its areal extent as at least 375 ha. Known parts of the archaeological site are located west of the Río Acelhuate on and around the locally prominent topographic features of low hills composed of weathered andesite rising some 50 m above the immediately surrounding flats. Elevation at the site varies from approximately 285 m to 333 m above sea level; the highest point at the site is the top of Structure P-7, the 13 m high pyramid in the Western Ceremonial Center. Unconfirmed reports suggest that the site may extend across the Acelhuate into the flat valley now planted in sugar cane.

Cihuatán was well supplied with water. Not only were there rivers on both sides, but Bruhns (1980a:3) reports at least three all season springs and a number of rainy season springs within the central occupation zone. Subsurface water is not deep, and families who lived at the site during the late 1970's relied on water from handdug wells. Soils on the hills are quite shallow and erode easily. Some check dams on steeper slopes at the periphery of the central zone may have been designed to prevent or curtail erosion; cobblefronted terraces may have served the same function while also providing relatively flat areas for structures and perhaps gardens. Valley soils, on the other hand, are deep and fertile; major crops were presumably grown in the flats surrounding the hills on which the site is located. The site of Cihuatán itself is in various stages of clearance and regrowth.

The Western Ceremonial Center, now owned and maintained by the Administración del Patrimonio Cultural, still has a few ceibas and other shade trees, but for the most part, it is kept cut. Parts of the site on private land are now in grassland pasture for cattle. Other portions, such as the steep east slopes fronting on the Río Acelhuate, support secondary growth. Still other parts, such as the Cerro de San Dieguito where we conducted most of our archaeological survey and excavation, are under regular cultivation. The most active destruction of archaeological resources at the present time is occurring as the result of cultivation with oxen drawn, iron tipped, Mediterranean style plows.

A Spatial Overview

The best known part of the site is the Western Ceremonial Center (WCC). For decades, this area was all that was known of Cihuatán (see Fowler 1981:40-45 and Bruhns 1980a:5-7 for a history of investigation at the site). Within its walls, the main pyramid

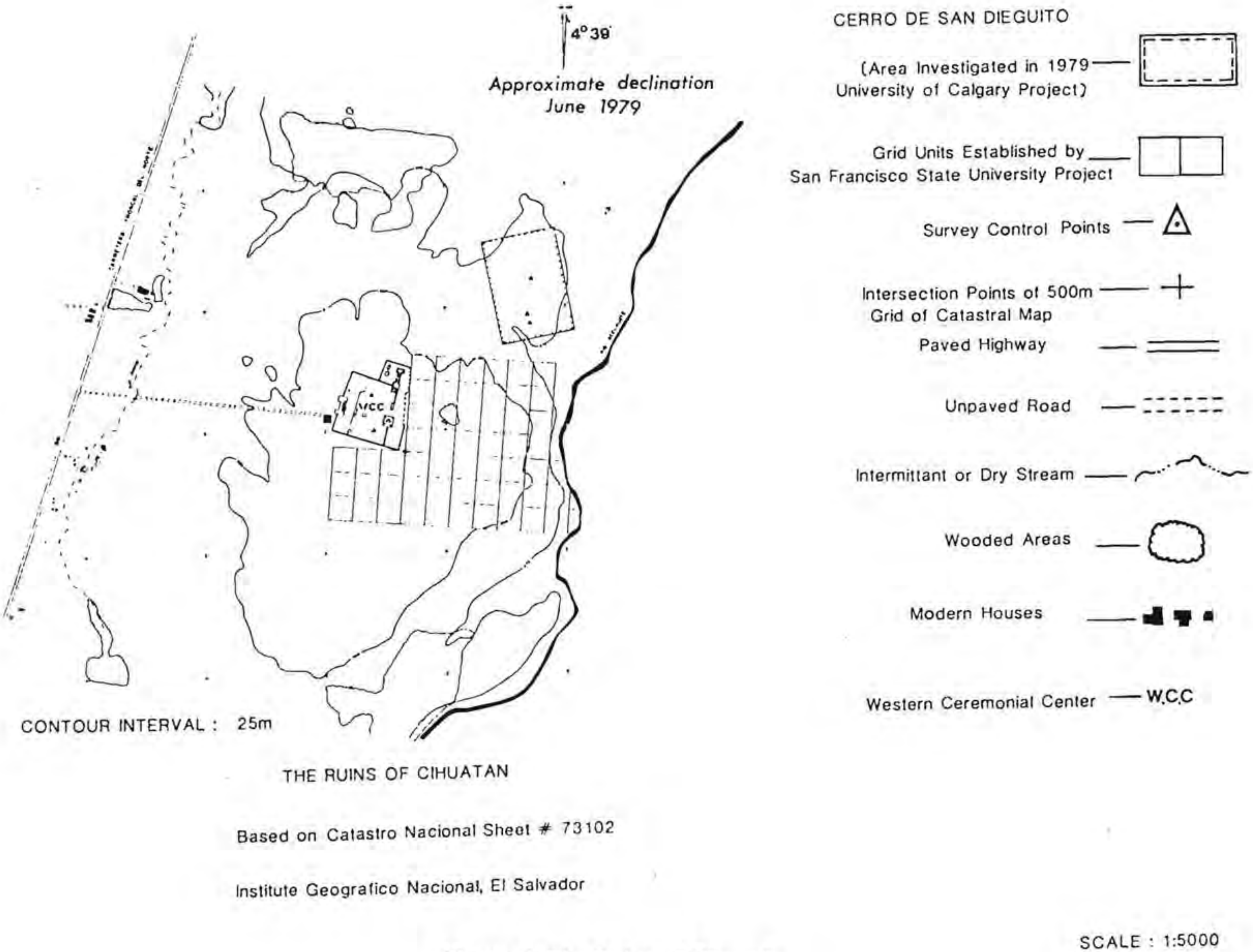


Figure 4. The Ruins of Cihuatán

(Structure P-7), two ballcourts, several platform mounds, and an elite palace complex have been investigated. This part of Cihuatán became a national monument in 1977.

It was only when extensive forest clearance occurred in the 1950's that the larger areal extent of the site became apparent (Boggs 1972:48).

The Eastern Ceremonial Center (ECC) has received very little investigation. Various sized mounds and mound groups are visible. Boggs (1972) excavated Structure 0-4 in 1965. It is tempting to speculate that the ECC served as the secular administrative center with an elite residential zone, whereas the WCC served as the religous/ceremonial center with, perhaps, a different category of elite.

Immediately to the south of the two centers is an area containing a number of mound and plazuela groups as well as large open areas (Bruhns 1980a; Cecil 1982). It is our impression that this area is less elite and less official than the two centers, but not as "domestic" or nonelite as other zones. It appears to have more definite spatial arrangements than the surrounding zones, and it has been suggested (but not tested) that the open areas could have been allocated to markets, reservoirs and various public activities. Whether or not this south zone turns out to be semi-elite and to contain public space, it is topographically a gently sloping, southward extension of the central zone. Together these three areas (the ECC, the WCC and the South Zone) occupy the long, north-south trending andesite hills along the west side of the Río Acelhuate that clearly constitute the heart of the site.

Immediately to the east of the central zone, the relatively flat or rolling terrain slopes abruptly down to the Acelhuate Valley. This entire slope, beginning at the very edge of the central zone, shows evidence of terracing and structural remains. This is regarded as a nonelite residential zone because of the nature, size and distribution of the structures and because this is [illegible] real estate than the top of the hill. Today this slope supports secondary growth that promotes noticeably greater heat and humidity and more persistent insects than more open areas; we suspect its topographic features always contributed to its being a less comfortable place to live than other parts of the site. On the positive side, these slopes would have had the advantage of easier access to the Acelhuate and its resources and to the flats across the river where we assume the main agricultural fields to have been located.

To the west of the central zone the land shades topographically into gentle slopes and low hills. The main approach to the site may have been much the same as today -- up the easy slopes from the west. Investigators have suggested markets and public areas just west of the WCC. As on the east side, nonelite residential areas begin at the western topographic edge of the central zone and extend out onto the small, low hills and intervening areas for an unknown distance.

To the north of the WCC, the slopes are intermediate; as one moves east toward the Acelhuate along the north side of the ECC, the slopes become steeper. As is the case in other peripheral zones, structures, terraces, and check dams are scattered over these slopes which end in a swale that drains this small area of the site into the Acelhuate during periods of run-off; the swale has a tendency to bog conditions at other times.

The Cerro de San Dieguito, the scene of the 1979 field work that is reported in this monograph, is located across this swale. It is now part of the Hacienda San Dieguito. The hacienda was formerly part of the Hacienda San Diego which appears on a 1768-1770 map as number 28 (see Plate 1). This watercolor map is one of 113 maps and plans made by the Archbishop Cortes y Larras on a two year tour of his diocese; these originally accompanied his monumental *Descripción Geográfica y Moral de La Diocesis de Goathemala* (AGI, Audiencia de Guatemala, Legajo 948).

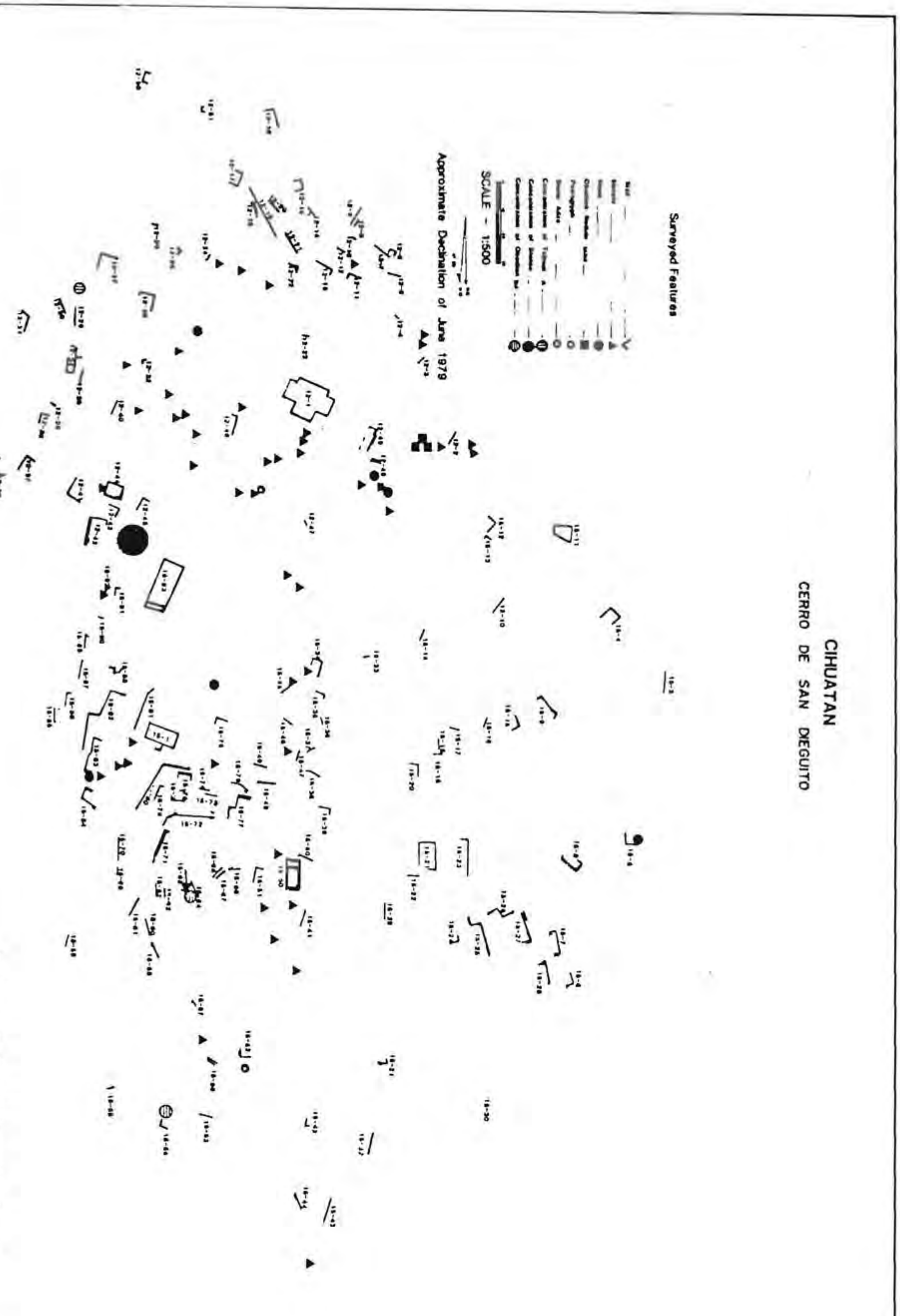


Figure 5. San Dieguito Survey

The nearer edge of the Cerro is approximately 1/2 km NNE of the WCC. Forming a natural topographic unit approximately 7.5 ha. in area, it has less abrupt slopes than the eastern slopes of the central zone. Today is it one of the most pleasant parts of the site, being well situated with regard to air circulation and visibility. The panoramic view from much of the now cleared hill includes the main pyramid in the WCC, the fronting slopes of the central zone, the flat valley east of the Acelhuate, Guazapa Volcano, low hills to the east and west, and the high sierra on the Honduran border.

San Dieguito, then, is somewhat separate from the rest of the site topographically. It forms part of the nonelite residential zone that appears to encircle the central part of the site. On the basis of surface indications, it resembles other peripheral areas in having an open settlement pattern with scattered structures and terraces. It differs from other peripheral zones in its distances and relative detachment from the central zone.

Development of the 1979 Research Strategies

It is, perhaps, of some methodological interest to trace certain significant shifts in our research strategies and the reasons for those shifts. Our initial research strategy relied heavily on a sampling program designed to give us information on different parts of the site. The basis for the sampling program was to be 100 meter square units previously mapped by Charles Cecil of San Francisco State University. Stratified random samples were to be selected for survey and, within those, further sampling procedures would be used to locate test excavations. We reasoned that the resultant information would provide a data base for assessing density of archaeological remains, kinds of structures present in different parts of the site, and differential distribution of artifact classes. These in turn could serve as the basis of inferences about spatial patterning of discrete traits within the site as a whole, and for further inferences about the nature of intrasite variability. M. Williams, as the project statistician, accompanied us to the site expressly for the purpose of implementing the sampling design.

Several factors caused us to abandon the sampling strategy. The most immediate and pragmatic reason was that the Cecil maps were not available when we arrived in El Salvador, nor could we locate his survey points in order to reestablish his grid. More fundamentally, after Williams fully appreciated the size of the site, he concluded that we would have to expand our projected sampling plan by a factor of at least one-hundred before we could achieve, in his opinion, a statistically sound and representative sample -- something that we clearly lacked the resources to do. He strongly recommended that we select areas for archaeological investigation on other grounds.

Fowler had already made an attempt at sampling the site, as is described in his dissertation (1981:54-77). Using the cadastral base map gridded in 500-meter squares (see Figure 41), he used a table of random numbers to select 50 m x 50 m units from each of the 500 meter squares. Each of the selected units was surveyed and a series of comparable observations were made. This information, which was made available to us, served as a starting point in our evaluation process. Although we explored the ECC and WCC as a means of familiarizing ourselves with the site, our serious efforts were directed to the nonelite residential zones of the site. Our options were further narrowed by practical considerations of obtaining permission from land owners (some absentee), and by considerations of allocating equipment among crews.

The 1979 Field Work[1]

The Cerro de San Dieguito was chosen as the main locus of our 1979 field research for the following reasons:

- it formed a natural separate part of the site,
- it had not been previously investigated,
- it was more distant from the centers than any part of the site previously investigated,
- it appeared, on the basis of initial evaluation, to represent a nonelite, essentially domestic sector of Cihuatán, and
- a large number of visible rock alignments appeared to represent structures and rockfronted terraces; artifacts were abundant on the surface.

Two separate field ventures were undertaken. The first, a partial survey of the hill, was designed to elucidate the pattern of settlement and the density of habitation or other structures, to assess the degree of contemporaneity and/or chronological variability on the basis of surface artifacts, and to seek evidence of differential use of space relevant to identifying specialized activities. The survey took the form of mapping features, noting location but not collecting surface artifacts belonging to selected categories such as manos, metates and obsidian and chert nodules. The second, a testing and excavation program, was designed primarily to provide contextual and architectural information about structures that seemed before excavation to embody different construction techniques and which were located in diverse topographic settings.

The Survey

Time did not allow a full and comprehensive survey to be completed. During the latter part of the season, ground visibility was obscured by the rapidly growing *flor amarilla*. The location of features and objects noted in the survey are presented in Figure 5.

A large number of cobble alignments following the contours of the hill were regarded as terrace walls. If we count those instances of cobble alignments that cross contour lines as possible structures, we can argue that there are minimally 79 structures on the hill. This estimate is undoubtedly too low because of previous destructive activities and the difficulties in surveying; also, some of the alignments following the contours may be downslope retaining walls for houses that have no other visible features. Such was the case for House 15-2 (Excavation Area B). We did not identify any plazuela groups; however, Fowler, whose random survey Quadrat 15 falls within the San Dieguito survey area, describes a three-mound plazuela group for this quadrat (Fowler 1981:70-73). The more common distributional pattern appears to be one of scattered individual structures and irregularly placed groups of structures, -- a spatial organization that suggests that dwellings and special function structures may have had kitchen gardens or at least a buffer zone surrounding them.

Using the number of structures noted above (79) for the 7.5 ha area surveyed, we can estimate minimally and roughly an average of nine structures per hectare. The question arises as to what the settlement pattern and density would have been at any one time. What was the longevity of any single structure? Did rebuilding occur? What is the total time period during which the hill was occupied? Unfortunately, we lack clear cut answers to any of the questions.

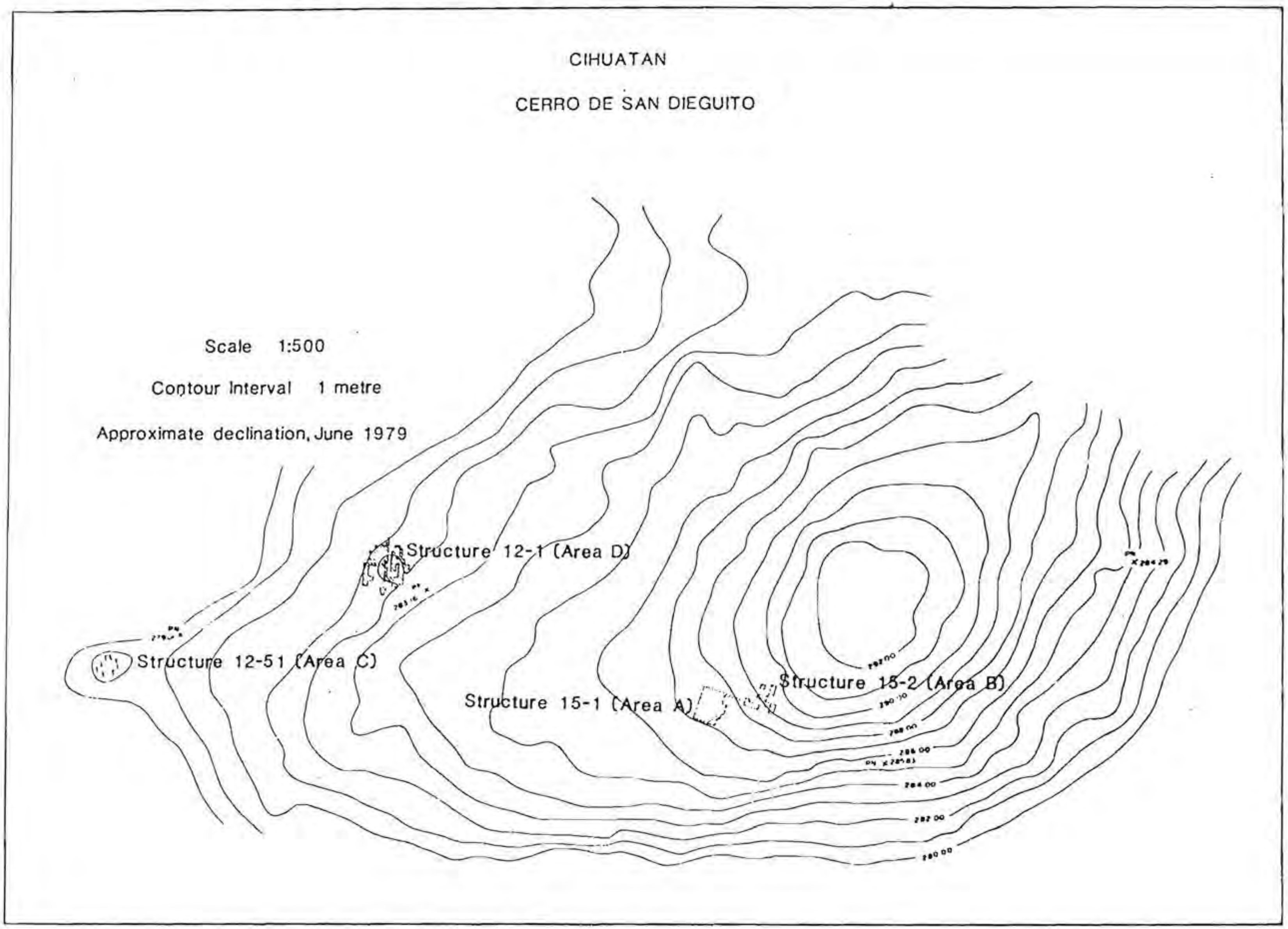


Figure 6. San Dieguito Excavation Areas

We observed no indication of rebuilding in the San Dieguito sector either in surveys or excavations. However, the presence of abundant artifacts in the construction fill of Structure 15-1 (Excavation Area A) strongly suggests some temporal differentiation in the building sequence. Our overwhelming impression is of lavish use of space and single occupations of individual structures or as yet undefined groups of structures.

We have no adequate means of short-term dating. By resorting to *if—, then—,* forms of reasoning, we can suggest the following possibilities. *If* we calculate 100 structures over 7.5 hectares, each occupied for 50 years during a 200 year occupation with a stable population size and density, *then* only 25 structures would be occupied at any one time, for an average of one structure per .3 ha or roughly three structures per hectare. By reducing structure longevity to twenty years, only ten structures would be occupied at one time, for an average of one structure per .75 hectare. Adams (1981:244-45) notes that 25% occupancy has been used traditionally for the Lowland Maya, but he now feels 75% occupancy may be too conservative. If we apply this higher estimate to the San Dieguito data, then we get ten inhabited structures per hectare at any one time. Permutations of this game are numerous as each variable can be altered within rather broad limits. Improved chronological control is a necessary prelude to more firmly grounded estimates, and this is not available at the present time.

Features recorded during the survey support our initial view that we were dealing with a nonelite zone which, in rather broad terms, can be called residential. Surface artifacts such as manos and metates indicate basic food processing at a level compatible with the inference that this is a nonelite domestic area. The observed distributional pattern of surface artifacts did not give indications of specialized ceramics belong to the same range of categories as found in excavated contexts. No temporal differentiation could be perceived on the basis of these observations.

The Excavations

Since the scale of proposed excavations could not yield a representative sample, we selected areas for investigation on grounds other than statistical sampling procedures. A judgmental sample was made of the basis of diversifying information on structural variability and the relationship of structures to terraces and to topographic variables within the confines of the Cerro de San Dieguito. Thus we selected:

1.a structure on a steeper part of the slope (Structure 15-2 in Excavation Area B).

2.a nearby structure on a more gentle slope (Structure 15-1 in Excavation Area A).

3.a mound toward the bottom of the hill (Structure 12-1 in Excavation Area D)

4.a location toward the bottom of the San Dieguito hill on a prominence overlooking the swale between San Dieguito and the central part of the site (Structure 12-51 in Excavation Area C).

The reason for selecting two adjacent structures (15-1 and 15-2) was to test the intervening area which included a cobble terrace and which, we thought, might provide evidence of extrastructural activity areas. We also wanted to check (albeit inadequately) for the possibility of non-mound/non-visible structures by

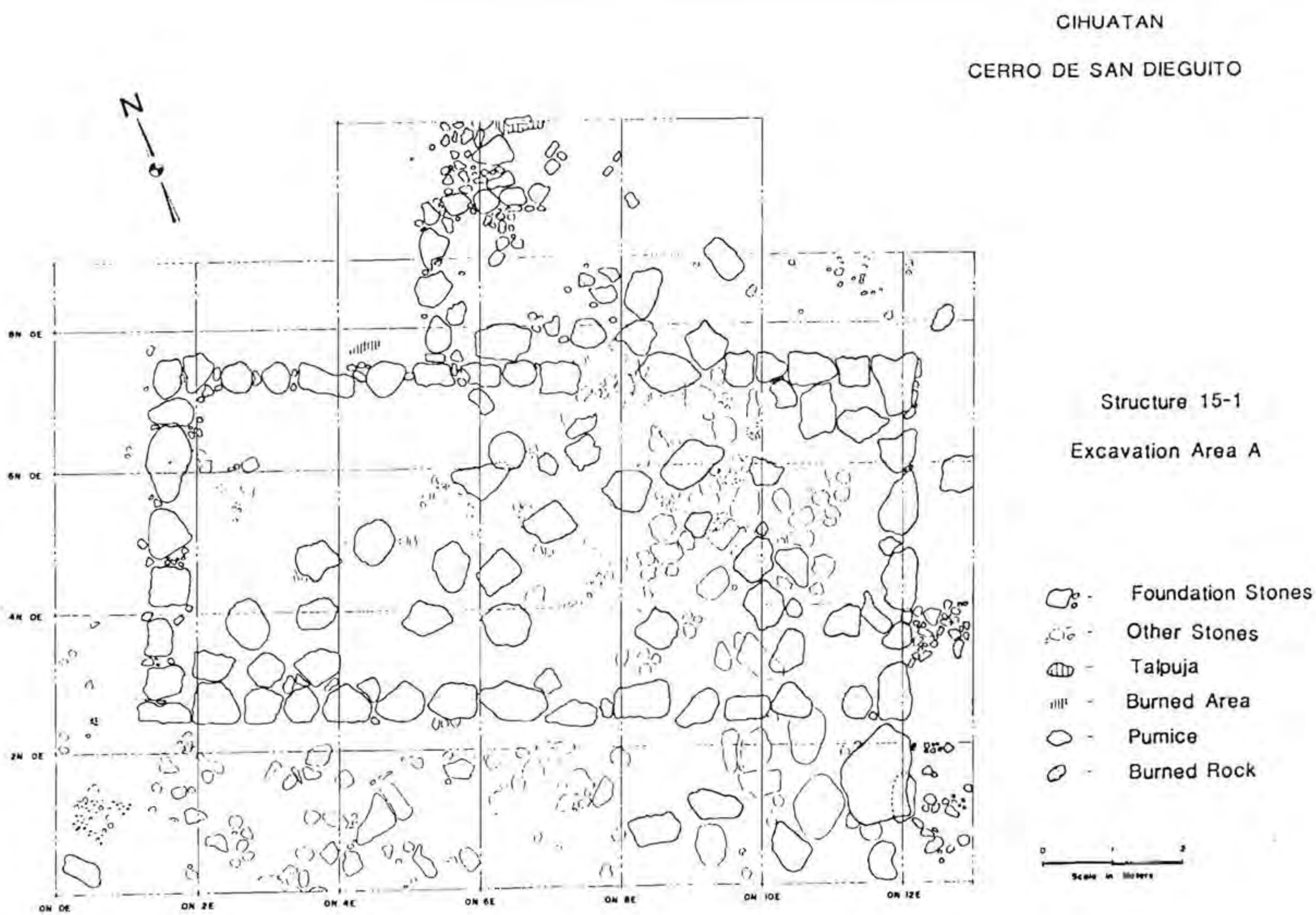


Figure 7. Plan of Structure 15-1 (Excavation Area A)

Domestic Architecture

Three of the four excavated structures are classed as domestic in function (Brethauer 1979). Each of the three exhibits a markedly different approach to providing the space on which to build structures. These differences are clearly related to microtopographic features, but we hesitate to invoke topographic imperatives as the sole explanation of the differences.

Platforms constructed of cobbles and fill occur on the flattest or least sloping land. Structure 15-1 (Excavation Area A; Figure 7) and other low platform mounds appear to be symmetrical and consistently larger than other domestic structures. The low platforms had obvious advantages in terms of drainage in their microtopographic settings.

Structures built on steeper hill slopes sometimes used a cut or cut-and-fill technique in which part of the structure was cut into the hill and part was placed on the natural surface or on a filled surface behind a terrace wall. Such was the case for Structure 15-2 (Excavation Area B) which was located so as to catch slope wash from the hill into which it was partially cut. No effort had been made to level the floor which had a decided slope to the east and south.

A third form of preparation for a structure is seen in Structure 12-51 (Excavation Area C). A finger like projection of the hill into the small drainage separating the hill from the main part of the site was leveled and shaped as a platform base.

It is not clear whether Structures 15-1 and 12-51 formed parts of larger groupings of structures. In both cases other mounds and retaining walls were nearby, but the relationships were unclear. Structure 15-2 was associated with, minimally, a small cobble outlined structure (15-78) placed on the same cobble fronted terrace (Figure 8). The assumption is that the small structure was a storage facility for Structure 15-2.

These three forms of basal construction do not exhaust the variability present on the hill as observed in the survey, but they do indicate considerable flexibility in matching basal construction techniques to the immediate topography. Each construction practice is eminently reasonable in its setting, but additional variables such as social and economic status must have affected selection of location, labor investment in construction, and size of structure.

The absence of collapsed stone walls or nonperishable building debris in all structures strongly suggests the super structures were constructed largely of perishable materials. Low walls may have been plastered, as is suggested by occasional finds of *bajareque* (fired clay). Structure 15-2 had low rock alignments outlining the walls and two areas along the south wall contained small stones between larger cobbles of unknown function. Neither Structure 15-2 nor 12- 51 had preserved floors paved with small rocks and/or plaster. The top of Structure 15-1 was badly eroded; remnants of a prepared floor were found in the southwest corner of the platform. Floor areas of Structures 15-1 and 15-2 were respectively ca. 14.5 m square and 9 m square. Floor area could not be calculated for Structure 12-51. No fire hearths or fire areas were found in any of the excavated structures. Cooking and activities employing fire were presumably conducted outside the structures.

It seems likely that most structures had porches, wind-breaks and possibly other structural adjuncts. Structure 15-1 had an external porch or windbreak on the north side (Figure 7). In Structure 15-2 an extension of the north wall to the west of the structure suggests a protected entryway (Figure 8). Evidence is less clear for Structure 12-51, but surface indications suggest continuation of structural components along the north margin. ***Talpuja*** (consolidated volcanic ash) blocks, more commonly used as facings and flooring on special function platforms, was occasionally used in domestic

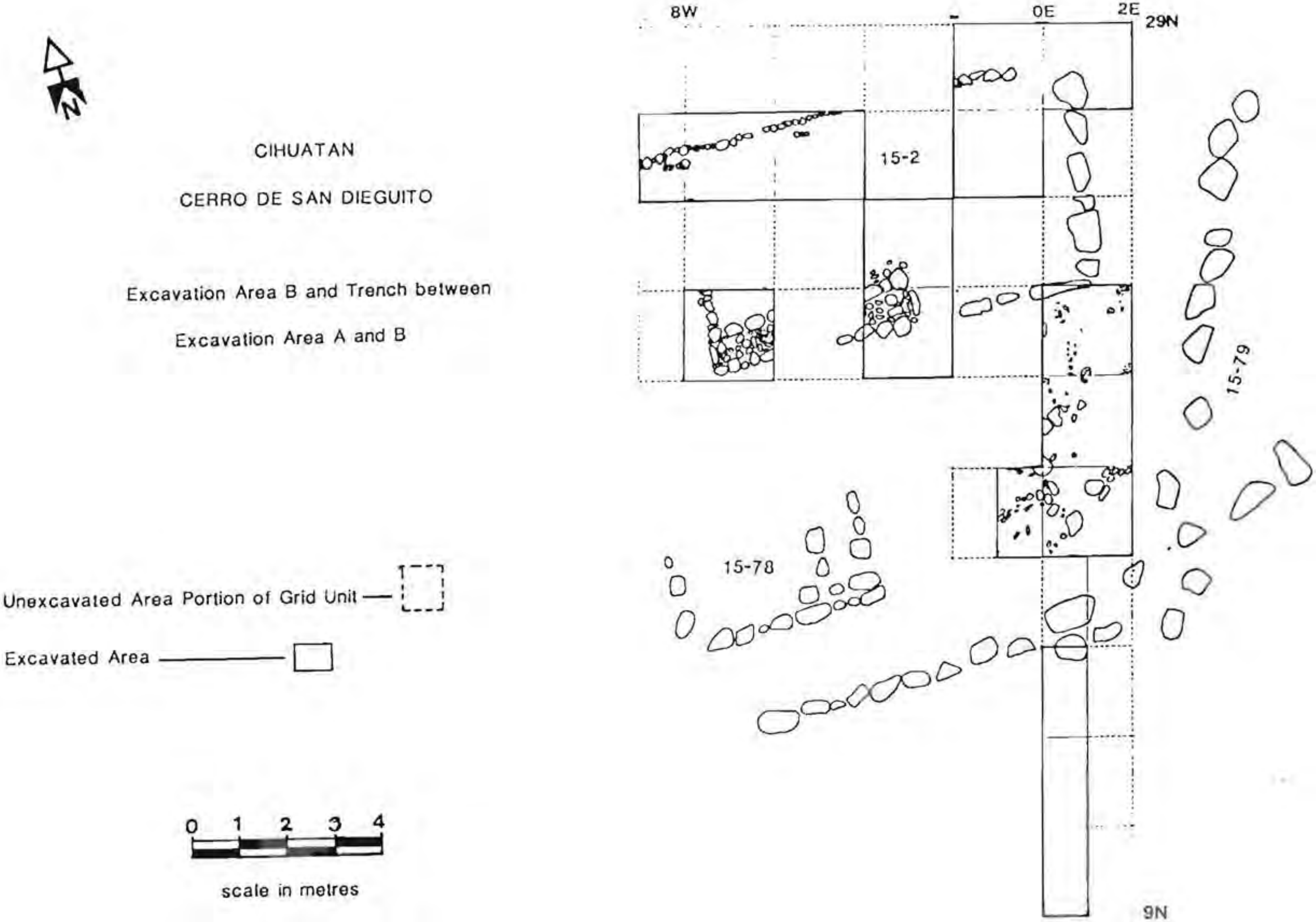


Figure 8. Plan of Structure 15-2 (Excavation Area B) and the Trench between Excavation Areas A and B

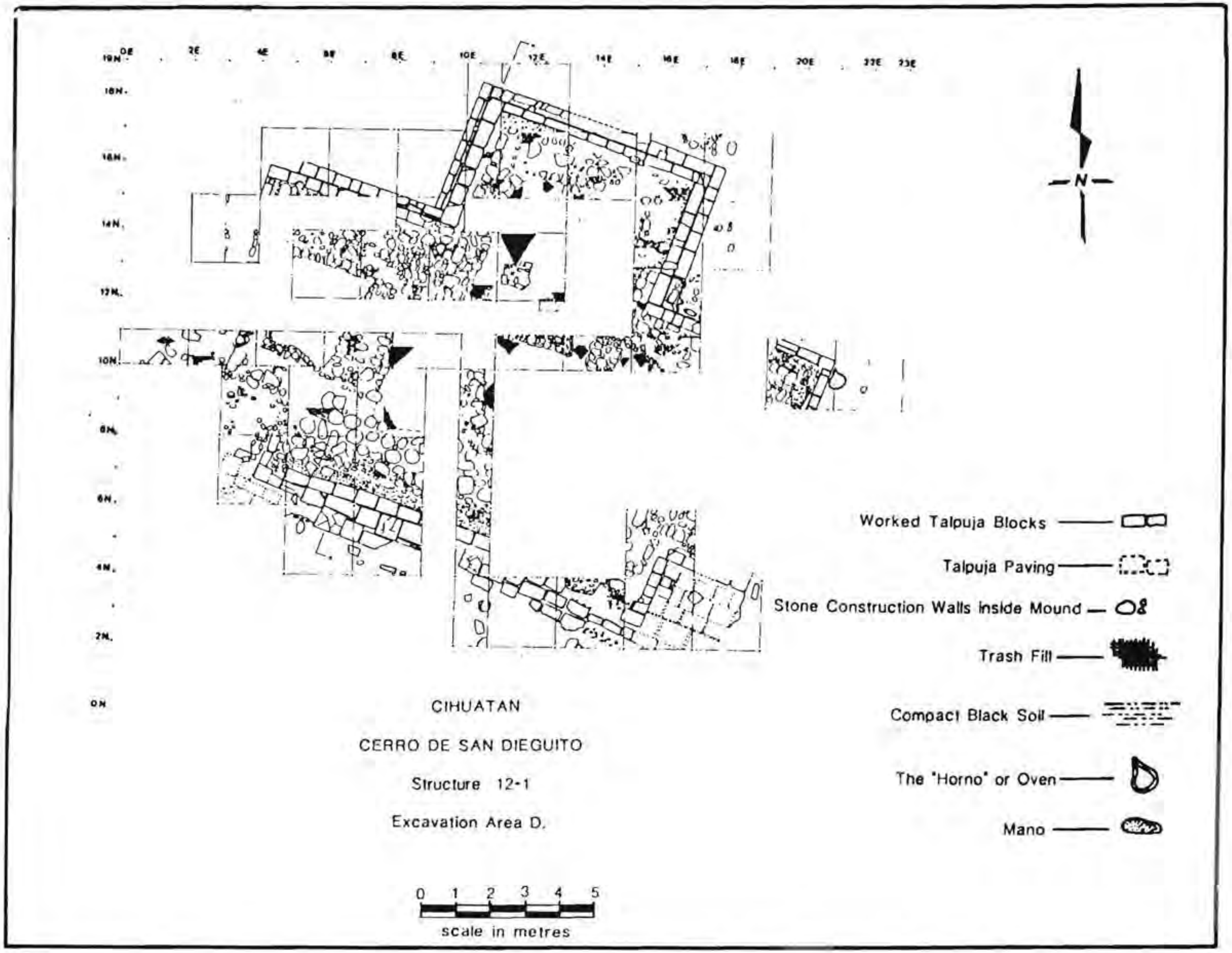


Figure 9. Plan of Structure 12-1 (Excavation Area D)

structures. Our limited evidence of such usage suggests its incorporation into the structural adjunct (the porch) of Structure 15-1 and as a step or in a structural appendage of Structure 12-51.

The Interstructure Trench

Our purposes in trenching between Structures 15-1 and 15-2 were to check for structures without visible surface remains, to assess artifact density between structures, and to look for extrastructural activity areas. No new structures were located, but this does not constitute a significant test of the idea that structures that are not visible at the present time might exist between the visible mounds and terraces.

A small obsidian workshop, or area where obsidian trash was deposited, was located above the terrace wall outside of and south of Structure 15-2. It is a reasonable although unconfirmed inference that this obsidian working or obsidian trash area was associated with that structure.

Although the artifacts from the trench were not included in the loan collections, observations made in the field suggest a definite decline in artifact density between the terrace wall below Structure 15-2 and Structure 15-1. This in turn suggests that artifacts formerly associated with eroded structures may be spatially discrete from those associated with other structures. Since most of the structures on the hill are eroded or damaged, spatially discrete patterning may ultimately prove to be a useful means of isolating household assemblages.

The Civic-Religious Structure

The fourth structure investigated was, prior to excavation, an amorphous plowed mound without visible shape or architectural features. Only the presence of *talpuja* in the plowed furrows and an unusual concentration of sherds caused us to consider testing here. Its location was suitable for our strategy of diversifying the topographic settings of structures chosen for investigation (Aliphat 1979).

What emerged was a T-shaped platform mound with *talud-tablero* construction and broad steps facing SSE (Figures 9, 10 and 11). In size and shape, this structure (12-1; Excavation Area D) was virtually identical to the small T-shaped platform mounds in the West Ceremonial Center.

The mound had its own internal structure consisting of rough cobble walls some 140 cm thick that rested on an old land surface. These internal walls provided the framework for the platform fill. Internal fill was partly a nearly sterile red clay, and partly a black soil containing more abundant sherds and obsidian. *Talpuja* blocks were used for the outside *talud-tablero* facing of the platform.

The upper surface of the platform was badly damaged by plowing. Enough remained to show that the platform had been floored with *talpuja* blocks. No features were identified on the top of the platform. The broad steps and adjacent balustrades were also badly damaged with only the lower part intact; however, their position and angle could be calculated (Figure 11).

The presence of a T-shaped mound in a largely domestic barrio indicates that some civic-religious services were extended into nonelite zones. As is discussed more fully later, the artifacts associated with Structure 12-1 are markedly different from those associated with similar platform mounds in the center.

The Context of Excavated Artifacts

The state of archaeological remains on the Cerro de San Dieguito is such that few structures are likely to have intact floors and *in situ* associated artifacts. For platform mounds such as 15-1, the best archaeological context is that

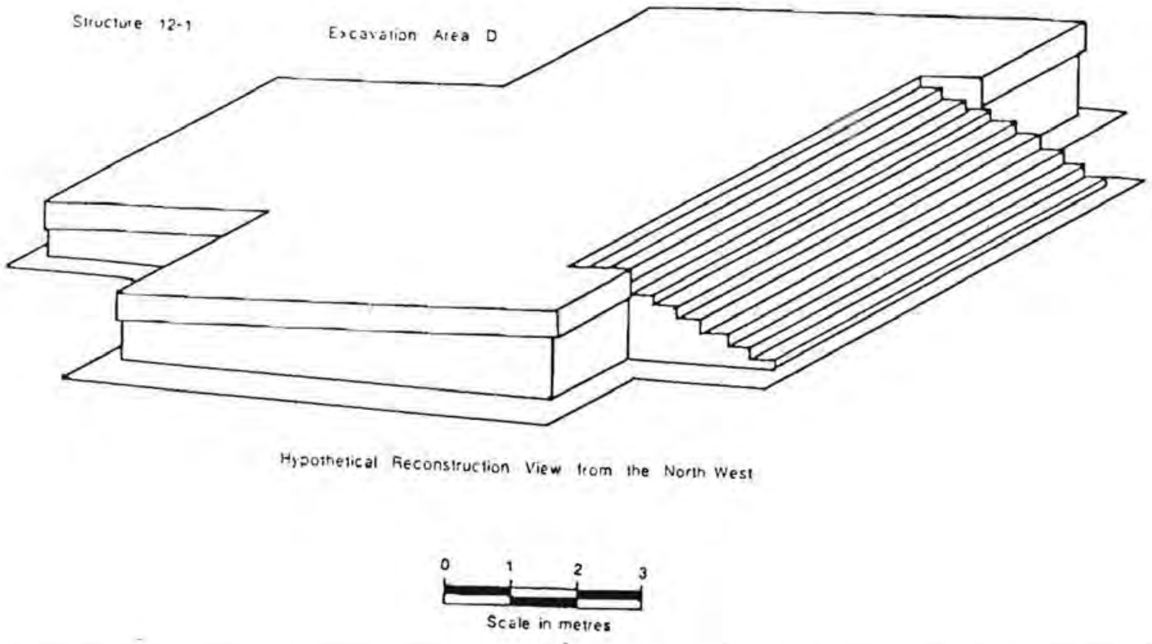


Figure 10. Hypothetical Reconstruction of Structure 12-1 (Excavation Area D) from the Northwest

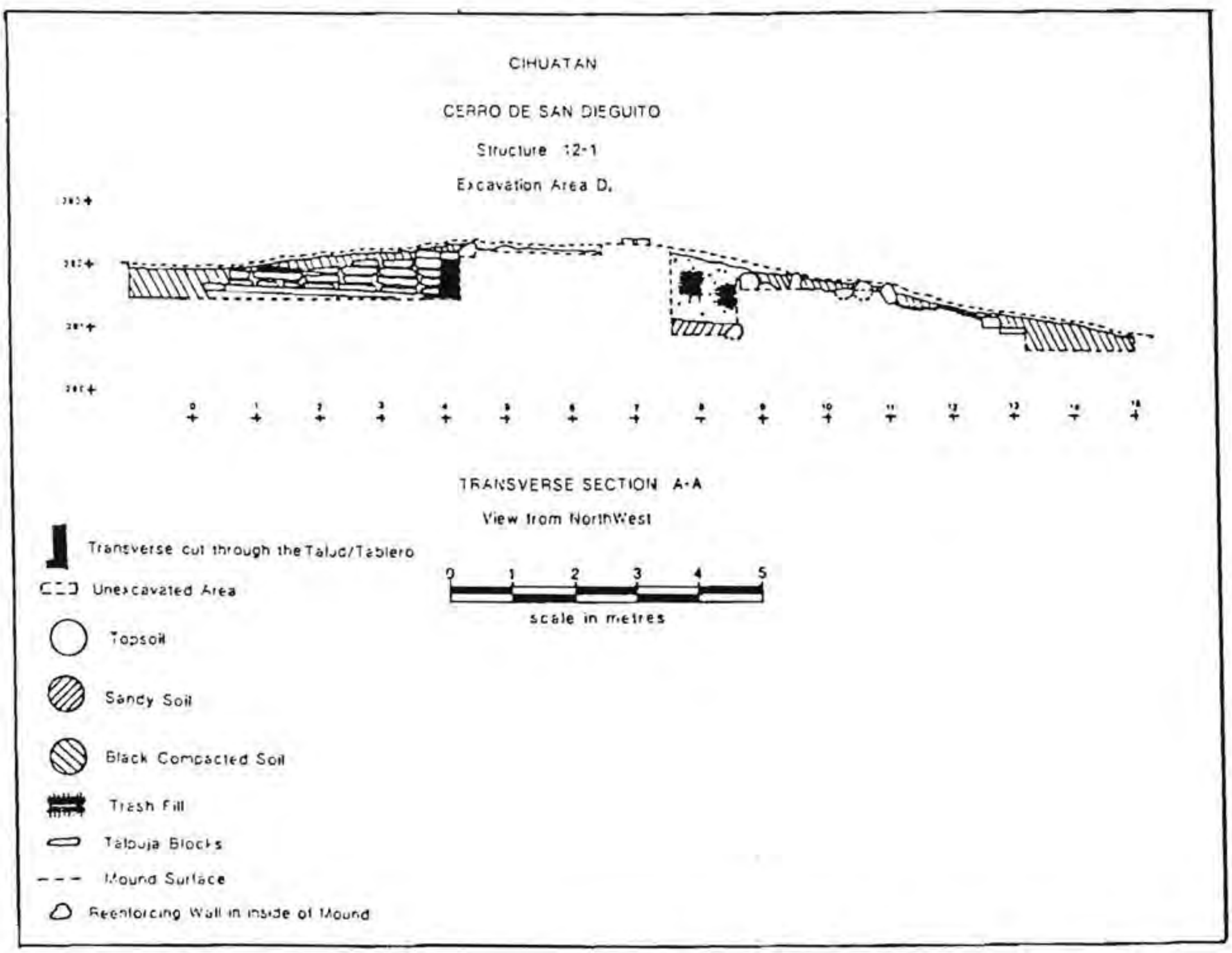


Figure 11. Transverse Section of Structure 12-1 (Excavation Area D) View from the Northwest

associated with construction fill; artifacts were considerably more numerous in the construction fill than outside the structure. Some artifacts were incorporated in the construction fill of the T-shaped mound (12-1), and the lower parts of the steps of this structure produced enormous quantities of pottery which are assumed to have been associated with the use of the structure. Few or no artifacts on top of Structure 12-1 could be regarded as associated with its occupation or period of active use, although some may have been.

Artifacts were less frequent in Structures 12-51 and 15-2, and in neither case was there a prepared mound containing construction fill or a clearly defined floor. The top of a buried pot in Structure 12-51 suggested the level of the floor in that structure, while relative frequency of artifacts by depth in Structure 15-2 indicated a portion of the fill most likely to represent occupation-associated remains.

In general, there is a real scarcity of artifacts demonstrably associated with an occupation. The sorts of inferences based on neat patterning of *in situ* artifacts are denied us. Even segregating artifacts likely to have been associated with a structure's occupation is risky, but two attempts were made to evaluate the possibility that the spacing of the structures resulted in spatially discrete clusters of artifacts. One was a scrutiny of artifact density between structures as seen in inter-structure trench. The other concerns an attempt to identify artifacts that might have been associated with Structure 15-1.

We first compared number and weight of sherds and obsidian from construction fill with those adjacent to and outside the mound. On the north and west, or uphill, sides of the mound, artifact frequencies were much lower than on the south and east, or downhill, sides. The exterior artifacts on the south and east, as well as those on the north porch, may be associated with the occupation of the mound, but the evidence is not strong.

Assuming that artifacts formerly associated with the Structure 15-1 living surface would have washed downslope, we made six surface collections on the east and southeast slope to see if distributional evidence supported such a hypothesis. The six areas were selected to include the most likely areas for slope-wash accumulation of materials moving from the platform mound and its immediate environs as well as less likely areas. Center points for each collection area were located; the collection area was a circular area delineated by a 2.5 m string (the radius of the circle) that served as the tether. Each collection area therefore had a diameter of 5 meters (see Figure 12 for locations relative to Structure 15-1). The collection from tethered unit 2 was not included in the loan collections; this is especially unfortunate as units 1 and 2 are, on topographic grounds, the ones most directly in the path of slope wash from the structure; field notes indicate that these two circles had heavy concentrations of sherds. Gross sherd counts, weight per sherd and number of pieces of obsidian from each tethered unit (except unit 2) are given in Table 2.

Table 2

Tethered Collection Units Near Structure 15-1
Tabulation of Artifacts Recovered

	Ceramics			Obsidian
Unit	Num.	Wt.	Ave. Wt. per sherd	Num. of pieces
1	66	834 g	12.63 g	0
2	collection unavailable in Calgary			
3	83	1141 g	13.74 g	8
4	15	437 g	29.13 g	4
5	64	372 g	4.27 g	87
6	1	50.5 g	50.5 g	0

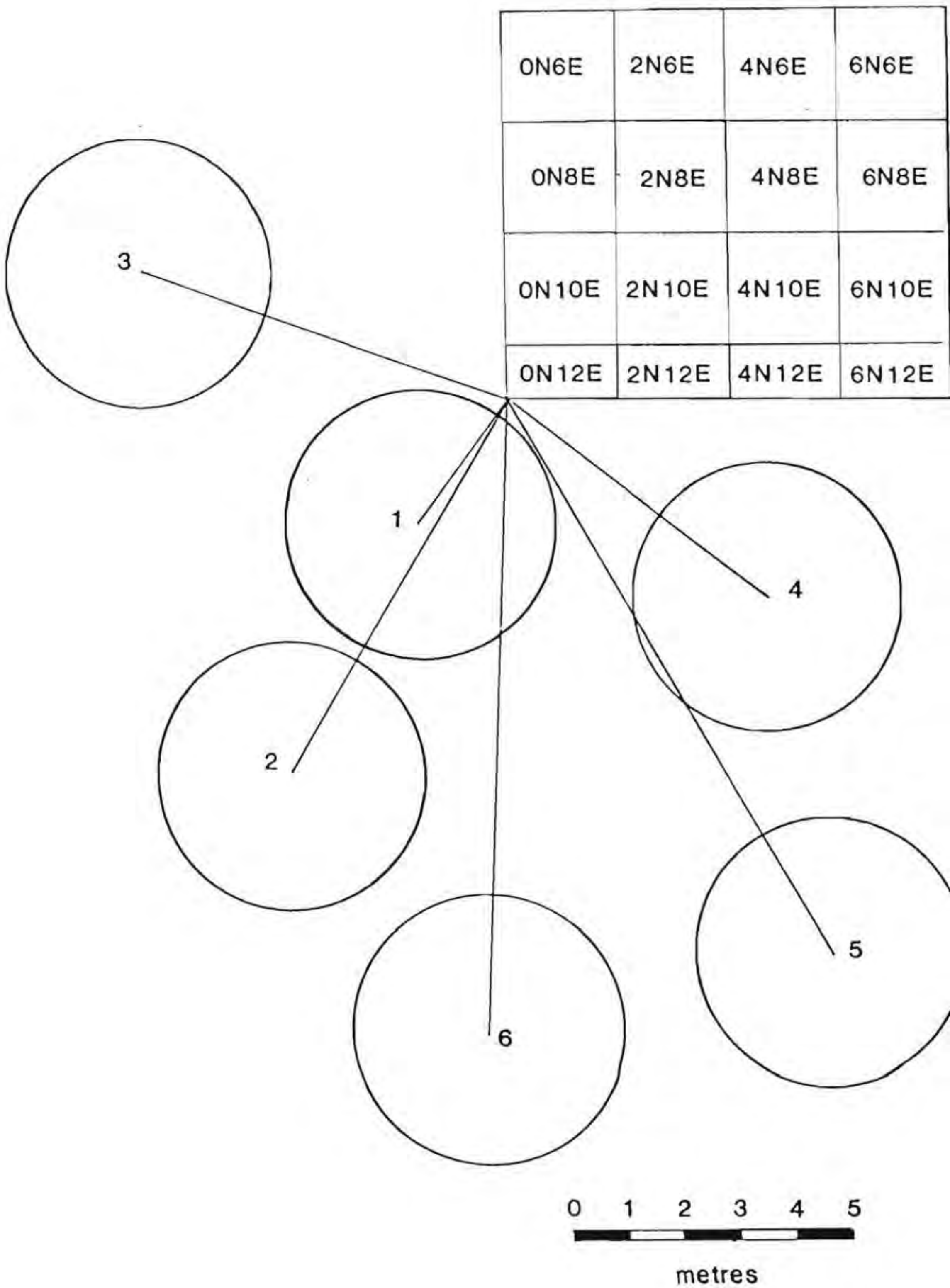


Figure 12. Tethered Collection Units

The frequency and distribution of artifacts probably reflects several variables at work. Unit 3, for example, had been recently plowed while the other 5 units had been planted with a digging stick. This undoubtedly contributes to the larger number of artifacts from Unit 3. We suspect that something other than slope wash accounts for the presence of artifacts in Unit 5, although what this might be is not clear. Unit 5 differs from other units in terms of ceramic and lithic categories represented.

Otherwise, the hypothesis that artifacts in the down-slope collecting units have a high probability of originating on or near Structure 15-1 seems reasonable in the absence of visible alternative sources in the intervening area. The density of surface artifacts was greater in tethered collecting units 1, 3, 4, and 5 than was the case on the surface of Structure 15-1 platform.

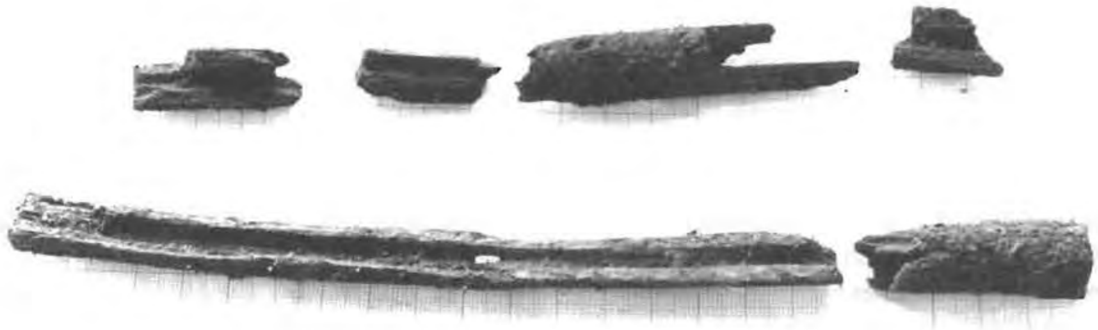
In summary, the artifact collections from the hill have provenience by excavation or survey units. The most extensive collection comes from the construction fill of Structure 15-1. Against that collection we have the ones from the tethered collections, which, with the exception of unit 5, have a reasonable chance of representing an occupational (as opposed to constructional) association with that same structure. Artifacts from Structure 12-51, also returned to Calgary, form part of the analyzed artifact sample.

Neither the Structure 12-1 nor the Structure 15-2 collections were loaned for study in Calgary. Some observations made on the Structure 12-1 collections in the field provide a preliminary data base for inferences about construction versus occupation associated artifacts, differences between the artifacts associated with a barrio civic-religious platform base and similar platforms in the center, and differences between domestic and civic-religious structures in the same barrio.

The "Oven"[2]

At the end of the 1979 field season at Cihuatán, a potentially significant feature was found at a corner of the temple platform (Structure 12-1). This feature, which we called an "oven" or "horno", was some 50 cm in diameter at the base, stood ca 42 cm high and looked rather like a decapitated bee hive. The broken top opening was ca 30 cm in diameter and it would, presumably, have been smaller in its original state. The "oven" was made of clay or *bajareque* fired from the heat contained within. Near the base on the north side was a ventilator or lateral opening some 10 cm in diameter with a clay trough that extended outward 12 cm from the oven. Inside the "oven" were more than 2 kilos of charcoal and partially charred wood which took up the lower portion of the "oven", and resting on top of the charcoal were three stones. In the charcoal were portions of a blow pipe (Plate 2).

The top of the "oven" was approximately 20 cm below the modern ground surface, and the bottom of the oven was on the same level as the temple base which was located only a few cms away. Indeed the west side of the "oven" was found in clearing this corner of the platform base, and a new excavation unit was opened to expose this feature. There was no detected evidence of any stratigraphic difference between the fill over the temple and that covering the "oven", nor was there any such evidence in the profile of the excavation unit in which the "oven" was located. Although there were no ceramics or obsidian in the "oven" and few sherds in the surrounding fill, such sherds as were found were within the range of the Postclassic ceramics of Cihuatán, and there were several large sherds in the excavation unit at the level of the bottom of the "oven". *Talpuja*, presumably from the platform facing, was



a

b

Plate 2. The "Oven"

a. Wooden blowpipe from the "oven"

b. The "oven"

incorporated into the base of the oven, suggesting that the oven postdated the temple.

We found the presence of incompletely charred wood worrisome, but insufficient grounds to reject the feature as meaningless in a Postclassic context. The evidence considered most relevant at the time of excavation, and for some weeks thereafter, included:

1. A feature that appeared to be designed to create higher temperatures than can be achieved in open fires.

2. A blow pipe.

3. A quantity of charcoal topped by three rocks that could have formed a rest for a container containing the materials for which a high temperature was required.

4. A bottom ventilator or opening that could serve as an air intake (aided by the blowpipe).

5. Apparent homogeneity and continuity of fill over the oven and platform base.

6. A case in which all artifacts in proximity to the "oven" were within the range of Postclassic Cihuatán specimens.

7. The common horizontal level of the "oven" base and the platform base.

8. The fact that *talpuja* from the platform facing was used in the base of the oven - suggesting that the temple platform had been exposed when the "oven" was built.

We considered various hypotheses as to the function of our "oven". For example, it could have been a kiln, but its size precluded the firing of any but the smallest pots. Or it could have been a device for processing some plant products necessitating reduction through the use of heat. However, of all the hypotheses we considered, the hypothesis that this was related to metallurgy was the most attractive.

Since the "oven" had failed to provide us with slag, cast pieces, or indeed direct and strong confirming evidence, we turned instead to marshalling indirect supportive evidence. Archaeologists often have to make inferences, assess hypotheses and otherwise go about their business of doing archaeology using arguments based on indirect evidence. Although each line of reasoning and each line of evidence may lack desirable strength in and of itself, a more reassuring level of support is achieved when multiple lines offer support and do not serve to disconfirm the hypothesis in question.

The first task was to review the other archaeological evidence in hand for things that might support an inference that metallurgy was practiced at Cihuatán. We found two items of interest. One was a stone "pendant" that looked very much like its inspiration was a copper bell (Plate 28g), and the other was the finding of what appeared to be copper bearing rocks in a deliberately buried ceramic vessel. Against this, there is the contrary observation that there is no record of metal objects being found at Cihuatán. But this is not compelling negative evidence because of the amount of work that has been done, and because only one burial has been excavated by archaeologists. Rumors persist of several tombs being opened by non-archaeologists, but we have no information as to their contents. The absence of metal objects could easily be attributable to incomplete information.

Without a doubt, the strongest supportive evidence was the blow pipe. Numerous accounts of metallurgy describe blow pipes, and numerous pictorial depictions of metallurgy and metallurgists show the metal worker using a blow pipe.

To proceed with the metallurgy hypothesis, we asked what sort of metallurgical process might be represented? The complete absence of metal or slag in the "oven" itself ruled out a version of the brazier technique in which ore is placed in direct contact with the charcoal and the blow pipe is employed to blow into the brazier from the top. Rather, the nature of the "hard" evidence dictated that a crucible was set on those three nicely positioned rocks on the top of the charcoal. This meant the process represented was not the extraction of metal from ore, but the preparation of metal for casting.

If we were to accept the idea of metallurgy on the basis of such circumstancial evidence, we had to ascertain if metallurgy at Cihuatán was unlikely on either temporal or spatial grounds. That is, if this had been a threshhold case that moved metallurgy to a significantly earlier time or that placed metallurgy beyond a geographic frontier of known metallurgy, then the circumstantial evidence would obviously be insufficient to argue a major departure from the received views about when and where metallurgy might be found. On these grounds, there is earlier metallurgy both to the north and to the south.

Finally, one last line of reasoning can be mentioned. There are several known large ceramic figures of Xipe Totec from Salvador, and Xipe Totec figures are known from Cihuatán. Xipe Totec was associated with metallurgy in Central Mexico.

I submit that we had pursued our inference about a potentially significant finding in reasonable and rational ways. In order to form a hypothesis about this intriguing feature, and then to evaluate the strength of that hypothesis, we followed the leads that were offered by the "hard" evidence. We used a variety of forms of reasoning and a number of standard methods. We looked for additional data, used analogy, used distributional and comparative evidence, considered alternatives, paid particular attention to the stratigraphic situation of the "oven" itself, and so on. And there was nothing up to this point that caused us to reject the hypothesis. And I suspect that if we had come forward with fully developed arguments for the ones I have only briefly sketched in, the hypothesis would have found favor with archaeologists. Or had this find been reported prior to 1949 when the Carbon 14 method created another line of evidence, it would have been accepted.

The first Carbon 14 date run by the Saskatchewan Research Council (S-1881) 165±65 B.P., which places this feature in the late 18th or early 19th century. A second C^{14} date run by Beta Analytic (Beta-4411) was 400±90 B.P. Although C^{14} is often quibbled over - especially when dates fail to meet preconceived ideas, we are not inclined to dismiss these dates. The hypothesis stands disconfirmed and rejected on the basis of one bit of "hard" evidence.

Now that the hypothesis is rejected and we reevaluate the evidence in the light of the new temporal placement, we can see clearly that we chose the wrong bits of evidence in the beginning. What now is relevant is the incompletely charred wood and the large number of macrobotanical specimens recovered by flotation in the excavation unit and in the fill from the oven itself. The rock we thought might be copper ore was later identified as graphite. And this stresses a very basic methodological problem – namely that we can never use all the evidence - or consider all the variables. Archaeologists perforce select which bits of data go together, which are relevant. Sometimes we go off down the wrong path. And it is amazing what a convincing case can be made for selected bits of evidence before the C^{14} dates are returned.

The feature is likely to be a historical still, as Boggs maintained all along.

Summary

As is so often the case in Mesoamerican sites, Cihuatán was long known on the basis of its ceremonial center. In recent years, however, perceptions of the site have changed, and several archaeologists have taken a more holistic look. To date none of the several projects mounted at Cihuatán have had resources to do more than carry out limited research designs. The result inevitably is a series of data bases and reports which are not entirely comparable since different investigators had different research goals, used different classification schemes, and had different levels of technical support.

Our 1979 field work contributes one more piece to the documentary mosaic pertaining to Cihuatán. The specific research strategies designed prior to our field work proved to be unworkable, and new plans had to be implemented; however, the fundamental research goal of exploring intrasite variability was retained. Instead of a random sampling approach to the whole site, we opted to add to and broaden the existing data base by working in a nonelite part of the site that had not been previously investigated.

This brief introduction to the site and the description of the 1979 field work sets the stage for a discussion of artifact classes (Chapters 3, 4, 5 and 6), the ecological setting (Chapter 7), and the survey of intrasite variability (Chapter 8).

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1. A preliminary report on the field work was given by Kelley (1980a).

2. The "oven" excavations were supervised by Mario Aliphat who also developed the metalurgy hypothesis. Similar accounts of the "oven" appear also in Kelley (1980b); Hanen and Kelley 1983; and Kelley and Hanen (1988).

CHAPTER 3

CERAMIC CLASSIFICATION

Ceramics form one of the most important artifact classes for assessing intrasite variability. Ceramic information for Cihuatán is expressed in two different classification systems which overlap to a considerable extent. The collections on which the two classification systems were developed are discrete universes in the sense that each investigator has created and applied his/her scheme to collections pertaining to his/her own excavations in different parts of the site. In assessing differences between the different parts of the site as expressed in the various schemes, it is not always clear whether we are dealing with a product of the different approaches or differences between different parts of the site. Nonetheless, some reasonably grounded inferences about ceramics at the site can be advanced.

Reasons underlying the formulation of multiple analytical schemes are of both methodological and substantive interest. First, and perhaps most significantly, Cihuatán ceramics do not segregate neatly into categories characterized by tight correlations of attributes. It might be said, then, that the nature of the data underdetermines its classification. Other factors affecting classification are judgemental decisions by investigators about the relative merits of classification schemes employed elsewhere (specifically, whether or not to use the type-variety system), individual research designs, investigator background and training, and decisions about which pottery attributes are to be given priority. Such factors characterize typology and classification generally, and there is never just one way to partition a ceramic universe.

The State of the Art: A Comparison of Existing Classification Systems

Karen Bruhns and William Fowler have been the two primary investigators at Cihuatán in recent years. Each has developed a ceramic classification scheme that has been presented to the archaeological community (Bruhns 1980a; Fowler 1981). From a generalized perspective, they share a similar view of the ceramic assemblage, each seeing an enormous amount of overlap in attributes of form, paste, and surface finish. Both see something of a mix-or-match or variations-on-a-theme quality in the Cihuatán pottery; both recognize pragmatic problems in dealing with pottery prone to losing its finish. The basis for sorting in the two systems is not radically different.

Bruhns feels that the type-variety system is inappropriate for classifying what is a "largely monochromatic tradition known almost entirely from sherds," and she prefers to follow Wauchope's (1975) lead in providing a more generalized scheme that points up the interrelationships between groupings (Bruhns 1980a:75-76). Her classification units carry descriptive names like Red-Slipped Ware, Coarse Ware, and Tan-to-Brown Monochrome, and these are not mutually exclusive categories. Fowler, on the other hand, uses a modified version of type-variety, "placing taxonomic emphasis on the ceramic group," thereby following the lead of Andrews V (1976) at Quelepa (Fowler 1981:124-125). Bruhns' scheme in many respects better captures the quality of Cihuatán ceramics but Fowler's scheme is more useful for certain kinds of data manipulation because sherds can be placed in a discrete classification category. A comparison of the equivalences and differences in the two schemes is a necessary prelude to a consideration of the ceramics from San Dieguito and, more generally, to the study of intrasite variability.

In terms of relative frequencies, perhaps 85% or 90% of Cihuatán ceramics belong to three main ceramic groups in Fowler's scheme (Las Lajas Coarse, Tamulasco Plain and Garcia Red) and to four overlapping categories in Bruhns' scheme (Coarse Ware, Tan-to-Brown Monochrome, Self-Slipped and Red-Slipped).

Coarse Categories

These are closely related in the two schemes, with complete agreement that certain forms (figurines, hollow figures, braziers, applique fillet or "pie crust" rim bowls, for example) belong here. Fowler classes roof tiles and drain pipes as a separate industry. For Fowler, the coarse pieces are unslipped whereas Bruhns sees them as sometimes overlapping with her Self-Slipped. Here, as elsewhere, there appear to be real perceptual differences between the two investigators in recognition of slips, and we found different analysts in our own project suffered from similar perceptual difficulties on this score. The word "coarse" for both investigators means a coarse paste with heavy temper and it perhaps also has connotations of overall coarseness of the finished product. Existing pieces of coarse ceramics exhibit little colored slip or paint. Bruhns feels many of these pieces may formerly have carried colored slips, painting and postfiring painting which has largely been lost because of the often soft and friable nature of pottery.

Although there is complete agreement on placing the forms mentioned above in this category, and both investigators assign large jars and some bowls here, it is not as clear where the line should be drawn between large jars and certain bowls in Las Lajas Coarse and Tamulasco Plain in Fowler's scheme. Bruhns' scheme has built-in overlap to other categories.

Red-Slipped Ceramics

Bruhns distinguishes a single Red-Slipped Ware whereas Fowler recognizes Naguapate Coarse Red and Garcia Red ceramic groups. The former is described as having a coarse paste like Las Lajas, being well smoothed, and having a thin red slip or wash that is usually darker (almost maroon) than the red of Garcia Red. Garcia Red has the same paste as Tamulasco Plain and is said to be characterized by a well polished red slip on bowls and jars. The Garcia Red ceramic group is made up of Garcia Red, Garcia Red Incised and Garcia Red Thick-Walled, Garcia Red-and-Brown, and Garcia Red-and-Black. Since Naguapate Red consitutes only 1% of Fowler's (1981) tabulated pottery there is, in practice, virtual agreement in terms of relative frequencies of red-slipped pottery between the two schemes.

Plain Pottery

Fowler's Tamulasco Plain encompasses much the same range as Bruhns' Tan and Brown monochromes and Self-Slipped. Bruhns discusses only comales and "Zacualpa comales" as forms found in Tan-to-Brown monochromes while Self-Slipped is said to occur primarily in ollas and jars and to overlap with coarse wares. Fowler identifies more forms for Tamulasco Plain; differential segregation between coarse and plain categories by the two investigators is indicated.

Other Categories

Painted pottery and other categories make up roughly between 10% and 15% of the Cihuatán ceramic assemblages in both classificatory schemes.

Bruhns identifies a White Ware that presumably equates with Quijano White of Fowler's Quijano White ceramic group which also includes Quijano Red-on-White. Bruhns notes that some all-white vessels seem to occur in "jars identical in form to the Red Ware ones", and all-white vessels occur in "smaller, and flaring bowls" (1980a:83). She also feels that some of the white-slipped sherds undoubtedly belong to "local" polychrome which "includes a range of red, white, grey, black and yellow-orange painted polychromes, most of which have the colors applied on a white base" (Bruhns 1980a:87). Insofar as these are on a white base, they correspond to Fowler's Zancudo White Polychrome. Bruhns also distinguishes a Cihuatán Trichrome which is characterized by "rather bold curvilinear pattern in black on matte white with red highlights" (Bruhns 1980a:88), and this too Fowler would call Zancudo White Polychrome. Fowler specifies that Quijano White and Quijano Red-on-White occur in vertical high-necked jars with everted rims.

Bruhns sees two red background polychromes: a geometric Bandera Red (as named by Boggs) and members of the Mixteca-Puebla series (both Policromo Firme and Policromo Laca). Fowler is reluctant to accept the implication that Mixteca-Puebla was imported without further confirmation and so combines these with Bandera into a single group: Joion Red Polychrome

The third background color for painted pottery is tan, and here the two schemes agree closely in sorting criteria if not in terminology. Bruhns calls this grouping Red-on-Tan (Marihua Red-on-Buff Variety) while Fowler defines a Tamoa Red-on-Buff ceramic group with a Tamoa Red-on-Buff type and a Tamoa Incised type. Both authors acknowledge the relationship to Marihua Red-on-Buff as described by Haberland (1964) while noting stylistic differences from it.

The best equivalent for Fowler's Tamoa Incised in Bruhns' scheme seems to be her Tan Incised which is one of three sub-groups she places in Incised Wares. Other submembers of her Incised Wares are a Monochrome Incised which can have a red or a white slip and a Bi-and-Trichrome Incised. The Red-Slipped Incised equates with Fowler's Garcia Red Incised. The white background and Bi-and-Trichrome Incised have no direct equivalents in Fowler's scheme.

Both authors identify a deliberately reduced black pottery which Bruhns calls Black Ware and Fowler calls Cachinflin Black-Brown. The latter represents a combination of two types Fowler (1980; 1981) previously distinguished: Peralta Brown and Cachinflin Black.

Fondo Sellado is classified separately by Bruhns. Fowler recognizes it but gives priority to surface color over the impressed designs in the bottom of bowls and assigns these sherds to Tamulasco Plain or Garcia Red.

Tohil Plumbate, Nicoya or Nicoya-like and *Baño Metalico* are identified by both investigators. Bruhns (1980b) argued for locally made False Plumbate. The range of sherds actually assigned to the Nicoya category by Bruhns and Fowler is probably not exactly the same. In particular, Fowler would use Nicoya-like to refer to at least some of the sherds Bruhns describes as Fine Paste Wares. Finally, Bruhns alone notes the presence of the Usulutan style wax resist painting on two vessels and one example of organic resist or "negative painting".

Fowler (1981:244-261) describes a number of "Unnamed Types".

Summary of the Two Schemes

Classification category equivalencies can be established between the two schemes in most cases. With regard to the three numerically dominant categories, the red-slipped category is most likely to be perceived the same way in independent sortings because of its visual distinctiveness. Certain forms would be identically placed in the respective coarse categories. The main differences emerge in assigning to a category the less distinctive sherds in the tan, buff, brown, terracotta, gray, color ranges. The "local" painted sherds are somewhat differently conceived by Fowler and Bruhns; which attribute takes precedence for classification purposes is differently defined in some instances.

San Dieguito Ceramics

Analysis of San Dieguito pottery was designed to address the central research problem of intrasite variability and to provide additional information on Cihuatán pottery more generally.

Raw data about ceramic artifacts from San Dieguito are expressed in a number of discrete sets of information:

1.Descriptive notes made in the Cihuatán field laboratory cover artifacts from Structures 15-1 (Excavation Area A) and 12-51 (Excavation Area C) and selected excavation units in Structure 12-1 (Excavation Area D). These data are partitioned by excavation and analytical units;

2.the results of coding an approximate 10% random sample of ceramics from Structures 15-1 and 12-51;

3.the results of coding 2030 rims from the Structures 15-1 and 12-51 collections;

4.further descriptive notes made on the collections loaned to the University of Calgary;

5.results of petrographic analysis of 100 thin sections; and

6.results of X-ray diffraction of sherds.

With the exception of the notes about Structure 12-1 pottery, the other sets of information are different representations of the same collections; these were deliberately designed to provide cross-checks on the results of one line of analysis against another. We reasoned that if the data were sturdy enough, the same trends should show up in, for example, the random sample and the total assemblage. Multiple expressions of trends would be regarded as stronger evidence than just one account. By the same token, factors of investigator bias and mechanical errors would be minimized and/or exposed. If the different lines of analysis failed to correspond, we would be forced to account for the differences.

Descriptive Data

At the site, we were fortunate in having both Bruhns and Fowler with us for limited periods for personalized instruction in their respective classification schemes. Their instruction facilitated our introduction to the pottery and undoubtedly shaped our perceptions.

For a number of reasons, we did not systematically use either classification scheme. Rather, for preliminary on-site sorting, we adopted a more frankly descriptive approach as more useful to our purposes. The main reasons for descending to the descriptive level were: 1) we felt we should not prejudge the identity of pottery from San Dieguito relative to that from other parts of the site through opting for ready-made classification units, 2) our basic goal was to increase understanding of intrasite variability. For this, it seemed not improbable that analytical levels other than named classification categories would provide the most sensitive indicators; 3) we were, from the beginning, much struck and frustrated by the enormous amount of overlap in attributes between the different categories as described by either investigator; and 4) we were as interested in variability as typology.

In the field we were, of course, grouping sherds in the descriptive notes for each excavation unit and not writing individual descriptions of the more than 30,000 sherds processed. Equivalencies to the two classification schemes can be extrapolated within limits. Our counts of red-slipped, for example, should correspond well to either of the classification schemes because we responded to the same visual cue. Similarly, the distinctive forms of figurines, braziers, and so on can easily be equated to the coarse categories. We had the most trouble assigning sherds to categories at exactly the point at which Bruhn's and Fowler's schemes show a lack of congruence - namely in the tan, gray, brown, terracotta range of non-distinctive sherds.

The descriptive notes were expanded for the loaned collections the following summer. Facilities in Calgary allowed us to lay out all of the loaned collections at once in contrast to the situation at Cihuatán where bags had to be processed one at a time. Not unnaturally, the Calgary laboratory situation provided opportunities for a differently structured approach. These descriptive notes are therefore arranged by form, surface finish and so on, cross squares and levels which form the organizational framework for the descriptive notes made in the field.

The Stratified Random Sample

For the collections destined to be loaned to the University of Calgary where subsequent analysis was to occur, we selected high information ceramic pieces (rims, handles, supports, spindle whorls, etc.) and drew a 10% random sample of remaining sherds for excavation unit collections of over 30 sherds. Smaller collections were included *in toto*. The first task in Calgary was to sample randomly the high information pieces at the 10% level. We then had an approximate 10% stratified sample of the total population of Structure 15-1 and 12-51 which will be referred to hereafter as the Random Sample for convenience. None of the artifacts from Structure 15-2 and 12-1 were included in the loan.

The sample of 2,567 pieces was coded according to a modified version of coding sheets designed and tested in the field laboratory. Michael Williams of the University of Calgary Computer Science Department assisted us in sampling and coding procedures at Cihuatán and he continued to work with us in Calgary on coding and computer analysis. Data on temper, paste color, surface color or colors, thickness, vessel part, vessel form, rims, and estimated diameter of rims were included, as were equivalent classifications in both Fowler's and Bruhns' schemes.

As expected, the random data do not faithfully mirror those derived from the total assemblages. All categories having preferential placement in the high information group had a better chance of being chosen than they would have had of being selected from the population at large. Their frequency was accordingly elevated. Thus, red slipped pottery (defined as having at least one red slipped surface) has

29.5% for the random sample. A grouping of "local" painted ceramics shows 3.6% in the total and 5.1% in the random sample; *Fondo Sellado* is .06% of the total and .1% of the random sample; Plumbate is .06% in the total and .1% in the random sample. The same trends occur in the random sample as in the total assemblage and the discrepancies can be attributed primarily to sampling procedures (see Tables 3 and 4).

This dual expression of similar trends is reassuring because we had been extremely concerned about mechanical errors, perceptual differences and investigator bias. We know from having a single investigator code sample units at different times and from having different analysts code or describe the same sample unit that the results were never identical. A speck of red slip would sometimes be regarded as sufficient to class a sherd as red slipped and at another time the same sherd could be coded "unable to observe". Since we lacked the time and resources to double code every sample, the emergence of similar trends in separate sets of observations was regarded as mutually supportive for both sets of data.

The Rim Sample

Relative frequencies of the classification categories in the Rim and Random samples (Table 6) are not terrible dissimilar, and one might legitimately say the same trends are manifest in both. Tamulasco Plain is quite close in the two. Garcia Red is appreciably higher in the rim sample. If these were the only data we had, we might conclude that the two samples reinforce each other in some straight forward manner, perhaps accounting for the increased frequency of Garcia Red in the rim sample by arguing that red vessels lost their red slip more frequently on body sherds, pointing to the decrease in the percentage of unclassified sherds in the rim sample as a back-up argument.

The situation appears to be considerably more complex, as can be seen by comparing the way vessel form frequencies behave in the two

Table 3

Classification of San Dieguito Pottery
Using Fowler's Scheme

	Random Sample (N = 2,567)	Rim Sample (N = 2,030)
Las Lajas	3.2%	1.8%
Tamulasco Plain	32.9%	32.3%
Garcia Red	29.5%	43.7%
Garcia Red Incised	0.4%	0.1%
Peralta Brown	3.0%	2.6%
Cachinflin Black	1.3%	0.6%
Tamoa Red-on-Buff	0.2%	0.1%
Zancudo White Polychrome	3.0%	3.5%
Jejen Polychrome	1.9%	2.0%
Tohil Plumbate	0.1%	0.0%
Nicoya-like Polychrome	0.1%	0.0%
Other/unclassified	24.3%	13.2%

Table 4

Classification of San Dieguito Pottery
Using Bruhns' Scheme

	Random Sample
Coarse Ware	3.5%
Tan-to-Brown Monochromes	33.9%
Self-Slipped	5.8%
Red Ware	29.6%
Monochrome Incised (Red)	0.3%
Black Ware	0.9%
Red-on-Tan (Marihua Variety)	0.2%
Local Polychrome	2.3%
Bandera Polychrome	1.0%
Plumbate	0.1%
Fondo Sellado	0.1%
Mixteca-Puebla Polychrome	0.0%
Nicoya Polychrome	0.1%
Other/unclassified	22.2%

samples (Table 5). We cannot deny that the chances for erroneous assignments to a form category are much higher in the random category because of the preponderance of low information body sherds. However, quite different variables underlie the apparent gross similarity in trends in the two samples, and the apparent similarities are in fact misleading, particularly in the case of Tamulasco Plain.

Table 5

Comparison of Vessel Form from Rim and Random Samples

	Random Sample (N = 2,567)	Rim Sample (N = 2,030)
Generalized Form Coding		
Convex walled vessels	49.2%	17.3%
Bowls	16.2%	64.9%
Comals	0.1%	0.6%
Ladles	0.1%	0.4%
Other and unclassified	34.4%	16.8%
	100.0%	100.0%
More Specialized Coding		
Convex Walled		
Wide mouthed ollas	2.8%	11.9%
Narrow necked jars	0.7%	1.0%
Tecomates	0.3%	1.4%
Total	(3.8%)	(14.3%)
Bowls		
Flaring/flat bottoms	8.1%	42.7%
"Hemispherical"	1.7%	8.5%
Total	(9.8%)	(51.2%)
Comals	0.1%	0.5%
Ladles	0.3%	0.7%
Braziers	0.1%	0.6%
Other/unclassified	85.9%	32.5%
	(86.4%)	(34.3%)
	100.0%	100.0%

Vessels of large size which have a comparatively large body area relative to rim diameter will be subject to breakage patterns favoring the production of more sherds per vessel; these factors will tend to give these forms a much better representation in the random or total samples. The variable of body area relative to rim diameter exerts little influence on the rim sample. Although ollas and jars may have an appreciably larger body area than bowls, their rim diameters overlap and cover much the same size range. If anything, bowls have the advantage in the rim sample and are likely to be over-represented relative to absolute numbers of vessels. Because rim diameters vary a great deal less than body area and because rim diameters of bowls and convex walled vessels largely overlap, the rim sample is believed to approximate more *closely* (although not exactly) the frequencies of actual vessels than does the random sample.

A comparison of rim and random samples shows that customary placement of painted design affects the frequencies of the combined local painted category in a minute but significant way. Designs placed just below the rim or lip have a better chance of appearing in the rim sample. *Fondo Sellado*, on the other hand, is characterized by impressed designs elsewhere on the bowl. Unless a *Fondo Sellado* bowl was broken to produce rim to base sherds showing the impressed design, this category would not be represented in the rim sample, and is not.

Table 6

Comparison of Classification Categories in the San Dieguito Rim and Random Samples

	Random Sample (N = 2,567)	Rim Sample (N = 2,030)
Las Lajas	3.2%	1.8%
Tamulasco Plain	32.9%	32.3%
Garcia Red		
(including G. R. Incised)	29.9%	43.8%
Cachinflin	4.3%	3.2%
Combined "local" painted	5.1%	5.6%
Plumbate	0.1%	0.0%
Nicoya-like	0.1%	0.0%
Fondo Sellado	0.1%	0.0
Indeterminate or other	24.3%	13.3%
	100.0%	100.0%

Table 7
Gross Vessel Form and Classification Category (using Rim Sample)

Fowler's Types	Gross Vessel Form (percentages)						
	form not designated	Convex Walled	Bowl	Comal	Ladle	Other	Totals
Not Recorded	0.04	-	-	-	-	-	0.04
Las Lajas	0.29	0.29	0.39	-	-	0.84	1.82
Garcia Red	4.87	2.51	35.86	0.04	0.04	0.39	43.74
Garcia Red Incised	-	0.04	0.04	-	-	-	0.09
Tamulasco	4.58	11.97	14.33	0.44	0.25	0.74	32.31
Cachinflin	0.15	0.04	0.44	-	-	-	0.64
Peralta	0.15	0.39	1.82	-	-	0.20	2.56
Tamoa Red on Buff	-	-	0.04	-	-	0.04	0.09
Zancudo Polychrome	0.25	0.29	2.85	-	-	0.09	3.50
Jejen Polychrome	0.15	0.29	1.38	-	-	0.15	1.97
Tohil Plumbate	-	-	-	-	-	0.04	0.04
Indeterminate or Other	3.39	1.43	7.72	0.09	0.13	0.33	13.15
Totals	13.89	17.29	64.93	0.59	0.44	2.86	99.96

The rim and random samples, then, are not just slightly different versions of the same variables at work on the same data but express differentially the effects of a somewhat different range of variables on significantly different populations drawn from the same universe. Each sample tells us things of value for particular purposes. The rim sample is more useful as an approximation of vessel frequencies and for fuller information on vessel form in the sense of having less unclassified information. The random sample is a better reflection of the total assemblage and, with descriptive data, is most useful for comparisons to other Cihuatán assemblages which have not been analyzed by rim samples or vessel lots.

San Dieguito Pottery and Existing Classification Categories

In order to make our data compatible with data provided by Fowler and Bruhns, we have tried to work with both of their classification systems. The Random Sample was coded for the analysts' opinion as to how a sherd would be classified in each scheme; the Rim Sample coding used only Fowler's scheme (Table 3).

In this section we use the rather gross classification categories representing equivalencies (or lack of) between the two existing classification schemes as a framework for presenting the San Dieguito data. We emphasize relationships between the categories, the problems we encountered in using the schemes, and our response to the classification schemes on the basis of our experiences in handling the San Dieguito ceramics. Macroscopic characteristics of the pottery form the basis of this discussion. A somewhat different picture emerges from the results of the technical analysis (see Chapter 5).

The Coarse Categories

Form is the most important characteristic of this grouping for both Fowler and Bruhns, and it turned out to be the only characteristic we could work with with any assurance. Figurines, brazier midsections showing the interior flange, applique fillet bowl rims, incised ledge rims, thick sherds from very large, heavy vessels, roof tiles, drain pipes, some but not all spindle whorls, clay balls, and most applique and modeled pieces were automatically assigned to the Coarse category.

The coarseness of the ceramic fabric, noted by both Fowler and Bruhns, was much less helpful as a criterion than we had anticipated. Some pieces such as the incised ledge rims actually do have heavy temper and a coarse paste. However, for most of the pieces assigned to the Coarse category on the basis of form, we found that size and amount of temper was much like the range of temper found in Fowler's ceramic groups of Tamulasco, Garcia Red and so on, and in Bruhns' roughly equivalent groupings.

After coming to this conclusion on the basis of macroscopic examination, Mavis Stout, the mineralogist on our project, did a careful assessment of temper sizes and frequencies on the thin sections used for petrographic analysis; she could not differentiate the so-called Coarse ceramics from others on these grounds. In fact, some of the fillet applique bowl rims have the least temper and the smallest sized temper particles of any sherds in our petrographic sample. Even these overlapped so thoroughly with what Fowler calls Tamulasco Plain that we were seldom able to pick out body sherds from the Plain category to match the applique fillet rims.

Our assignment of sherds or other ceramic pieces to the Coarse category is more limited than would have been the case if either Bruhns or Fowler had done the analysis. As a result, the frequency in our Random Sample must be seen as a minimal figure compared to their tabulations.

The Red-Slipped Ceramics

A red slip is sufficiently distinctive visually that this classification category is less subject than others to distortion resulting from incompatibilities in the two schemes or from investigator uncertainty about the most appropriate equivalents. Tabulations of red-slipped sherds include unpainted portions of red-slipped painted vessels, and we know that some formerly red-slipped sherds have completely lost their red slip because we have sherds that fit together - one being red-slipped and the other totally eroded. Bruhns (1980a) noted the same differential erosion of parts of the same vessel, a situation attributable to depositional conditions. Therefore, while red-slipped tabulations and frequencies are not an exact expression of red-slipped vessels, the category is nonetheless quite stable from an analytical perspective.

In the coding for red-slipped surfaces (interior and exterior), we, like Bruhns, recognized only one version of red-slipped, whereas Fowler distinguishes at least two that are assigned to the Naguapate Red and Garcia Red Ceramic groups. It may be that chemical analysis will eventually show that there is an objective basis for subdividing these slips, but we were unable systematically to make any meaningful distinctions. This is not to say that the red-slipped sherds all appear to be the same. There is enormous variation in color (from a clear bright red through darker reds, merging finally with the dark browns), in slip thickness (ranging from a wash to heavily applied multiple slips), and in degree of polishing. The entire picture is, of course, greatly complicated by differential erosion of the slipped surfaces.

Although we felt unable to separate different red slips, as such, and we discarded Fowler's Naguapate Red category, we did not classify all red-slipped ceramic pieces as Garcia

Red in Fowler's scheme. Red slipped figurines, drain pipes and heavy, barrel-shaped vessels were assigned to the Coarse category on the basis of form.

A red slip is often combined with a tan-slipped or unslipped portion of the vessel. Bowls, in particular, show considerable variation in the placement of these two colors. The interior of a bowl might be red-slipped with a red slip band carried over onto the tan-slipped exterior, or vice versa. Some bowls are red-slipped inside and out. Interior walls may be red-slipped while the basal interior is tan. Convex walled vessels such as narrow necked jars or pitchers might or might not have the exterior red slip carried over into the interior of the neck.

In the random and rim samples, interior and exterior red-slipped frequencies are:

	Random Sample	Rim Sample
Interior-red	17.5%	41.7%
Exterior-red	27.0%	40.9%

The random sample, having a preponderance of body sherds, shows a pronounced difference between interior and exterior red-slipped frequencies. This reflects the presence of both exterior slipped jars and red and tan bowl combinations. The near congruence of interior and exterior red slips in the rim category reflects the slipping of interior jar necks and red-slip bands carried over bowl rims.

Multiple slips appear to have been common. Not only do the red and tan combination vessels show double slipping, but some all-over red vessels show a tan underslip. Multiple red slips, either over a tan underslip or applied directly to the vessel surface, may have been used on some of the more heavily slipped vessels. The use of multiple slips accompanied by careful polishing suggest extremely careful finishing of some of the red-slipped vessels. Indeed, some of these are among the most carefully made vessels found at San Dieguito. The same carefully made pieces, however, can have large inclusions protruding onto the surface.

Not all red-slipped pieces were carefully produced and a considerable range of variation exists in presence or absence of the basic tan slip, thickness of the red slip (some being more like a red wash than a slip), and degree of polishing. We did not attempt to quantify these differences in the coding procedure because too many sherds were eroded and because these details could not be detected with any degree of accuracy on many of the sherds.

With regard to the size of temper particles (discussed above for the Coarse category), it is worth noting that the largest single inclusion we observed occurred in a red-slipped bowl sherd; the inclusion measures 9x4x5 mm.

The Plain Pottery

I tend to see the pottery that Fowler calls Tamulasco Plain and Bruhns calls Tan-to-Brown Monochromes and Self-slipped as the foundation, the core, of the "local" ceramic complex. This is the pottery that overlaps to a large extent with the red-slipped and white-slipped categories in form, vessel size and paste characteristics but which was not red or white-slipped. Because so much of the red-slipped category, especially, was first tan-slipped, one might say that red-slipped pottery is plain pottery carried one step farther in the manufacturing process. Conversely, the plain pottery can be seen as not having been carried through the extra step or steps of having red or white slips applied or being painted. Fowler made a similar point (1981:266).

Not only is this category the core of the local ceramic complex in the sense argued in the preceding paragraph, but it includes body portions of vessels that carried applique fillet rims (which were assigned to the Coarse category on the basis of rim form) and basal portions of bowls and ladles having a red slip band around the rim, and so on.

In both senses, then, this is a residual category characterized by the absence of red and white slips, the absence of painting, and the absence of forms or decorative structural details associated with the Coarse category. It can be said that every sherd assigned to the Plain category could have been assigned to a different category had one more variable, such as a red slip, been present.

In spite of the fact that assignment to this category depends more on what the pottery lacks than on distinctive characteristics limited to this one grouping, the category is real enough and accounts for perhaps one third of the classified pottery from San Dieguito. As will be discussed more fully in the chapter on vessel form, the Plain category can be differentiated from the red-slipped category in terms of frequencies of vessel forms, although the correlations of form and classification category are not strong.

The combination of raw materials and, presumably, a preference for using oxidizing firing conditions resulted in both the Plain and Coarse pottery running overwhelmingly toward the tan/buff/middle brown color range. Some sherds in the dull orange/terracotta color range appear to belong here, as do some sherds in the grey range. These color variations appear to be the result of uneven firing conditions and post-firing heating. On larger sherds and partially reconstructable vessels, considerable color variation can be observed.

Other Categories

The several minor categories recognized by Fowler and Bruhns present greater problems

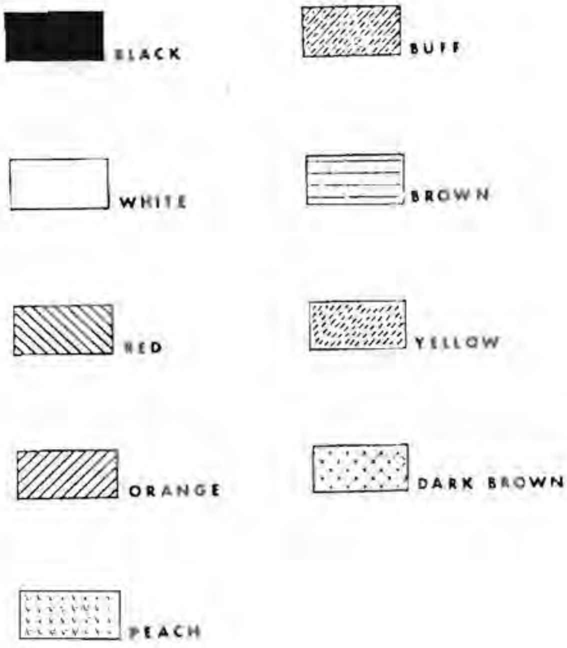


Figure 13. Color key for Ceramic Drawings.

Dieguito pottery into either scheme than do the three categories discussed above.

Polished Dark Brown: At the time we were analyzing the San Dieguito samples, Fowler was still distinguishing Peralta Brown, a type he later combined with Cachinflin Black. Bruhns would include the dark, polished brown sherds in her Tan-to-Brown monochrome series. We found it useful to distinguish this category in spite of its unquestioned tendency to shade off into the red-slipped (a single sherd shifts from bright red to dark brown, suggesting that the same slip clay could be used for both with the color difference being due to firing conditions), or to the middle range brown colors of the Plain category and the polished blacks.

The main reason we opted to differentiate this category is because small, thin, tulip-shaped vessels with a dark brown polished surface (cf. Figure 15d) are not duplicated in the Red-Slipped, Plain or Black categories, and hence

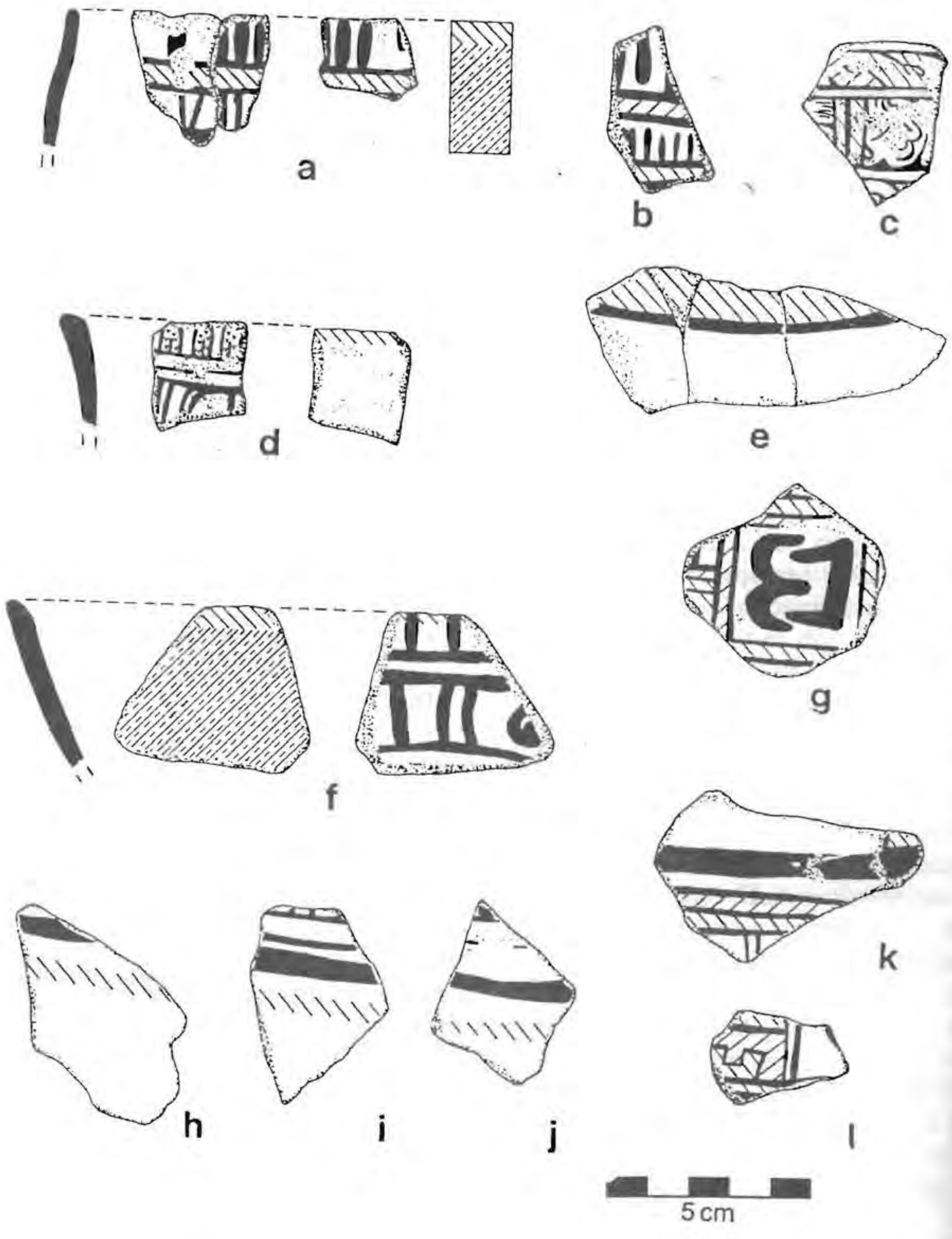


Figure 14. White Background Painted Sherds.
Sherds 14a, d, g and k also appear in Plate 3g, c, d and g

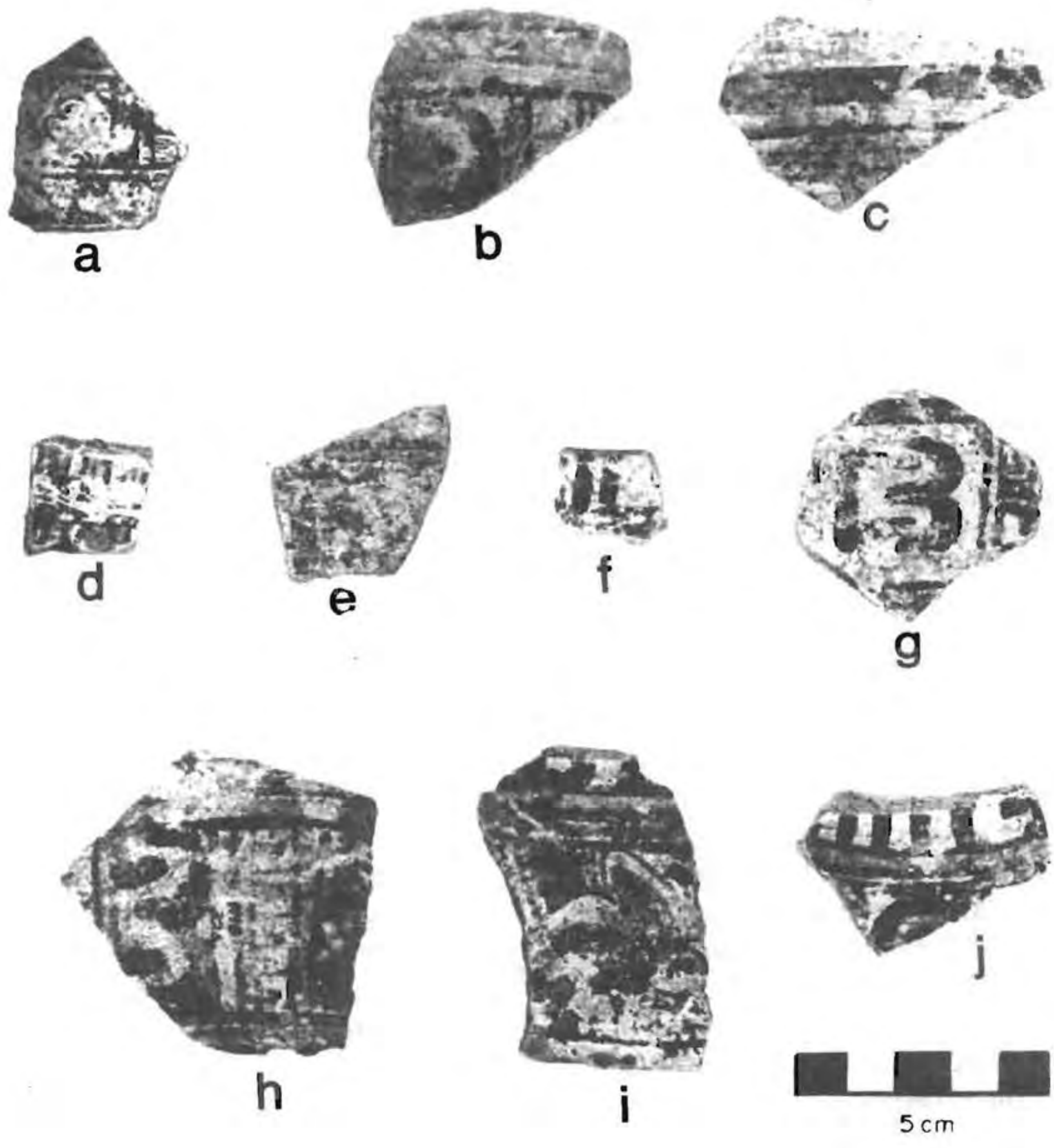


Plate 3. White Background Painted Pottery

Such limitation of variables is so unusual in Cihuatán pottery that we felt it should be recognized. Having allowed the dark brown tulip-shaped vessels, we extended this category to include sherds of similar color and finish which came from flaring walled bowls within the form range of Plain and Red-Slipped.

Polished Black: Both Fowler and Bruhns recognize a polished black pottery, although the former investigator now combines it with polished brown. We agree that there are intentionally produced polished black vessels, but these are difficult to segregate from the results of post-firing blackening and smudging, particularly on small, friable and eroded sherds. The most common form appears to be small and medium sized jars which, except for their color, are indistinguishable from other classification categories of the "local" pottery complex.

Red-on-Tan: As has been noted, the use of red slips in conjunction with tan slips is extremely common. These combinations of slips are not what is included by Fowler in his Tamoa Red-on-Buff or by Bruhns in her Red-on-Tan (Marihua variety). Both Fowler and Bruhns reserve their categories for red painted designs on a tan or buff background. We found very few sherds in the San Dieguito sample that had red painted designs (only 6 sherds were coded in these categories), and those in our sample exhibited loosely executed curvilinear designs on jar shoulders. We certainly have nothing that even approaches some of the sherds Fowler has classified as Tamoa Red-on-Buff in terms of the red color (a vibrant red-orange), hardness of the paste, or design.

White-Slipped and/or White Background Painted Pottery: We are uncertain as to whether or not there are all-white vessels in our sample. Fowler (1981:182) specifies that Quijano White occurs only as a high necked jar form. Zancudo Polychrome occurs in both high necked jars and vertical walled forms (ibid: Figure 42). There are sherds from San Dieguito with a white slip, but these could have come from painted vessels. Until we have a better understanding of variability in the white-slipped pottery, we prefer to deal with it in a single category, noting variation in descriptive terms. Therefore we collapse Fowler's Quijano and Zancudo groups into a single category.

Of all the painted categories, the white-slipped variety (or varieties) appears to have been the most popular in the San Dieguito collections, accounting for 3.0% of the Random Sample and 3.5% of the Rim Sample. This compares to 1.9% (Random) and 2.0% (Rim) for the red background painted category. Two caveats are necessary. First, it must be remembered that these figures are slightly exaggerated due to sampling procedures. Second, we included all white-slipped sherds in this category whether they were painted or not because we do not know if there are all white (unpainted) vessels and because white-slipped vessels were so prone to losing their painted designs. Only red-slipped sherds actually carrying painted designs were tabulated under that rubric; unpainted red-slipped sherds were assigned to the Red-Slipped category. Although the frequencies given above are not entirely equivalent, we can attest to the popularity of the white background painted vessels on the basis of descriptive data.

Just as red-slipped pottery often has a tan under-slip or a combination of red and tan slips, tan slips also occur in conjunction with white-slipped vessels. The addition of a white slip is sufficient for sherds to gain entry into this category.

Considerable color variation occurs in what we are classifying as white slips. These include cool grayish whites, warm creamy whites, and pinkish whites. As well, there is considerable variation in surface finish, some being quite smooth and well polished; the

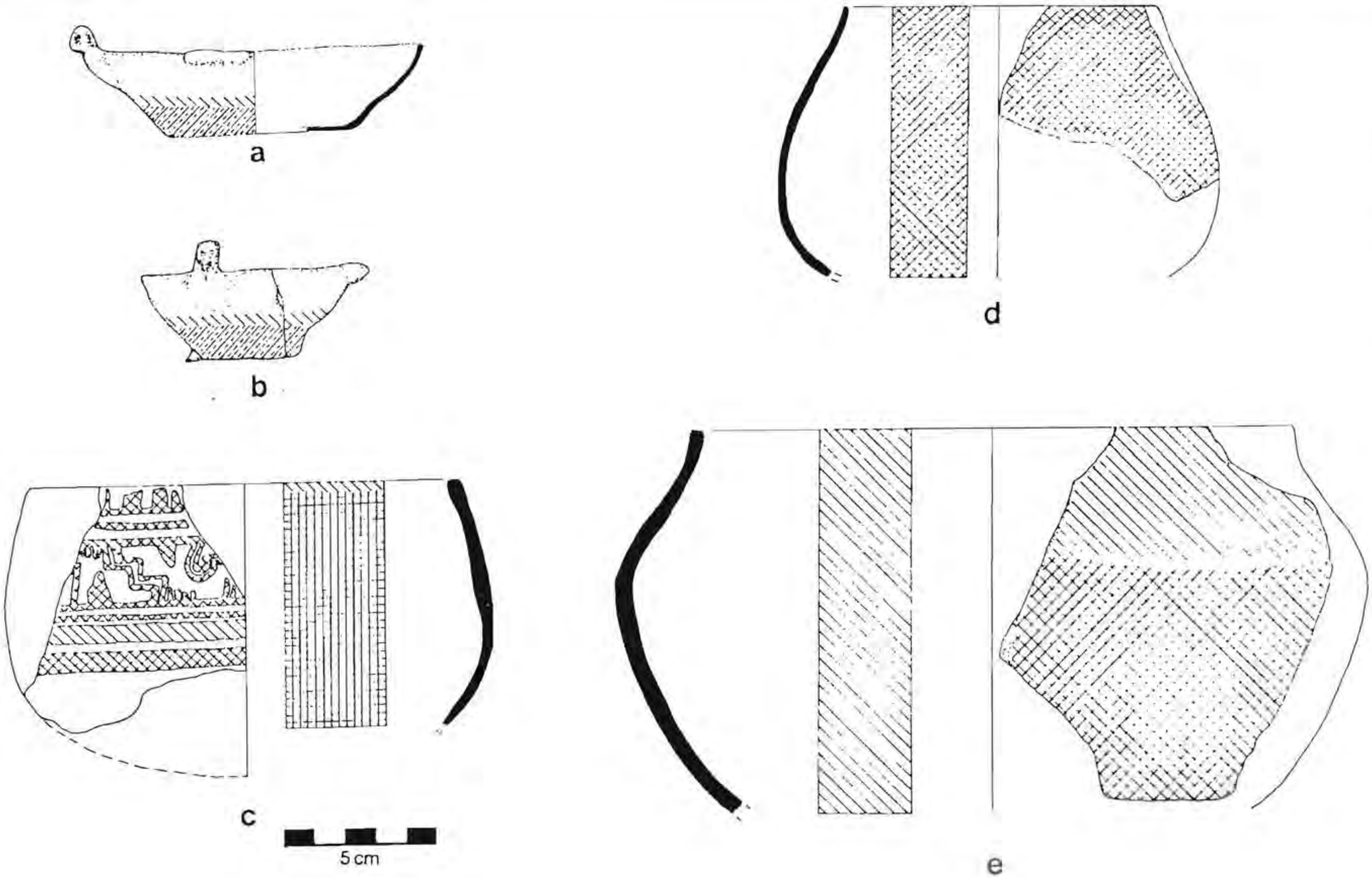


Figure 15. Bowls

a. Side view of white bowl with bird (?) adorno and rim tab; b. Another view of the same bowl

c. A white polychrome incurving bowl; d. Peralta Brown tulip-shaped vessel;

e. Tamulasco Plain incurving bowl

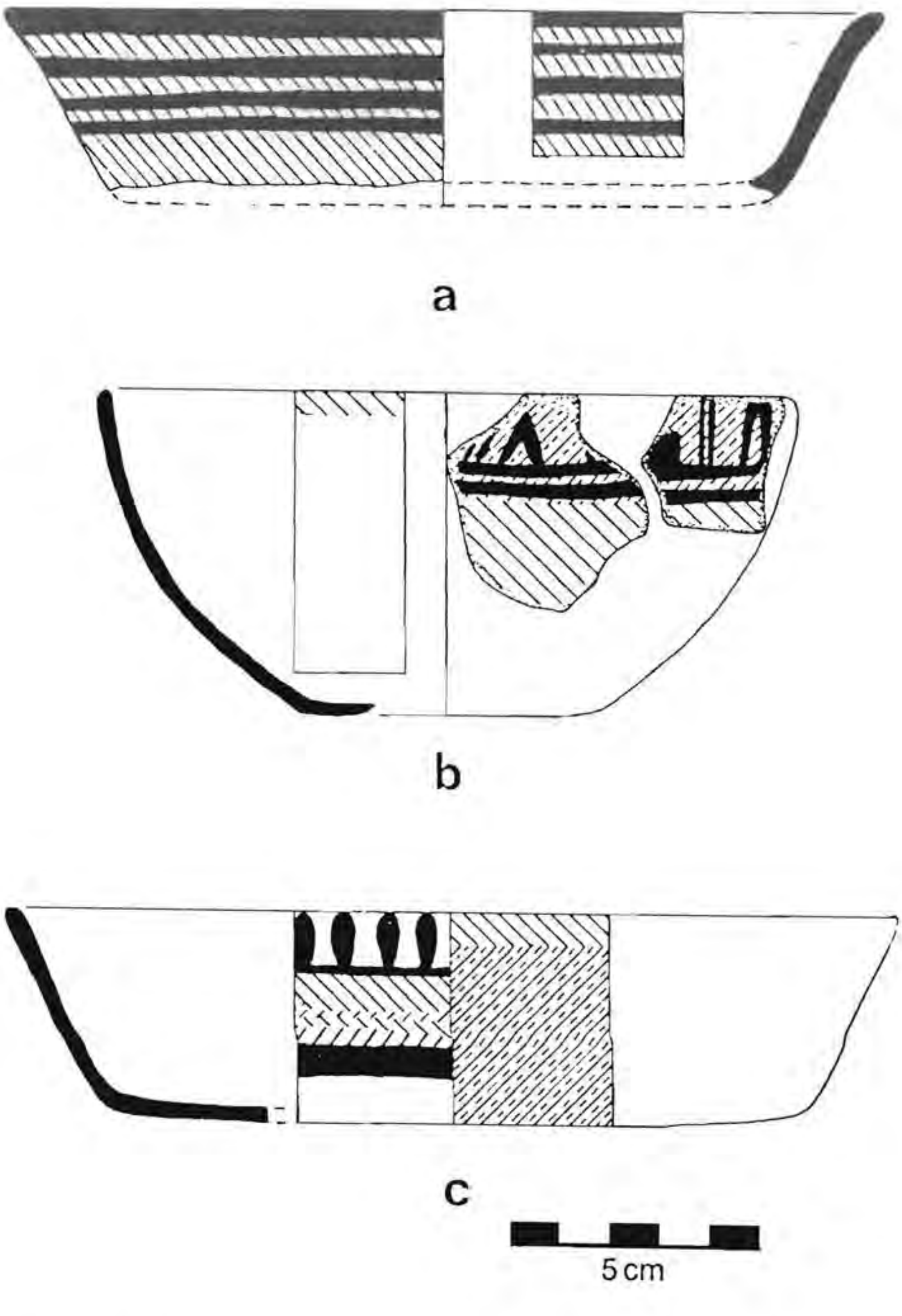


Figure 16. Painted Bowls

a. Unnamed Black-on-Red bowl;

b. Polychrome bowl with red slip band on white interior and Black-on-Red and tan exterior;

c. Polychrome bowl with black and red on white interior with red slip band on tan exterior majority, however, are decidedly flakey. Much of the white-slipped pottery has a paste that is macroscopically identical to the Plain pottery but the white-slipped vessels have been carried through these additional manufacturing steps. A macroscopically distinctive yellow ochre colored and rather friable paste seems also to be associated with white slipping. Petrographic analysis did not allow us to segregate these sherds on mineralogical grounds (but see Chapter 5). Given the variation in color of slip, surface finish and perhaps paste, future analysis may provide an objective basis for subdividing this category.

Information on forms of white-slipped vessels is quite inadequate. We can say that jars and several bowl forms occur, and that the flat bottomed, flaring-walled bowl form so common in the Plain and Red-Slipped categories does not seem to occur. Other forms may be represented. For example, there are two rim sherds from a tulip shaped polychrome vessel that may have had a white background.

For those vessels that were painted, stylistic information is also incomplete. None of the white-slipped jars or hemispherical bowls retain their designs, but they sometimes had specks of colored paint showing they were formerly painted. An incurving bowl (Plate 3g, h, i) has well painted designs reminiscent of the Mixteca-Puebla style.

The most complete stylistic information on white background bowls comes from a series of fragmentary small bowls with slightly convex bottoms and slightly outflaring walls (Figures 14, 15a, b, and c; Plate 4). On these, the design layout consist of vertically placed design elements arranged in panels joined at the base of the panels by a horizontal line or band. Additional designs might be placed in the basal interior. Execution is generally sloppy.

Less common is the use of horizontal lines or bands like those found on the unnamed Black-on-Red (see below). Since tan and white slips could be variously combined with red and/or black lines, a variety of visually distinct effects could be achieved. One bowl, for example, was initially tan slipped. White slip was applied to the interior walls (leaving the basal interior tan) and carried over in a broad slip band onto the exterior (leaving the lower exterior walls tan). The lip was painted with a narrow red band extending onto both interior and exterior walls, a red line was placed on the interior and exterior walls, and a red line was placed on the exterior white slip band. Finally, a black line encircled the interior at the junction of the tan base and the white slipped walls. One "schizophrenic" bowl had horizontal black lines on a red interior (fitting into the unnamed Black-on-Red category), while the exterior was Black-on-White with vertical lines and other motifs (Figure 17; c, d, and e).

It is not clear if bichrome vessels occur. The few Black-on-White sherds we have could have come from polychrome vessels, as could the more eroded and debatable Red-on-White sherds. The most common colors used in conjunction with white backgrounds are red and black. Yellow and/or yellow-orange as well as salmon pink were also used.

Red Background Painted Vessels: Fowler recognizes a single category (Jejen Red Polychrome), whereas Bruhns identifies Bandera Polychrome as defined by Boggs and two kinds of Mixteca-Puebla Polychromes.

In our analysis, a single coding category was used. On the basis of descriptive data, however, we can distinguish, minimally, three subgroups:

1. an unnamed Black-on-Red which seems to be limited to San Dieguito,

2. Bandera Polychrome, and

3. a polychrome limited to tulip-shaped vessels carrying naturalistic designs. This includes at

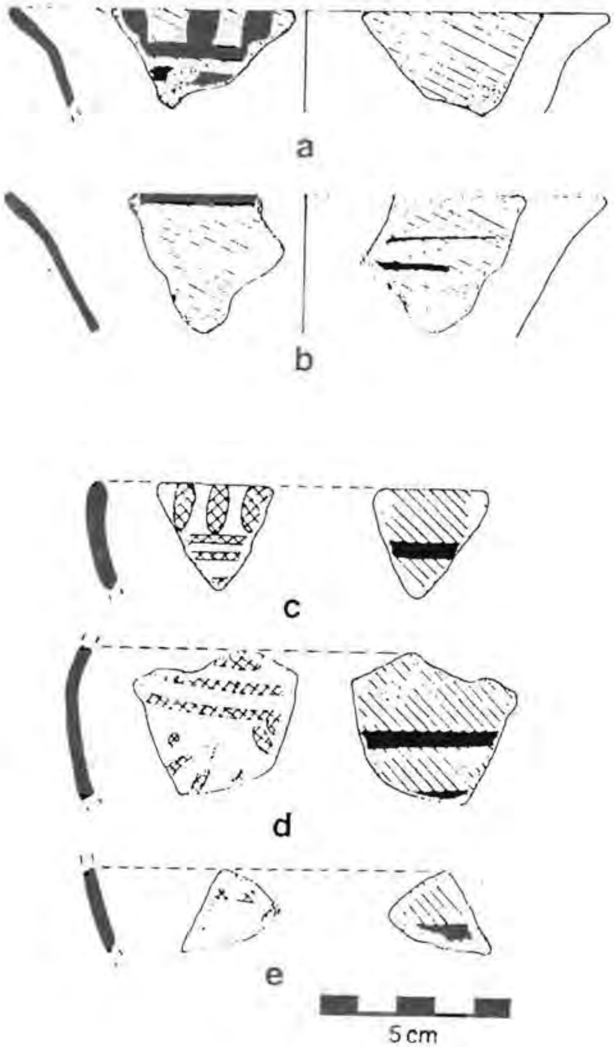


Figure 17. Red Background Bowls

a. Unnamed Black-on-Red bowl;

b. Unnamed Black-on-Red bowl;

c, d, and e. Three sherds with Black-on-White interior and Black-on-Red exterior

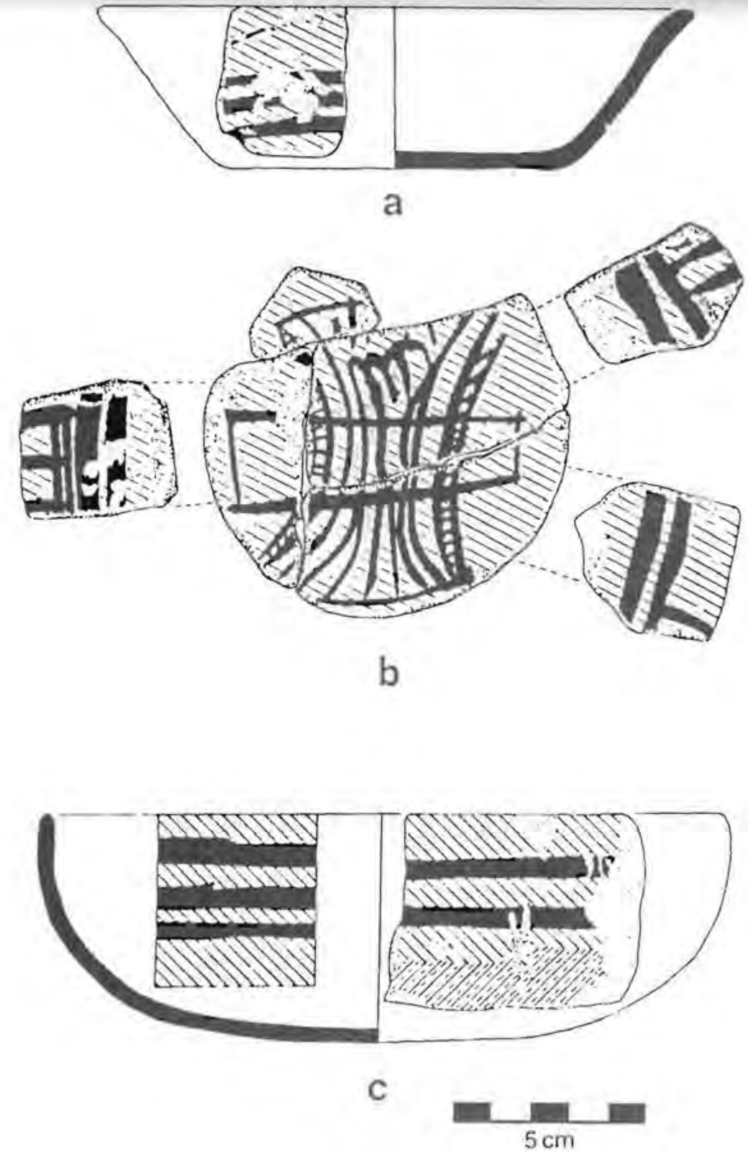


Figure 18. Red Background Bowls

a. Profile of an unnamed Black-on-Red Bowl with "reed-bundle" desig

b. Base and side-wall sherds of vessel shown in 'a';

c. Unnamed Black-on-Red hemispherical bowl

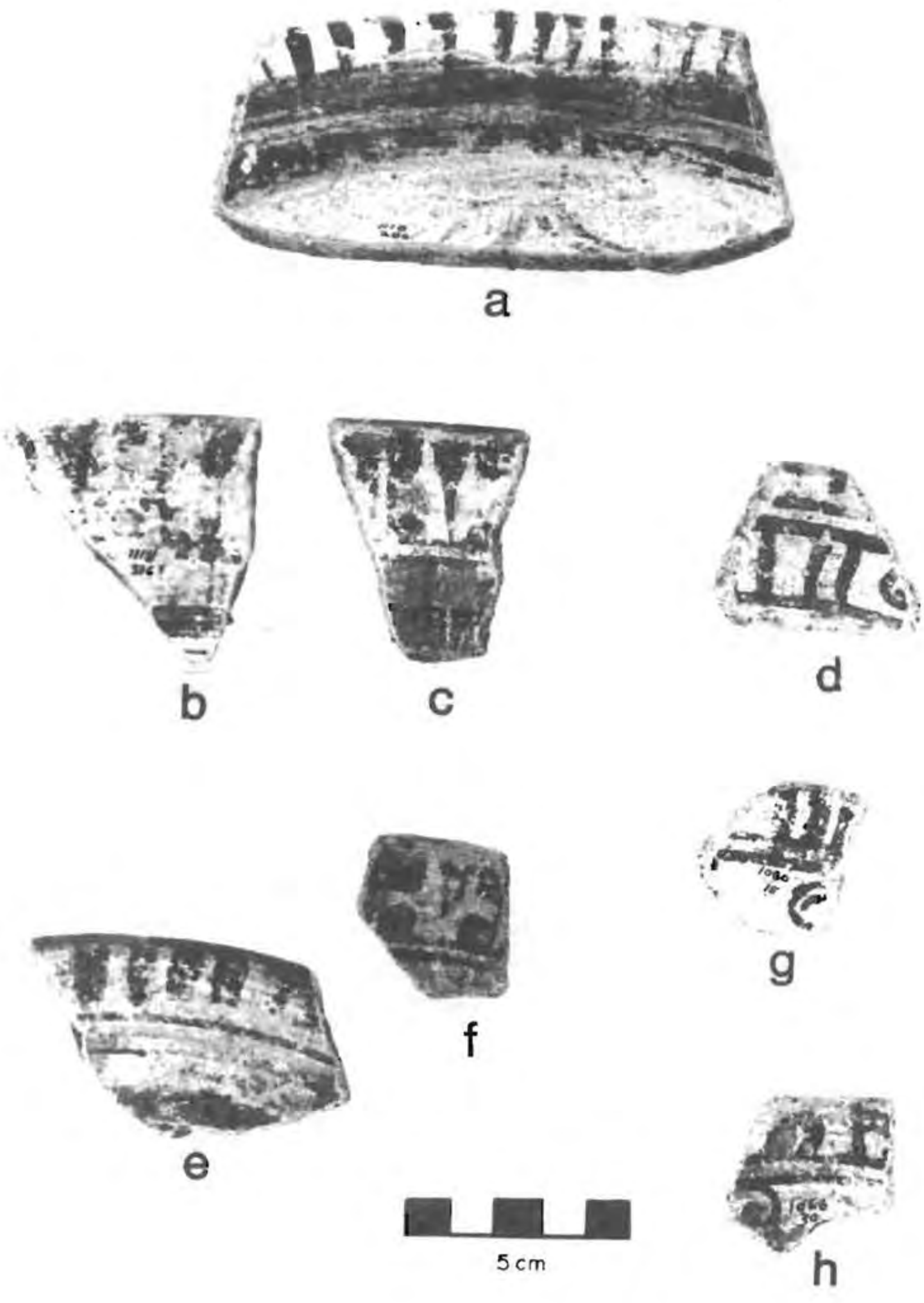


Plate 4. White Polychrome Bowl Rims

least part of what Bruhns would call Mixteca-Puebla.

The most numerous subgrouping in terms of both sherds (N= 36 in the loaned collections) and vessel lots is the unnamed Black-on-Red which seems to be confined to flaring walled and hemispherical bowls. Horizontal black lines are the dominant design. A great deal of variation could be achieved by shifting the location, number and width of black lines on interior and/or exterior, by using different combinations of red and tan slipped surfaces, and by adding a design to the basal interior or leaving it blank. Only two bowls, in fact, had a basal design; one was a "reed-bundle" design (Plate 5; Figure 18: a and b); the other appears to have a flower design in the base (Plate 6).

Since most sherds belonging to this subgroup were small rim sherds, little can be said about the number and placement of horizontal lines. One sherd, for example, had three lines of approximately even width on the interior and five lines of varying widths on the exterior.

Less common motifs are like those described for the white polychrome bowls in that vertical black lines beginning at the lip were linked by a horizontal black line at their base. These could occur on the interior or the exterior or on both surfaces. The case of the bowl with horizontal black lines on a red interior and a black on white design on the exterior has already been mentioned in the discussion of white background pottery.

Bandera Polychrome is characterized, first and foremost, by flag-like designs often occurring in pairs connected by a line. These are usually black rectangular areas outlined in white or white rectangular areas outlined in black. Additional motifs include spirals, spirals enclosing white spotchy flower-like designs, white flower-like designs without spirals, and

darker red-slipped background than the bright red of some Garcia Red – indeed the most complete bowl must be described as dark brown. Black lines may encircle the rim, the base, or both. Bowls with Bandera designs on the interior may have a red slip band on an otherwise tan exterior, with black lines on the slip band. Others have designs on both interior and exterior.

Bandera Polychrome is not common in San Dieguito ceramics. Eight sherds belonging to one flaring walled bowl, and six probably belonging to another were identified in the loan collections. Several eroded sherds may belong to other Bandera bowls. As well, Bandera designs or closely related geometric designs occur on two or three vessel lots of the thin tulip-shaped vessels. Except for the design motifs, the latter are identical to the tulip-shaped vessels with naturalistic or broad-lined designs.

Thin, tulip-shaped vessels occur in dark polished brown, red background polychromes, and in a white background polychrome. It is partly because this distinctive vessel form occurs in the dark polished brown and because the paste of these vessels appears macroscopically and petrographically to be within the "local" range that Fowler rejects the designation of Mixteca-Puebla for the polychromes of this subgroup, feeling that such a label implies unmerited assumptions about where these pieces were manufactured and how they were acquired.

The tulip-shaped polychromes were not common in the San Dieguito collections. Six vessel lots were tentatively identified and additional sherds from these or other vessels may belong here. Not enough of any vessel was recovered to allow definitive statements on design layout or style. Some vessels seem to have designs similar to Bandera Polychrome. Most, however, exhibit in fragmentary form more naturalistic design motifs such as faces and features that appear to have covered the exterior

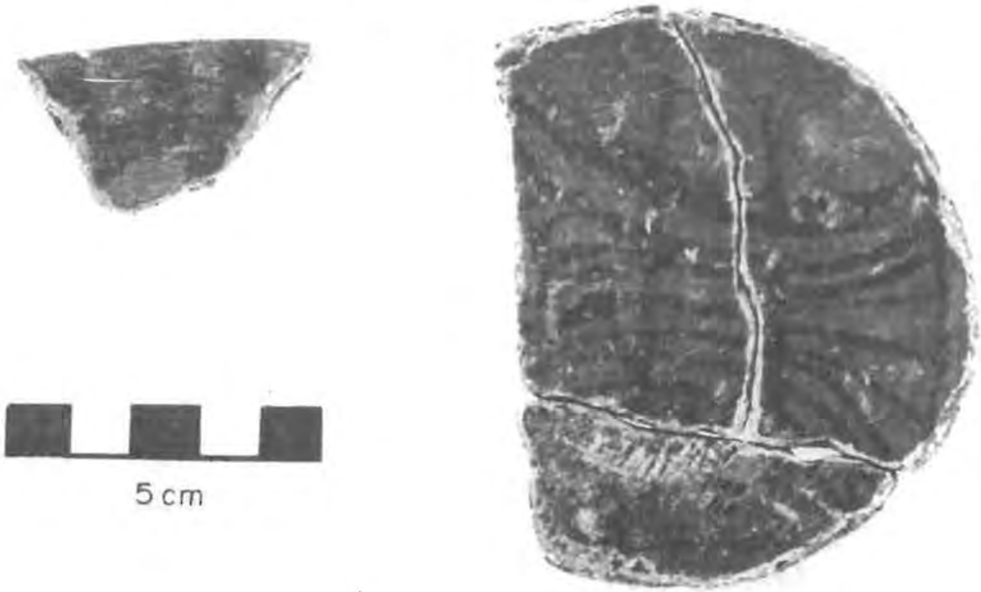


Plate 5. Unnamed Black-on-Red Bowl with "reed-bundle" Design
(also shown in Figure 18a and b)

Plate 6. Unnamed Black-on-Red Hemispherical Bowl with Eroded Basal Design

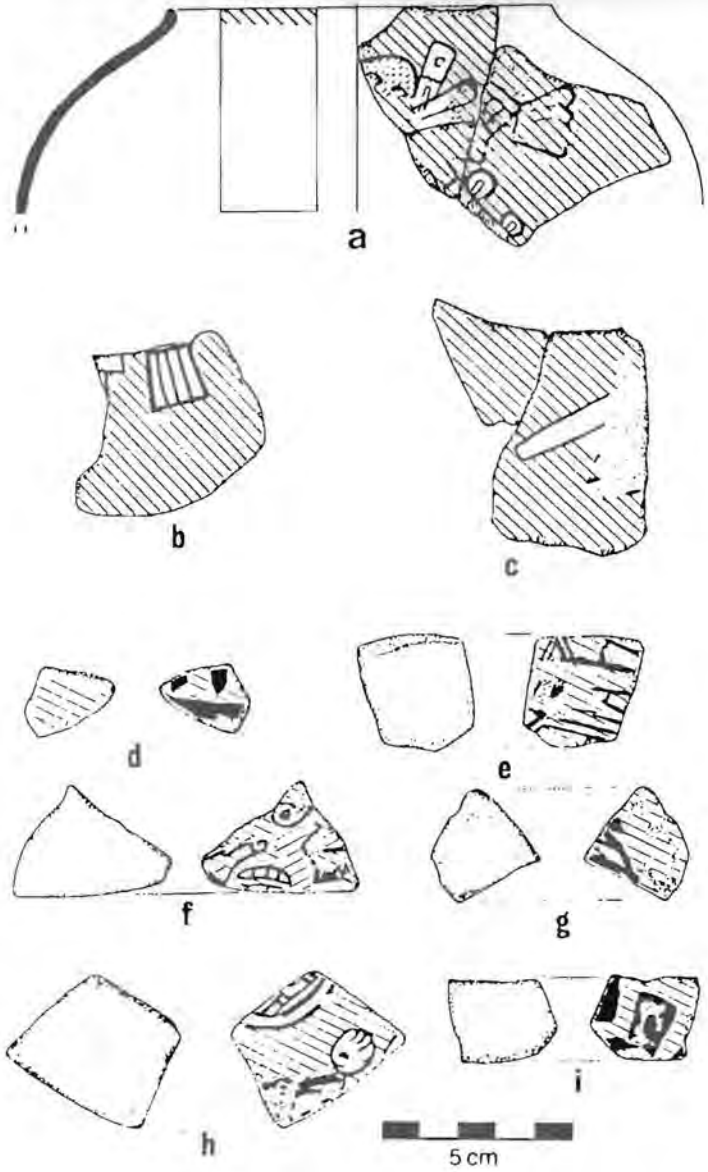


Figure 19. Red Polychrome Sherds

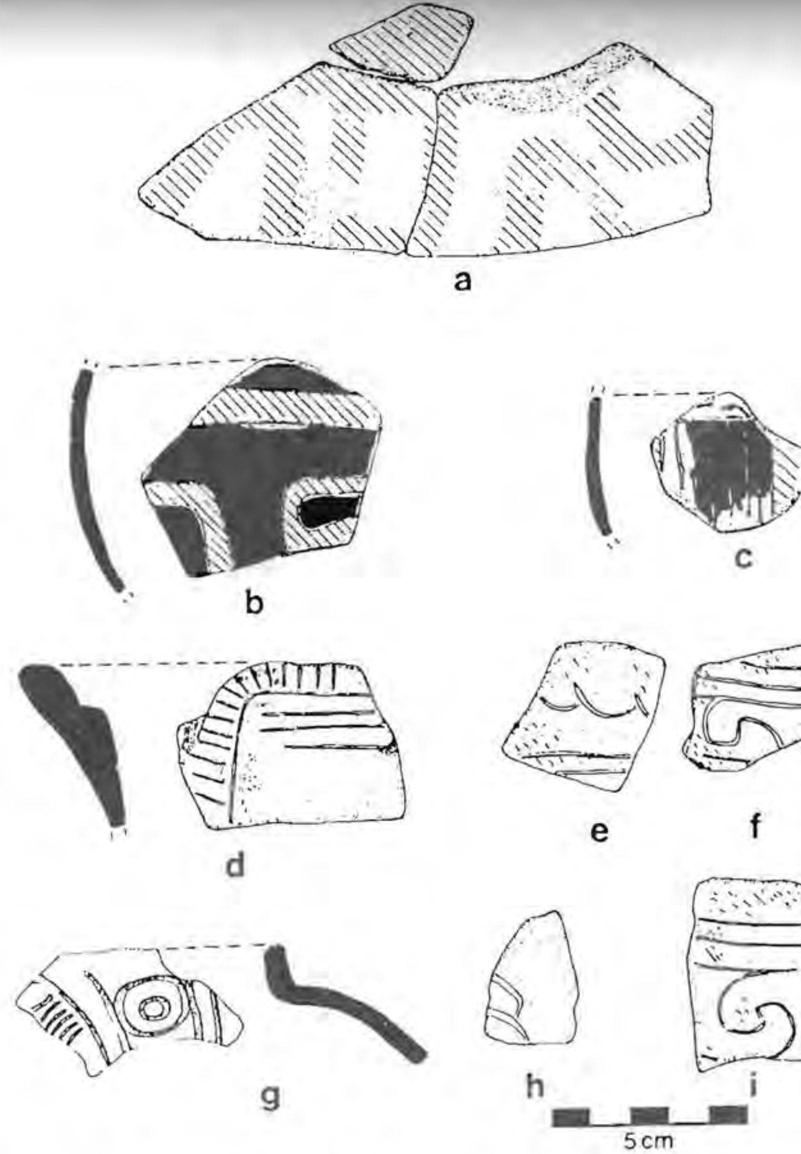


Figure 20. Miscellaneous Decorated Sherds

a. Red-on-Tan olla or jar sherds (also shown in Plate 7e and f); b, c. Zoned incised ware (also shown in Plate 7d); d. Modelled incised red slipped piece; e, f, h, i. Garcia Red Incised; g. Plumbate vessel lots have a black or white line encircling the rim.

Other Painted Categories: A number of sherds do not fit into the categories described above -- as flexible as they are. Some appear macroscopically to be "local" (numbers 1, 2 and 3 below) while others (numbers 4, 5, 6, 7 and 8) are good candidates for imports, but no typological equivalents or sources are known.

1. Four sherds, all probably from the same large, convex-walled vessel, have broad black lines outlining curvilinear red areas. The basic exterior slip is tan.

2. Four sherds from another large convex-walled vessel, also tan or cream slipped, have very broad black lines that may have been created with unevenly applied organic paint (Plate 7 a, b and c).

3. One large sherd shows an unusual finishing sequence. The vessel was first tan-slipped. Then, large red curvilinear areas were outlined in dark brown. Finally, a thin, almost transluscent dark brown slip or wash was applied.

4. Two sherds from different jars have curvilinear black and white designs on a reddish brown slip.

5. Six gray sherds, some with a bright red design, seem to belong to two vessels: a jar and a flat bottomed bowl.

6. Three very hard terracotta colored sherds carry designs in a dark brown, semi-translucent paint that is almost glaze-like. Dots and other elements are used. This is the only case of dots being used as a motif that we noted on San Dieguito pottery (Plate 7 g).

7. Eight sherds belonging to 3 vessels have very fine, soft paste which ranges in color from cream to gray, sometimes on the same sherd. Incisions outline zones of red and black on the unslipped, cream to gray surface. In paste, design layout, colors and use of outlining incisions, these sherds are quire unlike any other pottery from San Dieguito. Fowler, who examined these sherds, said that nothing like them came from his excavations in the WCC (Figure 20 b and c; Plate 7 c and d).

A "Mixtec-style" Incensario: Five widely scattered sherds from Structure 15-1 belong to a single vessel similar to those called "Mixtec" Incensarios (Figure 21a and b; Plate 8). It has a sharpely everted neck; the rim portion is almost channeled. The upper body had a series of angular cutout holes. A fragment of applique remains. Since no such cutout sherds from lower on the body occurred in our collections, it may be that the cutouts were confined to the upper body.

Baño Metálico, Plumbates and "Nicoya-like": Eighteen sherds in our collections can be identified as Tohil Plumbate. One solid support seems to have a Plumbate-like finish but the paste is wrong for Plumbate. This might fit in Bruhns' (1980b) False Plumbate which she argues is locally made. The "Nicoya-like" category is more problematic. Three sherds with a whitish paste, a talcum powder feel and bits of orange paint can reasonably be called "Nicoya-like". A large hollow vessel support has a creamy colored surface, patches of black and red paint and the talcum powder feel; the paste, however, is quite similar to "local" pottery (see discussion of petrographic sample number 20 in Chapter 5).

In looking over Fowler's collections, the sherds he has classed as "Nicoya-like" are much more varied, many being gray or terracotta in color and lacking the talcum powder feel. Such

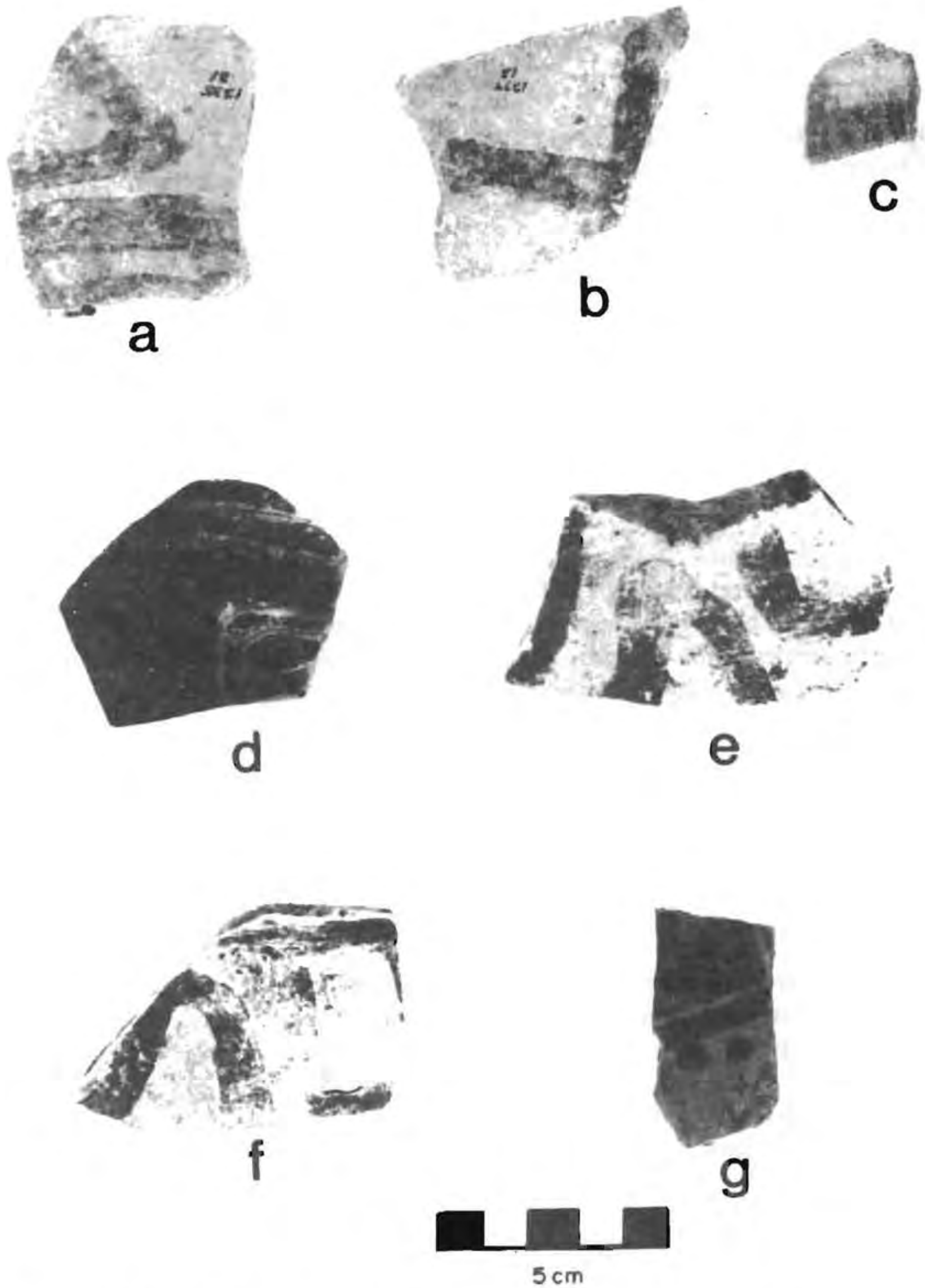


Plate 7. Painted Sherds Not Assigned to a Classification Category

a,b,c. Black-on-Tan designs on exterior; d. Zoned-Incised ware (also shown in Figure 20b);

e,f. Red-on-Tan designs on exterior (also shown in Figure 20a);

g. Hard glaze-like design with dots

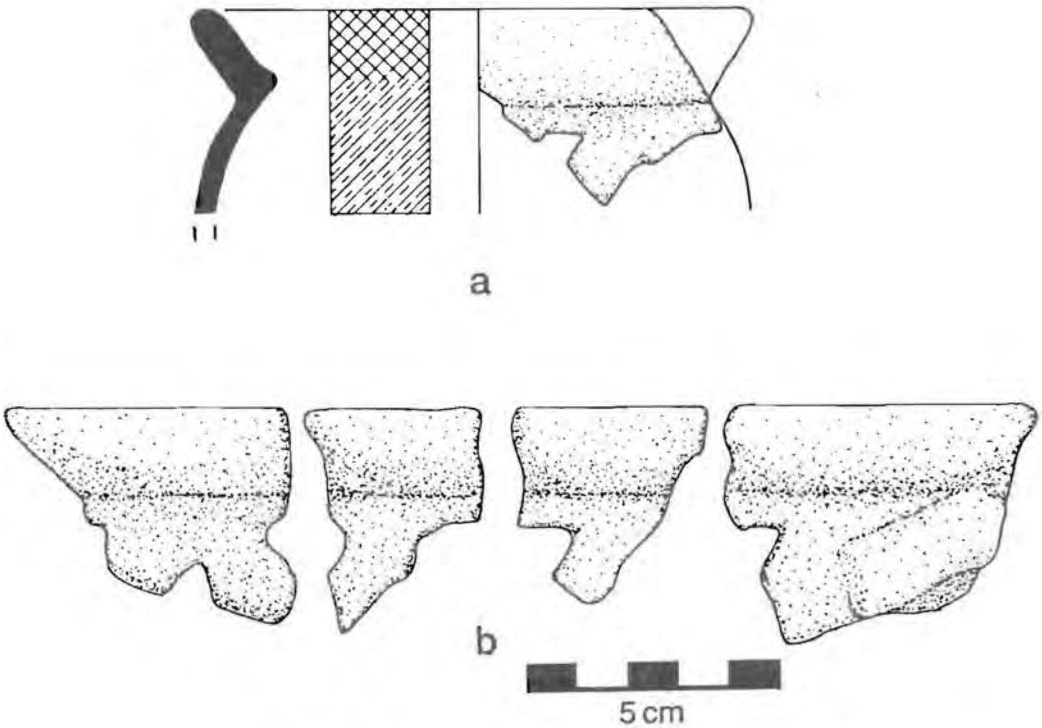


Figure 21. Mixteca-style Censer
a. Rim profile; b. Rim sherds

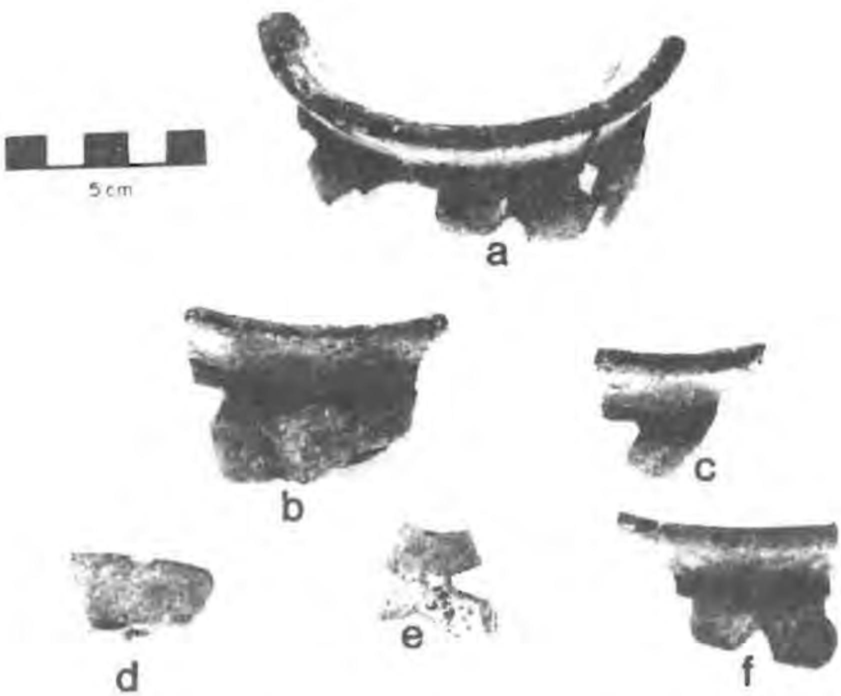


Plate 8. Mixteca-style Censer Sherds

"Nicoya-like" sherds are absent from the San Dieguito ceramics, but mineralogically, the two groups are quite similar (see Chapter 5).

What Bruhns (1980a:90) calls a local variant of *Baño Metálico* is designated as Unnamed "Metallic-Slipped" by Fowler (1981:227-233) who feels the implications of applying the foreign name to a pottery at Cihuatán without adequately demonstrating its external relationships could be misleading. In any event, both authors refer to the same kind of pottery, and this also occurs in small frequencies in the San Dieguito connections.

Unclassified

The coding analysts on the San Dieguito project used the "other/unclassified" coding category with some frequency. For the Random Sample (Table 6), 24.3% was so classified using Fowler's scheme and 22.2% using Bruhn's scheme. Fewer sherds were so classified for the Rim Sample (13.2%). These frequencies contrast markedly with the unclassified category in Fowler's tabulations where only .01% of the total was left unclassified. Such a pronounced discrepancy in the percentages of collections or samples remaining unclassified raises methodological questions for which there are no easy answers.

It is interesting to note Andrews classified only 25.3% of the 101,227 sherds found at Quelepa. He says,

> "All sherds were washed. Those which showed the original vessel surface or retained identifiable paste color or texture were saved for study, along with all the decorated sherds" (Andrews V 1976:46).

Clearly, there is a great deal of variation in recovery and analytical procedures as practiced in El Salvador. This has implications for inferences based on ceramic analysis and the degree of comparability between collections that can be achieved.

Within our own analytical sequence, we found that manual sorting of sherds into piles resulted in fewer "unclassified" than did the coding procedures. In the table-top sorting, we compared sherds, moved them around, looked for sherds from the same vessel, and otherwise employed a series of cues that extended the informational value of a sherd. These sorts of cues were inoperative in the coding procedure where each sherd was independently observed. Part of the discrepancy, then, can be explained on the basis of different analytical procedures employed in sorting as opposed to coding.

Another factor seems to be relative familiarity with the ceramic complex. Fowler worked with Cihuatán pottery for years in contrast to our more modest exposure. In particular, the individuals in Calgary who coded the San Dieguito samples had no prior familiarity with Cihuatán pottery. Not only was this dictated by necessity (other project members did not have time to do the coding), but we felt that the coding would be more objective if it was done by people who had no preconceptions about how to infer "what might have been" from low information sherds. And there genuinely are substantial numbers of low information and eroded sherds from San Dieguito. I suspect but cannot document that the sherds from Fowler's excavations in the elite residential sector of the Ceremonial Center were actually in better shape because of depositional factors than the San Dieguito sherds, and hence more retained their finish and were classifiable. Still the discrepancies are worrisome.

Summary of Classification

Assignment of sherds in the San Dieguito Random and Rim Samples to the two existing classification schemes provides a means of

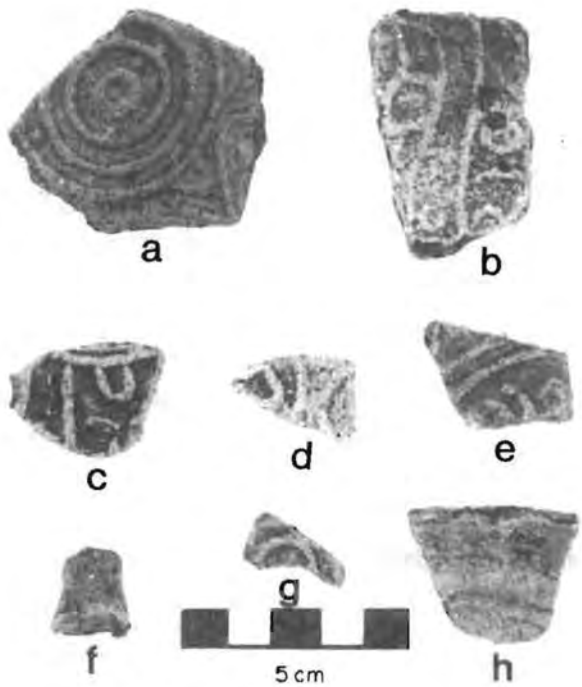


Plate 9. Fondo Sellado Sherds

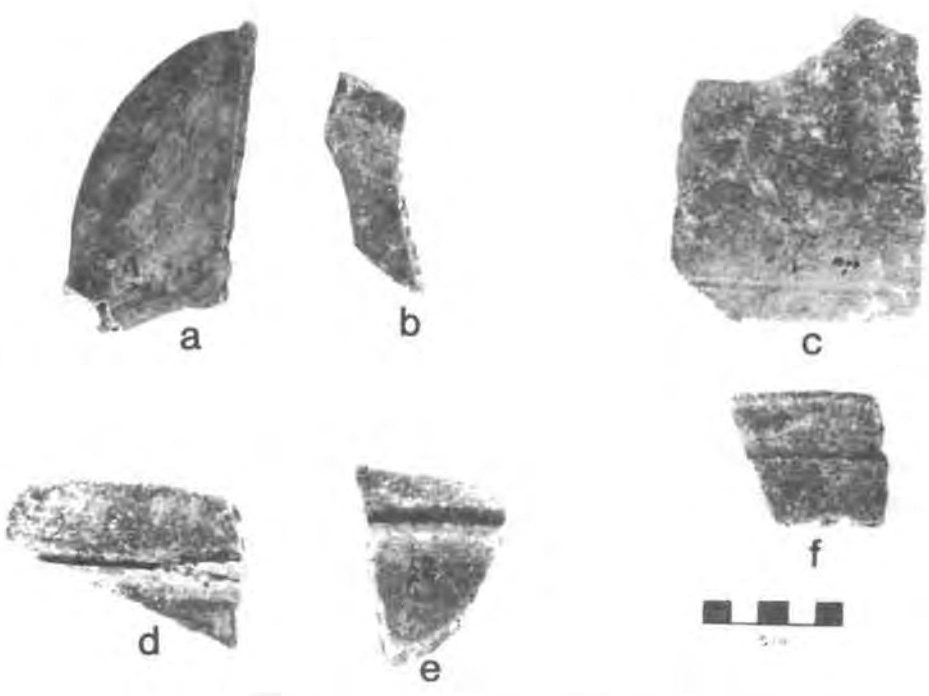


Plate 10. Pitcher Lips and Grooved Sherds

a,b. Red-on-Tan pitcher lips; c-f. Grooved sherds organizing this data in a form more or less compatible with other ceramic data from Cihuatán. All major classification categories recognized by Fowler and Bruhns are present at San Dieguito; differences in definitions of the minor local categories exist. Some kinds of pottery that Fowler calls Nicoya-like from the WCC are not represented in the San Dieguito collections.

Relationship of Classification Categories to Selected Attributes

Each investigator working at Cihuatán has been impressed by the amount of variability within classification categories and by the fluid way in which individual variables cross cut the classification categories. A modal analysis of selected variables gives a quantifiable basis for assessing variability within classification categories. It identifies and quantifies crosscutting variables and, most importantly, it gives a different and more sensitive ordering of the data with regard to factors that might be expected to reflect socioeconomic differences within the site. Although there is as yet no comparable information from other parts of the site, the results of the modal analysis provide clarification about the nature of the problems involved in classification and point the way for future studies. Unless otherwise noted, the following observations and inferences are based on coded information of the Random and Rim samples. Only information on ceramic vessels is included here.

Slip Combinations

Tan slips occur in conjunction with white and/or red slips on both painted and unpainted pottery. Tan slips also provide the background for red designs in Tamoa Red-on-Buff, to use Fowler's designation. Fowler and Bruhns virtually ignore the role of tan slips in the combination slipped vessels. It is unclear whether San Dieguito pottery actually is aberrant in having so many combination slipped vessels, or whether those authors regard a tan slip as ubiquitous background noise. I suspect the latter, and Fowler, who had an opportunity to study the San Dieguito collections in Calgary, agreed that he had considered tan slip to be a differentiating variable only when it was not found in combination with other slips or painting. Depending on the status given to the tan slips, monochromes could become bichromes, bichromes could become trichromes, and so on. A great deal of visual variability could be achieved by differential placement of one or two slips on the interior, the exterior, the basal interior, carrying a slip band over the rim, and the addition of horizontal lines and other designs. Cihuatán potters seem to have employed combinations of slips with a great deal of freedom, thereby producing variability within the classification categories recognized by archaeologists as well as a great deal of overlap between those categories.

Stylistic Variability

We did not code for style or design motifs because so few sherds in the two samples carried relevant information. The following descriptive remarks concern only the painted pottery presumed to be of "local" manufacture for which stylistic tendencies can be identified. Not included here are the more idiosyncratic designs or the Plumbates and "Nicoya-like".

The painted pottery presumed to be of "local" manufacture shows the same mix-and-match quality that characterizes the ceramic assemblage more generally. This effect is undoubtedly intensified by the scarcity of complete or reconstructable vessels in the San

Dieguito collections, and strong correlations may emerge in the future between classification categories and decorative style. Nevertheless, considerable overlap of styles across the classification categories can be demonstrated, as can some central tendencies of style within particular classification categories.

Horizontal lines tend to characterize the unnamed Black-on-Red bowls but are not confined to that subgrouping. Vertical lines from the lip or vertical panels joined by a horizontal line are most common in white background polychrome bowls but the vertical lines, at least, are found on Black-on-Red bowls. Naturalistic designs recognizable as faces, feathers and so on are virtually limited to the red (and white?) background polychrome tulip-shaped vessels, but a "reed-bundle" design served as the basal design in a Black-on-Red bowl. Although the polychrome designs of the red and white background tulip-shaped vessels are quite distinctive, the same vessel form occurs with an identical red background on which Bandera (or very similar) designs are painted, as well as in a polished brown.

Form and Size

On the basis of descriptive data and personal familiarity with the collections, we felt that, except for the Coarse category, form was not closely correlated with classification categories. To get a more objective statement of the strength of the relationships between form and classification, our statistician ran first a Chi Square on the rim sample, and then a Cramer's V test (both are part of SPSS).

The Chi Square results show that relationships between form and classification categories had only one chance in 10,000 of being due to chance. The strength of the relationship, however, is not given in that test. Cramer's V test allows the strengths of the relationship to be evaluated. In this test, a result of 1.00 demonstrates that the relationship is 100%; if Cramer's V is 0.0, then no relationship exists. For the whole sample (including missing data), Cramer's V is .24 for the relationship of gross vessel form to classification categories. This indicates a very weak relationship. By ignoring missing data, this rises to .30, which is still weak. For the specialized form coding, Cramer's V is .41 including missing data. When missing data are excluded, this decreased to .34. The strength of the relationship is stronger for the more detailed coding of form than for the gross form coding, but is still quite weak.

Although the overall relationship between form and classification category is not strong, the data can be partitioned in ways that show stronger links between form and classification categories. For example, ollas are almost exclusively found in the Plain category. That category, as a whole, is weakened in the strength of the relationship to form by the inclusion of bowls and jars - forms that cross cut the categories.

Cramer's test for strength of relationships between classification categories and estimated mean diameter of rims is even weaker: 0.16. Relationships of a type to mean wall thickness (0.20) and mean rim thickness (0.24) were also quite weak.

Indeed, the only coded attribute category that shows a reasonable but still not impressively strong relationship with classification categories is the slip color and painting of the surface. Cramer's V is 0.62 for the coding of the interior surface and 0.63 for coding of the exterior surface.

These are very powerful statistics which have been applied to a collection having only weak probabalistic integrity. One might justifiably ask: "So What?" The point is that this gives a quantified expression to our overwhelming impression that slipping and decoration are the most important attributes in delineating classification categories. We don't want to claim too much for the meaning of the statistics, however.

Summary

In this chapter we have reviewed existing classification systems and looked at some of the problems associated with classification. By partitioning the San Dieguito ceramic data in various ways, some of the reasons for the classification problems have become evident. It is only with some understanding about the nature of the ceramic universe that the discrete data sets from the site can be placed in perspective for comparative purposes.

CHAPTER 4

CERAMIC FORMS FROM SAN DIEGUITO

Form and size of vessels and other ceramic pieces is related to function which in turn affects what ceramic pieces are associated with households, civic-religious structures, craft manufacturing locales and so on. Form might therefore be a useful attribute for delineating social, economic and other sources of spatial variability at Cihuatán. For the moment, such inferences cannot be carried very far because the available comparative data are not systematically organized with regard to form/size variables. Methodological problems of sample size, reliability of form identification on the basis of sherd collections and degree of reliability in correctly identifying the archaeological context introduce other limitations.

In the following sections, form is used as the primary ordering dimension of variability within San Dieguito pottery from structures 15-1 and 12-51 (i.e. from the loan collections). Information derives both from descriptive data and from coded information for rim and random samples. Two levels of form information were coded for both samples. The first was quite generalized: bowl, convex-walled, comal, ladle, other and unable to observe. The second was somewhat more specific. Both coding levels were designed to elicit comparative and representative information within the constraints of observable attributes on the majority of sherds, and neither coding level was entirely satisfactory. When more specific designations were attempted, appreciably fewer sherds could be assigned to any category with any degree of reliability, especially in the random sample. The descriptive data, while non-representative, do provide additional information on manufacturing procedures, variability and rare occurrences. Size, an equally important aspect of the ceramics from a functional perspective, is mentioned here insofar as we have useful data pertaining to form and manufacturing procedures. The coded information on size is discussed separately below.

Vessel Forms

Bowls

Using the Rim Sample as the best approximation of frequency of bowls relative to other vessels, it appears that bowls may have accounted for 60 - 70% of the vessels in the San Dieguito Structures 15-1 and 12-51 collections; they certainly make up more than half. Insofar as I can judge from Bruhns' (1980a) account of crushed vessels associated with occupational fill in the structures she excavated, our inference that perhaps half of the vessels in presumably domestic contexts were bowls is not seriously out of line. Since Fowler presents his ceramic data in the type-variety system without

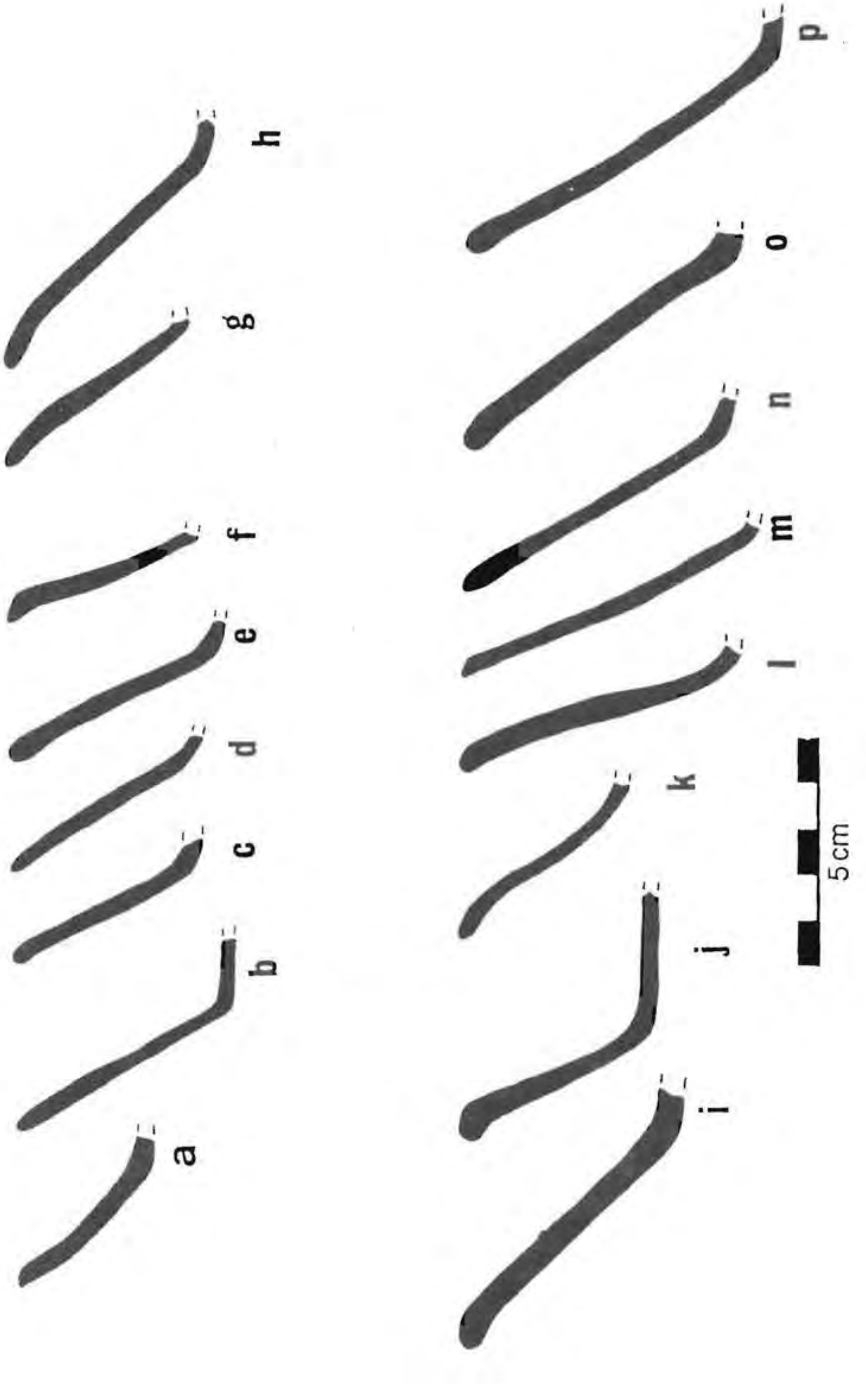


Figure 22. Bowl Profiles

quantifying forms, we have no comparable data on the frequency of bowls from the WCC.

"Common sense" reasoning suggests bowls in domestic contexts were used as serving dishes, for washing, for mixing, as containers for items that can be exposed to air, and for offerings.

Frequencies of gross vessel form by Fowler's classification categories in the San Dieguito Rim Sample are given in Table 7. It is clear that bowls were made in all "locally" produced classification units, but they are most common in Garcia Red, a category which they dominate (i.e. roughly 55% of all bowls in the sample were Garcia Red, and 81% of the Garcia Red in the Rim Sample were coded as bowls). After Garcia Red, Tamulasco Plain has the highest frequency of bowls (i.e. roughly 44% of the Tamulasco Plain rims were coded as belonging to bowls and 22% of all bowls were coded as Tamulasco Plain). All other classification categories are represented by considerably smaller frequencies, but within these limits, bowls account for 71% of Peralta Brown (using Fowler's older and now abandoned classification category which we still find useful), 81% of Zancudo Polychrome (or white-slipped), and 70% of the red background polychromes (or Jejen Polychrome). Within the Las Lajas or Coarse category, to which sherds or other ceramic pieces were assigned on the basis of form, roughly 21% represent the applique fillet bowl rims which, however, represent only 0.6% of all sherds coded as bowls in the rim sample.

Thus, while there is a better than 50/50 chance a bowl rim will be Garcia Red and an even better chance that a Garcia Red rim will belong to a bowl, there is still enough overlap between classification categories and gross vessel form that we are tempted to suggest that, had it been possible for an archaeologist to observe ceramic manufacturing procedures at Cihuatán (or wherever the "local" pottery was produced), the archaeologist might have found it difficult to predict with any degree of precision the classification category to which any particular bowl would belong until the latter stages of slipping and decorating - or even until a vessel had been fired.

A very gross and in some respects unsatisfactory breakdown of bowl forms was coded for both rim and random samples: flaring walled and hemispherical. This was realistic for the level of information available on most sherds, and even at this level of discrimination, more than half the sherds designated as "bowls" in the more generalized coding became "unable to code" in the more specialized breakdown of the random sample, although fewer were lost in the rim sample (cf. Table 6). A two-fold breakdown collapses the actual variability considerably, particularly with regard to depth of vessel and conformation of the lower walls.

Some idea of additional variability can be obtained by considering 16 bowl fragments with rim to base profiles for which conformation of the entire wall could be observed and standing depth estimated (Figure 22). These cannot be taken as representative of all bowls, nor do they exhaust the range of variability. The larger, deeper flaring walled/flat-bottomed bowls are not represented in this set since rim to basal sherds from these vessels were not present in the loan collections, nor are the apparently rare hemispherical bowls represented for the same reason (but see Figure 18c).

The group of 16 bowl fragments have estimated diameters ranging from 110 mm to ca. 290 or 300 mm; their standing depths vary from 15 to 65 mm. The relationship of estimated diameter to depth can be expressed as a figure obtained simply by dividing diameter by height (or depth). For this set of bowls, the resulting figures are 3.5 to 15, the latter being from a large, shallow-vessel (a plate) and the former from a deeper bowl. The relationship of estimated rim diameter to basal diameter can be expressed in a figure obtained by dividing rim

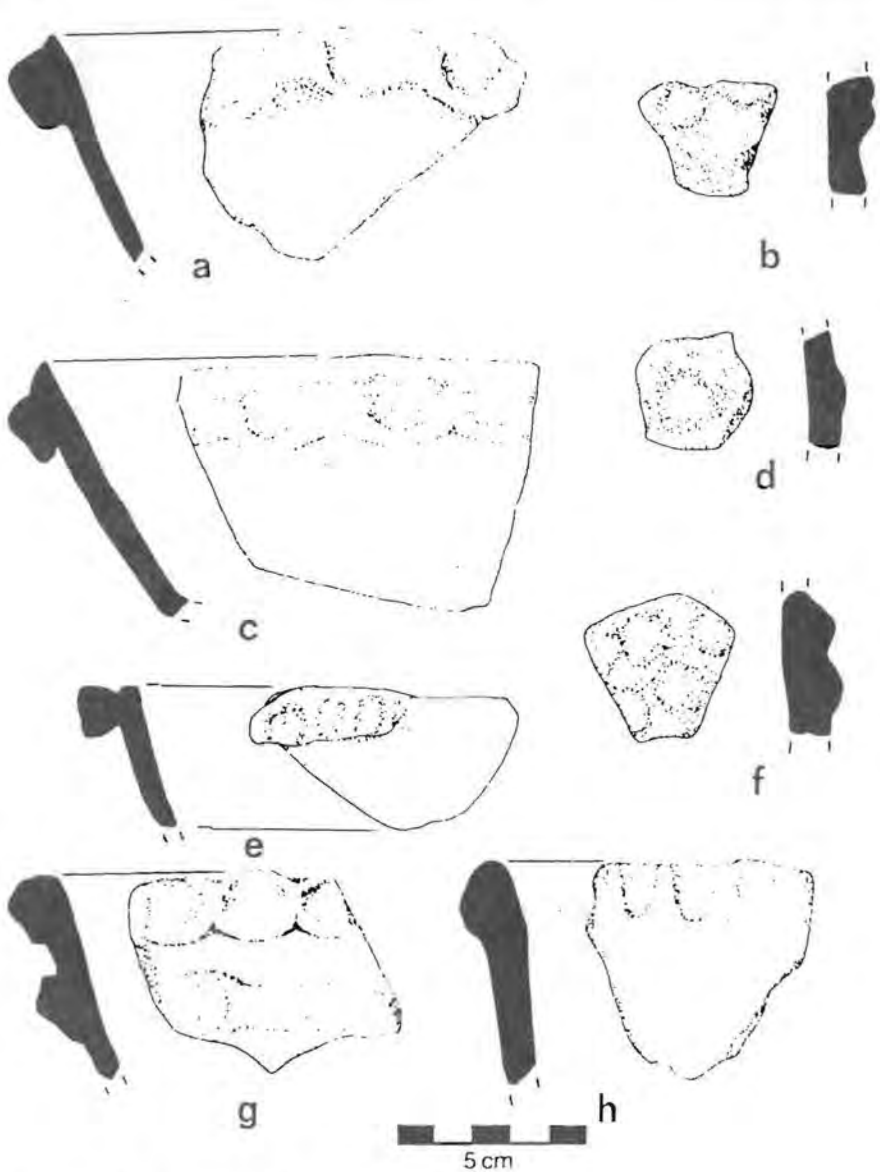


Figure 23. Sherds with Plastic Treatment

a, c, e, g and h. Las Lajas Fillet-Applique Rims;

b, d and f. Body sherds wih protuberances

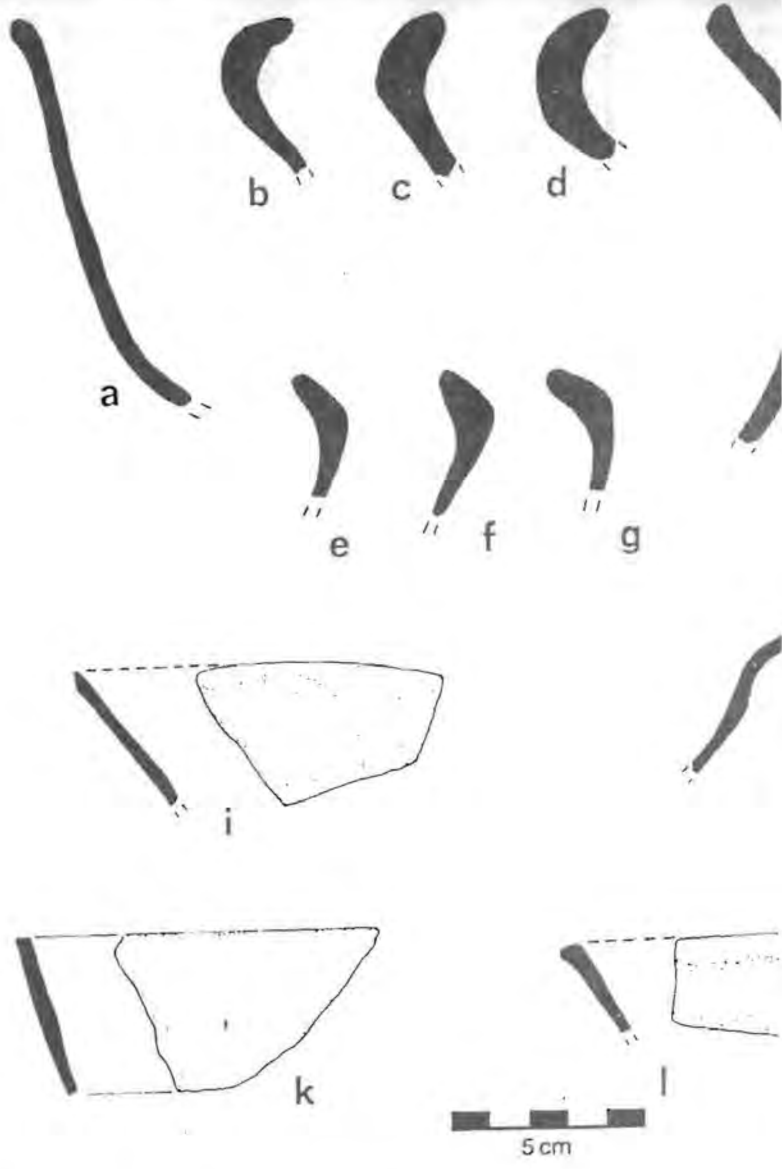


Figure 24. Miscellaneous Rim Profiles

a. Garcia Red; b, c, d. Tamulasco Plain olla rims;

e, f, g. Everted rims; h. Rim from large incurving brown-slipped over t

slipped vessel with horizontal groove; i,k,l. Tamulasco Plain bowl r

j. Peralta Brown bowl rim;

open or flaring the bowl is. For these bowls, 1.35 represents the most vertical walled bowl and 1.8 the most flaring.

As can be seen by referring to Figure 22, there is some variation in contour of side walls, ranging from virtually straight walls angularly attached to a flat base to more sinuous or curving side walls that lack the angular transition to a flat or slightly convex base. For sherds lacking the rim to base profile (that is, for most rim and side wall bowl sherds), there is clearly inadequate information about side wall/basal conformation, and when dealing with these sherds, a collapsing of variability seems inescapable.

This group of 16 bowl fragments from the San Dieguito Collection can be classified in Fowler's scheme as the polished brown he formerly called Peralta and now calls Cachinflin, Garcia Red, Zancudo White Polychrome, Tamulasco Plain as well as the unnamed Black-on-Red with a tan exterior. Apparently identical flaring-walled/flat bottomed bowls occur in the red background polychromes (Fowler's Jejen Polychrome). Judging from this fortuitous collection of 16 bowl fragments, as well as from our handling of the collections, we conclude that there is no exclusive correlation of bowl form, depth or size with any classification category, although all of the really large bowls (not represented in the fortuitous collection) are Garcia Red or Tamulasco Plain.

The flat bottoms of the flaring walled bowls seem to have been made with slab bases. Slab construction may also have been used for the side walls of some of these bowls. A major weld at the basal/wall juncture was used, and bases often break away from the walls at this point.

Bowl rims coded as hemispherical occur in lower frequencies and we have less descriptive information about variability. Minimally, this category includes half-spherical bowls, and *bowls with slightly incurving walls.*

There are probably body sherds coded as convex-walled vessels that might be more appropriately called incurving bowls. Size and depth would be relevant considerations, but we lack specimens from Structure 15-1 (Excavation Area A) that are complete enough to make this distinction. The complete brown-slipped vessel buried in the floor of Structure 12-51 (Excavation Area C) might be so regarded. The only class of vessels with clearly incurving, thickened rims are the *tecomates* which are placed in the convex-walled category. At least one small vessel of which we have only body sherds had white background polychrome designs painted on the exterior surface (Figure 14g). Without more of the vessel, it is a moot point as to whether it should be called a small olla or an incurving bowl.

A few vertical-walled sherds appear to come from relatively deep, rounded bottomed bowls. Known only in Garcia Red and Tamulasco Plain, they usually have a horizontal groove on the outside of the upper body. Sherds for which diameter can be estimated are in the 260 mm to 280 mm size range. Without more complete specimens, it is hard to decide whether these are large bowls or what have been called beer pots or "chicha barrels", whether there is a depth gradation from bowl to beer pots, or whether there are discrete clusters of vertical walled vessels. One Garcia Red rim sherd, estimated to have a diameter of 440 mm and to belong to a flaring bowl, has a mild 'S' body profile in cross section ("S-Z angle bowl").

The plain bowls (unslipped or tan/self-slipped) with applique fillet or pie-crust rims (automatically assigned to the Coarse Ware) (Figure 23) are usually from bowls of the middle size range. They are usually softer than other pottery, presumably because of lower firing temperatures. We have no specimen as complete as that illustrated by Bruhns (1980a: Figure 7a). Our examples suggest some *variation in depth; the most common* conformation seems to be dish-shaped. At least

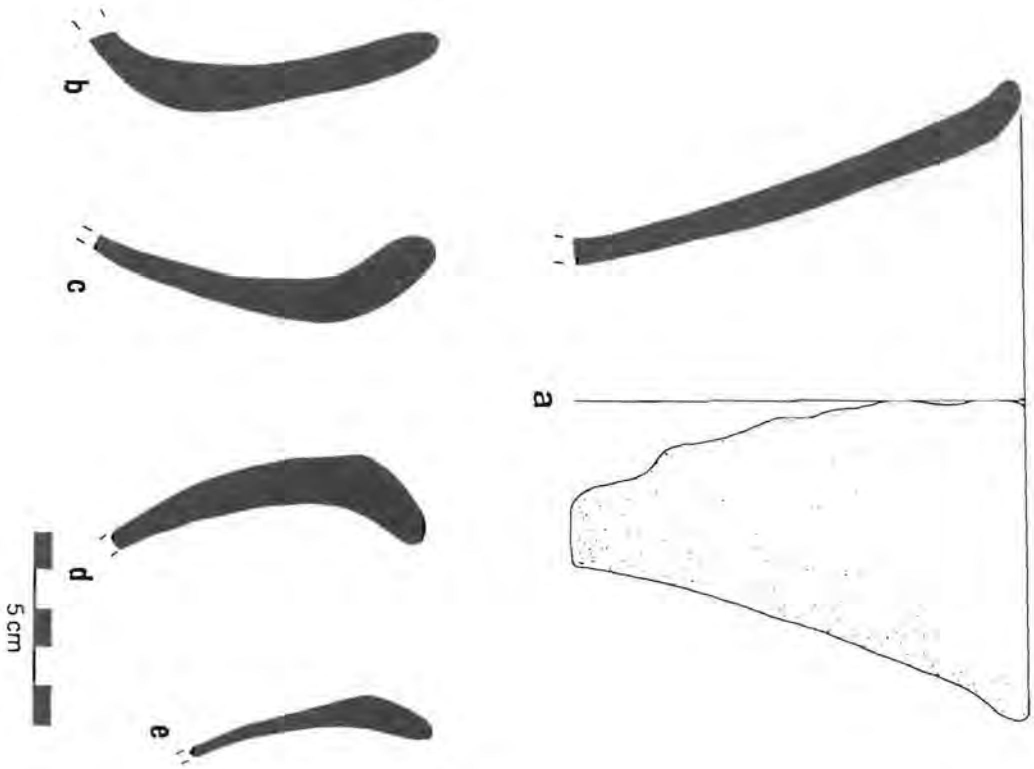


Figure 25. Tamulasco Jar Rims

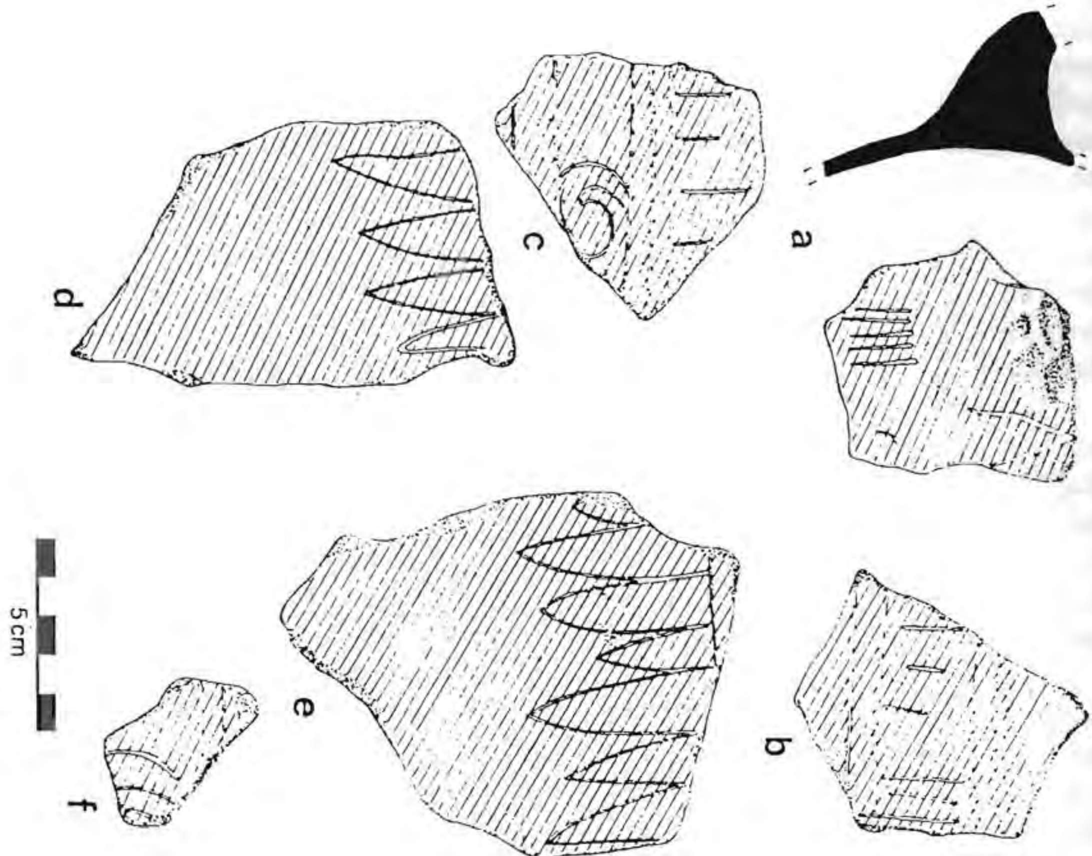


Figure 26. Garcia Red Incised Jar Sherds

some of these bowls were manufactured with direct rims to which the finger impressed strip was added to the exterior of the lip. The finger impressions of these may be a remnant of the adhering process which not infrequently produced such a poor weld that the applique breaks off, leaving the original direct rim (Figure 23e). Other sherds suggest that a separate applique strip was not used, but the clay at the top of the bowl was manipulated to form a thickened bolster which was finger impressed.

Some 18 sherds of *Fondo Sellado* bowls were found in Structure 15-1 (Excavation Area A) (Plate 9). These are like those reported by Bruhns in having low relief geometric designs stamped on the flat base of bowls. Like Bruhns, we could identify no upper bodies, but we assume these come from flaring walled bowls. Tan slipped and red slipped versions occur.

We do not know how many bowls were provided with other structural parts. Presumably most of the supports recovered were attached to bowls (supports are discussed separately). The number of supports relative to bowl sherds suggests that footed bowls were not numerous. Even fewer bowls had other structural additions. Some rim "tabs" occur and one large, deep, straight, flaring walled bowl had a horizontally placed coil handle at the base of the wall exterior. One white polychrome bowl had a small adorno and a "tab" on its rim (Figure 15a and 15b).

Convex-Walled Vessels

If one assumes these vessels served as water containers and cooking pots, and for storage, their frequency as reflected in the rim sample (17.29% of the total) seems low. Their much higher frequency in the Random Sample is thought to reflect their large surface area and breakage patterns, as is discussed above. Although some of the rims coded as Convex-walled in the generalized form coding are lost in the more specialized form coding (Table 6), it is clear that wide-mouthed ollas dominate this category.

As in the case of bowls, the coding of the samples does not provide information on certain characteristics of the assemblage that can be better extracted from descriptive data. We assume most convex-walled vessels to have been globular in shape. At least the flat vessel bottoms we found appear to belong, with two exceptions, to the flat bottomed, flaring bowl form. Bruhns (1980a:82) however notes "Most (Cihuatán ollas) appear to have had a rounded body, a flat bottom, and a vertical to everted rim". That our San Dieguito sample appears to differ from Bruhns' collections on this score may provide a clue for intrasite variability; this can only be assessed by a more consistent approach to samples drawn from various parts of the site.

We have no evidence to suggest that supports were added to jars, pitchers, or ollas, although some smaller convex-walled, decorated vessels may have had supports.

The most common structural additions to convex-walled vessels were one or more handles. Handles are described separately, but here it may be noted that handles were sometimes placed vertically and sometimes horizontally.

All olla rims in our sample are everted, and most are thickened and rounded (Figure 24b, c, d, e, f, and g). A definitely demarked vertical neck is not characteristic of the wide mouthed ollas, but some approach this. Depending on the height of the "neck" and degree of eversion of the rim, the neck/body transition can be smoothly sloping or more angular.

The only systematically acquired data about the size range of convex-walled vessels deals with estimated rim diameters; these are not a fully adequate guide to vessel size. On the basis of larger sherds, we can say that some small ollas perhaps 15 cm high occur. A more

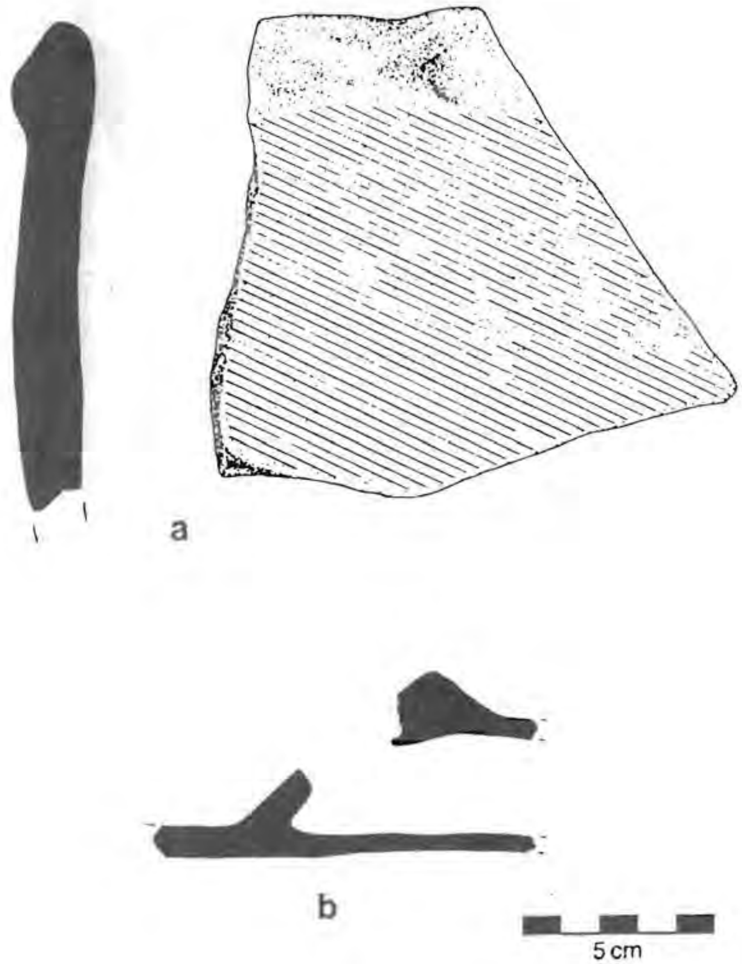


Figure 27. Miscellaneous Ceramic Pieces

a. Large heavy red-slipped rim sherd;

b. Profile of a ladle with a hole through the body wall into the hollow handle;

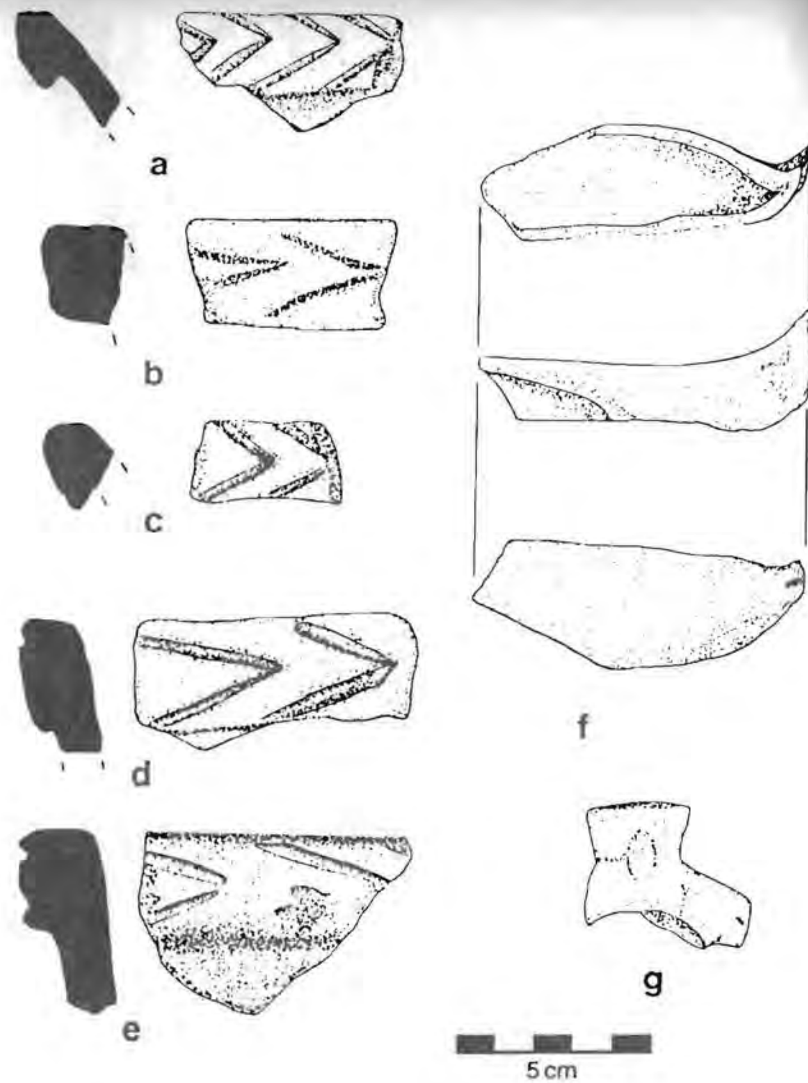


Figure 28. Incised Ledge Rims and Modelled Pieces

a,b,c,d,e. Incised ledge rims; f. Three views of a hollow handle finished t
pinching end together; g. Neck and upper torso fragment of a figurine

common size appears to be between 30 and 40 cm high.

Ollas were certainly one of the vessel forms used for cooking. Most of the fire blackened sherds were judged to come from ollas, and ollas tended to show considerable color variation as is consistent with post-firing exposure to heat. Indeed, some 8% of the random sample sherds had pastes and surfaces more properly called gray than tan/brown. Three sherds presumed to come from ollas had charred materials on the interior.

Most of the ollas coded in the rim sample are classified as Tamulasco Plain. Some, however, are classified as Garcia Red. If a red slipped olla form should be confirmed in the future, these should probably be segregated.

Ollas can be distinguished from jars on the basis of rim diameter and neck height. Although it is often difficult to distinguish between ollas and jars (or, for that matter, pitchers or other convex-walled vessels) on the basis of sherds, the distinction seems worth attempting when functional characteristics of the pottery are of interest.

Narrow-necked jars are a minor but consistent form at Cihuatán, being reported from most of Bruhns' excavations as well as from San Dieguito. These occur in a white slipped and/or white polychrome, red slipped, tan/brown slipped and probably black. They have globular bodies, narrow, vertical flaring necks (see Figure 25b, c, d and e), rims that are usually everted but rarely thickened, and at least some had strap handles. As is the case with ollas, size data is limited to rim diameters. The only large sherds of this form come from Garcia Red jars and suggest a vessel diameter of ca. 30 cm on these specimens.

A few were much larger, judging from the height and diameters of some necks. One Garcia Red neck, for example, had rim diameter of ca. 190 mm and was over 100 mm high. Another specimen is worth mentioning here. Opinion in the laboratory was divided as to whether this was a large, flaring Tamulasco jar neck or, if we reversed its orientation, a large hollow support. I am inclined to the former view. Its "rim" diameter is 167 mm; it contracts to a diameter of 85 mm at the "base", and stands 117 mm high (see Figure 25a).

Some Garcia Red and probably other "types" were incised with geometric and curvilinear motifs. Incision was most often done prior to slipping, but some incisions cut through the slip. The most elaborate incisions were placed on the upper body of jars (see Figure 26), but complementary designs could be placed on the neck . Bruhns reports an incised handle, but none occur in our collections.

Pitchers are rare. Only two rim sherds from San Dieguito could be assigned to this form and neither entered the random sample (see Plate 10 a and b). One was polished red on the exterior with a red slip band extending onto the tan interior of the spout which was quite tall and pronounced. The other was a Tamulasco sherd with a much less pronounced spout. Presumably the bodies were much like jars.

Vertical-Walled and Large Vessels

Fowler and Bruhns tend to agree on placing very large thick "plain" vessels in their respective coarse categories, although they disagree over whether or not these were slipped. Fowler designates a Naguapate Red for large, thick red-slipped or red-washed vessels, and he mentions large vertical-walled storage vessels as one form of Tamulasco Plain and Garcia Red. It is unclear how Garcia Thick-Walled relates to Naguapate Red except in the debatable quality of the red slip or wash. Bruhns notes, for Red Slipped Wares, "large tubular vessels with a vertical rim with a band of brushed decoration around the exterior, and a large slightly pyriform vessel with a ledge rim" (1980a:81). I am unsure how the large, thick walled vessels described in

Plate 11. Ladle Fragments

a. Flat ladle with handle (also shown in Figure 30);

b. Ladle fragment with hole through body wall (also shown in Figure 27b);

c. Flat ladle with handle

Plate 12. Collander Sherds

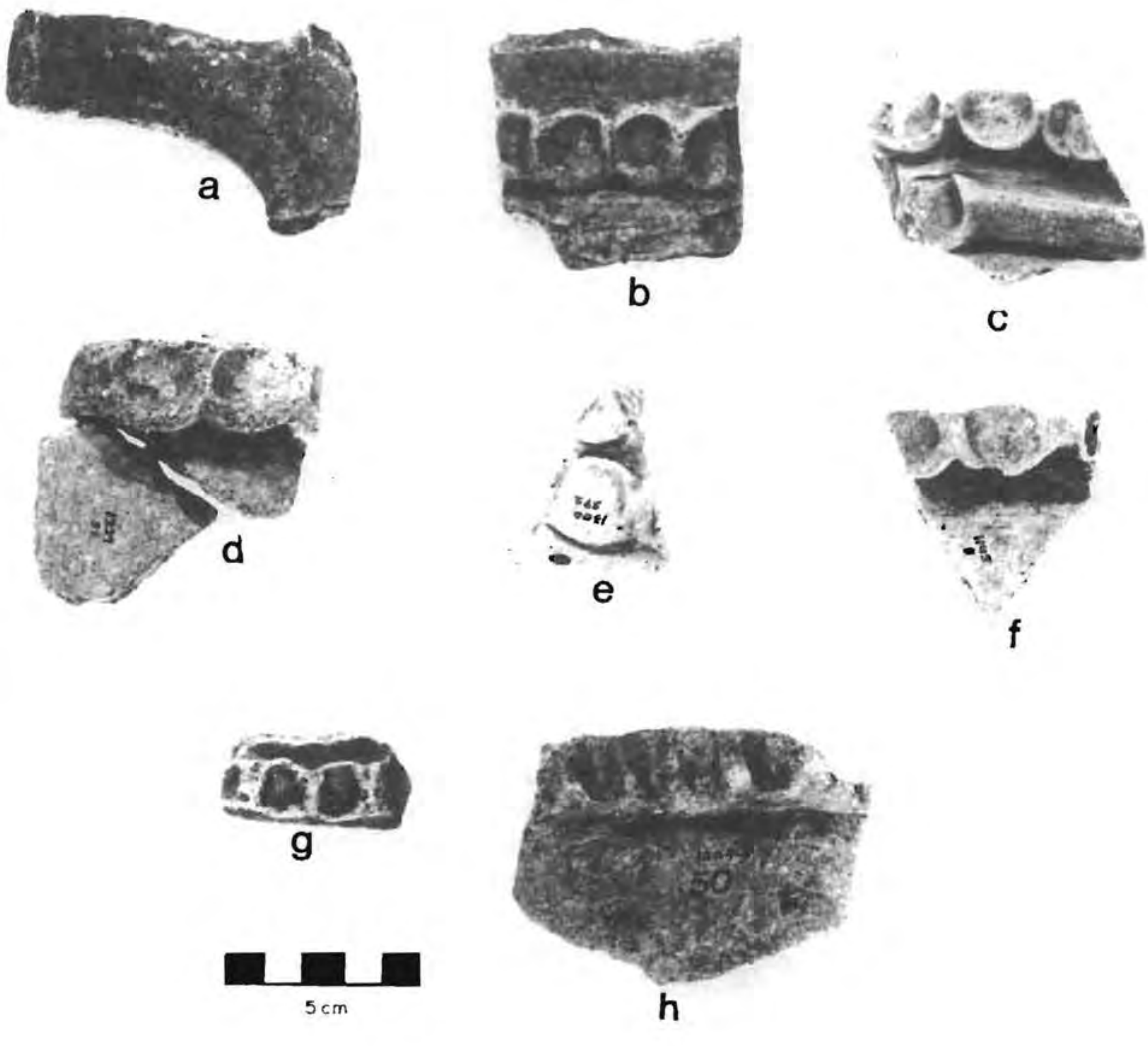


Plate 13. Basket Handle and Fillet Applique Sherds

a. Garcia Red basket handle;

b. Midsection of smooth brazier with applique decoration

c-h. Las Lajas Fillet Applique rims

this report on San Dieguito ceramics relate to the various categories in the two schemes.

In the Rim Sample, sherds having a wall thickness from 10 mm to 15 mm make up 4.5% of rim sherds. There is a major break in frequencies of wall thickness of rim sherds between 8 and 9 mm, and if one therefore considers a wall thickness range from 9 to 15 mm, 7.7% of the sherds can be included. On the other hand, there is another break between 12 and 13 mm, and only .4% of the sherds are 13 mm or thicker. In the Random Sample, *all* thick sherds (mean thickness 10.36 mm with a standard deviation of 4.65) were classed as Las Lajas Plain or Coarse Ware. These data, however, are not particularly helpful because few of the sherds pertaining to these vessels entered the samples (.4% in the random sample and 4 rims).

There are in our collections a number of sherds 10-22 mm thick that seem to come from very large vessels (see Figure 27a). Most are body sherds showing very little curvature. Few rim sherds seemed to go with these body sherds, and their shape - or range of shapes - remained something of a mystery for a long time. Eventually, we reviewed the loan collections in Calgary to collect more information on this elusive category.

From Structure 15-1 (Excavation Area A) collections, we selected 47 thick sherds (10 to 22 mm thick) that come from large diameter (ca. 30 cm to 56 cm or even larger) vessels. These occur in a number of different finishes; 13 had red slipped exteriors and tan slipped or unslipped interiors, one rim was red slipped, 14 were tan slipped inside and out, two had tan slipped interiors and eroded exteriors, four were eroded and/or unslipped, three had a thin, silvery black slip or wash, and 10 had striated or impressed unslipped exteriors. Three of the tan slipped sherds had a single, wide horizontal groove on the exterior.

Another group of sherds might be considered here, and those are the ledge rims with deep incisions on the exterior of the ledge (Figure 28 a through e). We have thought of these as brazier rims, because similar rims are found on large spiked braziers. This analogical reasoning may not be well founded, and there is no evidence on the sherds themselves to eliminate them from the large, vertical walled vessel class. Six of the seven rims would belong to vertical walled vessels, but the other (Figure 28a) is from a large flaring walled vessel (estimated 360 mm rim diameter). Two other similarly incised heavy pieces appear to be from the base of whatever vessel form these belong to, suggesting that whether the vessels are vertical (or flaring) walled vessels or braziers, the decoration on the rim could be mirrored on the base. This group of sherds has a coarse, hard paste; the surface is unslipped.

Ignoring for the moment these incised ledge rims, there appear to be at least three shapes of these large thick vessels that can be identified. One is a large, heavy jar, attested to by one informative sherd from the neck/body juncture of a red slipped jar. Wall thickness varied from 17.5 to 19 mm. The interior diameter of the neck aperture is estimated at 180 mm.

Another form is a vertical walled vessel with vertical, flat rims or slightly outcurving flat rims (Plate 10c through f). Some of these have a wide horizontal groove encircling the exterior. In one case the groove was immediately below the lip; others are placed further down on the vessel. These may be larger sized and thicker versions of the grooved "chicha barrels", as Fowler informally calls them. Without more complete specimens, we don't know how the bottom was shaped. Smaller beer pots had rounded bottoms, but some of the larger and thicker vessels may have had flat or flattened bottoms.

The third form is the censer or brazier. Unless the ledge rims referred to above are braziers, the only definite brazier fragments identified from San Dieguito are the flanged

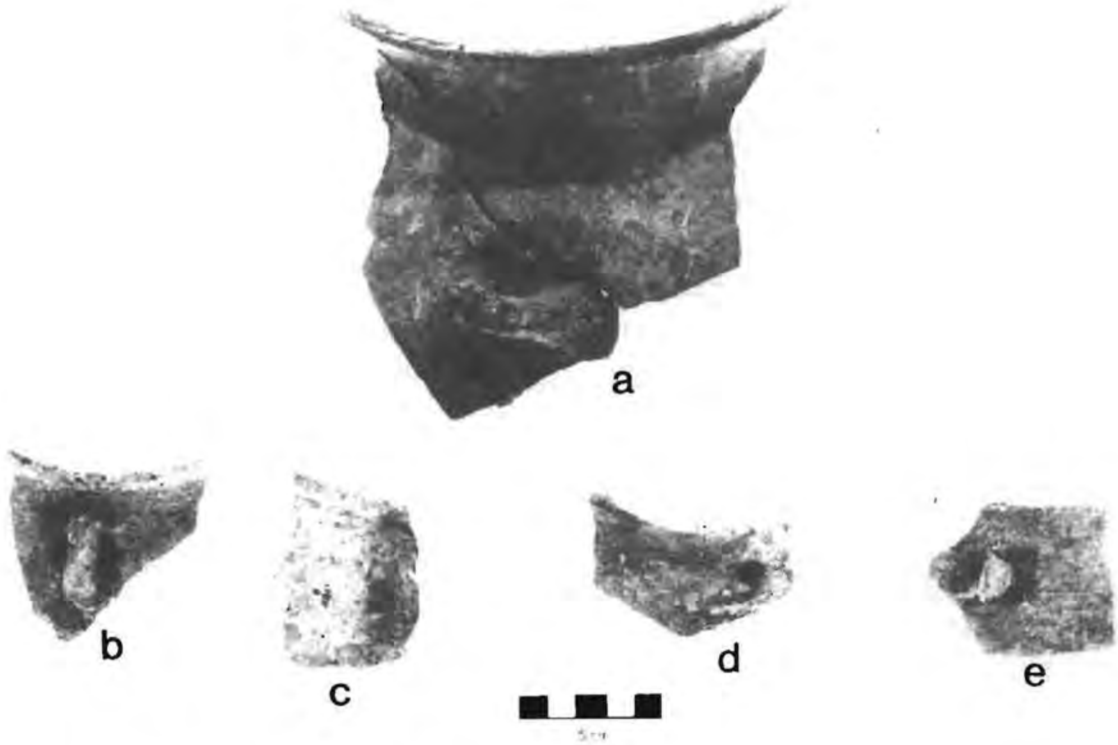


Plate 14. Handle Placements on Ollas
a. Small Tamulasco Plain olla (also shown in Figure 30a);
b. Small Tamulasco Plain olla (also shown in Figure 30b);
c,d. Tamulasco Plain ollas with handles;
e. Tecomate rim with lug (also shown in Figure 30e)

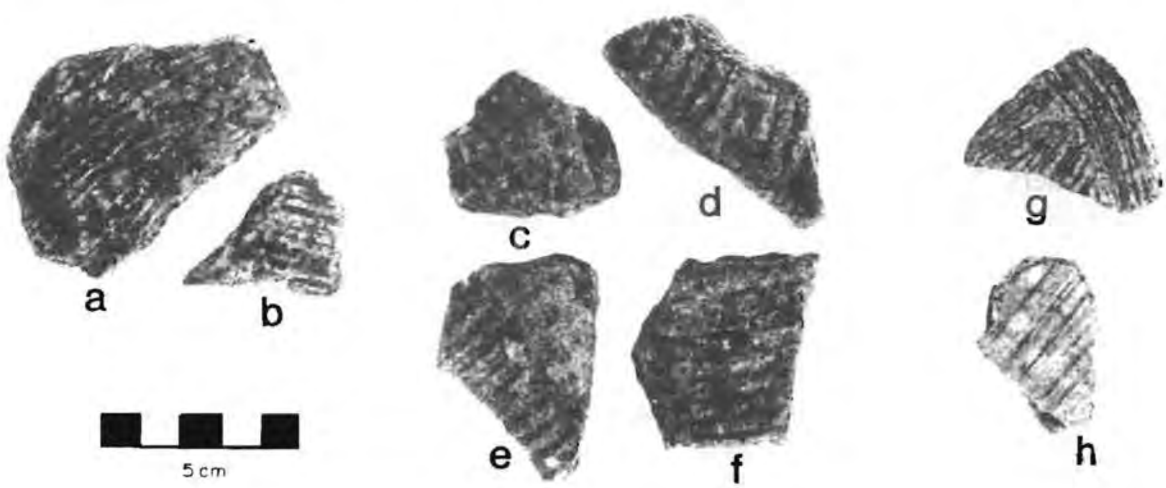


Plate 15. Straited and Impressed Sherds
a-d. Straited/Brushed sherds;
e-h. Impressed sherds

midsections of smooth vessels with applique decoration (Plate 13b).

Although the frequency of sherds perceived to belong to such large thick vessels in Structure 15-1 (Excavation Area A) is quite low, probably not exceeding .05% of the total, a very different picture emerges from surface collections made immediately to the east and south of Structure 15-1 (see discussion of "Tethered Collections" in Chapter 2), where, in one collection area, thick sherds from large, vertical walled vessels accounted for 20% of the small collection. Twenty-four thick sherds come from 5 collection areas. Of these 7 are red slipped and 13 are tan slipped and/or eroded. One of these is particularly interesting because it was quite flat and suggests that these large vessels may have had flat bases as postulated. As well, one debatable specimen discussed under "Roof Tiles" may instead be a flat base of unusual thickness (33 mm).

From Structure 12-51 (Excavation Area C), we have only one thick sherd - a rim from a smaller sized vessel than those considered above. Estimated rim diameter is 30 cm. The rim is flat, very slightly everted, and the same thickness as the vessel wall. It has the same conformation as the black slipped rims from Structure 15-1.

The function of these large vessels is not known. Some may have served as water and/or storage containers. The large aperture diameter of the better attested vertical walled form makes me wonder how effective these barrel shaped (?) vessels would have been as storage containers. One or two thick sherds have darkened interiors; the only sherds definitely showing fire blackening seem to have been exposed to the fire after breakage, since the blackening also covers the broken sherd edge. We cannot say whether or not they were customarily used for heating something. They would have been suitable for producing vegetable dyes and dying textiles, for fermenting rather large batches of beverages, and so on. Perhaps distributional evidence will eventually allow us to narrow the range of potential uses.

Comals

Comals are difficult to identify from body sherds, as is indicated by the small but significantly different percentages in the rim (0.6%) and random (0.1%) samples. In overall body flatness and general curvature they overlap with the shallower, flatter ladles and body sections of large convex walled vessels. Comals for which rim diameter could be estimated appear to average around 20 cm and this is considerably smaller than modern comals in the Cihuatán area which are also much thicker than the archaeological pieces. Comals have distinctive coiled or flattened coil handles placed on the same plane as the rim. Comals are often tan slipped, and occasionally have a red slip band at the rim. Some may have been only partially slipped or unslipped. Variability in paste and surface finish make it difficult to assign them to classification categories; but they could be classed as Tamulasco Plain, Las Lajas coarse, or Red-on-Tan. As a group, they are most at home in the "plain" range.

The low frequency of recognized comals at San Dieguito echoes Bruhns' findings elsewhere on the site. She concludes (1980a:82) that tortilla making was not particularly common. No examples of the so-called Zacualpa comal were recognized from San Dieguito.

Ladles

Whether these served prosaic domestic purposes and/or were used for burning incense, they can be considered as a group. Thirteen fragments of handle attachments to ladle bodies were in the Calgary loan collections, as were four handle fragments that may have come from ladles. Since the bowl portions of ladles are not readily distinguishable from other bowls, parts of these or similar vessels are undoubtedly coded with "bowls". All of these specimens have at least remnants of tan to brown slips somewhere on their surfaces. Most appear to have been slipped all over, although one may have had an unslipped interior. One has remnants of red slip on the flat interior of the base; two have red slip bands at the lip. The mid-section fragment of one handle is slipped in dark brown and another handle has a darkened red or brown slip. They fall, therefore, in the tan, brown and red-and-tan surface finishes and Fowler would classify them as Tamulasco Plain, Cachinflin Brown and a Red-on-Tan.

The bowls were made separately from the hollow handles; in the deeper, more bowl-like specimens, handles were fitted from bowl lip to base at the attachment point, narrowing to the rounded portion of the handle. Several of the specimens broke vertically through the handle attachment, giving a good view of the messy handle attachment technique. One ladle fragment (Figure 27b and Plate 11b) has a hole through the vessel wall and into the cavity of the handle. The shallow plate-like ladles also have the handle attached from tip to base, but in these, the handle is not attached to a definite side wall; rather it begins well underneath (cf. Figure 29). Of the four mid-section or distal end portions of handles that might have come from ladles, only two can definitely be said to have done so. A third, in dark, polished brown, is like a hollow tube with well smoothed walls of even thickness, unlike the messy interiors of most ladle handles. The fourth is an end section of a tube-like specimen that is closed simply by pushing the tube together and leaving it at that (Figure 28f).

Four of the 14 specimens retaining part of the ladle bowl are burned on the interior of the exterior suggesting that some ladles were indeed ladle incensarios but that ladles *per se* were multi-purpose.

Collanders (?)

A perforated flat base of a small, straight flaring walled Tamulasco or tan bowl may have been an collander (Plate 12). A perforation also occurs in the small section of side wall that remains. Only four other rim and body sherds showing perforations were noted for Structure 15-1 (Excavation Area A) (all Tamulasco) and one came from Structure 12-51 (Excavation Area C) (tan with a red slip band at the rim). One of the perforated rims may belong to a ladle, fragments of which were found in the same unit.

Structural Additions to Ceramic Vessels

Vessels could be elaborated beyond the basic form by the addition of handles, supports, or adornos.

Handles

Descriptive notes record ca. 310 ceramic pieces from Structure 15-1 (Excavation Area A) and 15 from Structure 12-51 (Excavation Area C) belonging to the broad category of handles. None are mentioned in the (incomplete) notes about Structure 12-1 (Excavation Area D). Of those described, 246 from Structure 15-1 and the 15 from Structure 12-51 were present in Calgary for analysis; the following descriptive remarks and Table 8 are based on those specimens in Calgary.

Frequency of handles in the Random Sample is 1.5% of the total sample; all of these

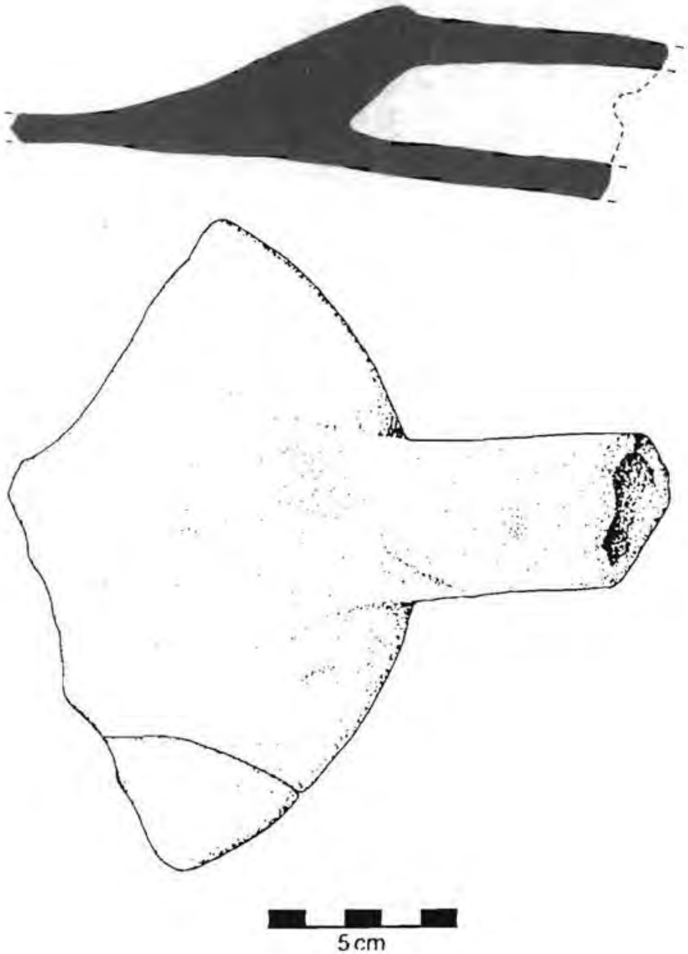


Figure 29. Flat Ladle

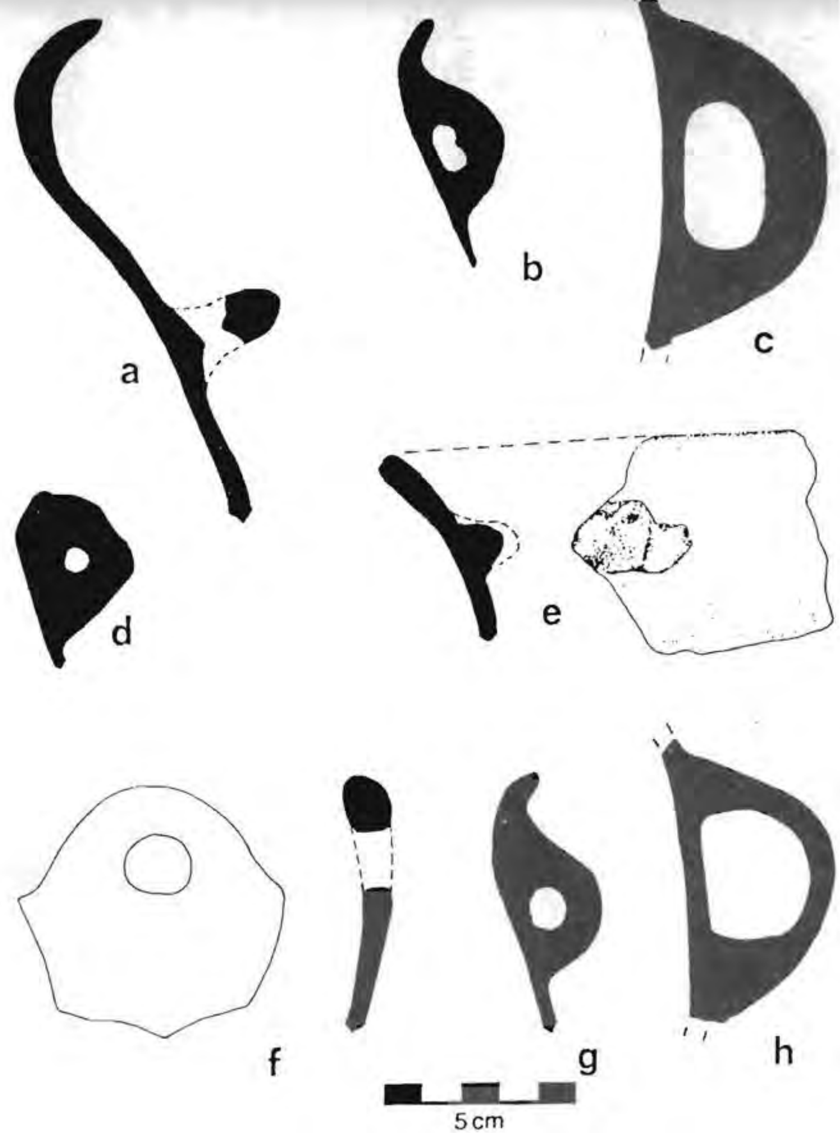


Figure 30. Handles

a. Tamulasco Plain olla; b. Small Tamulasco olla;
c. Red Slip over tan slip indented strap handle;
d. Perforated tab on Tamulasco Plain olla; e. Tecomate rim with lug;
f. Comal; g. Tamulasco olla; h. Garcia Red strap handle

Structure 12-51 entered the sample. This frequency is expectably higher than calculations based on the total assemblage of Structure 15-1 (1.2%) because of sampling procedures.

The three major forms of handles in terms of frequencies are the Strap (Figure 30h), Indented Strap, and Coil (Figure 30a) (cf. Table 8). One coiled handle was attached to the lower or basal portion of a large, flaring bowl exterior, and one coil handle was placed horizontally below a *tecomate* rim. Most of the other handles in these three categories are assumed to have belonged to vessels such as ollas, jars and pitchers.

Where we have large sherds showing vessel form and handle placement, coil handles

Table 8

Handles from Structures 15-1 and 12-51* (percentages in brackets)

	Plain	Red	Dk. Brown	Other	Eroded	Totals by Structures	Combined Structures 15-1 and 12-51
Strap Handles							
Structure 15-1	66(54.1)	31(25.4)	6(4.9)	2(1.6)	17(13.9)	122(49.6)	130(49.8)
Structure 12-51	5(62.5)				3(37.5)	8(53.3)	
Indented Strap							
Structure 15-1	17(42.5)	17(42.5)	1(2.5)	1(2.5)	4(10.0)	40(16.3)	43(16.5)
Structure 12-51	1(33.3)	2(66.6)				3(20.0)	
Coil							
Structure 15-1	40(83.3)	1(2.0)	–	1(2.0)	6(12.5)	48(19.5)	51(19.5)
Structure 12-51	2(66.6)				1(33.3)	3(20.0)	
Comal							
Structure 15-1	6(50.0)	–	–	2(16.6)	4(33.3)	12(4.9)	13(5.0)
Structure 12-51					1(100.0)	1(6.6)	
Tab							
Structure 15-1	5(41.6)	–	–	3(25.0)	4(33.3)	12(4.9)	12(4.6)
Lug							
Structure 15-1	3(75.0)	1(25.0)	–	–	–	4(1.6)	5(1.5)
Other							
Structure 15-1	3(37.5)	3(37.5)	–	–	2(25.0)	8(3.3)	13(3.1)
Totals							
Structure 15-1	140(56.9)	33(21.5)	7(2.7)	9(3.7)	37(15.0)	246(94.3)	261(100.0)
Structure 12-51	8(53.3)	2(13.3)			5(33.3)	15(5.7)	

* Only those handles present in the loan collection are tabulated here. N=246 from Structure 15-1 and 15 from Structure 12-51 or 261 total

are consistently found on ollas (with the two exceptions noted above). Almost no information is available as to what kinds of vessels carried the strap and indented strap handles. They were presumably associated with jars and pitchers, but their frequency (ca. 2/3 of all handles) seems at odds with the low frequency of jars and pitchers relative to ollas. Nor do we know how many handles were placed on individual vessels. Pitchers presumably had only one handle, and jar fragments complete enough to give information on handle placement and number of handles appear to have had single handles. Ollas often had two handles.

Over half of all handles are apparently on Tamulasco Plain vessels. Some of the sherds tabulated as "other" in Table 8 probably also belong in this category but were separated because the color was more of a reddish brown. If eroded sherds are disregarded for the strap, indented strap and coil categories, Tamulasco constitutes 62.8% of strap, 47.2% of indented strap and 95.2% of coil. Only the indented straps are as well represented in the red slipped as the tan range. A few strap and indented strap handles have a polished dark brown surface that Fowler would call Cachinflin. The only handle of these three forms that definitely falls outside of the Tamulasco, Garcia, Cachinflin categories is a white background polychrome with red and black paint (Zancudo White Polychrome for Fowler).

The comal handles are flattened coils extending out from the flattish vessel wall at the same angle as the rim (Figure 30f). Two of the rim tabs belong to such shallow vessels that they may also have belonged to comales. These are either Tamulasco or the reddish-brown color that probably belongs with Tamulasco.

Excluding the two rim tabs that may belong to comals, ten rim tabs are from bowls. One is a small vertical-walled bowl. The others for which enough of the sherd was present to estimate vessel form belong to sloping walled bowls, not to the most common form of straight, flaring walled bowls. One of these bowls is a white background polychrome mentioned elsewhere as having an adorno on the rim as well as the rim tab (Figure 15 a and b). Another is a red background painted bowl; and a third is a tan bowl with a dark brown slip band over the lip and rim tab. Although most rim tabs are Tamulasco Plain or Garcia Red, other classification categories are represented.

What we call lugs are quite variable in form, but they share attachment locations on the upper body and they are ***not*** strap, indented strap or coil handles. One of these is shaped like a perforated asymmetrical rim tab (Figure 30d). It is placed just below the constricted neck (ca. 70 mm diameter) of a small convex walled vessel slipped tan on the exterior. One appears to be simply a pinched off coil of clay pushed onto the upper wall of a large incurving bowl with a flaky brown slip (Figure 30e). This one is quite asymmetrical, being pushed out on either side of the central finger impression. The other two are shaped rather like the bifurcate feet described under "supports", but with little or no bifurcation. Both are tan slipped. One heavily red slipped handle is best called a basket handle (Plate 13a). It belonged, perhaps, to an incurving bowl with the handle crossing the aperture.

Handles were modeled separately from the vessels and attached at a late stage in the manufacturing sequence. Many of the strap, indented strap and coil handles retain evidence of their shaping and attachment techniques. Attachment was always on to (and not perforating) the vessel wall. Additional clay was shaped around attachment points to strengthen the bond, giving a splayed attachment surface, often leaving a discernible line between the original modeled handle piece and the added clay. Handles were added prior to slipping, and sometimes the underside of the handle and even the vessel wall immediately under the handle remained unslipped or, in the case of double slipping (red over tan, for example), the second slip might not reach all parts of the handle.

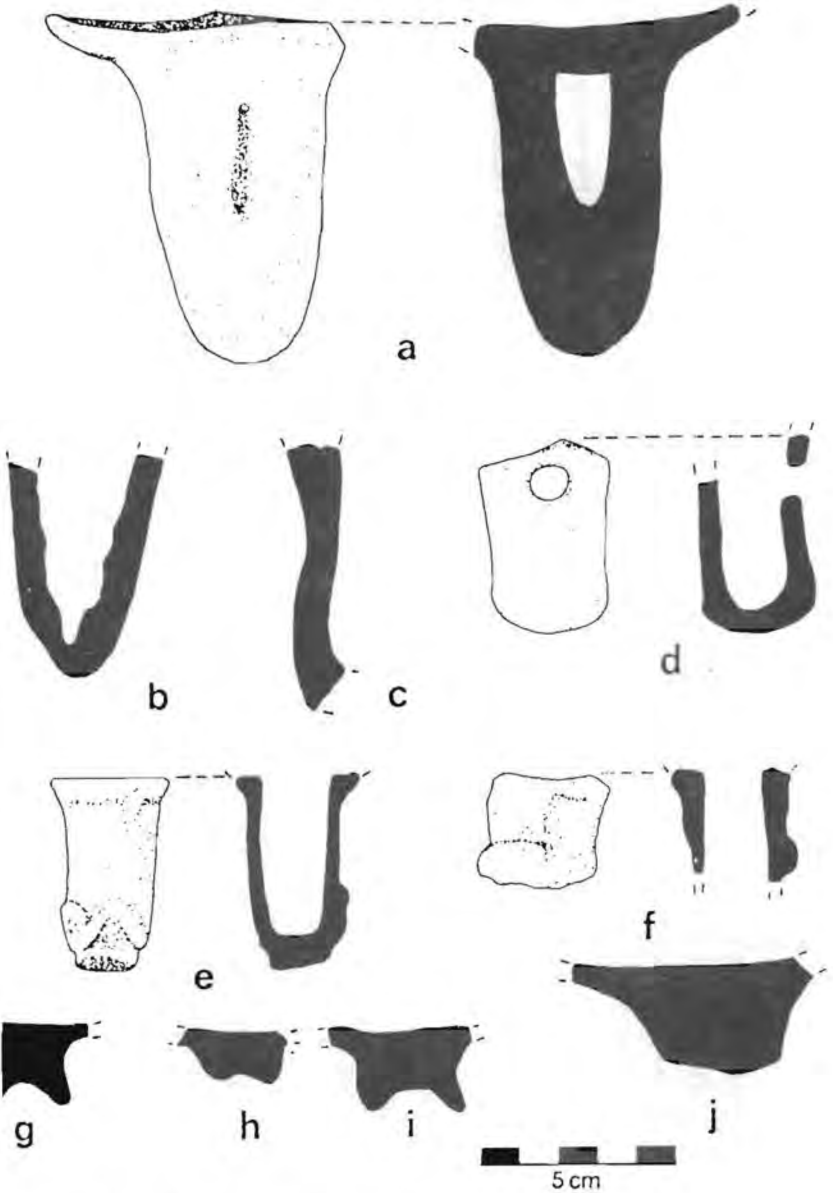


Figure 31. Ceramic Supports

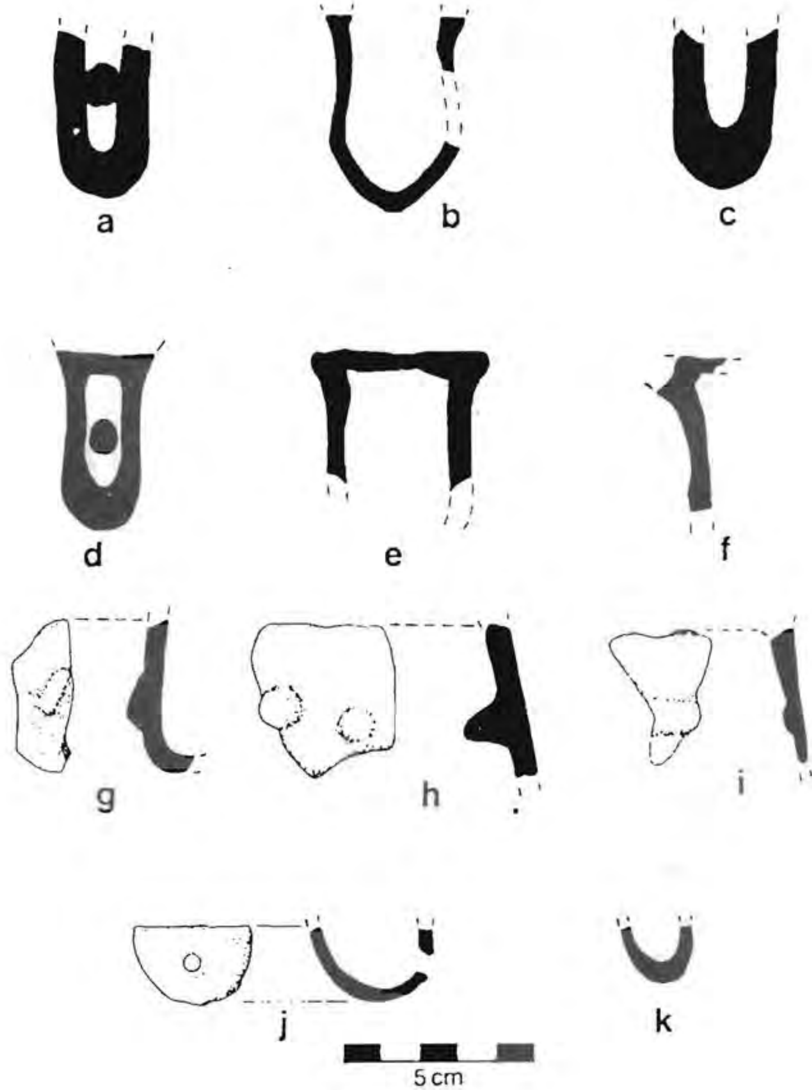


Figure 32. Supports for Vessels

Information about handle placement is too inadequate to extrapolate frequencies, but we can say that coil, strap and indented strap handles were attached both horizontally and vertically on convex walled vessels (Plate 14). Larger sherds with vertical placement suggest that these were attached from near the rim to the upper body. Horizontal handles may have been placed farther down on the upper body.

Vessel Supports

A total of 81 possible supports were recorded in the descriptive notes made at Cihuatán, but some are so fragmentary they could just as well be assigned to figurine parts or "miscellaneous modeled". This discussion is based on 45 specimens from Structure 15-1 (Excavation Area A) and 2 from Structure 12-51 (Excavation Area C) that were present in Calgary and that we believe could have served as supports. The number of supports, however calculated, is appreciably smaller than the number of handles. We conclude that while most convex walled vessels must have had handles, the supports, which must have been attached primarily to flat bottomed and dish shaped bowls, were less commonly used structural additions in the San Dieguito ceramic assemblage. Indeed, a relatively small percentage of bowls would have had supports.

Forty-two of the 47 can be described as hollow, while three are small, solid bifurcate forms; one is apparently a solid support; one annular base is included here. All but one of the hollow supports are round or roundish in horizontal cross-section; one (Figure 31b) is flattened. One is solid for about half its length and most are thicker at the bottom than at their midsections. Some are well made and relatively thin throughout. Most are rounded to slightly tapered and are without structural embellishments. Some are more contoured. Four have single round holes punched from the outside (cf. Figure 31d); one has two holes; and one (Figure 31a) has a vertical slit. Two have knobs or protuberances (cf. Figure 32b) and three have applique decoration (cf. Figure 31e and Figure 32g). Two of the latter may be parts of figurines; the appliqued pieces resemble the heavy necklaces on the seated figure Boggs (1982: Figure 23a) illustrates, but similar applique pieces on the third are definitely part of a support.

The hollow supports occur mostly in the tan slipped ware (Tamulasco Plain), with 3 in red-slipped (Garcia Red), one a darkened red or dark brown, and one can only be called gray. One of the highly eroded supports may have been from a white background polychrome, and one had an unusual waxy (or talcum powder) feel white slip and is classified as "Nicoya-like". Hollow supports on measurable specimens varied in diameter from ca. 25 mm to 60 mm and in height from ca. 35 mm to 86 mm.

Vessels and supports were made separately and joined. The bowl surface was sometimes roughened to expedite the weld which of necessity had to be accomplished from the outside of the support. Two of the hollow supports had double concentric circles of clay, and this, together with the splayed attachment contour, suggests that additional clay was used to strengthen the bond in the same way that this technique was used to apply handles. The bond was structurally weak, and although some supports have the vessel base attached, most have become detached at this point.

Rattles (or small clay or rock pellets that could serve as rattles) were undoubtedly placed in many of the hollow supports, but have been lost from the fragmentary specimens. One fragment, however, retains a small clay pellet that adhered to the support wall during the firing process, and one complete and sealed support retains its rattles.

The bifurcate forms of supports are found only in Tamulasco Plain and Garcia Red. The single annular base is a mere circular bump on the base (ca. 40 - 43 mm in diameter) of a Red-on-Tan bowl. The single solid support tapers to a flat base (the only flat support) and is the only example we have of what may be the false Plumbate Bruhns (1980b) describes.

Twelve additional supports are reported in the incomplete notes on the temple ceramic assemblage of Structure 12-1 (Excavation Area D). Other than the notation that two were Red-on-Tan, these are undescribed.

Separate Supports or Bases

Apparently braziers and perhaps other vessels sometimes were provided with a separate cylindrical (or other form) of support. It is not certain that any came from San Dieguito. Two possibilities might be considered. One is a coarse ware fillet applique rim from a vertical walled piece having an interior diameter of 7-8 cm. It is either a vertical neck of a large jar, or a hollow, cylindrical support. The other possible support, discussed elsewhere, is the large Tamulasco flaring neck of a jar or, if inverted, a hollow support. I am inclined to think the former may actually be a separate cylindrical support whereas the latter is a jar neck.

Possible Adornos

From Structure 15-1 only one white background polychrome bowl has an *adorno* fixed in place on its rim (Figure 15a and b); however, there are other fragments that seem to have served as *adornos* on vessels. One is a small animal head apparently from a bowl with a red slipped interior (Figure 33d). If we are correct, the animal head would have affixed side-ways. A stylized bird head, heavily red slipped, may have been attached to a bowl wall (Figure 33g). An unslipped snake head (?) may have been an *adorno* or something else (Figure 33h). No *adornos* were found in Structure 12-51

(1980a:91) reports finding only two adornos - one a reptilian *adorno* on a red strap handle and the other a human head attached to the wall of an incurving(?) bowl. It would appear that *adornos* are generally rare, at least in nonelite contexts.

Surface Alterations on Vessels

Although most vessels were finished by smoothing, wiping, polishing, and/or painting, a small percentage had their surfaces altered with tools or finger nails or with other plastic treatments. Most of these techniques have been mentioned in the above discussions, and some are given recognition in the classification categories (Garcia Red Incised or Monochrome Incised for example).

Incisions, Grooves, Impressions, and Striations: In the random sample, 1.8% of the sherds showed these treatments. The same frequency was noted in the rim sample. It is not clear, however, that these reflect the same variables and the frequency in the total population or by vessels may be slightly greater. Grooving has been mentioned in the discussion of vessel form as occurring on deep bowls, on vertical walled bowls and/or beer pots, and on the large, heavy, thick walled vessels. Most of the grooved sherds are red-slipped and the grooving was done prior to slipping at the leather hard stage.

Incision is also mainly found on red slipped vessels, especially the shoulders of jars. As was the case with the grooves, we assume most incision on Garcia Red jars occurred at the leather hard stage, as Bruhns (1980a:85) has noted. Such an assumption is supported by the nature of the incisions, which are usually shallow and rounded in cross- section, and the fact that the red slip usually covers the incisions. In a few cases, incision occurred after slipping.

The incised designs on the red-slipped vessels range from one or more encircling lines, to incisions framing geometric, curvilinear or spiked designs. These designs were usually crudely executed with shallow incisions (Figure 26).

In addition to incisions on Garcia Red jars, one red-slipped bowl had incisions on both the interior and the exterior. One Tamulasco olla had an incised line encircling the neck.

Quite a different kind of incision is found on the flat external surfaces of the heavy ledge rims (Figure 28 a through e); the incisions, quite deep and decisively executed, are used to create geometric designs. These, too, must have been executed at the leather hard stage or perhaps earlier. Since all ledge rims carry incised designs, we have a correlation between two ceramic variables (rim form and decorative techniques) that is unique in the San Dieguito ceramic assemblage.

Bruhns (1980a:85) recognizes Bichrome and Trichrome Incised; none was found in the San Dieguito collections, nor have we noted the post-firing white paint applied to incised areas as she describes (ibid). In our collections, the closest parallel to the Trichrome Incised would be the incised polychrome described as #7 in the unclassified category in Chapter 3 which is so unlike the "local" pottery that we assume it to have been imported. In particular, the use of incisions to outline color zones on our unclassified #7 sherds is unique in the San Dieguito collections (see Figure 20b and c and Plate 7d).

Other techniques include brushing or striation and impression (Plate 15). The most consistent use of brushing or striation is not on vessels but on drain pipes. The only other examples of striating occurred on two sherds from the basal interiors of flat bottomed Tamulasco bowls with fire blackened exteriors; these were more deeply striated or scored than the drain pipes and are the closest approximation to *molcajetes* in our collection.

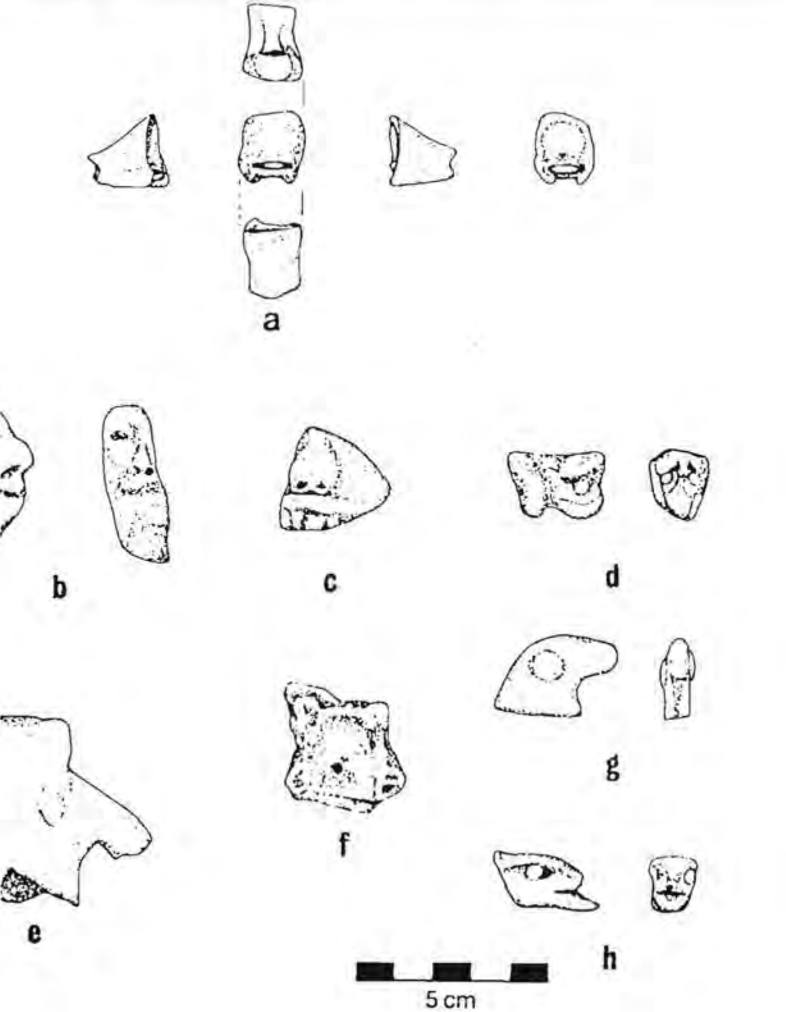
Impressed designs in the basal interior of bowls are the hallmark of *Fondo Sellado* (Plate 9) which occurs in red-slipped and tan-slipped finishes. Several of the spindle whorls carry impressed design on their upper surface (Figure 34 b,c and d). Several sherds of one of the large, thick vessels carry a partly smoothed rippled imprint on the exterior surface. The reciprocal impressing device cannot be identified.

Modeling and Applique on Vessels: Fillet appliques are most commonly found on the Las Lajas bowl rims (Plate 13c through h; Figure 23) and on smooth-bodied braziers at the rim, midsection and base (Plate 13b). In the "Miscellaneous Modeled" group of fragments (Plate 16a through h) there are three "buttons" (Plate 16f, g and h) and other forms that may have come from braziers but which are as likely to have come from figurines (discussed separately).

When these plastic techniques are used on vessels other than those of the Las Lajas or Coarse Ware, as they were infrequently, they are likely to be confined to the structural additions such as rim ornaments and supports (Figures 31 and 32; see also "Hollow Figurines and Figures", below); however, three sherds have knobs or protuberances on the surface (Figure 23b, d and f). The production of handles and some of the supports can be regarded as a form of modeling. Modeling as a form of vessel construction appears to be limited to one or two miniatures in our collections.

The Mixtec censer (Figure 21a and b) has appliques, but we assume this was not "locally" made.

Association of plastic techniques with other variables: For the San Dieguito ceramic collections, at least, these techniques have a tighter correlation with other variables than do others considered. It could hardly be otherwise for the Las Lajas fillet-applique-rim bowls, since the presence of the fillet applique rim is



ıre 33. Miscellaneous Modelled Pieces
Vhistle mouth piece; b. Modelled human head fragment;
Modelled human face from a ceramic vessel(?); d. small animal adorno;
igurine torso fragment; f. Eroded figurine head;
Red-slipped bird head (adorno?); h. Unslipped snake head adorno

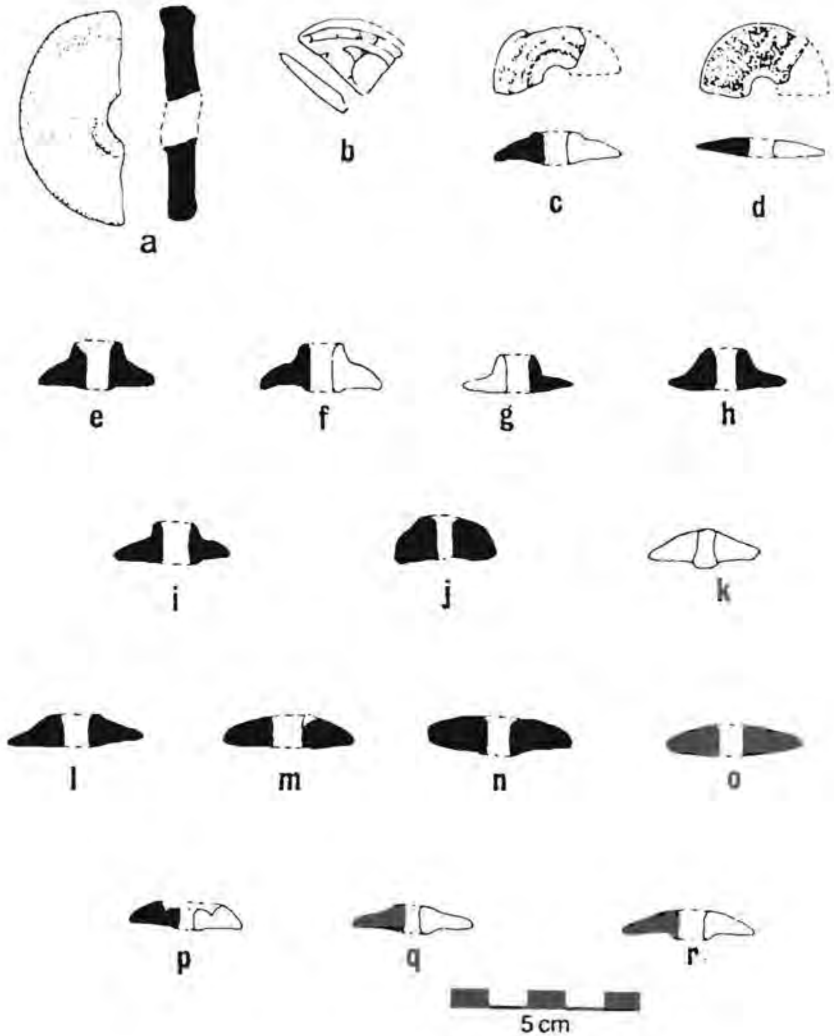


Figure 34. Spindle Whorls and a Wheel from a Figurine
a. Wheel of a wheeled figurine; b-r. Spindle whorls.

essentially what defines the category; the same bowls with a direct, unembellished rim would be classed as Tamulasco Plain. Indeed, since some fillet appliques were insecurely attached to bowls and could easily become detached (Figure 23e), it is not unlikely that this has actually happened. Similarly, ***Fondo Sellado*** is defined on the basis of basal impressed designs. In spite of this correlation through definition, the associations are real enough. There simply are no Garcia Red bowls or Tamulasco ollas with fillet applique rims. If a Garcia Red jar is to be decorated with any of these techniques, it is consistently decorated with shallow and rather poorly executed incisions.

Rim and Vessel Size Diameters and Wall Thickness

Size as well as form is an important aspect of the functional characteristics of vessels. Little information on diameter could be collected from the random sample (11.4% of the sherds in that sample - mostly rims - had a diameter estimated.) Rim coding produced much better information on rim diameters (89.3% rims had diameter estimated). Diameter was estimated by orienting the sherd to its presumed position so the rim was flat (except for pitchers), and moving it over a graduated scale of concentric circles one cm apart. A best-fit reading was made to the closest cm line. Estimating rim diameter is not a precise business. In an effort to check how much variation we might expect in the observations for individual specimens, we had different analysts measure the same rim sherd, and we remeasured some sherds at different times. Occasionally there were radically different estimates, but most sherds came through the duplicate measuring within a 10 mm limit. We also estimated the percentage

As can be seen by referring to Table 9, only 8.1% of the rims exceed 260 mm in diameter, 75.2% of the rims fall between 100 mm and 260 mm in diameter, and 5.3% are under 100 mm in diameter. The rim diameter range is from 20 mm to 800 mm. The mean (average) is 181 mm with a standard deviation of 73 mm.

Most interesting are the several clusters in the 100 mm to 260 mm size range. It appears that a series of sizes graduated at about 20 mm apart were favored: 100, 120, 140, 160, 180, 220 and 240 mm. Fewer vessels occur at the intervals of 260 and 280 and 300 mm; but the size gradation interval is maintained. This does not look like a random distribution, but suggests approximate size standardization. We can't be sure that the observed differences would not dissolve this apparent patterning if the rims were remeasured, and this should certainly be independently checked, but the size of the sample may protect these data against undue distortion due to investigator bias.

Vessel wall and rim thickness were recorded for the rim sample on the assumption that this information about the vessel structure might be related to factors such as size and surface finish (and classificatory categories). Mean wall thickness was 6 mm with a standard deviation of 2.5 mm; mean rim thickness was 7 mm with standard deviation of 2.5 mm - both calculated by ignoring missing data; 79.8% of wall thicknesses fall between 4 and 8 mm, with the largest concentration (25.2%) at 5 mm. Only 1.6% of the wall measurements are thinner than 4 mm, while 7.7% fall between 8 and 15 mm. Still thicker sherds are known from descriptive data. For the rim and lip thickness, which has only 1.1% missing data, 77.9% fall between 4 and 8 mm, 19.1% between 9 and 13 mm and 1.2% between 14 and 30 mm, and .3% have a thickness of less than 4 mm.

This information, by itself, is not very meaningful - beyond pointing out a fair degree of standardization in creating ceramic vessels.

Plate 16. Miscellaneous Modelled Pieces

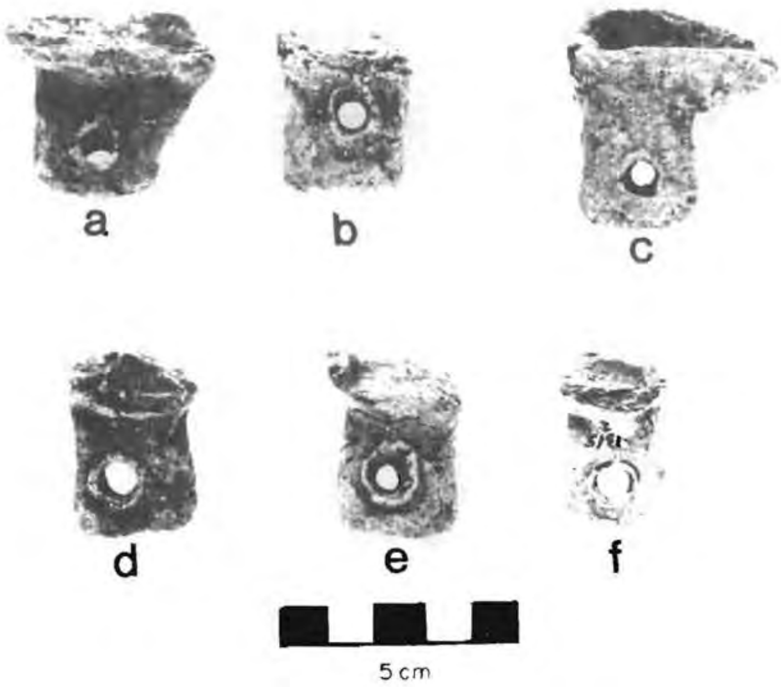


Plate 17. Wheeled Figurine Legs

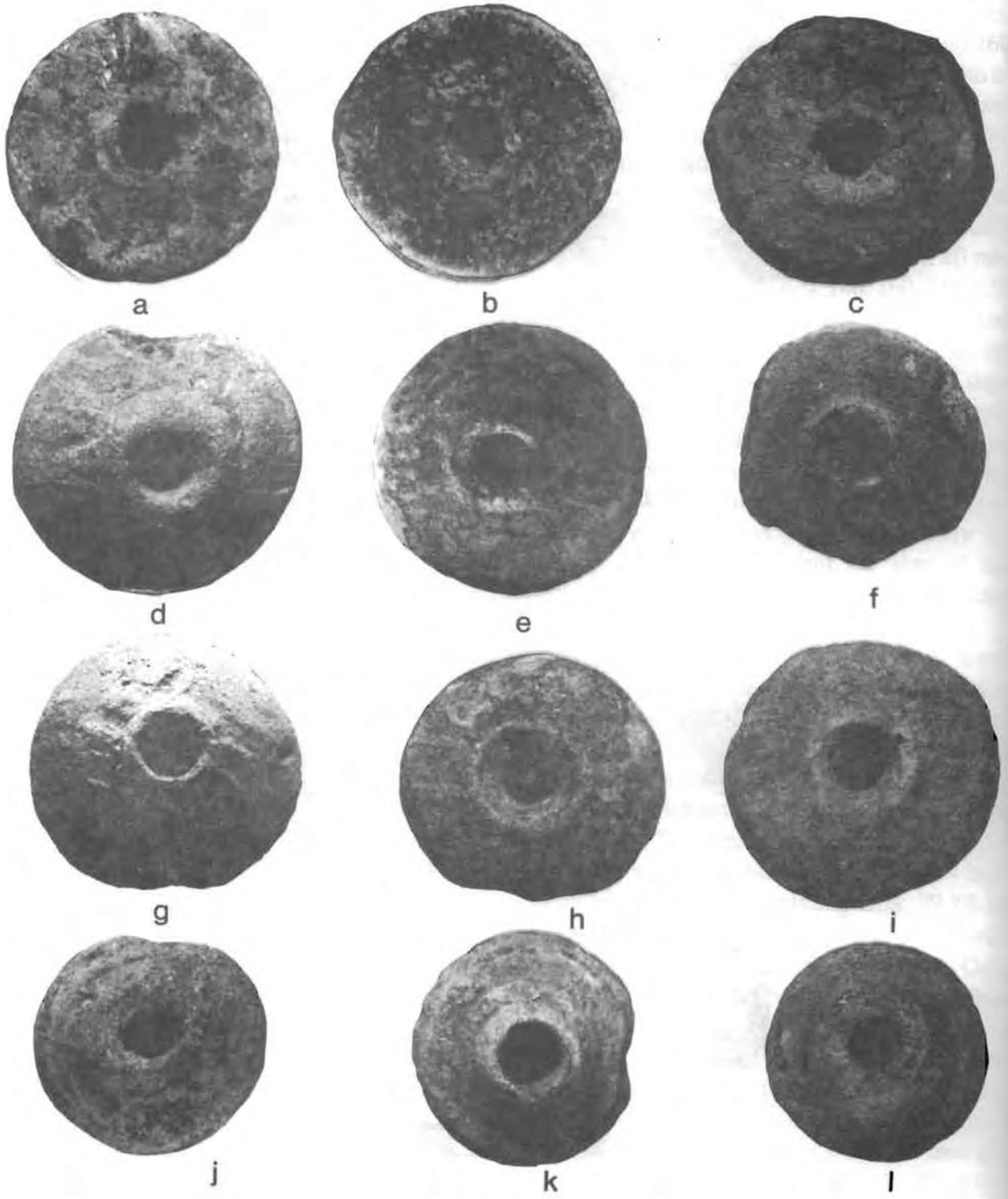


Plate 18. Wheels of Wheeled Figurines and Spindle Whorls
Photos courtesy of "David J. Guzmán" Museum
a,b. Wheels; c-l. Spindle whorls

category with rim diameter and wall and rim thickness. The results showed very weak relationships between these variables. Cramer's V for correlating rim diameter with classification category is only 0.16, while the correlation of wall thickness with classification category is 0.20, and of classification category with rim thickness is 0.24. What does emerge is that Las Lajas Coarse Ware in this sample was confined to very large, thick vessels (no figurines were included in the rim sample) and the wall thickness of the red painted sherds is very much more variable than the other categories with a coefficient of variation of 1.42 which compares to 0.33 for Garcia Red, which has the next highest coefficient of variation, and 0.15 for Garcia Red Incised, which has the lowest coefficient of variation.

Fired Clay Artifacts and Figurines

With the possible exception of a few spindle whorls, the objects described here are assumed to be part of "local" ceramic production. Both Fowler and Bruhns tend to place these objects into their respective Las Lajas or Coarse Ware classification categories.

Spindle Whorls

Some 29 spindle whorls are recorded in the descriptive notes, all from Structure 15-1, of which 18 were in the collections loaned to Calgary (Figure 34 b through r); at the Museo "David J. Guzmán", ten spindle whorls which were not permitted to leave the country for study purposes were photographed for us (Plate 18c-l).

Most spindle whorls appear to have "local" paste and to be part of the "local" ceramic complex. Specimens 1089-57 and 1085-82 (Figure 34 b and d), however, are made of very fine pastes (terracotta colored in one case and cream colored in the other); both are quite thin and bear impressed designs; one (1085-82) has remnants of an orange slip. These may well have been imported.

Table 9

Estimated Diameters of Rims*

Estimated Diameter in Millimeters	Absolute Frequency	Relative Frequency
not observed	217	10.7
20	1	0.04
40	7	0.3
50	1	0.04
60	30	1.5
80	70	3.4
90	2	0.1
100	106	5.2
110	2	0.1
120	166	8.2
130	1	0.04
140	277	13.6
150	5	0.2
160	256	12.6
170	7	0.3
180	216	10.6
190	4	0.2
200	163	8.0
210	2	0.1
220	154	7.6
230	2	0.1
240	101	5.0
260	72	3.5
270	2	0.1
280	40	2.0
300	32	1.6
310	2	0.1
320	16	0.8
340	21	1.0
360	18	0.9
380	7	0.3
400	9	0.4
420	4	0.2
440	10	0.5
460	2	0.1
560	1	0.04
600	1	0.04
800	2	0.1
Total	2037	100.0

* Empty intervals omitted

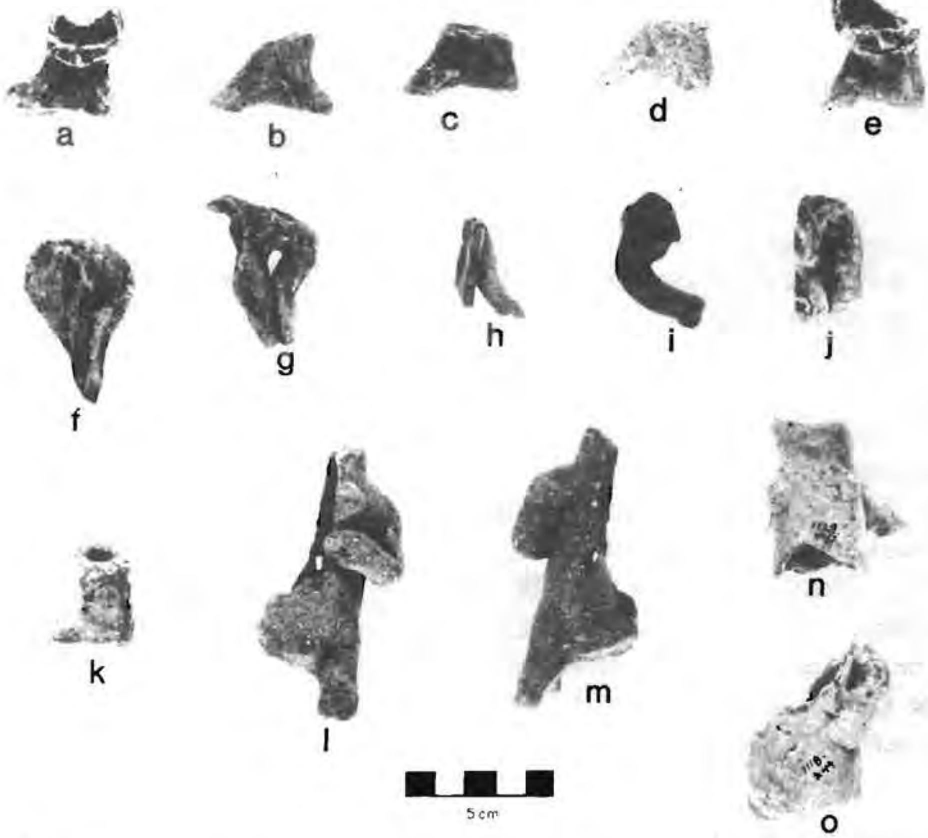


Plate 19. Figurine Parts

a-e. Solid feet of figurines; f-i. Arms and torso fragments of human figurines; k. foot of seated figurine; l,m. Front and back views of torso fragment; n,o. Torso fragments

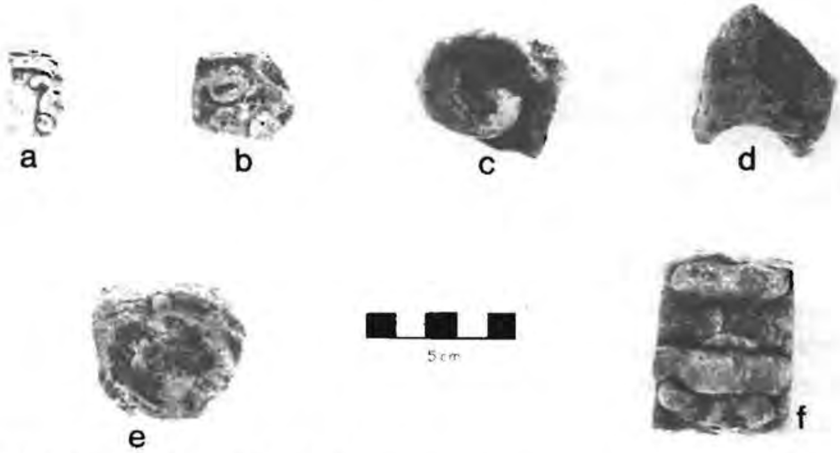


Plate 20. Modelled Ceramic Fragments

a. Human ear and headdress modelled on a vessel (?); b. Human head modelled on a vessel;

c. Modelled human ear about half scale, possibly from a hollow figure;

d,e. Two views of a bench that previously held a seated figure;

f. piece that looks like a (headless) baby on a cradle board

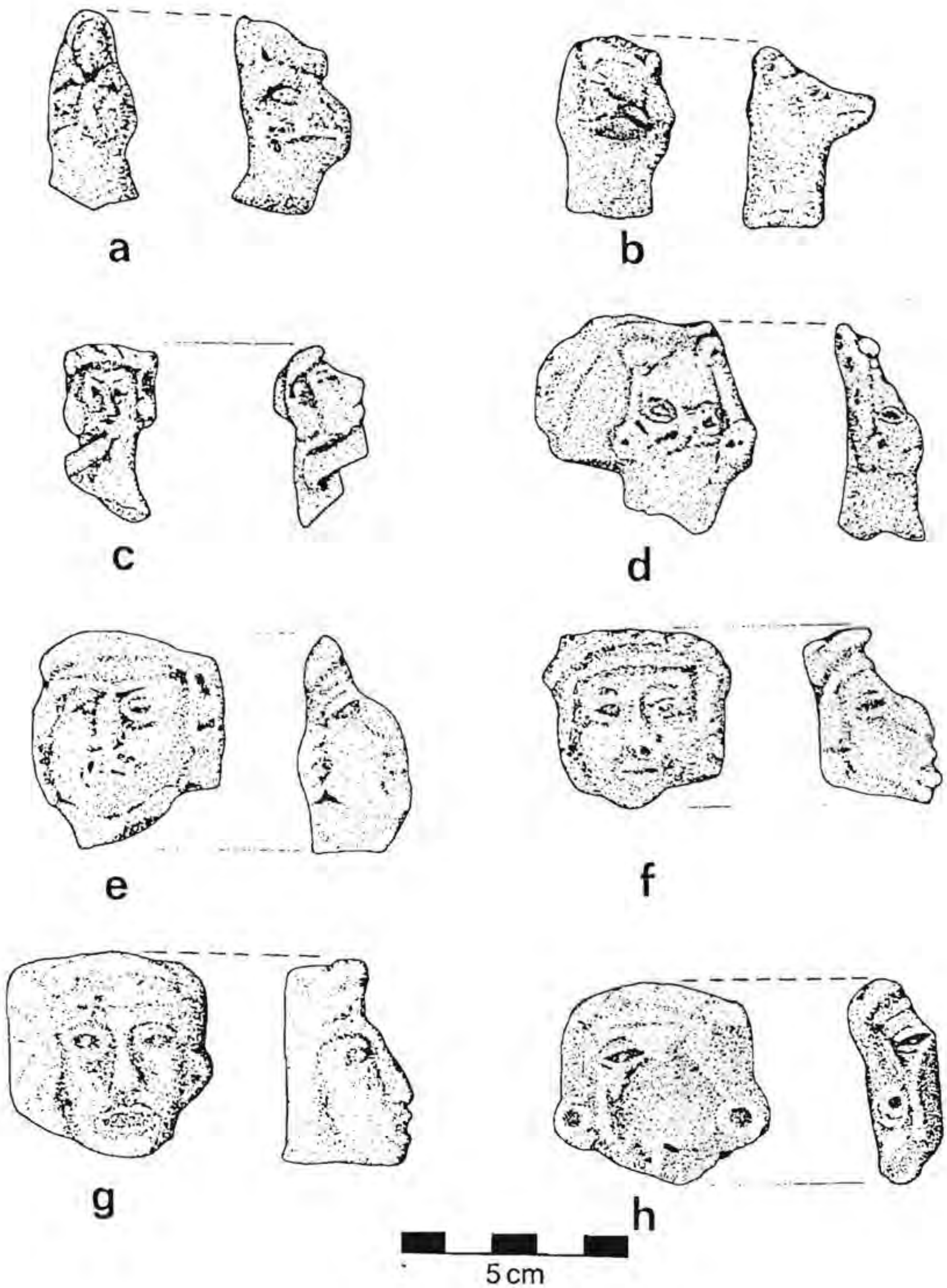


Figure 35. Figurine Heads

The range of forms can be seen in Figure 34; flat, biscuit shapes tend to be unslipped. Others carry traces of tan to dark brown slips, and one (Figure 34r) had patches of black paint on its lower surface. Several carry impressed designs (all badly eroded) on their upper surfaces (cf. Figure 34c). None are particularly heavy, but the variation in thickness and weight suggests that different kinds of thread were being produced.

Wheeled Figurines

Cihuatán is perhaps best known as the site that produces the Cihuatán type of wheeled figurines (Boggs 1972). From Structure 15-1 (Excavation Area A) in San Dieguito, six wheeled figurine legs were collected (Plate 17a to f), as well as one broken wheel (Figure 34a) and three complete wheels (Plate 18a and b). We assume that some of the animal figurine heads described below belonged to the wheeled versions, but have no basis for distinguishing them from the others. A horizontal hollow body fragment (not illustrated) is also presumed to have belonged to a wheeled figurine.

Other Figurines

Although no complete figurines were excavated at San Dieguito, a large number of fragments were found in Structure 15-1. These include 23 heads (cf. Figure 35), 8 torso fragments (Figures 28g and 33e; Plate 19 l, m, n and o), 5 benches or thrones (one of which has a headless figure seated on the bench [Plate 20d and e]), 28 arms or arms and torso fragments (Plate 19 f,g,h,i and j), 20 of the stylized feet of the sort found on standing figurines (Plate 19 a,b,c,d and e); and one leg and foot of the sort found on figures seated on benches (Plate 19 k). What appears to be a now headless baby strapped on a cradle board can be included here (Plate 20 f). Some of the 40 pieces consigned to the "Miscellaneous Modeled" category probably derive from figurines (Plate 16 a-h).

Aside from these fragments from Structure 15-1, a single head (Figure 35c) and two arm fragments were found in Structure 12-51. None came from Structure 12-1 (the temple).

These bits and pieces of figurines fall within the stylistic range of those previously described for Cihuatán. As a group, they may be less elaborate than those found in ceremonial contexts (cf. Boggs 1972). The San Dieguito specimens exhibit essentially the same manufacturing procedures described by Bruhns (1980a:94) in that most solid heads appear to be mold-made and the rest of the figurine hand-modeled. The San Dieguito figurine heads apparently have fewer details on the back of the head than Bruhns (op.cit.) describes, causing us to suggest a frontal mold was used with the back being finished by hand (see, for example, Specimen 1132-467, Plate 21 c, d and e). There is a possibility that some of the heads were modeled and not mold-made. Even mold-made faces and headdresses could have the details emphasized by hand.

Most figurine fragments are now unslipped and fall within Fowler's Las Lajas or Bruhns' Coarse Ware. Some however, are tan-slipped, and one figurine arm and torso fragment was heavily red-slipped.

Human heads are the most common (N=15 of 22), and of these, those having a headdress extending across the forehead and down the side of the face as well as ear plugs are best represented (Figure 35 e, f and h; Plate 21 f; Plate 22 a, b and c). Other human heads have ear plugs but are otherwise stylistically distinct. Specimen 1180-156 (a warrior?) wears a helmet and has a large lip plug (Plate 21 a and b); Specimen 1132-449 has a high headdress or hat (Plate 23 e); specimens 1097-4 (Plate 23 f), 1132-467 (Plate 21 c, d and e) and 1082-137 (Plate 22 f) depict quite different styles.

Torsos (now headless) provide some details about costume. The torso fragment

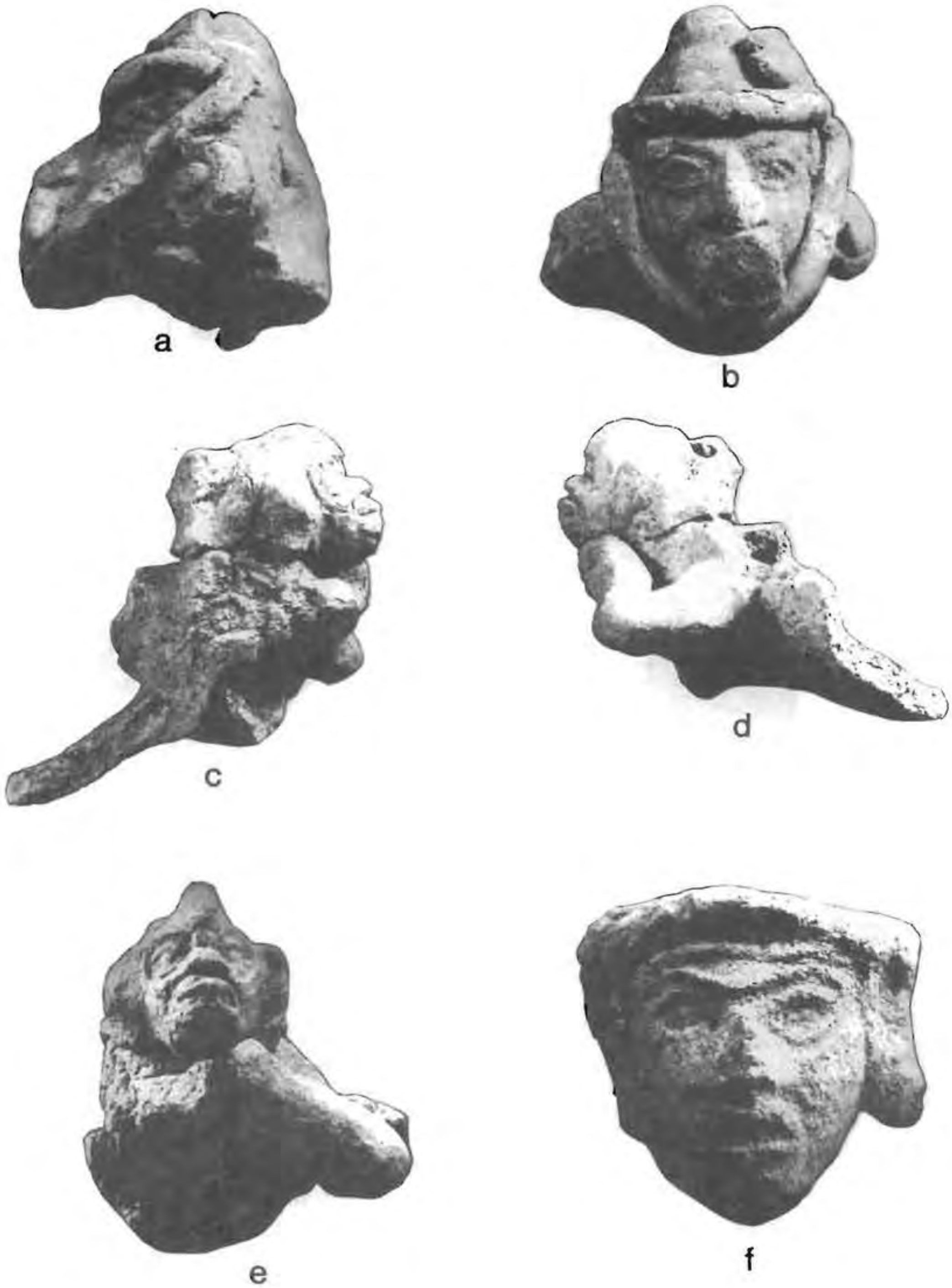


Plate 21. Figurine Heads

Photos courtesy of "David J. Guzmán" Museum

a,b. Two views of specimen 1080-56; c,d,e. Three views of specimen 1132-467; f. Specimen 1271-5

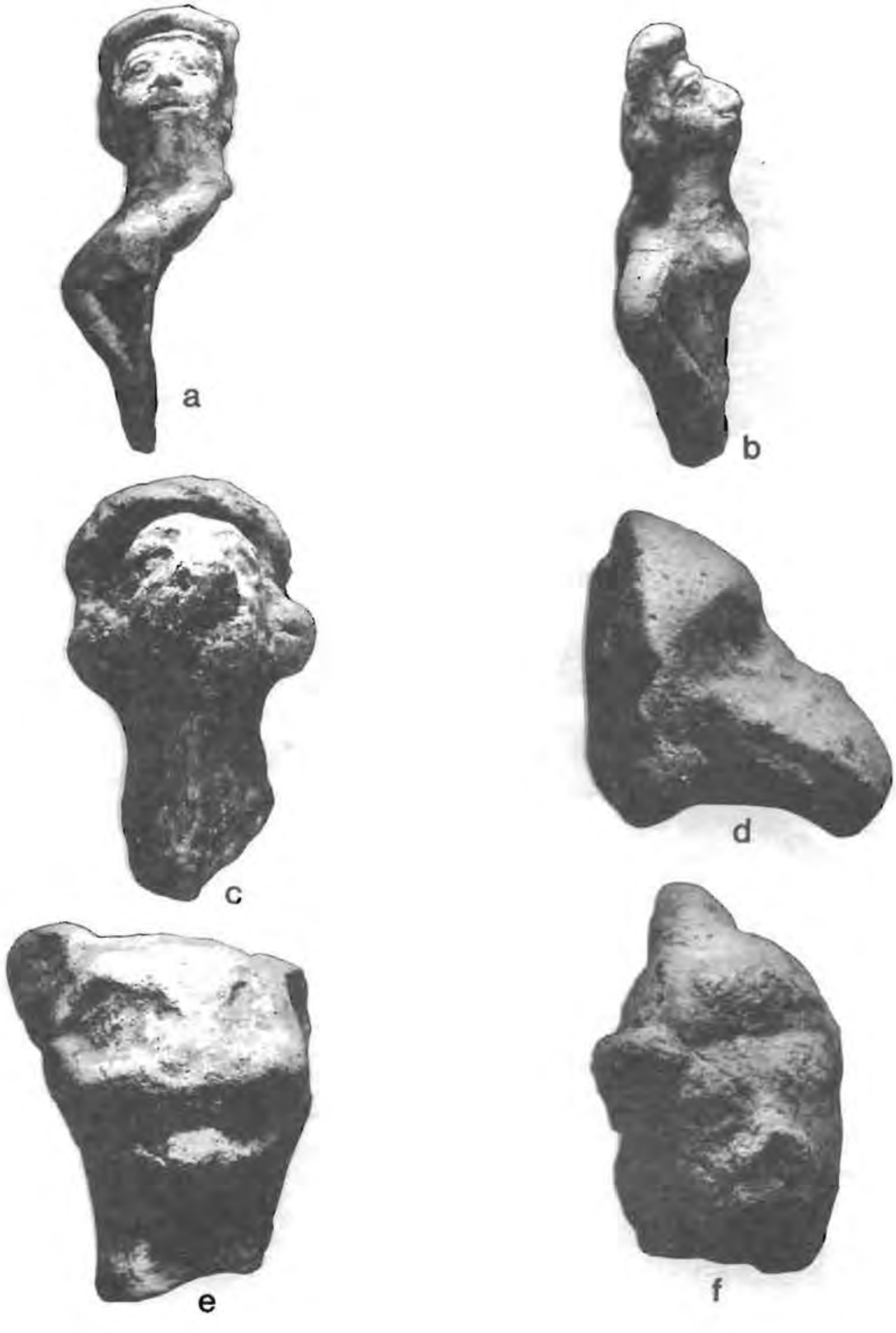


Plate 22. Figurine Heads

Photos courtesy of "David J. Guzmán" Museum

a,b. Two views of same specimen (number not given); c. Specimen 1320-37;

d. Vulture (?) head (specimen 1217-31); e. Animal head (number not give); f. Specimen 1082-137

(1008-1) seated on a bench (Plate 24 a, b and c) appears to have a "necklace" which probably once supported a large medallion such as is seen in Specimen 1323-1 (Plate 24 d and e). The latter is holding an unidentifiable object, and appears to have a cape (?) down the back. One of the arm fragments (Specimen 1253-23; not illustrated) has an upper arm bracelet or something over the shoulder. Some of the "Miscellaneous Modeled" pieces (Plate 16 a - h) are similar to items held in the hands of figurines illustrated by Boggs (1972).

The seated human figures with medallions on their chest are male (Plate 24), whereas at least some of the hollow torso fragments represent females (Plate 19 l, m and n). The hollow torso fragments lack evidence of dress or bodily decoration.

Animal figurine heads appear to represent a variety of animal forms (see Figure 35a and b; Plate 23 a,b,c,d; Plate 22 d and e). Not illustrated because of their poor condition are three others; one of these appears to be a feline with ear spools and a headdress (?), one appears to be a crested bird (?), and the other a dog (?). Not represented in the San Dieguito animal heads are deer heads such as Boggs (1972) describes for the wheeled figurines. We assume, however, that *if* we have heads from wheeled figurines, they are animal heads.

Hollow Figurines or Figures (?)

Three ceramic fragments of human faces are either from hollow figurines or the faces were modelled on vessels. Specimen 1070-16 (Figure 33c) carried a badly eroding dark red slip. Specimen 1132-465 (Plate 20a), of fine paste, has a suggestion of red slip on the exterior; fine applique on what may be a thin vessel exterior (3.25 mm thick) appears to represent a headband and ear spool. The third fragment, even less informative, has an eye and, presumably, part of the nose (Plate 20 b).

If these represent hollow figures, the first described above would be larger than the figurines but smaller than the large hollow figures known elsewhere at Cihuatán. The other two would fall within the size range of figurines. If, on the other hand, these represent modeling on vessels, they add a new dimension to modeling on vessels beyond that discussed above.

Large hollow figures may have been present at San Dieguito. The only firm evidence is a modelled human ear (Plate 20 c) which must have belonged to one of the hollow figures created at roughly 1/4 to 1/2 life size. Some "Miscellaneous Modelled" fragments might pertain to such figures.

Whistle Mouth-Piece

A single example was found in Structure 15-1 (Figure 33 a).

"Roof" Tiles (Plate 25 a and b)

Bruhns (1980a:93-94) discusses the so-called roof tiles, concluding they may in fact have adorned the ridge line of roofs. We have fragments of two of these from Structure 15-1. Both are thick (30 mm to 33 mm) and have shallow grooves. A third piece, equally flat and thick lacks any decoration and might equally well be a flat base of one of the large, vertical walled vessels.

Drain Tiles/Drain Pipes (Plate 25 c, d and e)

These tubular pipes from San Dieguito rather consistently have an outer diameter of ca. 14 cm, and are straited on the interior and exterior. Rims are flattened/direct as though they were cut off. We found 11 pieces in Structure 15-1 (Excavation Area A) fill and on

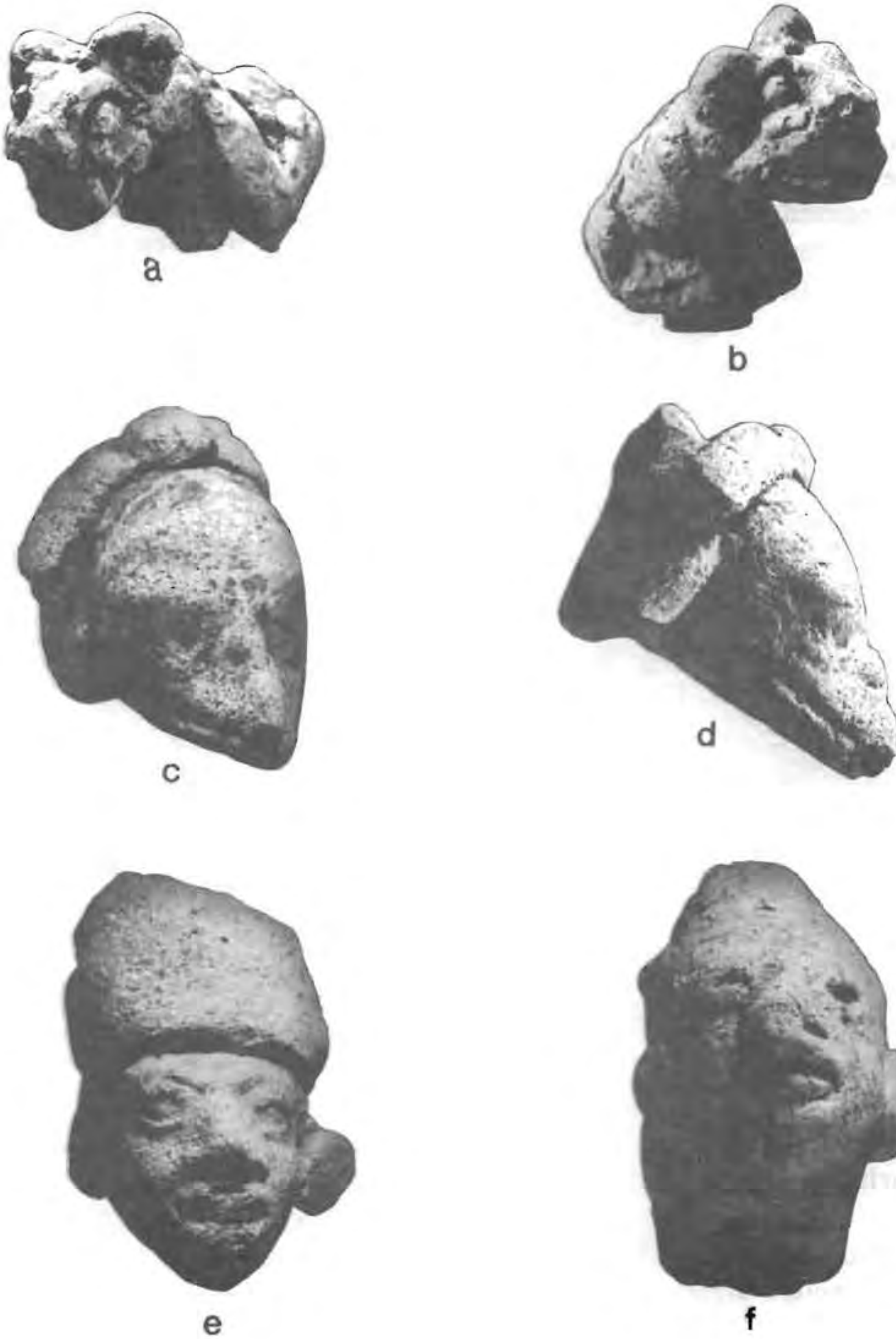


Plate 23. Figurine Heads

Photos courtesy of "David J. Guzmán" Museum

a,b. Two views of an animal figurine (specimen1255-1); c,d. Vulture (?) (number not given); e. Human head specimen 1132-449; f. Human head specimen 1097-4

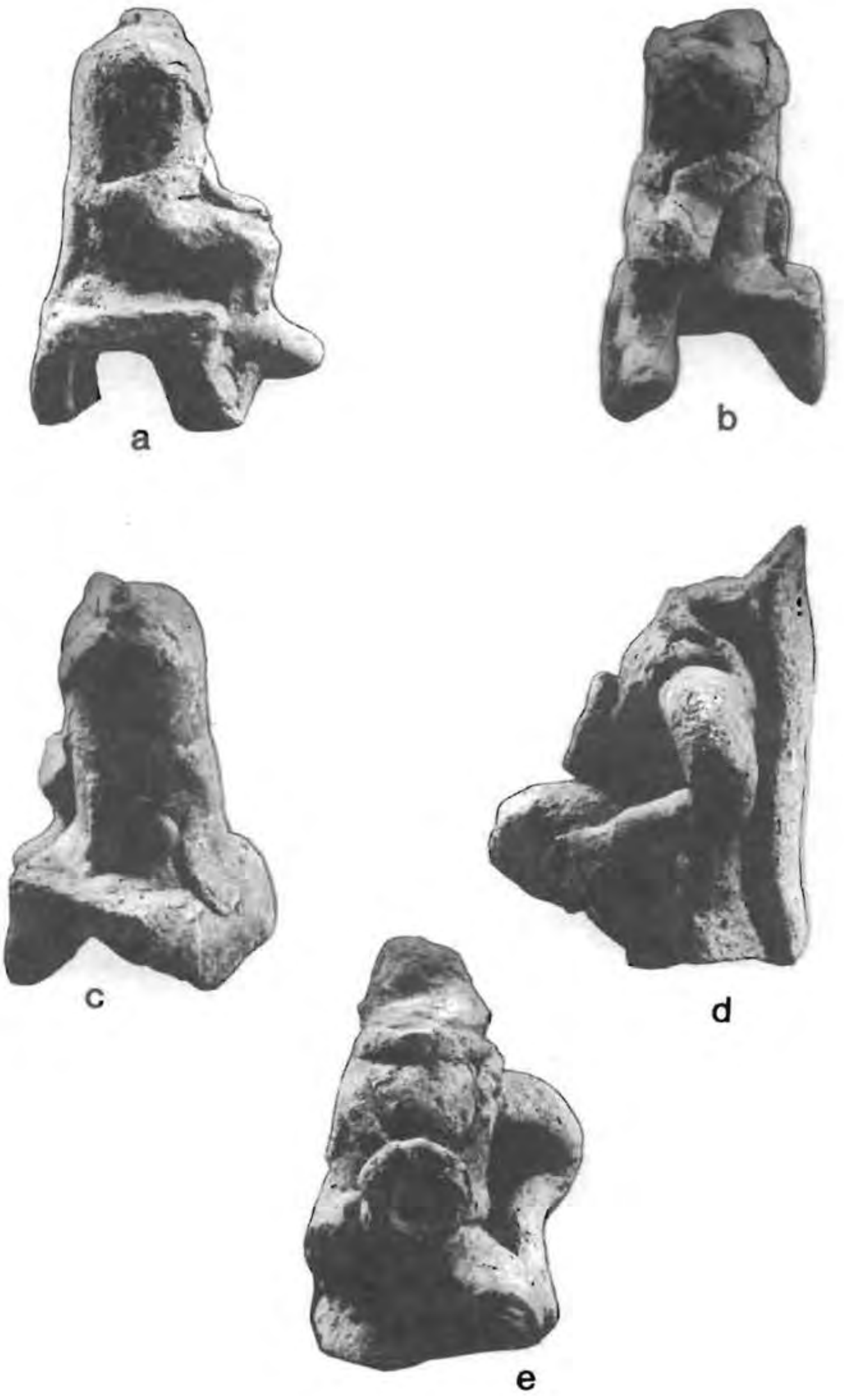


Plate 24. Seated Figure Fragments
a,b,c. Specimen 1008-1; d,e. Specimen 1323-1

the surface of the associated porch. Most of these are unslipped but one has unmistakable traces of red slip. None came from Structure 12-51 (Excavation Area C). At least six fragments came from the Temple (Structure 12-1, Excavation Area D), two of which were also red-slipped.

Bruhns (1980a:94) reports finding 10 pieces of drainpipe in the patio of NW-1 which are slipped dark red; these have diameters of ca. 10 cm and seem to be consistently smaller than the San Dieguito examples. Examples of drainpipe that clearly functioned as the name implied are known from the Western Ceremonial Center. The red-slipping of those Bruhns found as well as those from San Dieguito is curious. None of the archaeological contexts outside of the Western Ceremonial Center offer clues as to their function in domestic contexts.

Miscellaneous Modeled (Plate 16 a - h)

This catch-all category contains some 40 modeled pieces that could not be assigned with certainty to other, more definitive classes. Some are surely odds and ends off figurines. Others seem to be protuberances on vessel walls. Two pieces may be crudely modeled miniature vessels or parts of a hollow figure.

Clay Balls

Three unslipped fired clay balls varying from ca. 10-11 mm to 13 mm in diameter were found in Structure 15-1 (Excavation Area A). These may have been rattles in larger hollow vessel supports.

Summary

When the ceramic universe is partitioned [cut off]

categories, one is again struck by the malleable nature of Cihuatán ceramics with regard to classification.

The San Dieguito analyzed sample of ceramics pertains to domestic nonelite contexts. The pottery associated with the civic-religious Structure 12-1 is not discussed here because none of the sherds were included in the Loan Collections; however, the Structure 12-1 pottery is discussed in Chapter 8 where we use the descriptive field notes to draw similarities between this barrio civic-religious structure's associated pottery and that found in the domestic structures of the same barrio, on the one hand, and, on the other, to contrast the barrio civic-religious pottery with that associated with central civic-religious structures.

In spite of the fact that the large Structure 15-1 sample comes mostly from construction fill, we feel that we can say something about the composition of domestic ceramic assemblages in this sector of the site. A household assemblage of pottery was dominated by bowls of various sized and shapes. Bowls would have accounted for at least half of the vessels in a household, and perhaps as much as 60-70% -- a finding that is echoed in the actual floor assemblages reported by Bruhns from other parts of the site. Convex walled vessels make up the next most numerous category; wide mouthed ollas suitable for cooking and storage outnumbered jars; pitchers were apparently rare. Comals and ladles would also have been regular members of household assemblages.

A household assemblage might also contain minor amounts of vertical walled and large, thick vessels. The difference in the frequency of the large, thick vessels in the Structure 15-1 construction fill and the tethered collection areas that arguably produced artifacts associated with the occupation of the structure suggests that these large vessels were employed for some task associated with the occupation of the structure, and that this was a task that had

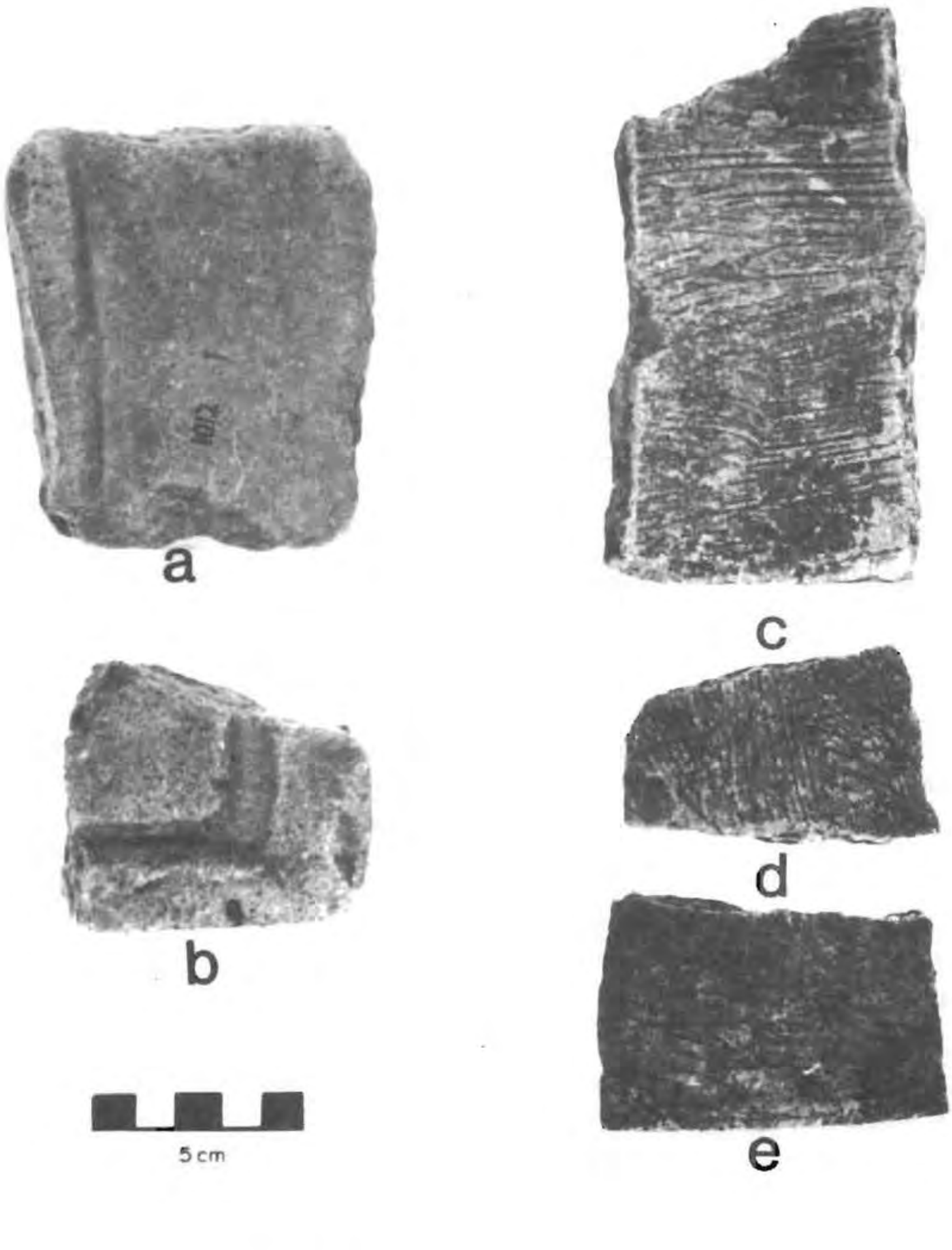


Plate 25. Roof Tiles and Drain Pipes

a,b. Roof tiles;

c,d,e. Drain pipes

construction fill was derived. The contrast between Structure 15-1 tethered collections and the Structure 12-51 sample also suggests differential distribution of the tasks associated with the large, thick vessels. These vessels would have been suitable for dying textile products, for mixing large batches of food or drink, or for other purposes.

Most of the vessels had rim diameters between 100 mm and 260 mm, with fewer vessels in the larger and smaller ranges. The apparent clustering for rim sizes at roughly 20 mm intervals is interesting, but this finding needs further investigation to be sure that it is not a product of our measuring techniques.

We have looked at form, size and other variables in the ceramic assemblage as a first step toward understanding the functional characteristics of Cihuatán pottery that will be useful in charting socio-economic differences within the site. Although previous ceramic analyses do not present data in this fashion, it is possible to make some comparisons to other parts of the site, and this is done in Chapter 8.

CHAPTER 5

RESULTS OF CERAMIC TECHNICAL ANALYSIS

This aspect of the study was undertaken to address four questions:

1. Do mineral differences correspond with ceramic classification categories?

2. Can mineralogical information aid in recognizing localized or specialized production of pottery?

3. Can imported be differentiated from local pottery?

4. Can inferences be made about production and distribution?

The latter point is especially relevant to a consideration socio-economic differentiation at the site, although it has little to add to the spatially based study of intrasite variability.

Petrographic Analysis

Petrographic analysis was the first technical procedure used on the San Dieguito ceramics. One hundred specimens were chosen in two ways, following the advice of statistician Williams. We selected 50 specimens in such a way that major macroscopically visible variation in paste and temper was represented; some presumed imports and rare specimens are included, as are members of all the "local" classification categories. The other 50 specimens were chosen randomly; these show a high incidence (19) of eroded and nondescript body sherds listed as "Unclassified". Such a sample cannot be regarded as representative of the San Dieguito collections, nor can the number of specimens in each classification category be presumed to reflect the full range of variability. It does, however, provide a useful glimpse of certain aspects of raw material selection and production factors. The mineralogical analysis was done by Mavis Stout. Basic data for each specimen are given in Appendices I and II. Selected thin sections are illustrated in Plates 26 and 27. Stout was given the 100 thin sections with their catalogue numbers. Her attention was drawn to the Plumbate and Nicoya specimens (i.e., she knew we thought these to be imports); otherwise, she was provided with no information about classification categories.

Mineralogy

This discussion serves both to present basic mineralogical data and to explain the notations in Appendix II.

Major mineral group categories present are Plagioclase and Alkali Feldspar, Amphibole, Pyroxene, and Pumice Glass. Rock fragments which cannot be distinguished in thin section are noted in Appendix II, as are quartz and other rare minerals. For each major group, percentages

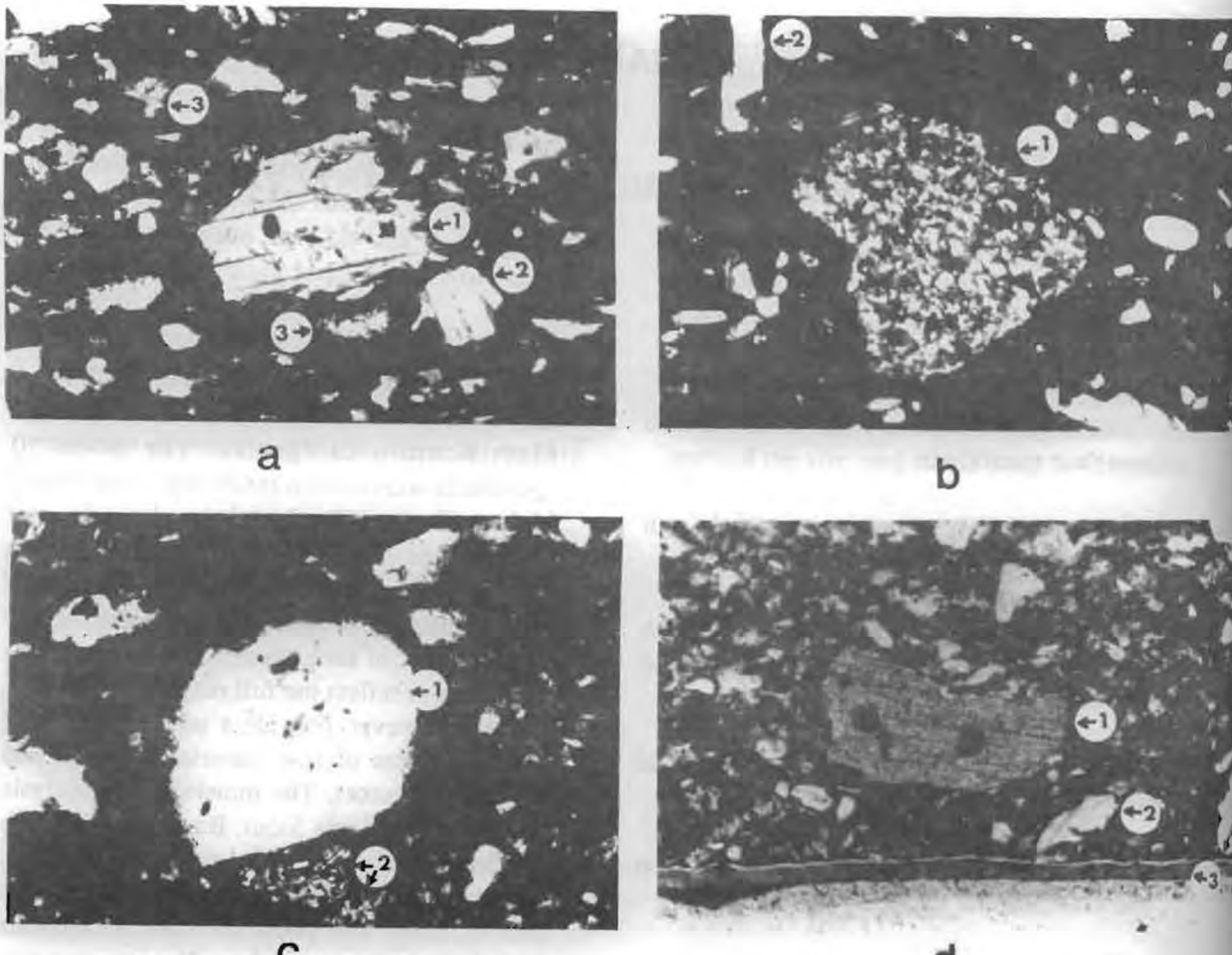


Plate 26. Ceramic Thin-Section Photographs

a. Nicoya sherd provided by Fowler from WCC

1. Orthopyroxene crystal (hypersthene); 2. Plagioclase feldspar crystal; 3. Pumice fragments; (also in photo are more feldspar and pumice)

b. Nicoya sherd provided by Fowler from WCC

1. Seconday quartz, probably replacing a large punice fragment; 2. Plagioclase feldspar crystal; (more feldspar in photo)

c. Plumbate sherd provided by Fowler from WCC

1. Primary quartz crystal; 2. Small pumice fragments

d. Nicoya sherd provided by Fowler from WCC

1.Clinopyroxene crystal (augite); 2. plagioclase feldspar crystal;

3. "Rind" of very fine grained materials

given in Appendix II are of the total thin section. Actual particle size range is given.

Plagioclase ($CaAl_2Si_2O_8$ - $NaAlSi_3O_8$): The An content (eg. An_{30}) is a measure of the calcic end member estimated from twin angles in plagioclase, when the necessary orientation of grains is available in thin section. An_{30} would be 30% calcite end member (anorthite). Due to the difficulty of identifying very fine-grained feldspars, the estimates of plagioclase to alkalai feldspar proportions may vary somewhat; in general, plagioclase would be slightly underestimated. The total feldspar estimate, however, is quite good. Notation is made of zoned phenocrysts.

Amphibole: This is a mineral group including many varieties. From color alone, all of the amphibole appears to be of the hornblende variety. A check-mark in the color column of the table in Appendix II indicates dark green light green tan brown (ie. hornblende). Many amphibole sections are rusty; these appear to be oxidized hornblende.

Pyroxene: Based on optical properties and color where present (very light pink-green), the varieties present are augite and/or hypersthene. A few specimens show no pyroxene.

Rock fragments: Fragments in most specimens are mostly altered and unidentifiable. If a rock fragment is identifiable, the (ax) column is checked in Appendix II. Minerals in the rock fragments are not included in the descriptions of plagioclase, quartz, etc.; they are accounted for only as "rock fragments."

Pumice glass: This refers to the texture of glassy fragments; spongy looking, shredded and cellular bits of glass. This glassy material composes large amounts of volcanic ashes and tuffs. The origin is suggested by the arcuate and crescent shapes of the glassy bits. Two sherds have distinctive glassy matrices. Glass sherds are noted separately. Secondary quartz and feldspar (which commonly infill the glassy vesicles) are included in the sizes and amounts under the Pumice Glass.

Alkali Feldspar ($NaAl_2Si_2O_8$ - $KAlSi_3O_8$): This is noted by percentage of total thin sectioned area and size range in mm. The proportion of alkalai feldspar to plagioclase feldspar may be somewhat over-estimated in some specimens, but, as noted above, the total feldspar proportion is good.

Quartz: This refers *only* to primary quartz, *not* to secondary quartz which commonly infills the glassy vesicles and can replace the glass which devitrifies very rapidly upon exposure of the rock. Neither this secondary quartz, nor the feldspar which also infills glassy vesicles, is included in the mineralogical data of Appendix II as it is not a primary mineral of the rock.

Other Minerals: Included here are other minerals present as alteration products of primary minerals. No percentages are given as they occur in very minor amounts. Also accounted for in this column are other primary minerals that occur as opaques which cannot be distinguished in thin section; of these, Fe-Ti oxides or sulphides can be recognized by their shape. The latter range in size from .01-.3 mm are are 1% of the temper. Other opaques (organic materials and alteration - oxidation products) are listed only as large "altered" fragments.

Possible sources of temper: Probable sources are suggested on the basis of the minerals present and their approximate amounts. Since individual pieces of the original rock may not have carried all the minerals in the same proportion, and since other variables may have intervened (ie., the potter may have mixed

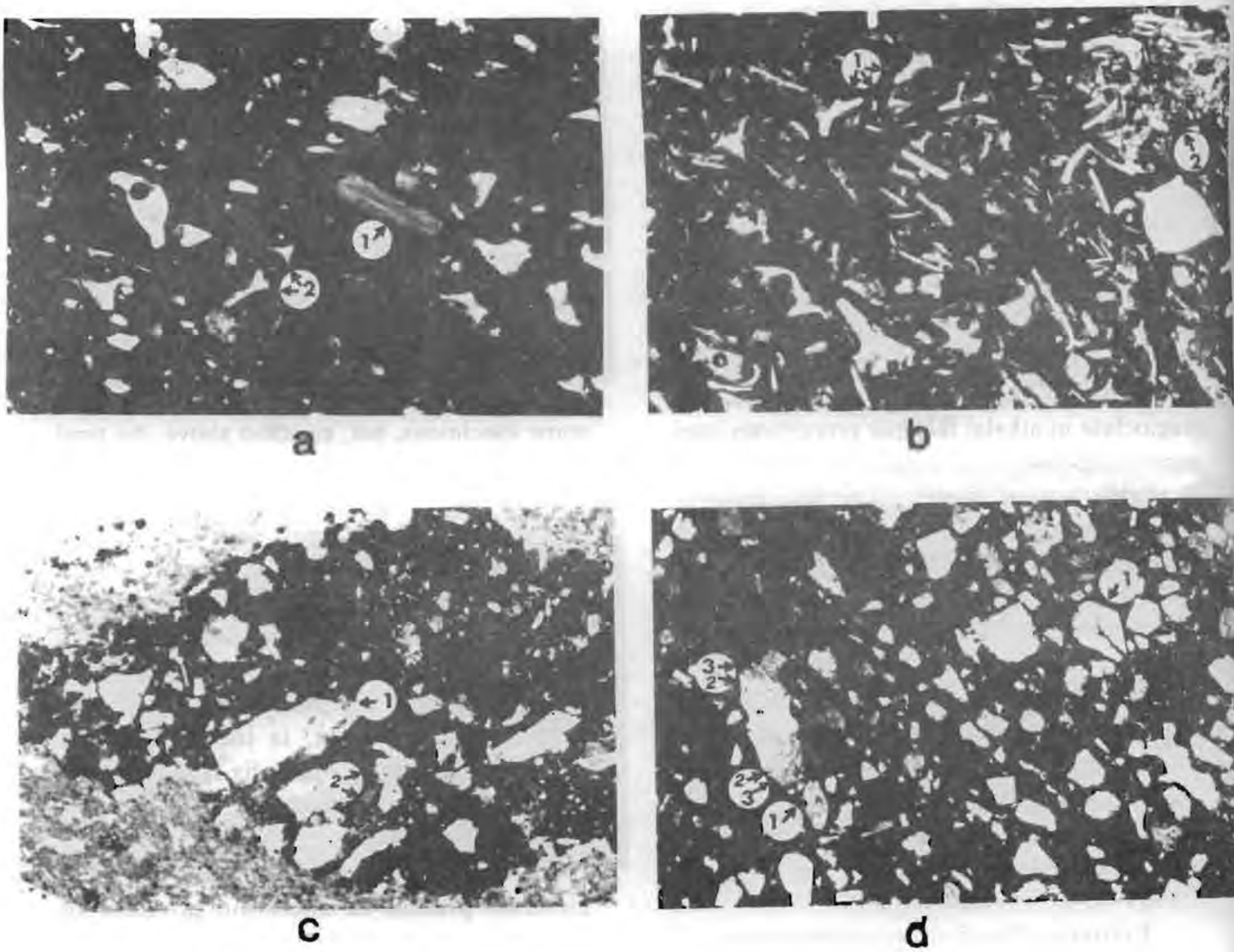


Plate 27. Ceramic Thin-Section Photographs

a. Nicoya sherd from San Dieguito

1. Biotite crystal; 2. Glass sherds

(also present in photo are more glass sherds and pumice)

b. Nicoya sherd from San Dieguito

1. Glass sherds; 2. Coherent pumice fragment;

(other glass sherds in various shapes and other pumice fragments also shown in photo)

c. Flat based bowl with red interior and blackened exterior; paste appeared unusual for Garcia-Red

1. Plagioclase feldspar crystal; 2. Amphibole crystals (hornblende);

(Photo shows large rock fragment (dia. = 2mm) with dark matrix; also present in photo : more feldspar, amphibole, altermaterial; light gray materials at edges of sherd are sherd matrix)

d. Garcia Red sherd

1. Amphibole crystals (hornblende) - the larger crystal shows characteristic diamond-shaped cleavage (56° to 124°); 2. Plagioclase feldspar crystal; 3. Attached pumice fragments

(also present in photo are more feldspar, amphibole and pumice) rocks), these are "best-guess" possibilities which are, however, consistent with rock types known to be present in El Salvador.

Interpreting the results of the thin section analysis is a difficult and in many respects unsatisfactory exercise because no unique "signature" minerals were present and all the sherds appear to be tempered with similar volcanic materials. Considerable variation occurs in proportions of the basic mineral groups (feldspars, pyroxenes, amphiboles and pumice glass). Stout felt, however, that the mineralogical suites for 94 of the 100 specimens were consistent with the inference that these sherds were tempered with dacite ash or tuff.

A First Look at Mineralogy and Ceramic Categories

Plumbate and Nicoya: Although the analyst had prior knowledge that these sherds should be mineralogically distinct from the "local" specimens, she tried to ignore this knowledge in her analysis in order to reach an unbiased conclusion about clustering of mineralogical attributes that would give her a basis for partitioning the total sample in meaningful ways. She found that no single mineralogical variable, or cluster of variables, sets them firmly apart from other specimens. Nor are the Plumbate or Nicoya sherds mineralogically identical within each type. For example, Nicoya is generally characterized by unusally low amphibole, but one of the nine specimens had amphibole proportions within the range of other specimens; nor is unusually low amphibole limited to the Nicoya specimens, although only five other specimens fall in the same range.

What does characterize the Plumbate and Nicoya specimens, as opposed to others, is a higher frequency of mineralogical attributes that are infrequent or rare in the total sample.

The Nicoya sherds tend to have primary quartz (present in six of nine specimens); they all have alkalai feldspar, and seven of the nine have high alkalai feldspar; three have epidote alterations; two have high pumice glass and one has low pumice glass; none have high amphibole and eight of the nine have very low amphibole; three have low plagioclase.

One support (Sample #20) was included in the sample because it had the typical talcum powder feel of Nicoya but the paste seemed "local" or at least atypical for Nicoya. It shares with the other Nicoya the low amphibole, and like #19, has epidote alteration. It lacks the low plagioclase of some specimens. The evidence is inconclusive, but we are inclined to accept it as an import and as Nicoya.

Plumbate sherds are most distinctive in that all six sherds have high amphibole. One has quartz, two have high pumice glass and two have chlorite alteration.

Together, these two types account for seven of 15 occurrences of primary quartz, two of six specimens believed to have rhyodacite derived temper, 10 of 11 instances of very high alkalai feldspar, the only instance of recognizable biotite, two of 19 cases of chlorite alteration and one of seven cases of epidote alteration.

In the end, Stout used her knowledge about the classification of these sherds in combination with the high incidence of infrequent or rare mineralogical attributes to decide that these two groups of sherds could legitimately be set apart from all others in the sample.

Other specimens: Stout was unwilling to create further partitions of the specimens on the grounds that there were no consistent correlations of proportions of the major mineral groups or of the occurrence of rare and infrequent minerals that would allow her to designate different raw materials with any degree of certainty. She felt that several different although closely related parent rocks were being used and she suspected that the picture was complicated by mixing of materials from different rocks.

Further Analysis

At this point, we reintroduced the information that had been withheld from the mineralogist in the interest of objectivity: the classification categories to which the specimen was assigned. We then looked at 1) the distribution of rare and infrequent mineral occurrences across the classification categories, and 2) internal mineralogical variability or consistency within the categories. To do this, we had to decide what constituted rare and infrequent occurrences and what was fairly standard. Since we are dealing with ranges of variation in the major mineral groups, the cut off points between "standard" and infrequent were somewhat arbitrary. We are on somewhat firmer ground with the other minerals such as primary quartz.

Mineralogical Distribution: An unremarkable specimen would have the following characteristics:

- Inclusions derived from dacite (found in 96 of 100 specimens).
- Low to no alkalai feldspar (true of 87 to 100 specimens).
- Some pyroxene (hypersthene only - found in 15; augite only - found in 46; both - found in 34)
- Medium pumice glass (found in 59 of 100 specimens)
- Medium plagioclase (found in 85 of 100 specimens)
- Medium amphibole (found in 77 of 100 specimens)
- No epidote alteration (found in 7 of 100 specimens)
- No chlorite alteration (found in 19 of 100 specimens)
- No primary quartz (found in 15 of 100 specimens)
- No mica (found in 1 of 100 specimens)

Looking first at the rare and infrequent occurrences relative to classification categories, we wanted to see if clusterings could be found:

1. **Primary quartz:** N = 15. Of these, six are Nicoya (#'s 1, 2, 3, 5, 17, 18), one is Plumbate (#8), one is an otherwise unremarkable tan or terracotta sherd (#22), one is a Black-on-Red Bowl (#23), one is white or white polychrome (347), two are polished brown (#74 and 92), one is a Tamulasco strap handle (#85), one is a red slipped, fine paste sherd believed to be imported (#68) and one is unclassified (#83). Although 8 of the 15 are believed to be imported, the others, believed to be "local", belong to several categories.

2. **Epidote alteration:** N = 7. Three are Nicoya (#1,19,20), one is the leg of a wheeled figurine (#14), one is a Tamulasco comal handle (#60), one is Cachinflin Black (#71) and one is unclassified (#80). This mineral is not significant in terms of identifying parent rocks, since it normally derives from pyroxene. However, this alteration, which results from weathering, may be useful in terms of distinguishing particular sources of raw materials. Even in the same deposit, deeper, unweathered rock would probably not show this alteration.

3. **Chlorite alteration:** N = 19. Two are Nicoya (#4,5), two Plumbate (#9,10), two benches of seated figurines (#12,16), one leg of wheeled figurine (#14), one figurine foot (#15), one spindle whorl (#13), one Red-on-Tan rim (#21), one red polychrome (#33), two Tamulasco (#66,99), two white or white polychrome (#67,70), one Peralta (#75) and three unclassified (#80,89,100). As in the case of epidote alteration, chlorite alteration is not useful in identifying parent rocks but

may indicate particular sources subject to weathering.

4. **Alkalai Feldspar:** N = 11. Eleven sherds have 5-15% alkalai feldspar. Of these, seven are Nicoya (#1,2,3,4,5,17,19), three are Plumbate (#6,7,10) and the other is the Red-on-Tan rim noted above (#21). All Nicoya, in fact, have alkalai feldspar which is, for most other specimens, low or absent.

5. **Absence of Pyroxene:** N = 5. These are the spindle whorl (#13), three sherds believed to be imported (#34,35,64) and a polished black (Cachinflin) (#40).

6. **High Plagioclase** (30-40%): N = 11. These are one polished brown (#43), one Red-on-Tan (#78), the drain pipe (#53), two thick Coarse Ware or Las Lajas vessel sherds (#76,77), two Tamulasco (#38,88) and four unclassified (#25, 42, 79, 97).

7. **Very low Plagioclase** (1-8%): N = 4. Three are Nicoya (#17,18,19) and one is the polychrome zoned incised believed to be imported (#31).

8. **High Amphibole** (1-5%) N = 10. Six are Plumbate, (#6,7,8,9,10,11), one is the leg of the wheeled figurine (#14), one is red polychrome (Bandera) (#29), one is white or white polychrome (Zancudo) (#30) and one is unclassified (#42).

9. **Very low Amphibole:** <1%. N = 13. Eight are Nicoya (#1, 2, 3, 4, 5, 17, 19, 20), one the Red-on-Tan rim noted above (#21), one is white or white polychrome (#24), one is polished brown (#57), one is Garcia Red (#94) and one unclassified (#96).

From the above, it can be seen that certain "types" and certain specimens recur more frequently than others, but, at the same time, several classification categories are represented in each infrequent or rare mineralogical listing.

The next step in trying to make sense of the petrographic analysis was to see if certain rare and infrequent mineralogical attributes co-occur with each other. The more significant co-occurrences are:

1. Quartz (N=15) with Alkalai Feldspar (5) and Low Amphibole (5) (all Nicoya).

2. Rhyodacite origin (N=6) is determined primarily on absence or very low amounts of pyroxene. However, all six specimens also show very high pumice glass (Nicoya: #18,19; presumed imports #34,39,68; Black Cachinflin #40).

3. Low Amphibole (N=13) co-occurs in eight specimens with Alkalai feldspar (seven are Nicoya; one is the Red-on-Tan rim #21).

Other co-occurrences are not as significant.

Mineralogy of Classification Categories

Another approach is to order the data by classification categories and/or on subjective grounds, and to see how these are characterized in their mineralogical profiles. Plumbate and Nicoya will not be discussed again, except to note that they display a higher incidence of rare and unusual traits than any other group. In the Nicoya, one sherd (#19) shows six rare and infrequent characteristics (the record in this sample), three sherds show four infrequent characteristics, three sherds show three, and one sherd (#20) has only two. Among the Plumbates, one sherd shows four infrequent characteristics, one sherd shows three, three show two and one (#11) shows only one.

The following discussion uses only some of the data provided in Appendix II. This sort of analysis could be extended to cover more limited ranges of mineral proportions, and, for example, whether hypersthene or augite was the pyroxene represented - or both. For the present, the less common characteristics show more promise.

Four sherds (#28,31,39 and 68) appear to be macroscopically similar in having a fine soft paste and in being either red slipped or having zoned incision (see #7 in Unclassified in San Dieguito Ceramics, Chapter 3). These are not mineralogically uniform, but the individual sherds appear on several short lists of rare and infrequent characteristics: one has quartz (#68), all four have 30% or more pumice glass, two have no pyroxene (#9,68) and these same two are believed to have temper derived from a rhyodacite source. Specimen #68 therefore shows three rare or infrequent characteristics, #39 shows two, and #28 and #31 show only one. As a group defined on macroscopic grounds, they do seem to stand apart from other groupings. The mineralogical record supports the view that they do not belong to the locally produced pottery assemblage.

Specimen #34 was, on macroscopic and stylistic grounds, believed to be imported (see #6 in Unclassified, San Dieguito Ceramics, Chapter 3). Some mineralogical support for this view is seen in the absence of pyroxene and a probable rhyodacite source of the temper. Another sherd (#35), thought to be an undecorated sherd of the same type, turns out to have a non-distinctive mineral profile.

Specimens #22 and 91 were included in the sample as possible imports because of their unusual hardness and bright terracotta and orange colors. The former has primary quartz; the latter possesses no distinguishing characteristics.

Only two Red-on-Tan specimens were included in the sample (#21 and 78); both were assumed to be "local". Specimen #21 is the only one, other than Plumbate and Nicoya, with high alkalai feldspar; it also shows very low amphibole and chlorite alteration (i.e., it has three of the rare or infrequent traits). It certainly falls outside the normal range, but it is unclear what this means. The other Red-on-Tan specimen (#78) is distinguished by having high plagioclase.

Only two polished black or Cachinflin sherds were included (#40 and 71). The former has no pyroxene, is believed to have temper derived from rhyodacite, and has 40% pumice glass. Specimen #71 shows epidote alteration.

Six polished brown sherds (Peralta in Fowler's old classification and brown Cachinflin in his latest classification) were included (#43, 44, 57, 74, 75 and 92). Two of these have primary quartz (#74 and 92), one has high plagioclase (#43), one has chlorite alteration (#75) and one has very low amphibole (#57). Five of the six (or 83%) exhibit one infrequent characteristic and only one is unremarkable. This is a very high proportion of out-of-the- ordinary characteristics for a ceramic category assumed to be "local", or, to put it another way, the internal variability is high. The small sample size must, of course, be remembered.

The six white or white polychromes (#24, 30, 38, 47, 67 and 70) are as internally diverse as the polished browns. Infrequent characteristics include two that show chlorite alteration (#67 and 70), one with high amphibole (#30), one with low amphibole (#24), two with high pumice glass (#24,47), and one with primary quartz (#47). Two of the six (#24 and 47) show two of the infrequent characteristics, three (#30,67 and 70) show two, and only one is unremarkable (#38). As a group, there is a substantial amount of variability.

Red background polychromes (Jejen Polychrome in Fowler's classification) (#29, 32, 33, 37 and 51) showed considerably less internal diversity than the groups discussed above. Infrequent characteristics represented include one with high amphibole (#29), and one with chlorite alteration (#33). Three of the five (or

60% of the small sample) are unremarkable. Since we deliberately selected sherds to represent both Bandera Polychrome (#20), the "codex" style of painting (#37), and the tulip shaped vessels (#51), as well as two that can only be described as red background polychromes (#32 and 33), this mineralogical overlap with the majority of specimens represented in the sample is noteworthy. This tends to support Fowler's (1981:205-206) arguments that this group belongs to the locally produced assemblage.

Red-slipped or Garcia Red sherds, (#45, 46, 48, 49, 54, 65, 87 and 94) show considerably less internal variability. Two (#45,65) have high pumice glass (20-35%) and one (#94) shows low amphibole. The other five (or 63%) are quite ordinary.

The Plain pottery (Tamulasco) was represented by 16 sherds (#52, 58, 59, 60, 61, 63, 64, 66, 69, 72, 85, 86, 88, 93 and 99), and it is highly likely that most described below as "Unclassified" also belong here. Infrequent characteristics represented are: two have high plagioclase (#58 and 88), three have high pumice glass (#85, 88 and 99), one has chlorite alteration (#66), one has primary quartz (#85) and one has epidote alteration (#60). Two specimens, then, show two infrequent characteristics (#85 and 88), and three show one (#58, 66, and 99). The other 10 specimens (or 62%) are within the "ordinary" range.

The one sherd of *Fondo Sellado*, in the sample (#26), defined exclusively on the basis of having an impressed design in the basal interior, is non-distinctive, fitting in well with the Tamulasco Plain in its mineralogical profile.

The group of specimens assigned to the Coarse or Las Lajas category on the basis of form are particularly interesting in their mineralogical makeup. The group includes the following:

- 1 drain pipe fragment (#55)
- 2 thick sherds (#76,77)
- 2 benches of seated figurines (#12,16)
- 1 wheeled figurine leg (#14)
- 1 figurine foot (#15)
- 1 spindle whorl (#13)
- 4 fillet applique rims (#55,56,73,82)

The four fillet applique rims stand apart from the others, with three showing no infrequent characteristics and one (#55) having 25% pumice glass. As a sub-set of the Las Lajas category, these belong to the "normal" range and fit in very nicely with the Tamulasco Plain. The other specimens, however, seem to be distinctive. The drain pipe (#53) has high plagioclase as do the two very thick sherds (#76 and 77), and these seem to form a second sub-set within the group.

The other five specimens are from figurines and a spindle whorl, all made at least partly by modeling. All five show chlorite alteration. In addition, the spindle whorl (#13) has no pyroxene, and the wheeled figurine leg (#14) shows high amphibole and epidote alteration. That all five specimens show at least one infrequent characteristic, one (#13) shows two, and one (#14) shows three, is most intriguing. This suggests that special raw materials were used for ceramic objects other than vessels. Whether this has a basis in technique of manufacture (modeling), in specialized "local" manufacture, or even in importation of this class of objects is not clear. However, as a group, all specimens show a higher incidence of chlorite and epidote alteration than any other "local" group, indicating, within the limits of the sample represented, that weathered ash or tuff was being systematically selected.

The Las Lajas or Coarse Ware group, then, appears to have some significant subdivisions. If these should continue to hold up after further testing, it would seem reasonable for these differences to be reflected in revision of the classification category.

The remaining group of 19 sherds (#25, 27, 36, 41, 42, 50, 62, 79, 80, 81, 83, 84, 89, 90, 95, 96, 97, 98 and 100) are either eroded or are nondescript. They are designated as "Unclassified". Infrequent characteristics present in this group are: four have high plagioclase (#25, 42, 79 and 97), one has amphibole (#42), one has very low amphibole (#96), one shows epidote alteration (#80), two show chlorite alteration (#80, 89 and 100) and one has primary quartz (#83). Two sherds (#42 and 80) show two infrequent characteristics, while seven show single infrequent characteristics. The other 10 specimens (or 52%) are unremarkable. Most of these fit within the "normal" or "ordinary" range and could be Tamulasco and/or Garcia Red.

Possible Geological Sources of Temper Inclusions

Working with published geological information (especially Williams and Meyer-Abich 1955), we note that the nearby Guazapa volcano with its (primarily) olivine-rich basalt flows is unlikely to have ejected the ash or tuff used as temper. Coatepeque cones were built of andesitic, basaltic and dacite flows and pyroclastic ejects; subsequent explosions consisted of pumice and ash. Boqueron, also built of andesitic and basaltic flows, later erupted extensive dacite pumice consisting mainly of pumice glass in which the most abundant mineral is plagioclase (at 35-55%), followed by hornblende, hypersthene, augite and magnetite in decreasing amounts (all much less than the plagioclase). Near the Guatemalan border there are extensive hornblende-biotite rhyolites. We have no information about the geographical area covered by ash falls from the various volcanoes, but Boqueron and Coatepeque ash presumably reached the Cihuatán area and were probably locally available. Thick ash deposits are exposed in the banks of the Acelhuate River and elsewhere, but we unfortunately did not take samples for comparative purposes. If heavier rock or tuff was the temper source, it would probably have had to be acquired from nearer the volcanoes that produced dacite and rhyodacite ejections.

Although the tempering materials or non-clay inclusions cannot be directly correlated with published information about volcanic sources (and we very much regret that we did not have a minerologist with us in the field), the minerals found in the specimens can be accounted for within El Salvador and Guatemala, but are not limited to those areas. It is possible that "local" high plagioclase specimens incorporated Boqueron ash. Ash from Boqueron and Coatepeque (either separately or mixed) could account for a large percentage of the tempering materials.

Discussion of Petrographic Results

Methodologically, it is interesting that the mineralogist was unable to suggest meaningful partitions of the sample when the entire sample was seen as an unsegregated universe. The considerable amount of variation did not show consistent patterns of the sort that a mineralogist could recognize with any assurance. Even the Nicoya and Plumbate, the most distinctive groupings, might have been regarded as part of what appeared to be an amorphous sample without the classification data. Our attempt at objectivity (to be achieved through *not* influencing the analyst with the archaeologists' views of categories within the sample) produced a dead-end. Had there been marked mineralogical differences denoting rocks of recognizably different geological origins, such a "blind" approach to analysis would have provided a useful check on other ways of ordering the data. When all specimens are variations-on-a-theme of volcanic ash or tuff inclusions, this approach was definitely counter-productive.

With regard to the three questions posed at the beginning of this chapter, the "answers" are at best indefinite. There are no tight correlations between classification categories and mineralogical profile. We cannot say, for example, that the white group shows a distinctive mineral which is unique to that group. Therefore, in answer to the question: "Do mineral differences correspond with classified groups of sherds?", the answer must be: not in any straight forward or unambiguous way.

The second question is "can mineralogical information aid in recognizing localized or specialized production of pottery?" In framing this question, we had hoped that significant correlations of ceramics categories with certain mineralogical characteristics might emerge, if so, we would have felt justified in suggesting that Zancudo White, say, was probably manufactured in one place. Such simplistic expectations were clearly misguided, as is discussed more fully below. In a different vein, we are unsure whether or not the mineralogical information will help in identifying centers of ceramic production, but future geological field work combined with these results might eventually yield useful results.

The third question, "Can imported pottery be differentiated from local pottery?", receives a mixed "yes" and "no". Mineralogical information gives support to inferences derived from macroscopic and stylistic information. Having already identified Plumbate, Nicoya and a few other sherds as undoubted or possible imports, the mineralogical information *for these sherds* can then be evaluated and arguments can be offered. Without the external reasons for segregating these sherds, it would have been more difficult to identify them or to argue their imported status. There are other sherds that we had no macroscopic or stylistic reasons to segregate which show several of the presumably more diagnostic rare and infrequent minerals. Some of these may be imported but we lack the additional information that would provide justification for making such a claim. At this stage of the analysis, nothing could be said about factors of production and distribution beyond what is implied for the third question.

Throughout this monograph, the term "local" has been used – the connotation being that "local" pottery was produced within the region (undefined), perhaps at Cihuatán. In contrast, imported pottery was seen as coming from some distance away, and from outside the geographical area producing the "local" assemblage. This kind of dichotomy is simplistic both in its design and in its theoretical base; it can be justified only as reflecting the unsatisfactory state of our data base at the present time.

Judging from Fowler's (1981:126) petrographic analysis of 20 sherds drawn from both Cihuatán and Santa María, "local" must be interpreted as encompassing at least the lower Acelhuate valley and adjacent zones of the Lempa Valley, because sherds from the two sites could not be separated on mineralogical grounds. Also, the same classification categories and forms occur in both sites in, apparently, much the same frequencies.

Within the "local" pottery, it is fairly hopeless to try to identify particular sources of raw materials without detailed comparative geological data. Furthermore, there is a possibility that rock sources were being mixed; the variability of mineral profiles is pronounced. For these resons, we abandoned our attempt to segregate the sample by temper categories that might reflect raw material sources, taking another approach - with some unexpected results which have implications for the fourth question about production and distribution.

We began by ignoring the actual mineral involved in the rare and infrequent occurrences, i.e. whether it was high amphibole or quartz or whatever. Instead, we simply viewed them as generic additions to the "standard", "ordinary", "unremarkable" base. The number of additions for specimens in each category was then determined. The results of this simplistic approach are tabulated in several forms in Table 10. In spite of the obvious problems (totally inadequate sample size within several categories, uneven representation, the perhaps unjustified inclusion of the unclassified group, the loss of identity for the rare and infrequent characteristics, collapsing of the mineralogical variability represented, incomplete use of mineralogical data), the findings are worth considering. Although we had all of this information in other contexts, this particular patterning of the data escaped us until it was tabulated in this form.

What emerges is that the specimens from the "local" assemblage fall into two distinct groups on the basis of number of specimens showing the rare and infrequent characteristics. The first group consists of Tamulasco Plain, the single sherd of *Fondo Sellado* (which is Tamulasco Plain with a basal impressed design), Garcia Red, the red-background polychromes (Fowler's Jejen group), and the Las Lajas Fillet applique rims. None of the specimens in this group have three rare or infrequent characteristics, although two categories (one

Table 10

Frequencies of Rare Mineralogical Characteristics for Selected Classification Categories and by Two Arbitrary Groupings

Table 10A

Number of Specimens with Rare Characteristics (percentages in brackets)

Group 1					Group 2				
	Number of Rare Characteristics					Number of Rare Characteristics			
Category	3	2	1	0	Category	3	2	1	0
Tamulasco Plain N=15		2(13)	5(33)	8(53)	Black Cachinflin N=2	1(50)		1(50)	
Fondo Sellado N=1				1(100)	Brown Cachinflin N=6			5(83)	1(13)
Garcia Red N=8			3(37)	5(63)	Red-on-Tan N=2	1(50)		1(50)	
Unclassified N=19		1(5)	8(42)	10(53)	Whites (Zancudo) N=6		2(33)	3(50)	1(16)
Red-background N=5 Polychrome			2(40)	3(60)	Black-on-Red N=1			1(100)	
					Las Lajas Modeled N=5	1(20)	1(20)	3(60)	
Las Lajas Fillet Rim N=4			1(25)	3(75)	Las Lajas Thick Walled (including drain pipe) N=3			3(100)	

Table 10B (as a % with that many characteristics)

# of rare characteristics	Combined Group #1 (N=52)	Combined Group #2 (N=25)
3		3(100)
2	3(50)	3(50)
1	19(53)	17(47)
0	30(94)	2(6)

Table 10C (as a % of the group N)

# of rare characteristics	Combined Group #1 (N=52)	Combined Group #2 (N=25)
3	0(0)	3(12)
2	3(5)	3(12)
1	19(36)	17(68)
0	30(58)	2(8)

being Unclassified) have specimens with two rare or infrequent characteristics. If the *Fondo Sellado* is combined with Tamulasco, then all categories in Group 1 have specimens with one infrequent characteristic. In every category, more than 50% of the sherds are unremarkable (i.e. have no "additions"). Local sherds assigned to Group 2 consistently have more "additions" and fewer unremarkable sherds (cf. Table 10A).

The two groups are clearly not mutually exclusive, but whether comparisons are made between individual classification categories or between the two major groups, significant differences are apparent (cf. Table 10B and 10C). Group 1 is more homogeneous, having a lower frequency of "additions" than Group 2, while the latter exhibits much greater variability.

Assuming we have not been misled by the problems inherent in this ordering of the data, the patterning can be viewed as bimodal or as polar extremes of a continuum. What this means is unclear, but we cautiously suggest that the differences are related to production and distribution patterns within what must have been a complex system. The numerically dominant categories in the total "local" assemblage (Tamulasco Plain and Garcia Red) seem to be the core of one system of production and distribution while the minor categories of Group 2 were, we would argue, produced and distributed in another way.

The comparatively greater homogeneity of Group 1 can be interpreted in several conflicting ways, and at the moment we lack information that would allow us to select one of the alternatives as more likely than the others. One possibility is that perhaps 50 - 70% of the most common vessels in use at Cihuatán and Santa María were mass produced. A few manufacturing centers using the same or similar sources for raw materials could account for the degree of homogeneity (or level of variability). This implies specialists producing for household consumption in a market exchange context. Although we are comfortable with the idea of specialization on this scale at Cihuatán, we feel this is something to be carefully evaluated and tested rather than assumed. Alternatively, the opposite extreme of household manufacture and use for the dominant vessels used is not impossible. In this case, one must account for the degree of homogeneity by assuming access to the same or similar sources of raw materials. Or, perhaps raw materials were acquired by specialists or a limited number of individuals who dispersed these raw materials to individual potters through some exchange mechanism. Functional reasons for using certain temper inclusions or combinations of tempering materials would reflect manufacturing patterns but not necessarily distribution patterns.

The variability of Group 2 implies to us that a different kind of specialization was operative from that seen in Group 1. All categories represented in Group 2 are minor in terms of absolute number of vessels being produced compared to the numerically dominant Tamulasco Plain and Garcia Red. If each classification category was coming from a single manufacturing locale, we would expect greater internal consistency in their mineralogical profiles. If they were being produced along with Garcia Red and Tamulasco, we would expect the mineralogical profiles to overlap more - unless there are unperceived functional reasons for the use of more "additions". We are inclined to interpret Group 2 as reflecting small scale specialization. By this we mean the volume of production in each minor category was on a much more modest scale than was the case for Tamulasco Plain or Garcia Red, and fewer specialists would be required. Variability in the mineralogical profiles suggests that these potters were not centralized.

Still other alternatives could be proposed, but further speculation at this level would serve no useful purpose. What is important here is that unexpected patterning has emerged from one

Table 11

Semi-quantified Estimates of Clay Minerals

Specimen	Kaolin	Illite	Chlorite	Montmorillinite	Mixed Layers
31	?	Trace?	3	3	Present
40	0	Trace?	1.5	1.5	?
46	0	Trace?	?	2	Present
49	0	0	0	0	0
66	4	6	2	Trace	0
69	Trace	2.5	1.5	2	?
74	0	0	1.5	1.5	0
86	4	Trace	?	1.5	?
101	?	3 or 4	2	2	?
103	3	5	3	2	Present

approach to the mineralogical information. This patterning raises new directions of inquiry and demonstrates that our initial problem formulation was overly simplistic. Should this patterning hold up under more extensive testing, some of the alternatives can be tested. A study that combines mineralogical considerations with other ceramic attributes such as Rice's (1980) study of Postclassic production and exchange in the Peten would be extremely useful.

To move to another level of speculation, our feeling, based on both the mineralogical investigation and other aspects of the ceramic analysis, is that ceramic production and distribution was extremely complex. Although some household manufacture and use must have occurred, we don't see this as a major component of the total system. The scale of the postulated exchange network is completely unclear, but we are willing to consider parts of the region of the lower Acelhuate and Upper Lempa as being differentially involved. Within this, pottery must have been made at Cihuatán and Santa María since both were major centers, but it may also have been produced at smaller and/or other archaeologically unidentified sites. On a cost/benefit or efficiency basis, it seems reasonable to assume that the bulk of the pottery used at Cihuatán was produced at the site or nearby. This may prove not to be the case. Several kinds and scales of exchange were undoubtedly operative.

X-Ray Diffraction

A second analytical procedure was undertaken primarily to obtain information on clay minerals since these cannot be identified in petrographic analysis. We also wanted to double check the petrographic mineralogical identifications and to see if other and perhaps more diagnostic non-clay minerals could be identified.

A total of 46 specimens were selected; 37 are from the petrographic sample and 9 others were added. Specimens numbered between 1 - 100 refer to specimens with the same numbers in the petrographic analysis. Numbers 101-109 were not included in that analysis. Each sample was manually ground until the entire sample passed through a 350 mesh sieve.

Samples were loose packed into a rectangular holder for diffraction in order to minimize preferred orientation. Samples were prepared and run by David Harvey, Department of Geology, University of Calgary, and jointly analyzed by Harvey and Stout.

The most interesting difference between the petrographic and X-ray diffraction results is that the latter showed quartz peaks for every specimen. Rechecking of the petrographic thin-sections made it clear that secondary quartz was actually a major component of all specimens. Stout had included all secondary minerals resulting from infilling of pumice glass in the pumice glass column of Appendix II, including both quartz and feldspar. In X-ray diffraction, primary quartz is not distinguishable from secondary quartz. The specimens earlier identified as containing primary quartz in the petrographic analysis could not be distinguished from the others on the basis of peak height or peak intensity in the diffraction results.

Nine samples had more quartz than any other mineral, while feldspar was the dominant mineral in all others. The analysts felt the amount of a mineral might prove to be useful in identifying particular sources of raw material in the event that ash or tuff sources of markedly different ages were locally available. There was not a great deal of difference in peak intensity across the samples, however.

Aside from the quartz problem, X-ray diffraction for six specimens showed minor peaks identified by Harvey as mica or illite. Stout found only one grain of identifiable mica in 100 thin sections. Illite belongs to the mica group of minerals, and this partly explains the apparent greater showing of mica on the diffraction results. However, clay sized mica particles other than illite would not be detectable microscopically. Also, thin sections are one slice through a specimen, whereas the powdered sample contains more parts of the specimen, and extremely low frequency minerals may simply have been missed in thin-sectioning. A re-examination of the matching thin sections for the specimens showing peak intensity in the mica group reveals no microscopically identifiable mica.

It is difficult to compare directly and in detail the results of X-ray diffraction and petrographic analysis, as the above discussion of quartz and mica indicates. More generally, results of the two procedures seem to be mutually reinforcing. Our hope that some and distinctive signature mineral would be recognized in the x-ray diffraction analysis did not materialize.

Surprisingly little clay showed on the X-ray patterns. Some specimens showed no recognizable clay peaks at all. Ten specimens showing evidence of clay in the first diffraction group were chosen for further clay analysis.

The powdered samples were placed in distilled water and decanted according to a time-distance formula for the settling of different particular sizes. The clay sized particles were removed to a glass slide and allowed to air dry overnight before being glycolated - a procedure that expands the clay by filling in the lattices. Diffraction, limited to the clay portion of the spectrum, was run at 2 degrees per minute (i.e. at the same rate as the first group of samples). So little clay was apparent that Harvey felt further analysis (heat treatments, for example) would be unprofitable.

On all samples, there is a fair amount of background noise in this part of the spectrum which Harvey feels is more than just electronic. He suspects minor amounts of mixed layered clays. Small sample size and minor amounts prevent further refinement. Peak intensity is low for all clays on all samples. Indeed, identifiable clays range from roughly 3% to 12 or 14% of the total specimen. Rough, semi-quantified estimates of clay minerals in the samples are given in Table 11. Since peak height is not a true reflection of amount, the figures given have been factored to give approximate equivalence between the clay groups in terms of amount identified.

We suspect that clay sources available to potters contained very mixed clay minerals; deliberate mixing of clays is also possible. The apparent absence of kaolin may reflect firing temperature as the kaolinites lose their crystalline structure at lower temperatures than other clays.

The temperatures at which clays lose their structure actually varies a great deal, as Shepard (1965:20) notes. In Geology Technical Services at the University of Calgary, they find that kaolin collapses at about 550° C in 30 minutes. It will collapse at 500°C over a period of one to two hours, and with still longer heating, the collapse point can occur at even lower temperatures. Firing procedures during the Postclassic period in El Salvador are unknown, but we assume less even heat distribution than in the Geology Department ovens, and longer heating periods. It is not unreasonable to assume effective firing temperatures ranging from ca. 450°C (or even lower) to perhaps 600°C, judging from the clay minerals that have not lost their structure in the analyzed samples. Specimens #66, 87 and 103 still retain kaolin and presumably were fired at under 500°C or, more likely, at under 450°C or 475°C for a longer period. Specimen 49, on the other hand, retains no crystalline clay minerals, suggesting that temperatures of approximately 600°C (or lower for a longer period) were achieved for the montmorillinite to have lost its structure, assuming it was once present. Specimens #31, 40, 46 and 74 have no kaolin and little or no illite, but retain chlorite and/or montmorillinite, suggesting in-between firing temperatures.

How Much Clay?

Neither X-ray diffraction nor petrographic analysis can provide useful information on clay minerals that have lost their crystalline structure. In the petrographic analysis, Stout gave proportions of visible inclusions present in each thin section. These non-clay inclusions range from roughly 30% to 70% of the total area. From X-ray diffraction, we know that non-clay inclusions occur in smaller particle sizes than are visible in a petrographic microscope. It begins to look as though some of the "local" pottery contained remarkably little clay. In the most extreme cases, the clay might have made up only 20-30% of the fabric. This may help explain why the "local" pottery is so liable to losing its finish.

Summary

In retrospect, a very important omission from our field staff was a mineralogist or a geologist familiar with regional volcanics. The technical analyses that were carried out as part of our project failed to identify distinctive signature minerals of the sort that would be intrinsically the most satisfying in terms of identifying localized production centers of pottery manufacture. The analyses provides new ways of looking at the pottery from Cihuatán which allows us to create hypotheses about multiple forms of ceramic production that hopefully will be adequately tested in the future.

CHAPTER 6

STONE ARTIFACTS FROM SAN DIEGUITO

Stone artifacts provide information on implements used for a variety of purposes and, in the case of obsidian, on production matters. The chipped stone collections were sufficiently large, and a large enough sample was included in the loan collections, for a fairly detailed analysis to be conducted. Ground stone objects were not included in the loan collections and so their treatment here is at the level of preliminary description.

Chipped Stone

The Study Sample

The analyzed collection of 9915 artifacts represents most of the chipped stone from the Structure 15-1 excavations, some of the pieces from the concentration of obsidian pieces near Structure 15-2, the obsidian from the tethered collections included in the loan collection related to Structure 15-1, and all the lithics from Structure 12-51. Additional but untabulated information comes from descriptive field notes of certain excavation units from the civic religious structure (12-1) and from photographs provided by Salvadoran authorities of artifacts removed from the loan collections.

Raw Materials

Obsidian was the heavily favored raw material. Of the analyzed collection; 9874 pieces are obsidian and only 41 are other materials such as chert, chalcedony and quartz.

Obsidian Sources

Trace-element analysis of 20 obsidian samples indicates that the Cihuatán obsidian comes from the El Chayal, Ixtepeque, and Rio Pixcaya sources in Guatemala (Fowler et al. 1987). Some implications derived from distance to the obsidian sources are discussed in Chapter 9.

Analysis of the Chipped Stone Artifacts (N=9915) in the Loan Collection

The following analysis was undertaken by William Fowler. The theoretical framework and analytical methodology follow those used in Fowler's (1981) dissertation which in turn is closely modeled on Sheets' (1975:1978) work dealing with chipped stone from Chalchuapa. Since one of the main goals of our project is the investigation of intrasite variability, it is entirely appropriate that detailed comparisons be made to Fowler's lithic remains from the Western

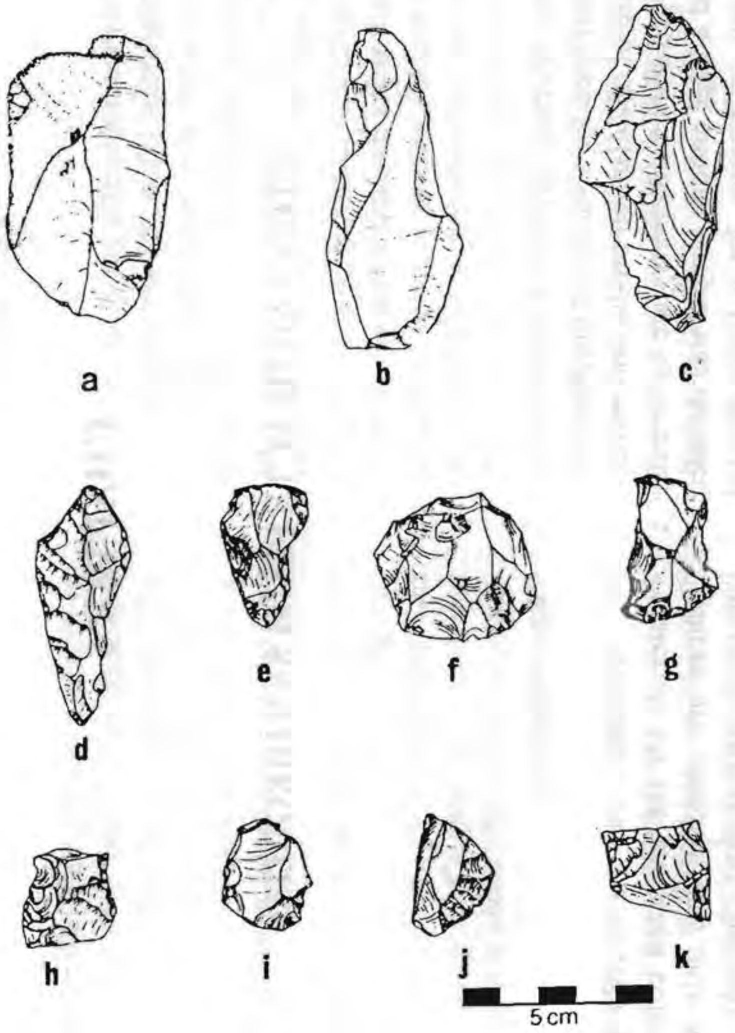


Figure 36. Obsidian
a-c. Large flakes; d-k. Worked flakes

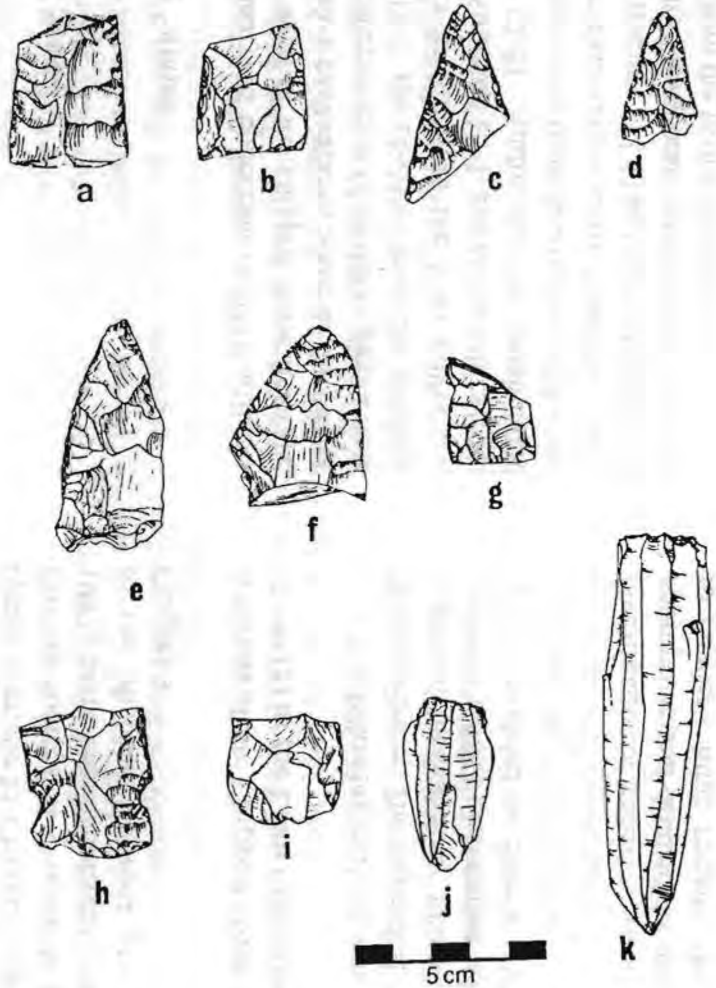


Figure 37. Obsidian Pieces
a-i. Obsidian bifaces; j,k. Polyhedral cores

Ceremonial Center, and that this be done within the same analytical framework and by the same investigator (see also Fowler et al. 1987).

Wastage: This category of artifacts includes all forms of debitage, or residual lithic material resulting from tool manufacture or from the unintentional breakage of chipped stone artifacts (Crabtree 1972:58). A total of 4,559 specimens (46% of the analyzed collection) were classified as wastage. The category is further subdivided into core-blade debitage (N=3,580; 36.2%), thinning flakes (N=967; 9.8%), and undifferentiated debitage (N=10; 0.1%). These totals include three pieces of core-blade debitage of chert, two chert thinning flakes, one piece of undifferentiated debitage of chalcedony, and seven of chert.

The frequency of wastage in the San Dieguito collection is much higher than that found in Fowler's previous analysis of Cihuatán chipped stone. In the latter, 1,685 pieces of wastage (10.8% of the total of 15,634 chipped stone artifacts analyzed) were recorded, including 1,544 specimens of general debitage (mostly core-blade) and 141 thinning flakes (Fowler 1981: 290-292). In both analyses, however, core-blade debitage strongly predominates over thinning flakes as the most frequent form of wastage.

Utilized Flakes: A total of 33 obsidian utilized flakes (0.3%) were tabulated for the San Dieguito collection. As in the previous analysis, utilized flakes appear to be relatively rare at Cihuatán (ibid: 294).

Macroblades: These are represented in the present analysis by 120 specimens (1.2%) (see Figure 39n - r), whereas in the previous analysis 523 (3.3%) were recorded (ibid.) The present analysis recognizes small percussion blades as a distinct type, while these were classified with macroblades in the previous analysis. The following are metric data for macroblades:

	SanDieguito Study	Previous[a] Study
Width:		
Mean	2.98 cm	2.64 cm
Standard Deviation	0.82	0.71
Number Measured	75	61.
Thickness:		
Mean	0.86 cm	0.77 cm
Standard Deviation	0.27	0.34
Number Measured	75.	61.
Flake Angle:		
Mean	87.8°	87.2°
Standard Deviation	3.6	5.7
Number Measured	36	52

a: from Fowler 1981: Table 6

Small Percussion Blades: Small blades removed from a polyhedral core during the final stages of core-shaping by percussion are referred to as "small percussion blades." Their size approximates that of large prismatic blades. Small percussion blades, like macroblades, are characterized by relatively large bulbs of force, compression rings, and frequently crushed platforms. Some small percussion blades were produced by shearing fractures, in which case the bulb of force is hardly discernable and prominent ripple marks extend the entire length of the axis of the blade on the ventral surface.

Metric Data for Small Percussion Blades

	Platform Length	Platform Width
Mean	0.99 cm	0.41 cm
Standard Deviation	0.22	0.09
Number Measured	11	11

	Blade Width	Blade Thickness
Mean	1.68 cm	0.42 cm
Standard Deviation	0.43	0.12
Number Measured	25	25

	Eraillure Length
Mean	1.11 cm
Standard Deviation	0.18
Number Measured	11

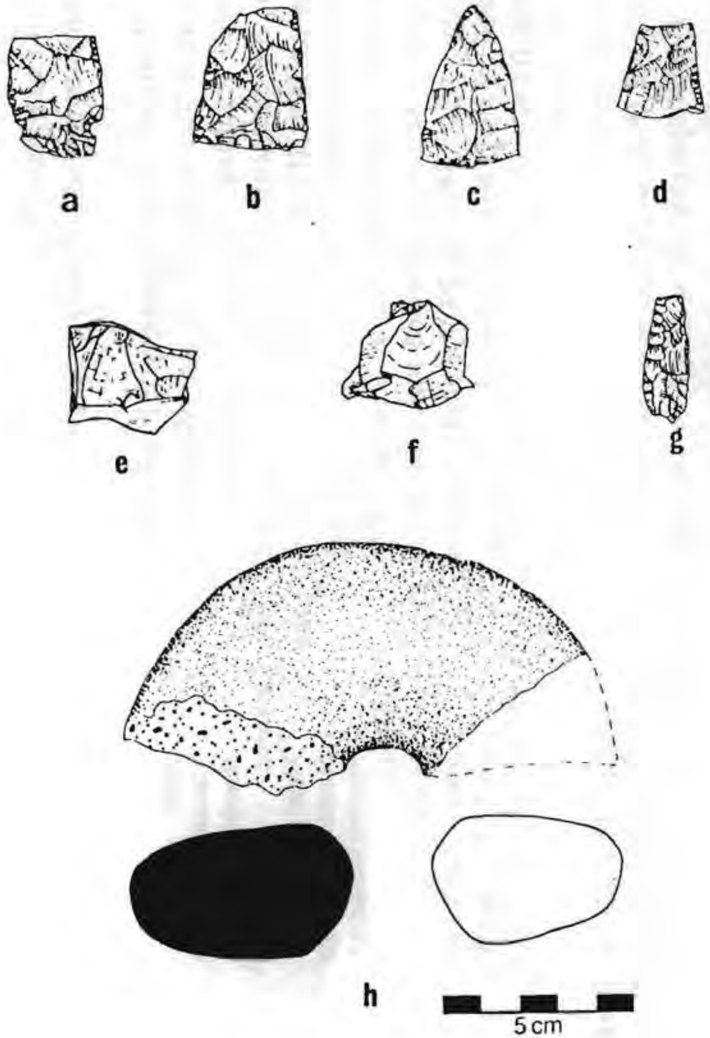


Figure 38. Chert Artifacts and "Doughnut" Stone
a,b,c,d,f,g. Chert bifaces; e,f. Amorphous cores; h. "Doughnut" stone

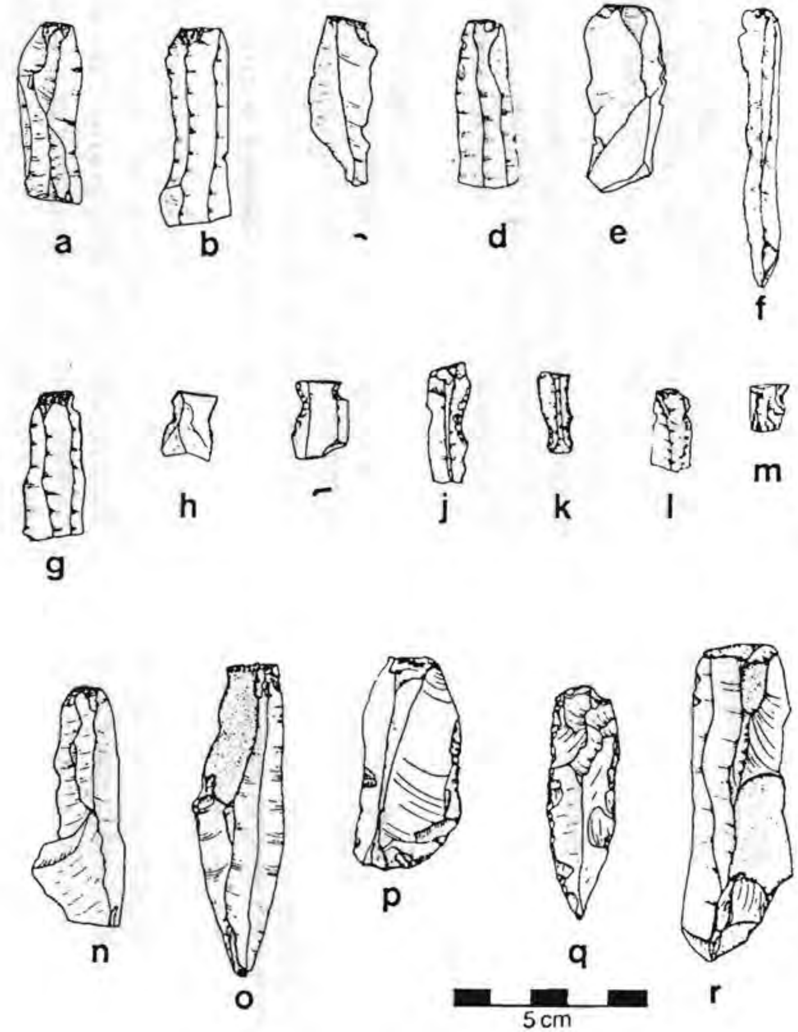


Figure 39. Obsidian Blades

A total of 257 small percussion blades were tabulated (2.6%). Twelve complete specimens range from 3.3 to 4.8 cm in length, with a mean of 4.05 cm, and a standard deviation of 0.41. Further metric data has been summarized on the previous page.

Prismatic Blades: Prismatic blades, probably produced by impulsive pressure, are the most frequently encountered chipped stone artifacts at Cihuatán. They are represented in the San Dieguito collection by 4,859 specimens (49.1%) (Figure 39a-m). Prismatic blades in the previous analysis accounted for 83.5% of all chipped stone artifacts analyzed from Cihuatán.

The lengths of four complete San Dieguito specimens measure 7.25, 7.1, 4.2, and 4.0 cm. Over 1,400 proximal segments were subjected to analysis of platform length and width, blade width and thickness,and eraillure length. For this preliminary report, the means and standard deviations of these variables were computed for 200 specimens. The results, compared with similar values from the previous analysis (Fowler 1981: Table 8), are summarized below:

	SanDieguito Study	Previous Study
Platform Length		
Mean	0.75 cm	0.84 cm
Standard Deviation	0.21	0.25
Number Measured	200	295
Platform Width:		
Mean	0.27 cm	0.31 cm
Standard Deviation	0.09	0.09
Number Measured	200	299
Blade Thickness:		
Mean	0.36 cm	0.37 cm
Standard Deviation	0.08	0.09
Number Measured	200	301
Eraillure Length:		
Mean	0.78 cm	0.81 cm
Standard Deviation	0.19	0.15
Number Measured	200	65

These attributes appear to show no significant variation between the two analyzed collections. It is worthy of note, however, that the two collections diverge slightly in mean platform length and width, and that these variables in the San Dieguito collection are more closely related to the mean platform length and width of specimens from the related site of Santa María (0.7 and 0.28) cm respectively) than those calculated in the previous Cihuatán analysis.

The mode and intensity of platform preparation and platform lip preparation were evaluated on 613 San Dieguito specimens. Heavy platform grinding is a common trait of prismatic blades of Postclassic Mesoamerica. A total of 532 specimens (86.8) had ground platforms, while 79 (12.9%) had striated platforms. Two specimens had plain or unprepared platforms. These ratios are quite similar to those of a sample of 410 prismatic blades from Cihuatán and Santa María studied in the previous analysis.

The technique of platform overhang removal on prismatic blades from San Dieguito was most often by light grinding (348) specimens, 56.8%. Medium grinding at the platform lip was observed on 196 specimens (32%), while heavy grinding was recorded for 42 specimens (6.9%). The platform overhang of five specimens (0.8%) had been removed by light flaking rather than grinding, and that of 22 specimens (3.6%) had not been removed at all. In the previous analysis 85.9% of the 410 prismatic blade specimens from Cihuatán and Santa María which were studied in detail showed grinding as the form of platform overhang removal. In the San Dieguito analysis this ratio is slightly higher with ground platform lips representing 95.7% of the 613 specimens for which this variable was studied. Like platform grinding, platform lip grinding to remove the platform overhang is a common Postclassic trait.

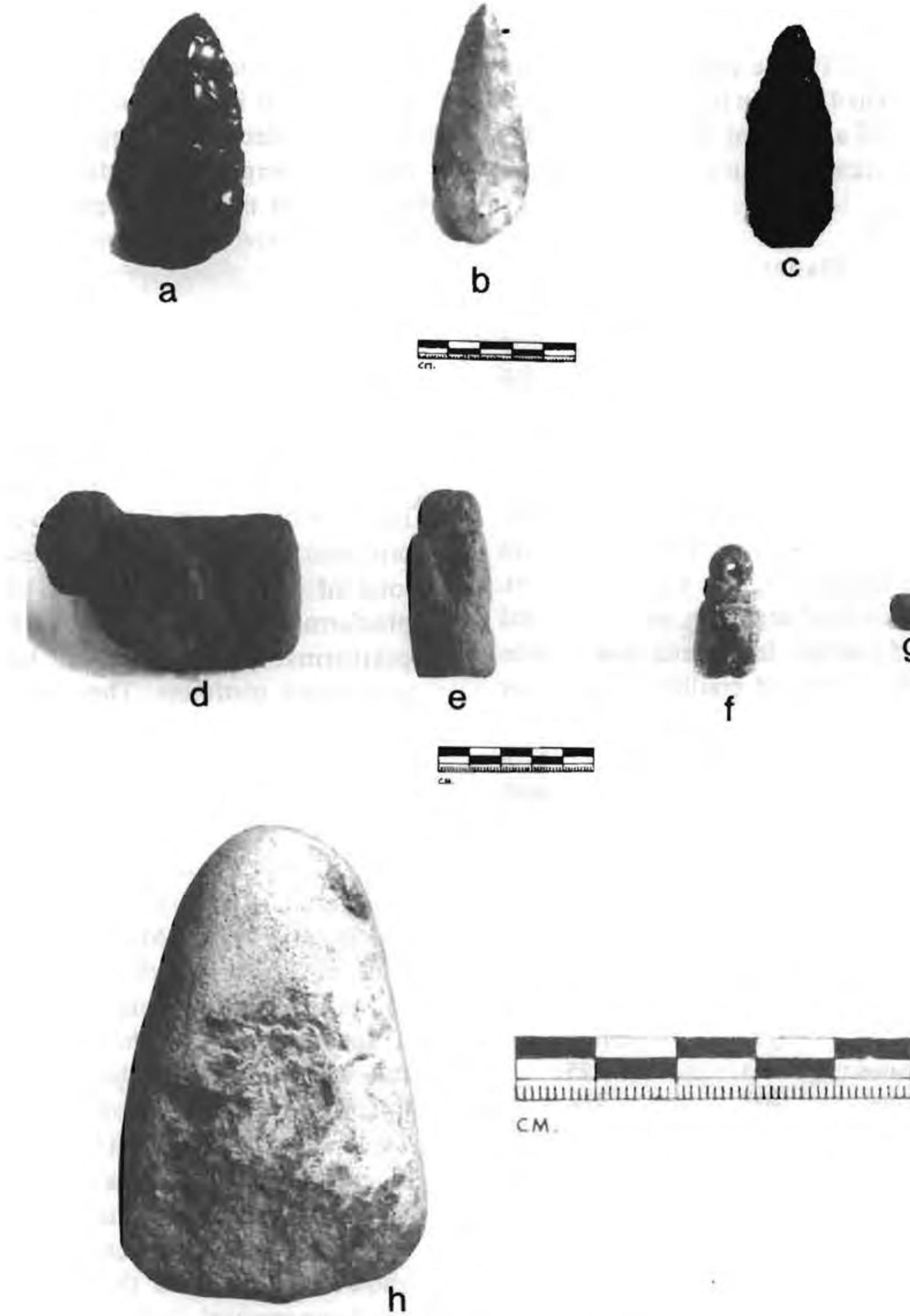


Plate 28. Miscellaneous Stone Items

a,b,c. Bifacial tools;

d,e. Two views of stone figure;

f. Cylindrical stone bead;

g. Stone bead;

h. Celt

The incidence of manufacturing errors recorded for San Dieguito prismatic blades is considerably higher than that noted in the previous analysis. Of the 4,859 prismatic blades in the San Dieguito collection, 123 (2.5%) had hinged off their parent cores prematurely. In the previous analysis only 93 of 13,428 (0.7%) blade fragments showed hinge fractures.

The cutting edge to mass (CE/M) ratio, which is an efficiency index measuring the total acute cutting edge (measured in cm) per gram of obsidian invested in prismatic blade production, was calculated on a total of 3,300 specimens from San Dieguito. The mean CE/M ratio for San Dieguito prismatic blades is 4.68 cm/g. This ratio is slightly higher than that of 4.07 cm/g calculated in the previous analysis on a sample of 4,490 prismatic blade fragments from Fowler's earlier study. The CE/M data from San Dieguito support the conclusion drawn in the previous analysis that obsidian was a valuable commodity for the inhabitants of Cihuatán.

Polyhedral Cores: A total of 17 polyhedral cores (Figure 37, j and k) were found in the San Dieguito collection (0.17% of all chipped stone analyzed from San Dieguito). Polyhedral cores in the previous analysis numbered 96 (0.6% of the 15,634 chipped stone specimens analyzed).

Amorphous Cores: Only one amorphous core (of silicified wood) was recorded in the previous analysis. Ten amorphous cores were noted in the San Dieguito analysis (Figure 38 e and f).

Unifacially Retouched Implements: Unifacially retouched chipped stone artifacts in the San Dieguito loan collection consist of one retouched prismatic blade tip, nine laterally notched prismatic blade segments, 11 prismatic blades or blade segments which were retouched along the edge(s), four retouched macroblade tips, and four scrapers from macroblade blanks (see Figure 36). All these types were recognized in minor frequencies in the previous analysis. The San Dieguito scrapers are further classified as two general scrapers, a domed scraper, and a thin, elongate scraper.

Laterally Retouched Implements: Only two laterally retouched implements were found in the San Dieguito collection. These are a rectangular stem from a prismatic blade point comparable to a similar specimen reported from the previous analysis (Fowler 1981:373-374, Figure 61x) and an ovate point made from a small percussion blade blank.

Bifaces: Twenty-nine bifaces are present in the San Dieguito loan collection. Some of these are illustrated in Figure 37a-h.

Not included in the loan collections were seven bifacially shaped artifacts from Structure 15-1 fill and one from Structure 12-51. These are illustrated in Plate 29. A projectile point from the 0-20 cm level of the civic-religious Structure 12-1 excavation unit 15N13E (which places it near the outer part of the T part of the platform mound) was not included in the loan collections, nor do we have an illustration of it. The field sketch shows it to have a contracting base. Three additional specimens found in the survey of San Dieguito are illustrated in Plate 28a, b and c.

The illustrated specimens can be described as projectile points (N=4), and obsidian bifaces (N=4). Two of the projectile points are large side notched specimens with straight or very slightly concave bases. One is of obsidian and one of white chert (Plate 29d and f). The other two projectile points as well as the unillustrated specimen from the civic-religious structure are large specimens with contracting bases (Plate 29e and g).

The four obsidian bifaces have somewhat irregular outlines but tend to be ovoid with mildly pointed tips. These appear to have been multipurpose tools.

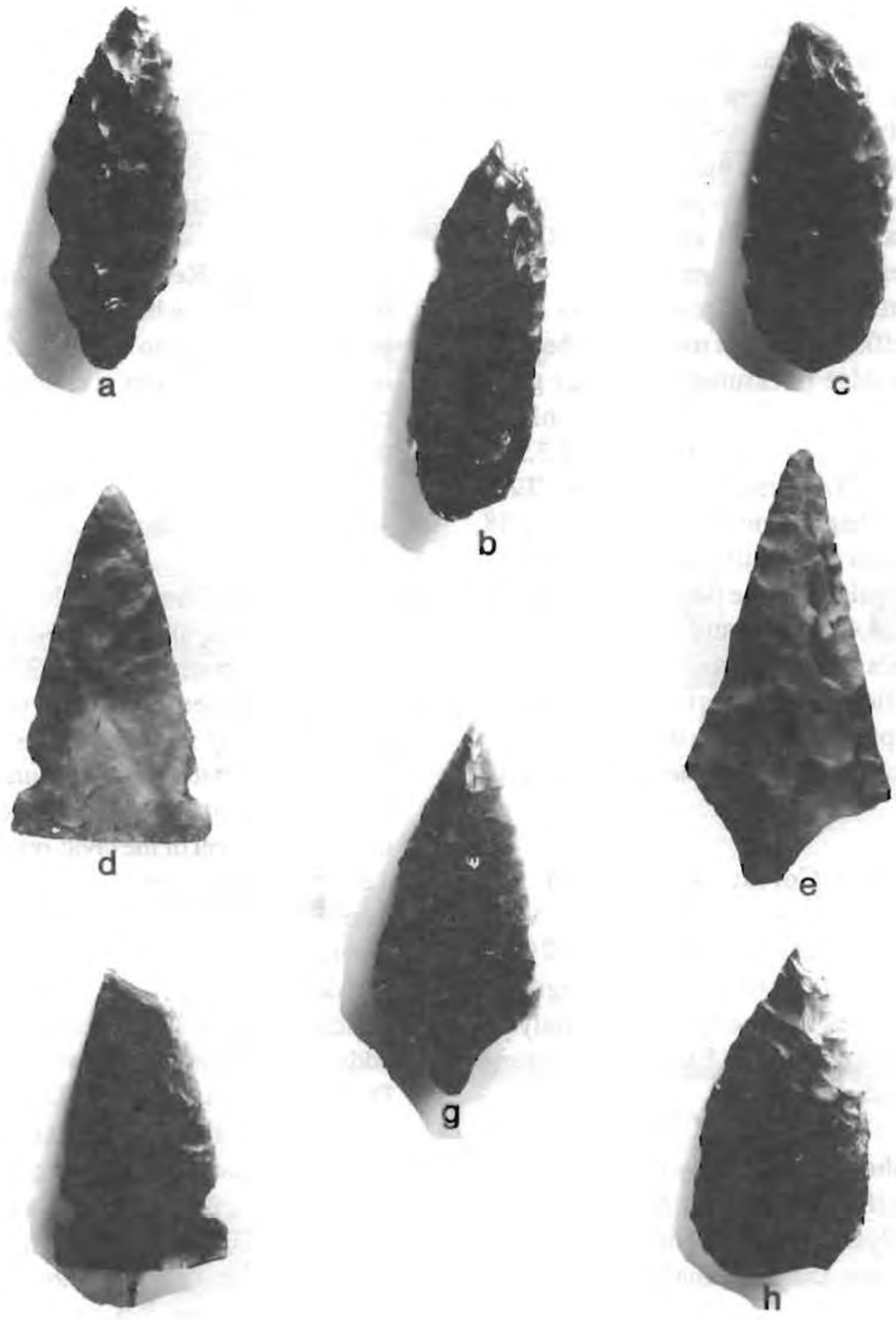


Plate 29. Bifaces

Photos courtesy of "David J. Guzmán" Museum

a,b,c,f,g,h. Obsidian;

d,e. Chert

Discussion: Obsidian was heavily favored for the chipped stone industry (only 41 of the tabulated specimens were of other materials). San Dieguito has a great deal more debitage or wastage, including thinning flakes, and an appreciably smaller frequency of prismatic blades relative to central parts of the site (Table 12). Although the frequency of cortex on obsidian pieces was not tabulated, it was very low. This suggests that obsidian was mostly imported in worked forms, probably as macroblades or preforms.

The total number of reported polyhedral cores from Cihuatán (N=113) relative to prismatic blades (N=7790) gives an overall polyhedral cores:prismatic blade ratio of 69 prismatic blades per core. This compares with ratios of 78 prismatic blades per core for the 1978 Zapotitán Basin Collections (Sheets 1983:210) and 97 for Chalchuapa (Sheets 1978:11, 14) for numbers of blades and cores. It therefore appears that prismatic blade production occurred at Cihuatán. The distribution of polyhedral cores and the

Table 12

Summary of Frequencies of Lithic Categories
Fowlers 1981 Analysis and the San Dieguito Loan Collections

Category	Fowler (1981) N= 15,634	San Dieguito Loan Collection N = 9,915
Wastage		
General Debitage	9.8%[a]	36.3%
Thinning Flakes	0.9	9.8
Totals	10.8	46.0
Tools		
Utilized Flakes	0.6	0.3
Macroblades	3.3	1.2
Small Percussion Blades	Sorted with prismatic blades	2.6
Prismatic Blades	83.5	49.1
Cores		
Polyhedral	0.6	0.17
Amorphous	(N=1)	0.1
Totals	0.62	0.27
Unifacially Retouched Implements	0.3	0.29
Laterally Retouched	0.1	0.02
Bifaces	0.4	0.2

[a] Core/blade and undifferentiated debitage combined

polyhedral core:prismatic blade ratio is unevenly distributed at Cihuatán. The ratio from the more central parts of the site, as reflected in the frequencies obtained in Fowler's 1981 study, is 47, while the San Dieguito ratio is 194 prismatic blades per core. By itself, these ratios suggest controlled production concentrated in but not limited to the central zone and its immediate peripheries. This interpretation, however, ignores the high debitage factor at San Dieguito, most of which derives from core/blade manufacture.

Ground Stone

Ground stone objects were rare to non-existent in the San Dieguito excavations. A substantial number of ground stone tools were noted but not collected or described in any detail in the San Dieguito survey. A descriptive approach seems best suited to the quantity and quality of the data.

Stone Bead

A stone bead from construction fill of Structure 15-1 (Excavation Area A) was recovered in the flotation process. Approximately 2 cms long, its shape is reminiscent of copper bells (Plate 28f). The stone was a fine grained sedimentary rock of dark reddish-brown color. Another is shown in Plate 28g. Stone beads are never numerous at Cihuatán; Fowler (1981:458) reports four from his excavations. None are reported by Bruhns (1980a).

A Stone Figure

A rather amorphous animal figure made of volcanic stone was found in the survey of San Dieguito (Plate 28d and e).

Carved Jadeite Piece

A broken carved jadeite found in the ceramic vessel buried in the floor of Structure 12-51 (Excavation Area C) was not included in the loan collections.

Stone "Doughnut"

A broken granitic stone "doughnut" was found in unit ON/OE 0-10 cms of Structure 15-1 (Figure 38h); it was located among the cobbles/boulders that appear to be a meaningful extension of the southeast corner of the platform. The most likely function is as a digging stick weight (see Hummer 1983:245-247 for a discussion of these biconically perforated stone discs).

Stone Celts

Not included in the loan collection was a celt of unidentified hard, green stone (not jade or jadeite). Salvadoran authorities have provided a photograph (Plate 28h). This celt was found in construction fill of the southwest corner of Structure 15-1.

A second celt was noted (but not collected) in the San Dieguito survey and recorded as Feature 148. It is described in the field notes as being made of a medium hard gray stone (hardness ca. 6) and as being ca. 3" long and 2" wide across the bit. In other parts of Cihuatán, Fowler (1981:458) reports nine celts from his excavations and Bruhns (1980) reports an unfinished celt from HP-102. On the basis of available information, celts and axes appear to have been scarce items concentrated in elite zones but found in small numbers in nonelite zones.

Bark Beaters

A single bark beater was observed but not collected on the surface of a structure at the top of the Cerro de San Dieguito. Longitudinal grooves occurred in one surface (for comparative information, see Fowler 1981:427-430 and Hummer 1984:244-245).

Grinding Stones

Manos, metates, and other grinding stones were absent from two of our four excavations. Outside of the southwest corner of the Structure 15-1 platform (ON/OE 0-10 cm), five fragments belonging to two grinding stones were found. One, consisting of two fragments, is made of a dark brown volcanic stone; the fragments create a concave grinding face ca. 13.5 x 9 x 3 to 3.5 cms. The second, nearly flat grinding stone measures 15 x 11 x 2.5 to 3 cm and is made of a gray volcanic stone. The edge fragment of the latter is quite rough and unground, leading us to suppose that this was not a metate but a more expedient grinding stone. Two manos and a metate fragment were associated with Structure 12-1.

If metates and manos were remarkably underrepresented in the excavation collections, they were relatively common as surface finds (uncollected) on the Cerro de San Dieguito. These were noted as "features" and their locations mapped on the San Dieguito survey (see Figure 5 for locations). Of the 48 metates and eight manos, only two metates were spatially associated with visible alignments of rocks; all others appeared to be isolated.

This quantity of grinding implements noted on San Dieguito is considerably more than has been previously reported for other parts of Cihuatán. Fowler reports a total of 24 metates and nine manos from his excavations and surface collection (1981:458). Bruhns (1980) mentions several mano and metate fragments from SS-49, a mano, a pestle and an ovoid metate from SS-54, parts of two metates and a mano from HP-102, two metate fragments from Structure 1 in NW-1, two mano fragments and one metate fragment from Structure P-16, a fragment of an effigy metate and another grinding stone from the patio of NW-1, Structure 4, and a mano from NW-3 (estimated minimum total of manos is 6; estimated minimum number of metates is 8).

It is interesting to note that manos are consistently found in smaller numbers than metates, but this discrepancy is most noticeable in the San Dieguito surface survey. The high incidence of isolated surface finds, combined with the absence of these artifacts in our excavations raises questions about where corn grinding was practiced on the Cerro de San Dieguito relative to structures.

Of the 49 metate fragments reported for the San Dieguito survey, only four had legs. Only one of Fowler's 24 metates was legged; Bruhns notes (1980:100-101) that metates could have one to three short legs, but I am unable to ascertain if she actually found legged metates other than the effigy metate (Bruhns 1980, Fig. 18a). We infer that legged metates were the least common form in use at Cihuatán.

Summary

Detailed analysis of the chipped stone assemblage from the Cerro de San Dieguito and comparison with the similarly structured analysis of materials from the Western Ceremonial Center shows that the same range of obsidian tools were in use, and obsidian working occurred in both parts of the site, but with some interesting differences in frequencies. For example, the cutting-edge to mass ratio of prismatic blades was higher and the ratio of cores to blades is much lower in the nonelite zone. More study of the ground stone industry is badly needed; however, these preliminary and descriptive findings allow us to make certain observations that contribute to the basic research goal of better understanding intrasite variability. We can note that the range of ground stone tool categories is much the same for San Dieguito and the WCC; food grinding implements are more common in the San Dieguito collections, and adzes are more common in the WCC.

CHAPTER 7

MAN AND ENVIRONMENT AT CIHUATÁN

Although the geographical unit we now recognize as Central America forms a narrow physical land connection between North and South America, this is a relatively recent development in geological terms. During most of the Cretaceous, some 3,000 km separated the two land masses. About 80 million years ago, a general uplift resulted in northern Central America and the northern Andes beginning to approach their modern configuration, with a direct land connection being established about 5.7 million years ago (Raven and Axelrod 1975:422). "Sweepstakes disperal" between the two land masses occurred before a land connection was established, and "rapid direct dispersal" occurred afterward. As a result, there is a remarkable uniformity in the biota of Latin America from Mexico to Argentina.

A widely accepted interpretation of this phenomenon which takes into account recent advances in plate tectonics and continental movements is summarized in Raven and Axelrod (1975). By correlating time of separation of Africa and South America, length of time they were reasonably close before South America drifted to its present position, and rates of evolution of certain taxa, they explain taxonomic similarities and differences between South (and Central) America and Africa. Thus, rainforests and seasonally dry tropical forests in Africa bear striking structural and compositional resemblances to those in the Americas.

Topography in Central America varies from extensive lowland through mid-elevational upland to mountain peaks. The climatic factors, especially barometric pressure and marine currents, are different from the Caribbean to the Pacific sides. These factors cause a remarkable range of climate, and hence of vegetation, within the confines of this relatively small geographical unit. Generally, the Caribbean side enjoys a more continuous distribution of tropical rainforest than the Pacific side. Because Panama is a narrow strip, climatic and vegetational differences between its two sides are minimal. Northward, the land widens, with increasing differences on the western and eastern sides at the same latitude. These differences become more pronounced where rugged high elevational terrain occurs in the interior, such uplifts being generally more common as the land mass widens northward. As a result, on the Pacific side, there is a fairly continuous distribution of dry tropical forests – the Semi-Humid Deciduous Tropical Forest or Monsoon Forest of some authors (see Beard [1944 and 1955] for a discussion of the classification of tropical vegetation). Because of recent, fairly efficient dispersal of flora between the contiguous American land masses, vegetation types would appear quite similar in South and Central America, at least regarding species presence, if not abundance, dispersion, and diversity. An interesting recent study (Hubbell 1979) analyzes these vegetational parameters for a tropical dry forest in Costa Rica, but more work is needed to determine the extent of similarity throughout Latin America.

Small areas with similar vegetation occur northward into Durango and Sinaloa, Mexico (farthest extension on the Pacific side of cloud forest cf. Rzedowski 1981), and into Nayarit, southeastern San Luis Potosi and northern Veracruz (supporting some tropical deciduous forest with rainforest elements; op.cit). In southern Mexico, thorn forest and tropical scrub vegetation types become increasingly more important than they are further south, largely in response to a weakening of the "monsoonal" regime, reduced total precipitation and more pronounced atmospheric aridity.

Jorge A. Lagos (1973), Professor of Pharmacy and Agronomy at the National University of El Salvador, published a general account of the vegetational zones of that country. Following earlier designations, he recognizes three major climatic zones with corresponding differences in vegetation. The *tierra caliente* or hot land (sea level to about 500 m), exhibits various general subdivisions: (1) upland (e.g. hills, ridges) , (2) lowland (e.g. floodplains), (3) valley (in both the lower and upper elevational reaches, but hilly terrain in the lower *tierra caliente* is limited). True tropical rainforest elements are found in the lowland phases where ground water is abundant during the extended dry season. Cihuatán is located in the *tierra caliente*. The *tierra templada* occurs at a higher elevation and is dominated by pines and oaks. The last zone, the *tierra fria*, is found in the highest elevations in El Salvador. Especially where enshrouded in perpetual fog, these regions support a cloud forest with temperate as well as tropically derived elements.

Understanding and reconstructing past biotic states for the Paraíso Basin is extremely difficult, as it is for all parts of El Salvador. Both natural and human intervention have had profound effects upon the environment. The natural hazard of volcanism is particularly well documented for the Zapotitán Basin where an interdisciplinary team has studied the effects of the Ilopango eruption and subsequent recovery (Sheets 1979a; 1983).

Daugherty (1969) reconstructed climax vegetation of El Salvador by relying on multiple lines of evidence. While all or most of the "formations" he defines may have been involved in the overall economic network of which Cihuatán was a part, the site itself and the Paraíso Basin were located in the lowland formation which extends from sea level to 800 - 1,000 m above sea level -- or to the dividing line between the *tierra caliente* and the *tierra templada*. Within the lowland formation, Daugherty differentiates seasonal formations from swamp and seasonal swamp formations. The former is further subdivided into pioneer beach vegetation, evergreen forest, semi-evergreen forest and deciduous forest. Deciduous forests may once have covered ca. 90% of El Salvador (Daugherty 1969:49). The evergreen and semi-evergreen forests were formerly distributed along the coastal plain and along rivers or streams as gallery forests.

Natural climax vegetations were long ago altered by human factors. It is generally agreed that the first significant modification of the environment by humans accompanied the introduction of agriculture in the Preclassic (Sheets 1964:8; Fowler 1981:698). Citing early Spanish accounts related to the nature of the Salvadoran landscape at contact, Daugherty says:

> ...the distinct impression emerges that the lower elevations were densely settled and cultivated and thus greatly altered by man, while most of the upper slopes remained heavily forested and largely unaffected by man. The greatest degree of vegetation modification probably occurred below the 1,000 meter contour (1969:124-125).

Post contact modification of the landscape was much more severe. It was "greatly altered...before 1800 and nearly destroyed before 1900--before any major botanical research had been undertaken. Thus, the precise nature and distribution of the undisturbed formations are unknown" (Daugherty 1969:42-43).

Given the much altered state of vegetation, the problems of reconstructing the environment of the Paraíso Basin and at Cihuatán for the Postclassic period appear at first glance to be overwhelming. The picture may not be as bleak as it seems, however. In 1979 plant communities were observed in a small forest remnant in a protected woodlot, along the banks of the Acelhuate and the Ixcanal Rivers, and in a number of differentially disturbed habitats. Botanical and ecological information about plants and their habitat requirements as well as about plant communities can be used to extend modern ecological observations. The same species of plants recovered archaeologically through flotation still occur in the immediate vicinity.

Faunal resources must have been important to the inhabitants of Cihuatán. The native fauna is not discussed here since we recovered no faunal materials in archaeological contexts, and we had no zoologist on the project. Fowler (1981:781-816) reviews relevant evidence, noting the range of available faunal resources.

Phytogeography

Cihuatán is located in the middle reaches of the *tierra caliente*. Located at ca. 285 m to 333 m elevation, it is situated well below the 1,000 m level within the zone Daugherty feels was most modified by human activity in preconquest times. The thin soils on the andesite hills forming the core of the site are of volcanic origin. Their thinness may be in part due to depth of deposited volcanic material, but erosion has undoubtedly also affected the depth. The wide, flat Acelhuate Valley has deeper soils, as does the more local Ixcanal Valley. Short drainages off the Cihuatán hills to the Acelhuate and Ixcanal tend to develop swales.

The Acelhuate River heads near San Salvador; it has a much larger watershed and a steeper gradient relative to the Ixcanal with its smaller, more localized drainage area and lesser gradient. The Río Lempa, about 16 km distance, formerly had an extensive flood plain with local remnants of forest vegetation.

Because of land clearing begun about 40 years ago, open areas have become a major habitat at the site and the surrounding area. Some open areas seem to be relatively little managed. Most, however, are managed to a considerable extent. Upland open areas are dominantly maize milpas, or, depending upon the land ownership and topography, they are in pasture. Flat upland areas are sometimes used for upland rice. Low-lying areas may be used for pasture if swales are common, but more frequently cash-crop *fincas* are planted in sugarcane.

Along the Río Ixcanal a narrow strip of bottomland immediately adjacent to the stream may be planted in produce, or left as a band of trees representative of the earlier forest vegetation. When the trees are cleared for growing of produce, and a backwater is nearby, intergradation of wild, more or less hydrophytic plants (e.g. *Araceae, Heliconia, Calathea macrocephala,* etc.), occurs with corn, bean, squash and several tended weeds.

The small tract of forest or woodlot (less than 1 km x 1 km) on land belonging to Doña Adelita Prieto Mira was left uncleared when large-scale forest clearing was undertaken near Cihuatán about 40 years ago. Since then, selective cutting has occurred. Wood is still widely used for cooking in the villages as well as the country; few woodlots remain; illegal poaching of wood from Doña Prieto's woodlot has intensified in recent years.

Examples of tree species occurring in the canopy stratum of the woodlot include:

Calycophyllum candidissium (Vahl) D.C. (salamo)
Ceiba pentandra L. Gaertn (pochote)
Enterolobium cyclocarpum (Jacq.) Griseb (guanacaste, concaste)
Copaifera hymenaefolia moric (quiebra-hacha)
Cedrella odorata L. (cedro)
Bursera simaruba L.Sarg. (jiote).

Because the woodlot is relatively young and somewhat disturbed, there is not a clear distinction between midstory and understory. Trees that now belong to the midstratum include:

Morus celtidifolia H.B.K. (mora)
Pithecollobium sp. (conacaste blanco)
Erythroxylon sp. (coca)
Cordia alba (Jacq.) Roem. & Schult (tiguilote)
Cochlospermum vitifolium Spreng (tecomasuche)
Acacia sp. (cutupito)
Acacia farnesiana (L.) Willd. (espino blanco)
Acacia hindsii Banth (iscanal)
Piper ssp. (cordoncillo)

The much larger (at least 8 km x 8 km) forest covering the Cerro de Colima and environs includes more microhabitats, more species, and some patches that are similar to Sra. Prieto's woodlot. Other, perhaps less disturbed, patches exhibit increased stratification with at least two species becoming canopy emergents:

Ficus glabrata H.B.K. (chilamate)
Enterolobium cyclocarpum Jacq. Griseb.

The Cerro de Colima patches are a little more diverse than the woodlot in the canopy and subcanopy. The following are examples of additional overstory species not represented in the woodlot:

Bursera graveolens (H.B.K.) Triana & Plarch (jiote)
Bursera simaruba L. Sarg.
Tabernaemontana Donnell-Smithii Rose ex Donn. Sm.(cajon de puerco)
Plumeria acutifolia (Poir) Woodson (flor de Mayo, flor de la Cruz Blanca)

Additional species in the mid-level stratum include, for example:

Luehea candida D.C. Mart. (cabo de hacha)
Psidium guajava L. (guayabo)
Guazuma ulmifolia Lam. (caulote)

Well lighted forest areas are densely carpeted with *Calathea macrocephala* (Poepp & Endl.) Koernicke, *Dorstensia contrajerva* L., *Commelina* sp., *Lygonium polymorphum* (Cav.) H.B.K. and other ferns, *Selaginella* sp., and *Begonia* sp. Near oxcart trails and at the edges of milpas and other clearing, shrubs and vines become prominent, for example:

Capsicum annuum L. var. conoides (chile)
Rivina humilis L. (flor blanca)
Hamelia patens Jacq. (chichipinco)
Petastoma sp. (bejuco de corral, bejuco de casa)
Desmodium sp. (bejuco capitan)

El Salvador has a mean annual precipitation range of between 1,000 and 3,000 mm. For the Cihuatán area, weather records from the nearby Ingenio La Cabána covering the period from 1957 to 1978 give mean annual rainfall as 1704 mm (Bruhns 1980a:112). Most of this (as much as 94%) falls within the rainy season. Thus, the five to seven month dry season is very dry (although the relative humidity of the air is frequently high), and the rainy season is very wet (see Vivo Escoto 1964; Lange 1984). True tropical, evergreen rainforest species cannot tolerate extended periods of low soil moisture. At Cerro de Colima, rainforest elements such as the *Castilla elastica* (fig) or *Bactris subglobosa* (huiscoyol), are restricted to areas where drainage patterns provide a continuous supply of water for their shallow roots -- for example, adjacent to semipermanent drainages, along floodplains, and near seeps and springs. The banks of the Acelhuate adjacent to Cihuatán also provide a refugium for rainforest elements. *Carica papaya* (wild papaya) prefers forest edge habitat and *Crescentia alba* (moro) is common in open areas everywhere.

Thus, the Cerro de Colima appears to be covered with a mosaic of forest patches, differing somewhat in composition and structure as related to type, extent, how recently disturbance has occurred, and to topographic and microhabitat differences.

Microhabitats

The easily identifiable modern conditions that have most seriously affected the local ecological situation generally and the nature of microhabitats on the site in particular are the virtual destruction of the forest and the deep entrenchment of the Acelhuate. These two factors are of such magnitude that direct analogy to prehistoric conditions would be inappropriate. We lack basic data on climatic changes and the effects of more recent volcanic episodes. Certain factors seem to be rather constant (topography, for example), and some arguments about prehistoric microhabitats can be advanced. The modern situation can be cautiously used as an analogue to prehistoric conditions.

At the present time, different microhabitats are plentiful. Upland habitats include wood lots, small tracts of forest, seeps, ravines, fence rows and rock walls. Lowland habitats support diverse communities of forest species whose composition reflects backwater development, degree of clearing and steepness of terrain.

It seems reasonable to assume that in the past the soils on the andesite hills were shallower than valley soils, as they are today. The hill soils would have been subject to erosion without rapid replenishment of soil nutrients. The Acelhuate valley soils, on the other hand, are deep. Before the Acelhuate was so deeply entrenched, an alluvial situation is indicated if not yet studied by geologists. The Acelhuate in this stretch of the river probably resembled the Río Lempa prior to World War II or even more recently – until the hydroelectric dam and reservoir developments which removed a major self-renewing and highly productive resource from cultivation. The Acelhuate valley today has an upland character due to the recent entrenchment of the river. The Río Ixcanal with its small drainage area does not have sufficient flow for the river to entrench at its mouth. Fields near the Ixcanal have a bottomland character. The short, local drainages off the andesite hills of Cihuatán have a tendency to develop swales in their lower reaches.

The several drainages and rivers on and adjacent to the site probably created a number of microhabitats in prehistoric times that would have reflected volume and rate of flow, sediment loads, and flooding cycles. Local, intermittent drainages would have been controlled by runoff and topography. Other microhabitats would have been created by springs and seeps, buildings, forest clearance and regrowth succession, and agricultural practices.

The diversity of the local flora can be more completely appreciated by reference to Tables 13 and 14 in which plants identified from all microhabitats are listed. The reason there are two lists rather than an integrated list is that there were two discrete identification episodes. Identifications given in Table 13 were initiated at Cihuatán: common names of plants obtained from ethnobotanical informants often served as the starting point for identification. The search for proper botanical identification was pursued in the herbarium in San Salvador, through the relevant botanical literature, and finally in the herbarium at the University of Arizona. The second episode (Table 14) was undertaken at the Missouri Botanical Gardens, where Van Asdall had the assistance of Mr. Ronald Liesner for General Families, Dr. William G. D'Arcy (Solanaceae), Dr. Gerrit Davidse (Graminae), Dr. John D. Dwyer (Rubiaceae), and Dr. Alwyn H. Gentry (Bignoniaceae). The latter list is regarded by Van Asdall as representing a much higher quality of identification than the one made previously, and he feels it is premature to create a definitive integrated list for the Cihuatán locale.

The diversity represented in these two lists gives a clear indication of the floral richness, and a great many different microhabitats could be produced within dynamic and ongoing man/plant relationships. Not only would forest clearing have produced the plant communities similar to the oxcart trails on the Cerro Colima or those that characterize well lighted forest floor areas at the present time, but it seems likely that forest clearance would have been selective, with useful trees and other plants left.

Although we cannot identify specific prehistoric microhabitats and list their plant communities or give a precise delineation of their location or extent, we can postulate a dynamic situation of multiple and changing microhabitats ranging from upland to bottomland in character and exhibiting a wide variety of plant communities varying from the several kinds of dense forest to large cleared areas.

Table 13

Plant Species of Cihuatán

Working roster of local plants compiled during 1979 field season. This list is not definitive either for the Cihuatán area or for the 1979 field season. Approximately 70 species remained to be identified to genus and about 25% of those identified required further verification. The listing includes at least one common name as well as the scientific name, family affiliation where known, and life form. There are probably some non-current scientific names.
*Except for species starred (*), plants are housed at the University of Arizona, Tucson in pressed or dried form.
**When these names were given to us, they were spelled phonetically and have not yet been found.

Family / Scientific Name	Common Name	Life Form
Acanthaceae		
Elytraria imbricata (Vahl) Pers.	–	–
Amaranthaceae		
Amaranthus sp.	–	herb
Iresine sp.	–	–
Anacardiaceae		
*Anacardium occidentale L.	cashew	tree
*Spondias	jocote	tree
Anonaceae		
Anona purpurea Moc. & Sesse	cincuyo	tree

Table 13 Continued...

Family / Scientific Name	Common Name	Life Form
Apocynaceae		
*Plumeria acuminate (Poir) Woodson	frangipani	tree
*Plumeria acutifolia (Poir) Woodson	flor de mayo, flor de cruz blanco	tree
Rauwolfia tetraphylla L. Stemmadenia sp.	amatillo	shrub
Tabernae montana donell-smithii. Rose ex Donn. -Sm	cojon de puerco	tree
Araceae		
*Alocasia sp	–	herb
Caladium sp.	corazon	herb
Araliaceae		
Dendropanax	–	shrub/tree
Asclepiadaceae		
**Asclepias enordatus	–	–
Begoniaceae		
*Begonia sp.	–	herb
Bignoniaceae		
Crescentia alba Roem & Schult.	moro	tree
Petastoma sp.	bejuco de casa, bejuco de corra	vine
Tabebuia pentaphylla (L.) Hemsl.	pink poui	
Tecoma stans (L.) H.B.K.	San Andres	–
Bombacaceae		
Ceiba pentandra (L.) Gaertn.	kapok, pochote	tree
Boraginaceae		
Cordia alba (Jacq.) Roem. & Schult.	tihuilote	tree
Heliotropium sp.	–	herb
Heliotropium terantum Vahl.	–	herb
Burseraceae		
*Bursera graveolens (H.B.K.) Triana & Plark	jiote	tree
*Bursera simaruba (L.) Sarg.	jiote	tree
Cactaceae		
Pereskia autumnalis (Eichlam) Rose	matial	succulent
Caprifoliaceae		
Polonosia viscosa ?	tabaquillo	herb
Clavariaceae		
Ramaria sp.	–	fungus
Cochlospermaceae		
Cochlospermum vitifolium Spreng.	tecomasuche	tree

Table 13 Continued...

Family / Scientific Name	Common Name	Life Form
Commelinaceae		
Commelina sp.	–	herb
Compositae		
Baltimora recta (L.) Mant	flor amarilla	herb
Convolvulaceae		
Convolvulus sp.	–	vine
Cyperaceae		
Cyperus terminus	–	grasslike
Cyperus sp.	–	grasslike
Dilleniaceae		
Curatella americana L.	chaparro	tree
Erythroxylaceae		
Erythroxylon sp.	–	–
Euphorbiaceae		
Croton hirtus L'Her. Stirp.	–	–
Euphorbia glomerifera (Millsp.) Wheeler	–	–
Euphorbia heterophylla L.	euforbio del monte	herb
Jatropha curcas L.	tempate	shrub
Manihot esculenta Crantz	manioc	herb
Manihot sylvestris–	manioc	herb
Ganodermataceae		
Ganoderma lucidum (W. Curt.; Fr.) Karst.	–	fungus
Gesneriaceae		
Gesneria sp.	–	–
Gramineae		
Bambusa sp.	–	grass
Cenchrus sp.	–	grasslike
Echinochloa colonum (L.) Link	–	grass
Rhynchelytrum roseum (Nees) Stapf & Hubb.	–	grass
Gutiferaceae		
*Mammea americana L.	mamey	tree
Hymenochaetaceae		
Phellinis badius (Berk.) G.H. Cunn	–	fungus
Lauraceae		
*Persea sp.	avocado	tree

Table 13 Continued...

Family / Scientific Name	Common Name	Life Form
Leguminoseae		
Acacia angustissima (Mill.) Kuntze	guajillo	tree
*Acacia farnesiana L. Willd	espino blanco	tree
Acacia hensei Benth.	Iscanal	tree
Bauhinia diversifolia	pata de vaca	shrub-tree
Caesalpinia pulcherrima (L.) Swartz	flor barbona	tree
Cassia grandis L.	carao	tree
Copaifera hymenaefolia moric	quiebra-hacha	tree
Crotalaria sp.	–	herb
Desmodium	capitan de bejuco	
*Enterolobium cyclocarpum (Jacq.) Griseb.	guanacaste	tree
*Gliricidia sepium (Jacq.) Steud.	madrecacao	tree
Indigofera suffructicosa	añil	shrub
Inga spuria Willd	pepetillo	tree
Lonchocarpus minimiflorus Donn. -Sm.	chapernonegro	tree
Mimosa pigra L.	sorza	vine
Mimosa pudica L.	–	shrub
Pithecollobium sp.	conacaste blanco	tree
Loasaceae		
Gronovia scandens L.	pan oaliente	vine
Lycoperdaceae		
Geaster sp.	–	fungus
Malpighiaceae		
*Byrsonia crassifolia (L.) D.C.	nance	tree
Mascagnia ovatifolia Ndz.	–	tree/shrub
Malvaceae		
Sida acuta Burm.	escobilla	herb
Maranthaceae		
Calathea macrocephala (Poepp. & Endl.) Koernicke.	chufle	herb
*Marantha arundinacea L.	–	herb
Martyniaceae		
Martynia diandra ?	–	herb
Meliaceae		
Cedrela mexicana M. Roemer	cedro	tree
Cedrella odorata L.	cedro	tree
Moraceae		
Dorstenia contrajerba	contrayerba	herb
Ficus glabrata H.B.K.	chilamate (fig)	tree
Morus celtidifolia H.B.K.	palo mora	–

Table 13 Continued...

Family / Scientific Name	Common Name	Life Form
Musaceae		
*Heliconia latispatha Benth.	platanillo	herb
Myrtaceae		
Psidium guajava L.	guayabo	tree
Nyctaginaceae		
Boerhavia erecta L.	golondrina/iscorian	herb
Bougainvillaea glabra Choisy	–	vine
Palmae		
*Sabal sp.	palmetto	tree
Papayaceae		
Carica papaya L.	papaya	tree
Passifloraceae		
Passiflora coriacea Juss.	–	vine
Passiflora foetida Vell. var. gossypufolia (Desv.) Masters	granadilla	vine
Phytolaccaceae		
Rivinia humilis L.	flor blanca	herb
Pinaceae		
*Pinus oocarpa Schiede	pino	tree
Piperaceae		
Piper triquetrum ? Trel.	cordoncillo	shrub
Piper Tuberculatum Jacq.	cordoncillo	shrub
Polygalaceae		
Polygala sp.	–	–
Polyporaceae		
Tramentes hirsuta (Wlf.; Fr.) Pilat	–	fungus
Tramentes sp.	–	fungus
Rubiaceae		
Calycophyllum candidissium (Vahl) D.C.	solano	tree
Coffea arabica L.		tree
Hamelia patens Jacq.	chichipinco	tree
Randia armata (Swartz) D.C.	torolio	shrub
Rutacceae		
Murraya paniculata	–	shrub
Ruta graveolens L.	ruda	herb

Table 13 Continued...

Family / Scientific Name	Common Name	Life Form
Sapindaceae		
Melicocca bijuga Kitanov	momon	tree
Paullinia fausecens	–	–
Sapindus microcarpus Jardin	–	tree
Sapotaceae		
*Calcocarpum mammosum (L.) Pierre	sapote	tree
Schizoacaceae		
Anemia hirsuta Hieron	helechito	fern
Lygonium polymorphum (Cav) HBK	crespillo	fern
Selaginellaceae		
Selaginella cuspidata	selaginela	prostrate herb
Solanaceae		
Capsicum annuum L. var. conoides	chile picante	shrub
Capsicum sp.		shrub
Physalis sp.		herb
Solanum bicolor ?		
Sterculiaceae		
Guazuma ulmifolia Lam.	caulote	tree
Melochia pyramididata ?	escobilla colorada	
Sclerocarpus divaricatus ?	colacate	herb
Tiliaceae		
Luchea candida (D.C.) Mart.	cabo de hacha	tree
Luehea speciosa Willd.	contamal	–
Muntingia calabura L.	capulin	tree
Turneraceae		
Tunera ulmifolia L.	damiana	shrub
Ulmaceae		
Trema micrantha (L.) Blume	capulin montes	–
Verbenaceae		
Cornutia pyramidata L.	zapalote	vine/shrub
Hyptis capitata Jacq.	chibola	shrub
*Lantana sp.	cinco negritos	shrub
Priva lappulaceae L.	mozote	herb
Zygophyllaceae		
Kallstroemia maxima L.	verdolagita	herb

Table 14

List of Species in Cihuatán Area As Identified at the Missouri Botanical Gardens

Species	Life Form	Family
Achyranthes aspera L.	vine	Amaranthaceae
Amaranthus spinosus L.	herb	Amaranthaceae
Annona holosericea Safford	tree	Annonaceae
Bauhinia ungulata L.	shrub	Leguminosae
Boerhaavia erecta L.	herb	Nyctaginaceae
Brachiaria fasiculata (Sw.) Parodi	grasslike	Gramineae
Brachiaria mollis (Swartz) L.R. Parodi	grasslike	Gramineae
Calopogonium mucunoides Desv.	vine	Leguminosae
Capsicum annuum L.	herb	Solanaceae
Cesearia corymbosaH.B.K.	tree	Flacourtiaceae
Cenchrus pilosus H.B.K.	grasslike	Gramineae
Chomelia spinosa Jacq.	tree	Rubiaceae
Commelina erecta L.	herb	Commelinaceae
Cordia dentata Poir.	tree	Boraginaceae
Cordia inermis (Mill.) I.M. Johnston	herb	Boraginaceae
Crotalaria vitellina Ker. Vel. sp. aff.	herb	Leguminosae
Croton lobatus L.	herb	Euphorbiaceae
Croton payaquensis Standl.	shrub	Euphorbiaceae
Curatella americana L.	tree	Dilleniaceae
Cyperus odoratus L.	grasslike	Cyperaceae
Cyperus rotundus L.	grasslike	Cyperaceae
Dendropanax sp.	tree	Araliaceae
Dichorisandra hexandra Standl.	herb	Commelinaceae
Echinochloa colonum (L.) Link	grasslike	Gramineae
Eleusine indica (L.) Gaertn.	grasslike	Gramineae
Elytraria imbricata Pers.	herb	Acanthaceae
Eragrostis cilianensis (All.) Link ex Wizn.	grasslike	Gramineae
Eragrostis ciliaris L.	grasslike	Gramineae
Ficus inamoena, c.f. Standl.	shrub	Moraceae
Genipa americana L.	tree	Rubiaceae
Hackelochloa granularis (L.) Kuntze	grasslike	Gramineae
Hamelia patens Jacq.	shrub	Rubiaceae
Heliotropium ternatum Vahl.	herb	Boraginaceae
Hemidiodia ocimifolia (Willd.) Schum.	herb-shrub	Rubiaceae
Hyparrhenia rufa (Nees) Stapf	grasslike	Gramineae
Hyptis verticillata Jacq.	shrub	Labiatae
Inga vera Willd. ssp. spuria (Willd.) V. Leon	tree	Leguminosae
Jatropha curcas L.	herb	Euphorbiaceae
Julocroton argenteus (L.) Didr.	herb	Euphorbiaceae
Kohleria sp.	herb	Gesneriaceae
Lasiacis ruscifolia (H.B.K.) Hitchc.	grasslike	Gramineae
Leptochloa filiformis (Lam.) Beauv.	grasslike	Gramineae
Leptochloa filimis (Lam.) Beauv.	grasslike	Gramineae
Licania arboreaSeem.	tree	Chrysobalanaceae
Lonchocarpus phaseolifolius Benth.	tree	Leguminosae
Lygodium polymorphus (Cav.) H.B.K.	fern	Schizaeaceae
Lysiloma divaricatum (jacq.) MacBride	tree	Leguminosae
Maranta arundinacea L.	herb	Marantaceae
Matelea trianae (Dene) Spellman	vine	Asclepiadaceae
Mollugo verticillata L.	herb	Aizoaceae
Muntingia calabura L.	tree	Elaeocarpaceae
Panicum lepidulum Hitchc. & Chase.	grasslike	Gramineae
Panicum maximum Jacq.	grasslike	Gramineae
Passiflora foetida Vell.	vine	Passifloraceae
Paullinia pinnata L.	herb	Sapindaceae
Pereskia autumnalis (Eichlam) Rose	succulent	Cactaceae
Pharus latifolius L.	grasslike	Gramineae
Physalis lagascae Roem. & Schult	herb	Solanaceae
Piper auritum H.B.K.	herb	Piperaceae
Piper tuberculatum Jacq.	shrub-tree	Piperaceae
Pithecoctenium crucigerum A. Gentry	vine	Bignoniaceae
Polygala brizoides St. Hil.	herb	Polygalaceae
Polygala cururu L.	shrub	Polygalaceae
Psidium guajava L.	shrub	Myrtaceae
Psychotria carthaginensis Jacq.	shrub	Rubiaceae
Psychotria sp.	shrub	Rubiaceae
Randia aculeata L.	shrub-tree	Rubiaceae
Randia mitis L.	shrub	Rubiaceae
Randia sp.	shrub	Rubiaceae
Rauwolfia tetraphylla L.s.l.	shrub	Apocynaceae
Richardia scabra L.	herb	Rubiaceae
Rivina humilis L.	herb-shrub	Phytolaccaceae
Russelia sarmentosa Jacq.	vine	Scrophulariaceae
Ruta graveolens L.	shrub	Rutaceae
Rytidostylis carthaginensis (Jacq.)Kuntze	vine	Cucurbitaceae

Table 14 Continued...

Selaginella pallescens (Presl) Spring	herb	Selaginaceae
Solanum hazenii Britton	herb-shrub	Solanaceae
Stemmadenia obovata var. Mollis (Benth.) Woods	tree	Apocynaceae
Tabernaemontana	shrub-tree	Apocynaceae
Tetracera volubilis L.	shrub	Dilleniaceae
Trichilia americana (Sesse & Mocino) Pennington	tree	Meliaceae
Trigonia rugosa Benth.	tree	Trigoneaceae
Triplaris sp.	tree	Polygonaceae
Urechites andrieuxii Muell. Arg.	vine	Apocynaceae

Subsistence and Economy

The extent to which Cihuatán was self-sufficient in basic subsistence plant products is unknown, as is the size of the population supported. On the basis of the distribution of known early Postclassic sites, the environmental characteristics of the Cihuatán locale, and the observed settlement patterns at Cihuatán, we postulate a mixed local economy.

Household gardens seem likely in the nonelite sections of the site given the open settlement pattern. Household or dooryard gardens are well known for Mexico, Guatamala and Honduras, although they are not, at present, well established in the Aguilares area of El Salvador. Aguilares was only founded in the 1930s, however, and lacks continuity in population and tradition to earlier local populations. Nevertheless, many houses today have small orchards around them that provide shade and food, and small gardens are found adjacent to some rural houses. It is not unreasonable to assume (although difficult to confirm) that many Cihuatán houses may have had adjacent small mixed gardens.

The steeper erosional terraces around the ceremonial center, the terraces in the residential parts of the site and the more public and/or civic religious areas of the site could have been provided with economically useful and aesthetically pleasing tree species such as *Crescentia alata* H.B.K. (moro), *Spondias lutea* L. (jobo), *Spondias mombin* L. (jocote), *Melicocca bijuga* L. (mamon), *Anacardium occidentale* L. (cashew), *Curatella americana* (chaparro), *Byrsonia crassifolia* (L.) D.C. (nance), *Lonchocarpus rugoso* (balche) *Annona* sp. (annona), *Calopocarpum mammusum* (L.) Pierre (sapote), *Mammua americana* L. (mamey), *Cordia alba* (Jacq.) Roem. & Schult (tiguiloti), *Psidium guajava* L. (guayava), *Muntigia calabura* (capulin), the *Carica papaya* L. (wild papaya), and *Persea* sp. (avocado), all of which can be found growing in the Aguilares area today. These trees could have been left standing in selective forest clearance or deliberately planted. Miksicek has recovered nance by flotation from Preclassic levels at Cuello in Belize, tiguiloti from Classic horizons at Chapernalito, El Salvador, and jobo from both Preclassic and Classic levels at Santa Leticia, El Salvador, indicating some generic support for the hypothesis that these tree products may have been used at Cihuatán (see also Fowler 1981:705).

Although maize, beans, squash and probably other plants could have been cultivated on terraces and in household gardens, the heavier milpa production of basic food crops and cotton undoubtedly occurred on the better agricultural land of the river valleys, especially in the Río Acelhuate floodplain. Sectors of the adjacent valleys were undoubtedly cultivated by individuals from the nonelite parts of Cihuatán. As a large and arguably urban center, Cihuatán probably also drew on the agricultural production of the lower Acelhuate valley for subsistence items, and possibly from the entire Paraíso Basin.

It seems unlikely that the elite of Cihuatán were directly involved in agricultural pursuits. We are willing to entertain as a hypothesis the proposition that unknown segments of the population were part or full-time specialists who were not involved or only partly involved in food production. If these premises are accepted, it becomes clear that some intrasite exchange of food and other plant products was mandatory. How far down the socio/political scale such exchange might have occurred is entirely speculative, but various levels of exchange ranging from household and kin-based exchanges to a thriving market system are possible.

Flotation: Method and Results

Flotation samples were collected from several excavation contexts on San Dieguito. A 35 liter volume of excavated soil was utilized as the sample standard; this volume seemed to provide adequate recovery. Because of problems with water availability and the transportation of such large volumes of soil, rainwater was collected so flotation could be performed at the excavation site. A half barrel contained the water. Samples were placed into a plastic laundry basket filled with a screen bottom which was in turn placed in the barrel. The heavy materials were not collected. Floated materials were removed with two sizes of strainers and air dried. Once dried, the samples were analyzed in the field laboratory using a binocular microscope.

The main comparative materials available in the field laboratory were the herbarium specimens collected by the botanists and subsequently placed in the Herbarium, University of Arizona. The lack of comparative botanical remains from archaeological contexts in El Salvador was unfortunate; however, Miksicek, who handled the flotation and did the identification, had previous experience in analysis of botanical remains from tropical lowlands and was well acquainted with the botanical spectrum represented. Floated macrobotanical specimens can be identified with varying degrees of certainty. In some cases species level identifications are possible while others can only be identified at the family level or classed as unknown with a verbal description. A descriptive approach characterizes the identifications made in Tables 15 and 16.

The excavated areas from which float samples were taken were in a field that has been seasonally cleared by burning. Plowing with a Mediterranean style steel tipped plow has mixed the soil to a depth of 10 to 15 cm. in some locations. In order to minimize modern contamination, samples were collected only from deeper fill.

Aside from plowing, other sources of potential contamination of prehistoric deposits with modern botanical intrusions exist. Doña Adelita Prieto Mira graphically described deep cracks in the soil that routinely occur during the dry season. Burnt seeds from field clearance could easily drop into these cracks and become incorporated into archaeological deposits. Migration of materials in the soil could be caused by burrowing animals and insects. In interpreting Tables 15 and 16, the number of *Baltimora recta* L. Mant (flor amarilla), *Sida* (escobilla), *Desmodium* (beggar's lice), *Convolvulaceae* (morning glory) and Unknown A could serve as a partial guide to the amount of disturbance. These same plants, however, could also be regarded as reflections of the daily lifestyle and microhabitat of the prehistoric inhabitants of Cihuatán.

The floated botanical remains from the trashy midden construction fill of Structure 15-1 provide evidence of the basic Mesoamerican subsistence triad: maize, beans and squash. Two tree fruits [*Bactris subglobusa* (huiscoyol) and *Anacardium occidentale* L. (cashew)] are present. *Gossypium* (cotton) and *Theobroma cacao* (cacao) are tentatively identified. The morning glory seeds (unknown species of *Convolvulaceae*) are interesting because the seeds of some species of *Impomoca* and *Rivea* contain lysergic acid derivatives and were consumed as hallucinogens in Oaxaca. Bruhns (personal communication) has wondered if production of hallucinogenics might have been a commercial enterprise at Cihuatán, as perhaps was the case. On the other hand the morning glory seeds may simply be part of the background flora. Some *Convolvulaceae* species are used today in El Salvador as a *quelite* or green vegetable.

Numerous representatives of weedy elements of the local flora were represented in the float samples including *Baltimora recta* L. Mant (flor amarilla), *Mimosa*, *Sida* (escobilla) and the "beggar's lice" or stickweed (*Desmodium*) which could have been picked off the loincloth after a hard day in the fields.

Five *Indigofera* (indigo) seeds and several indigo wood fragments were recovered from flotation samples. Tentative identification of two heart-shaped legumes from Structure 15-1 as indigo was made in the field. Other indigo seeds and wood fragments were more firmly identified later. Indigo grows wild at the site today, and the most prominent species represented at the present time is I. *Suffructicosa*– the species most commonly used in the production of indigo or *añil*.

Of particular interest is the high percentage (81%) of *Pinus* (pine) in the wood charcoal recovered from Structure 15-1 fill. Two kinds of pine are represented. The nearest known source of pine today is the sierra to the north near Las Palmas, an air distance of at least 35 km. In the past, pine may also have grown on Guazapa volcano some 10 km to the southeast. If this were the case, transport to Cihuatán from the cutting site could have been expedited by floating the logs down the Guazapa and Acelhuate rivers. Pine may have been a preferred material for construction purposes because the fairly tall, straight trees could be cut more easily with a stone axe than the several hardwoods that were undoubtedly part of the local forest habitat. Pitch sticks of pine are also valued for torches in Mesoamerica.

The other 19% of the wood-like taxa were probably acquired locally. Some of the specimens that are described but not identified may be from *Sabal* (palmetto). Found today no closer than the forest remnants along the Lempa, it was undoubtedly present at Cihuatán in past centuries since it is a forest succession plant and would have been found along the Acelhuate if nowhere else. Although slender, the palmetto has great compaction qualities which would have made it useful for certain construction purposes.

Flotation results from the civic-religious platform (Structure 12-1) excavations are given in Table 16. It will be noted that recovery of botanical materials was much higher in unit 9N 21E in the 20-50 cm level than elsewhere in this structure and that specimens are greatly diminished in the 60-80 cm level of the same unit. The frequencies of botanical remains in the 20-50 cm level of 9N 21E is, however, lower than those routinely recovered from the float samples from Structure 15-1.

Unit 9N 21E of Structure 12-1 contained the "oven" feature discussed in Chapter 2 of this monograph and in Kelley and Hanen (1988: Chapter 8). The favored hypothesis in the field was that the "oven" was associated with metallurgy during the Postclassic occupation of Cihuatán, and it was only after that hypothesis was rejected on the grounds of very recent Carbon 14 dates that we reevaluated the flotation evidence as relevant to the problem of dating that feature. In the reevaluation, the higher counts of taxa believed to be a measure of background flora and/or of modern contamination were noted. Their greater frequency is noteworthy within the context of the botanical assemblage from the adjacent civic/religious structure, but a comparison with Structure 15-1 indicates that, in absolute terms, the numbers of specimens from 9N 21E (20-50 cm) are low, especially for Unknown Seed A.

Table 15

Macro-Botanical Remains Collected by Flotation from Construction Fill of Domestic Structure 15-1

Identification made in the field by C. Miksicek

Location Codes A : 0N10E 10-20 cm. B : 2N6E 20-30 cm. C : 2N6E 30-40 cm. D : 2N10E 30-40 cm.
E : 2N10E 40-50 cm. F : 4N8E 20-30 cm. G : 6N10E 20-30 cm. H : 6N10E 30-40 cm.

	Location									% of samples
	A	B	C	D	E	F	G	H	Totals	with taxa
Zea mays										
kernels	2		1	1			1	1	6	63
cupules		1	1				3		5	38
Leguminosae										
Large cmmn. bean	1								1	12
Small cmmn. bean	1		1		4		1		7	50
Cucurbitaceae										
Squash rind						1	1		2	25
Gossypium										
hirsutum (cf)			1					1	2	25
Theobroma										
cacao (cf)	1								1	12
Anacardium occidentale										
Cashew				2					2	12
Bactris subglobosa										
Huiscoyol palm							1	1	2	25
Panicoid Grass								1	1	12
Festucoid Grass	1						1		2	25
Unknown Legume (possibly indigo)	10		1					3	14	38
Convolvulaceae										
Sm. Morning Glory	8		4	1	12	6		1	32	75
Unknown Seed Type A	110	3	15	21	16		3	18	186	88
Baltimora recta										
Flor Amarilla	8		2		1	1			12	50
Desmodium sp.										
Beggar's Lice	29	1	14	8	14	1	6	3	76	100
Sida sp.										
Escobilla	11		2		7	1	1		22	63
Mimosa sp.										
Sensitive plant			2		1		2		5	38
Compositae			2						2	12

Table 15 (Continued)

	Location									% of wood
	A	B	C	D	E	F	G	H	Totals	Charcoal
Wood Charcoal:										
Large Resin Duct *Pinus*, cf.	1	7	7	2	8	2	9	7	43	62
Small Resin Duct *Pinus*, cf.		5	4	2		2			13	39
Leguminosae (large vessels, small rays)	1			1		1		2	5	7
Leguminosae (med. vessels, wide rays)							2		2	3
Non-Leguminous (lg. vessels, small rays)	1	1					1		3	4
Unknown (tiny dense vessels, wide rays)	2					1			3	4

Nevertheless, we feel that this piece of evidence, when combined with others, supports a recent date for the feature.

Other evidence now perceived to be significant in evaluating the "oven" is that of the kinds of wood identified from within the "oven" itself. It contained several hardwoods including *Guaiacum* sp. (not listed in Table 16) which are missing from the other flotation samples. Initially interpreted as evidence of selecting woods for obtaining hotter fires for metallurgical purposes, we now compare these woods to the high incidence of pine in Structure 15-1 fill and wonder if the hard woods would have been as accessible with stone axes. Given the recent Carbon 14 dates on the "oven" charcoal, we can postulate that the selectivity of hard woods in this case is associated with metal axes.

Other flotation results from the civic-religious Structure 12-1 contrast with those from domestic construction fill from Structure 15-1 in the absence of maize, squash and beans. Pine forms only 7% of the identified wood charcoal and only the Small Resin Duct pine is represented in Structure 12-1. The nature of the Structure 12-1 mound fill was less trashy than that used for flotation samples from Structure 15-1 and we did not have the impression in the field that the Structure 12-1 fill was derived from near-primary domestic trash. The botanical evidence supports this view.

Food Sources

The flotation evidence for maize, beans and squash has been presented. There is no question that maize and beans are well suited to this region, and the colonial period reports filed in the Archivo General de Indias from this region routinely mention maize and beans (frixol) production, but never squash. Fowler (1981:752) also noted that squash are not mentioned in the documents on which he relied. That squash was routinely ignored in the Spanish documentation probably reflects the fact that it, like other vegetables which were also ignored, was a household garden plot plant rather than a field crop. Six, ten or 20 squash plants would supply a family's annual needs, and the plants bear over the course of several weeks.

Table 16

Partial List of Macro-Botanical Remains Collected by Flotation from Civic-Religious Structure 12-1

Location Codes A : 2N11E 40-50cm. B : 2N11E 50-60 cm. C : 6N7E 30 cm
D : 9N21E 20-50 cm (around and over oven) E : 9N21E 50-60 cm. (around oven)
F : 14N8E 60-80 cm. G : 17N10E 25 cm. H : Trench 2 Segment R 50-70 cm.

	Location									% of samples with
	A	B	C	D	E	F	G	H	total	taxa
Leguminosae										
Small Common Bean				3					3	12
Panioid Grass								1	1	12
Unknown Type A				6			1		7	25
Convolvulaceae										
Sm. Morning Glory 1				10					11	25
Lg. Morning Glory				4					4	12
Baltimora recta sp.										
Flor Amarilla				4					4	12
Desmodium sp										
Beggar's Lice.	1	1		4					6	50
Sida sp. Escobilla			13				1		14	25
Leguminosae										
Sm. Kidney Shaped Legume		1							1	12
Unknown Type B		1				2	1		3	25
										% of Wood Charcoal
Wood Charcoal										
Small Resin Duct *Pinus* cf.					2				2	6
"Palm"	1			3					4	13
Leguminosae										
Legume, small triplet vessels, narrow rays					1				1	3
Legume, small single vessels, narrow rays					2				2	6
Unknown large single vessels, narrow rays		6					5		11	34
Unknown 2 vessels/duct, narrow rays						2		2	4	13
Unknown dense single vessels, narrow rays		1	2		2			5	16	
Unknown tiny sparse vessels, wide rays 2									2	6
Unknown tiny dense vessels, wide rays			1						1	3

It is interesting to note that the "Estado General Que Manifiesta los Productos de Granos por Todos los pueblos...en el Districto de la Intendencia de Sn. Salvador, San Miguel y San Vicente de Austria..." states that San Salvador was the province in which *frixol* was principally harvested (AGI, Audiencia de Guatemala, Legajo 971, February 26, 1788). Overall, however, there were remarkably few beans grown in El Salvador in the 1780s (cf. also AGI, Audiencia de Guatemala, Legajo 456 for the 1787 *Estados*...), and many towns were recorded as planting no beans.

In addition to maize, beans and squash, Fowler (1981:745 ff) has suggested that *Capsium* sp. (chili peppers), *Ipomoea batatas* (sweet potatoes) and *Manihot esculenta* (manioc) may also have been cultivated. These, with the known staples and the many available tended or collected plant foods, would have provided a considerable amount of dietary variability on a seasonal basis.

The question of manioc or *yuca* production has been raised by several investigators. The 1979 project produced neither direct botanical evidence nor artifactual evidence in the form of graters that it was grown. Sweet manioc does not require grating. Bruhns (1980a:75) reports that a "preliminary phytolith analysis by Arlene Miller...suggests that manioc was grown". Elsewhere Bruhns (1978) notes that the phytolith analysis gave evidence of *yuca* bark. It can be noted that manioc or *yuca* was an important crop in parts of the area in the late 18th and early 19th centuries as is indicated in three entries in the *Gazeta de Guatemala* for 1802. The listing of crops planted in the 21 pueblos of Chalatenango is as follows:

> 2016 medios de maiz
> 625 id de arroz
> 486 id de frijol
> 45890 matas de yuca
> 79200 id de platanos
> (Tomo VI, numero 282, folios 299-300)

A letter to the editor of the *Gazeta* sent from San Salvador discusses at some length the sustaining qualities of bread made from *yuca* for the poor of San Salvador and environs who had experienced several years of disastrous crop failures. The letter writer notes that *yuca* is much more resistant to destruction by insects than other crops; indeed the *yuca* suffered very little from the insect infestations that were a prime cause of the failures of the other crops (*Gazeta de Guatemala*, Tomo VI, numero 281, folios 261 - 263). In the same volume, the crops listed for Sacatecoluca are "maiz, frijol, arroz, yuca, camoti y platanos" (ibid. Tomo VI, numero 271, folio 211).

Soils and Cropping

The soils of El Salvador are generally fertile (Lange 1984:46). Not only is the ultimate origin of the soils volcanic, but geologically recent volcanic action has renewed soil fertility. A recent soils map of El Salvador was made as part of the World Soil Mapping Project of UNESCOL (Rico 1974). The ridge on which the central part of Cihuatán is located is shown as soil type #13, "grumosoles, Litosoles, y Latosoles Arcillo Rojizos". Surrounding the ridge, and reaching on the north to the Río Lempa, is a large area classed as soil type #1: "Suelos Regosoles y Aluviales Entisoles". The latter are heterogeneous in character, but share a water laid origin of non-consolidated materials which have not had the parent materials modified by the formation process (Rico 1974:9). These soils are particularly well suited to the production of sugar cane, cotton, rice and other food stuffs.

A soil sample from San Dieguito Structure 15-2 analyzed at the University of Arizona showed that the soils of the hill are somewhat acidic, have a very high nitrogen content, give no indication of water penetration problems, and are fairly good for most agricultural purposes (see below).

The farmers who presently have milpas on San Dieguito report that they prefer to plant the same plot for two years and let it lie fallow for three or four years. Three sets of fields are needed to allow rotation. These informants noted that there was great variation in the time plots could be continuously cropped and the length of the fallowing periods. They mentioned a plot near Palo Verde in the Acelhuate valley to the north of Cihuatán that has been planted every summer and winter for at least 40 years.

A. Harlan has suggested that, given the ecological limitations, the Postclassic Cihuatán inhabitants could have grown maize and perhaps beans as well as other milpa plants in the valley during the rainy season and cotton during the dry season. This would have the effect of slowing the loss of nitrogen from the soil as happens when cotten is monocropped. Household gardens on the hills would probably be most productive during the rainy season. Early documentary evidence of double cropping is found for Tecoyluca (modern Tecoluca) , a tributary pueblo to San Salvador, in 1538. The *tasaciones* in question are found in AGI Patronato Real 70-1-1, Justicia 286, and Indiferente General 857 (see Kramer, Lovell and Lutz 1986). The copy used here is from AGI Patronato Real 70-1-1. Further, many of the San Salvador tributary towns are shown to be double cropping maize in the better known Cerrato *tasación* (AGI, Audiencia de Guatemala, Legajo 128)

Ecological, documentary and modern informant derived information thus suggest that richer land with a water source for the dry season could be double cropped for extended periods and that less fertile land was subject to rotational fallowing and single (rainy) season production.

Water Management and Erosional Control

The question of whether or not irrigation was practiced is crucial to a hypothesis of commercial cacao growing, as is discussed below, and it is of interest if one postulates any dry season crop. We did not undertake a systematic search for hydraulic systems, and, insofar as we are aware, none have been noted at the site. If, as we assume, the Río Acelhuate was not deeply entrenched in the Early Postclassic, irrigation from the river may have been practiced.

Soil Analysis - Structure 15-2 (Excavation Area B) (21N/8W)

Analysis performed by Soils, Water and Plant Tissue Testing Lab, Department of Soils, Water, and Engineering, College of Agriculture, University of Arizona

		Saturation Extract						
Level	ph	EC_e $\times 10^3$	Soluable salts ppm	Na meg/L	K meg/L	ESP	N ppm	P ppm
Level A	5.6	0.47	329	0.66	0.90	-0.49	55.0	1.50
Level B	5.5	0.64	448	1.12	0.31	-0.22	39.0	1.50
Level C	6.0	0.63	441	1.80	0.30	0.57	24.0	3.00

ph - Paste with distilled H_2O

ESP - Estimated exchangable sodium percentage

N - From CO_2 extraction. Technicon reduction of nitrate reported as N

P - CO_2 extraction and orthophosphate determination (Technicon)

While the existence of an irrigation system remains problematic, there is ample evidence that extensive efforts were directed to certain aspects of water management and erosional control. The steepest gullies are cobble lined to retard erosion and the numerous stone walled terraces served to hold soil, check erosion, and spread water.

Tools Related to Plants and Plant Products

Because the creation of the site created an open, disturbed habitat, a rank growth of weeds, shrubs and grass undoubtedly occurred at the time of occupation as it does today. Indeed, strong parallels between Postclassic and modern times are suggested by the flotation results. The disturbed habitat plants grow rapidly during the wet season, and some degree of seasonal control through cutting seems mandatory. The nonelite sections of the site may have had less routine clearing than the central core and public areas. Aside from shade trees and perhaps other species selected on aesthetic grounds, elite and public areas were probably kept cleared. Despite the romantic illustration by Catherwood in Stephen's *Travels in the Yucatan* of strangler figs covering abandoned Maya temples, it seems extremely doubtful if such woody species would have been allowed to proliferate on buildings, platform mounds, pyramids or compound walls. Their roots could cause serious damage if allowed to grow beyond a minimal size.

Obsidian blades were common at Cihuatán, as is expected (see Chapter 6). Set in a wooden handle, the blades would have formed a serrated edge of great utility in reducing the omnipresent vegetation cover through cutting grass, weeds, and strangler figs. Such tools would also have been useful in harvesting crops and preparing vegetable products in various ways.

The question of manioc production was raised previously. In the absence of direct botanical evidence, manioc usage might also be identified through the recovery of manioc processing tools - namely graters. We doubt that obsidian manioc graters are effective because of the virtually inevitable contamination of the processed food with microspalls which would have had direct consequences for the gastrointestional track of the consumers, as Payson Sheets argued at the Puleston Conference on the "History and Development of Maya Subsistence" (University of Minnesota, October 1979). In any event, we have no artifactual evidence of manioc production.

Stone celts so far reported from Cihuatán are not numerous. It is assumed that these were used for heavier clearing and for obtaining timber, but their scarcity does not fit well with our preconceptions about their utility in what was presumably a heavily forested environment. Celts are apparently collected today by local people, and this factor would affect surface survey tabulations. Perhaps the forest was managed in other ways such as girdling, firing, or drilling techniques – or perhaps our sample is totally non-representative.

Manos and metates are not particularly numerous but occur. We suspect that maize was processed and used in several ways, and that by no means was all of it ground. The scarcity of artifacts that could have functioned as *comales* indicated that *tortillas* were not a dietary staple; Fowler (1981:749), however, feels that *pupusas* (the "fat" tortilla filled with beans or other substances) were a standard food that was probably introduced by the Nahuat speakers. Some corn may have been processed in wooden mortars. Whole kernel corn dishes may have been common.

The manufacture of bark cloth or bark paper is indicates by grooved bark beaters. Fowler (1981:427-430; Figure 66) found one in the Southeast Patio complex in the Western

Ceremonial Center. Another grooved bark beater was noted (but not collected) on the surface survey of San Dieguito in association with a house foundation on the top of the hill.

Other tools or artifacts that may have been directly associated with man/plant interaction in some capacity include a doughnut shaped stone that may have been a digging stick weight, the spindle whorls, and ceramic vessels.

Hypotheses About Commercial Crops and Wider Exchange Networks

Aside from the obsidian from Ixtepeque, El Chayal and Río Pixcayá, and some presumably "foreign" pottery, direct evidence of trade, exchange, or commerce is difficult to identify in any straightforward way.

As has been frequently noted, Cihuatán is located on old trade routes (Bruhns 1979 and 1986) and most investigators who have worked at the site have inferred that the site played a major role in the trade networks of Early Postclassic times. Starting from the premise that trade beyond the immediate locality was an important *raison d'être* for Cihuatán's size and apparent prominence, various investigators have suggested products that might have been involved in wider interaction networks of which trade and exchange may have been the dominant mechanisms, although some products may have been procured directly by people from Cihuatán going to the source.

A hypothesis of regular contacts with the coast for acquiring shell fish, fresh, dried and salted fish, and salt is not unreasonable, and the distances involved do not make it untenable on pragmatic grounds. Doña Adelita Prieto Miro told us that when Structure P-7 (the main pyramid) was first cleared, the clearly visible mortar was made of lime in which shell fragments (which she thought were marine shells) were visible. Fowler (1981:804 and 732-733) gives a definite identification of the marine shells used to make the mortar: *Anadara tuberculosa.* This mollusk occurs exclusively in shallow, brackish water; he is inclined to see the source of these mollusks as the Pacific estuaries some 200 km away.

The ocean was not the only potential source of fish and fish products, as numerous species of fish formerly inhabited the rivers and lakes (cf. Fowler 1981:800-802). Aside from local fishing in the Acelhuate, the Lempa and several lakes would have been easily accessible; these would have provided other species.

Bruhns (1978 and 1986) suggests that the Cihuatán area may have been important for the commercial production and export of cacao. Miksicek, Harlan and Van Asdall find this hypothesis to be unlikely unless irrigation was routinely used – and even then, they are doubtful. Fowler (1981:766-767) also takes issue with the commercial cacao hypothesis.

Cacao is at present a minor crop in El Salvador; the only known production is one small plantation in the San Miguel area. Formerly, however, cacao was grown in several areas of El Salvador. The evidence has been debated with regard to whether or not the historical distribution reflected anything of prehistoric distribution. Writing in 1955, Millon felt that the Izalco area was the most probable center of preconquest cacao production in El Salvador. He constructed his case carefully, noting that ceremonies associated with cacao, as described in García de Palacio in the 1570s, suggest that cacao was not a Spanish introduction; however, since the ceremonies could have been generalized agricultural rites transferred to cacao after the Spanish conquest, he remained cautious about accepting cacao as definitely preconquest in El Salvador (Millon 1955:172).

As more early Spanish documents pertaining to western and central El Salvador receive scrutiny from geographers and archaeologists, the cautiousness of Millon's tentative acceptance is replaced with a growing certainty that cacao was indeed grown in prehistoric El Salvador (Bergman 1969; Fowler 1987). There is, for example, the evidence of the two tribute lists described and illustrated by Fuentes y Guzmán (1932-1933:pt 2, bk 2, ch 11:109) which give cacao as a tribute item. Fowler (1981:765-766) argues that these are preconquest in origin, probably pertaining to the prehistoric Pipil state of Izalco (Fowler 1987:156).

Since *cacaotals* (cacao orchards) require a certain amount of time to become established and productive, Spanish references to cacao growing locations or cacao as a tribute item during the first half of the sixteenth century might be assumed to reflect prehistoric growing locations. If anything, the locations as given would err on the conservative side as it is likely that some *cacaotals* would have been abandoned (Bergmann 1969:91; Fowler 1987:152). The 1536-1541 *tasaciones* of Marroquin and Maldonado (cf. Kramer, Lovell and Lutz 1986) show that Ciguateguacan (Santa Ana) was assessed 500 *xiquipiles* of cacao in tribute. This is the only town noted as giving cacao in tribute in this *tasación*, but we know it to be fragmentary and incomplete. In the Cerrato *tasaciones* for 1548 and 1549 (AGI, Audiencia de Guatemala, Legajo 128), the Izalco area is noteworthy for the number of towns giving tribute in cacao. Several towns in the province of San Salvador also give tribute in cacao, including The Pokoman-Pipil settlement of Chalchuapa.

To ascertain that cacao was grown prehistorically in El Salvador is not to say that it was grown commercially at Cihuatán. Relevant to assessing Bruhns' hypothesis of commercial cacao production at the site are the ecological requirements of cacao.

Cacao grows best in an area with 45 to 100 inches of rain a year and in soils with a pH between 6 and 7.5. Cihuatán meets both of these prerequisites. However, cacao requires a short dry season and cannot tolerate extended dry periods (cf. Millon 1955). Although Cihuatán has a mean average percipitation of ca 1700 mm, it has a severe dry season of at least four months duration. Precipitation records from the Ingenio La Cabaña near Cihuatán for the years 1957 to 1978 show that no precipitation was recorded for the month of January in 75% of those years, and for the month of February, no precipitation was recorded in half of those years. The average precipitation from December to March is less than 3 cm.

Cacao could have been grown at Cihuatán with irrigation and there is some documentary evidence of irrigated cacao production elsewhere. Millon (1955:73) notes that "Ciudad Real (1872, v. 1 p. 434) mentions the cultivation of cacao by irrigation in what seems to have been an arroyo near Santa Ana." Irrigation for cacao is also cited for the Escuintla area of Guatemala. There may therefore be a precedent for postulating irrigated cacao outside of the monsoonal areas of El Salvador. Even with irrigation at Cihuatán, the water stress for cacao would have been severe, unless the climate has changed.

On the basis of information about the ecological requirements for cacao (cf. Millon 1955), we regard Bruhns' commercial cacao hypothesis as unconvincing. It seems more likely that Cihuatán obtained cacao by trade, possibly from southern El Salvador or from the Izalco area; small amounts may have been grown locally.

Tobacco should perhaps be considered as having been grown in El Salvador in Precolumbian times. Without either early documentary or archaeological evidence, we merely note that there was a major tobacco factory in San Salvador in the late 18th century; the accounts for 1786 and 1787 show large amounts of tobacco from Yxtepeque (AGI, Audiencia de Guatemala, Legajo 456, Document "Estado que...", 31 de Deciembre, 1787). Fowler (1981:771-772) has a review of the evidence for this plant.

Our own favored commercial crop hypothesis is that Cihuatán was a cotton growing and processing center and that cotton products were exported. Our rather circumstantial case is constructed as follows. Archaeological evidence for our commercial cotton hypothesis is seen in the number of spindle whorls from San Dieguito as well as the tentative identification of cotton seeds from Structure 15-1.

Several colonial and historical documents mention cotton production in this general area as, for example, the *tasación* records for 1538 - 1548 (AGI, Patronato Real 70-1-1). In that document, the pueblo of Tecuyluca is cited as being in the jurisdiction of the city of San Salvador. Barón Castro (1942:570) more precisely locates Tecoyluca or Tecoluca in the Department of San Vicente. The *tasación* notes that this pueblo planted cotton and, in the 1538 tribute assessment, gave 100 *huipiles*, 100 large white *mantas* which measured 2 varas by 1 1/2 varas, 100 *naguas*, 100 *masteles*, 10 large *mantas de pared*, and 8 *sabanas*. For 1544, it is noted for the town of Teculucelo (not identified as to department in Barón Castro 1942:570, although listed) that *if* the encomendero provides cotton, they must spin as much as 200 *arrobas*. Referring again to Tecoyluca for the year 1548, it is said that 10 *hanegas (fanegas)* of cotton were planted, and from this the pueblo gave each year, as tribute, 150 *naguas*, 200 white *toldillos*, 100 *huipiles* and 6 large *mantas de pared* "painted in the size and manner to which they are accustomed", and six white *sabanas*. For Teculucelo in 1548, it is said they planted four *hanegas* of cotton.

In the more famous *tasación* for the same period (AGI Audiencia de Guatemala Legajo 128), cotton is mentioned as tribute in 1548 from Cacatecoyluca (Zacatecoluca) in the following context:

> "...and they plant each year 6 *hanegas* of beans and 8 *hanegas* of cotton which they gather and they give to the encomendero each two months 50 *mantas* and 100 white *toldillos* of size such as they are accustomed to give..."

For Cuscatlan, 6 *hanegas* of cotton were planted, and each month the indians gave 40 white *toldillos*, and many other San Salvador towns paid tribute in mantas and other cotton products. For Santa Ana (or Ciguatescan), only 2 *hanegas* of cotton were planted, and each year, the indians gave as tribute 100 *toldillos*. No cotton is reported for Ahuachapan.

Jorge Larde y Larín (1957) contains several references to crops of this general area for the period between 1740 and 1807:

1.Guazapa, 1807 - "se cultivan todos frutos y semillo y se labora añil" (p.177).

2.1740 - "Tonacatepeque producía maiz, algodon, cana, gallinas y ganado de cerda" (p. 517).

3.1740 - Nejapa - "Las producciones naturales eran maiz, gallinas, algodón, ganado de cerda, y caña" (p.259).

4.1807 - Nejapa - "cultivo de añil, maices y otras semillas" (p.259).

5.1807 - Santa Ana - "La única ocupación de sus habitantes...a excepcion de los tejidos de algodón con algún mérito y exclusivos en la cabecera, es al cultivo de arroces, caña dulce, maices, frijol y raices que consumen con alguna porcion de azucares y añil que destinan al tráfico y comercio" (p.419).

The *Gazeta de Guatemala* offers the following note which mentions cotton:

> "Otros varios frutos que deven formar unos ramos de extracción accompanaran a la tinta

> Añil...(son) los algodones, los cafes, los ricos cacaos, el balzamo, los azucares, el palo bracilere, caobas, cedros, y otras exquisitas maderas..." (Tomo V, numero 195, 1801, folio 421).

A second part of our commercial cotton production hypothesis concerns dyes that may have been used in a textile industry. El Salvador was until the early 1900's one of the world's leading exporters of indigo or *añil*, and indigo was the leading export of El Salvador throughout much of the historic period.

Ample documentation of this can be advanced (see Sanchez 1976). To quote again from the *Gazeta de Guatemala:*

> "El único fruto que Sostiene este Reyno, y con que se hace todo de su comercio interior y exterior, se cosecha en las immediasiones de este mar. Escuintla, Sonsonate, Santa Ana, Chalatenango, San Salvador, Vicente, Zacatecoluca, y S. Miguel, estan en esta costa...Este fruto es el añil...(Tomo V, numero 195, 1801, folio 420).

An incomplete estimate of 178,281 pounds (*libras*) for the añil crop for 1802 is given in Tomo VI, numero 282, folio 297 of the *Gazeta*, and this list of *partidos* omitted several of the high producing areas such as Santa Ana. Indeed, the *Gazeta* is replete with information on the *añil* industry, including prices in Cadiz and elsewhere as well as comments on the state of the crop and harvests. More formal information on the *añil* industry is given in the reports of the Monte Pio de Cosechos de Añil to the Crown (AGI, Audiencia de Guatemala Legajo 668) and in Barón Castro (1942).

Añil production so dominated Salvadoran thought in the early 1800's that an account in the *Gazeta* of snake bites in Zacatecoluca gives the temporal placement of the bites as "En la temporada de *añil*..." (Tomo V, numero 216, 1801, folio 531).

There can be no doubt that the enormous commercial production of *añil* recorded for the 18th and 19th centuries is postconquest. *Añil* production was stressed so heavily that subsistence and other crops were curtailed. A lengthy letter to the editor of the ever informative *Gazeta* in 1797 was signed "El Patriota forastero" from San Salvador. In this letter, he argues that the production of *añil* at the expense of basic foodstuffs was in large measure responsible for the near famine conditions of the time (Tomo I, numero 36, folio 283-288) – conditions that later elicited the letter referred to above on the sustaining qualities of *yuca*.

There has always been some debate about whether the indigo industry was "introduced" by the Spanish or whether it is prehistoric. This seems to us to be an Eurocentric argument. The local name for indigo, *xiguilite*, comes from the Nahuatl words for blue - *xi* and herb-*quitiel* or turquoise - herb-*xiutil* and blue - *texutli*. *Añil* is mentioned in the Maya book of *Chilam Balam* and in Landa's *Relaciones de Yucatan*. The genus *Indigofera* has at least three species native to Central America, the most commonly used for obtaining blue dye being *I. sufructicosa* which grows wild at Cihuatán. The unidentified heart-shaped legume seeds from Structure 15-1 may be indigo, and as noted above; firmer identification of indigo plant parts was made in the herbarium at the University of Arizona after the field season concluded. Thus, several lines of evidence suggest that indigo production may have been important at Cihuatán (also see Fowler 1981:706-712).

A number of other plants native to the Cihuatán area could have furnished dyes for the postulated textile industry. Guzmán (1926, Tomo 2:348-349) provides the following list:

Achiote, *Bixa orellana*	yellow,red
Aromo, *Acacia farnesiana*	yellow
Limoncillo , *Zantoxilum perroti*	yellow
Palo mora , *Morus celtidifolia*	yellow
Campeche , *Hematoxylon campechianum*	brilliant red, blue (depends on pH)
Nance , *Brysonima crassifolia*	scarlet

Palo Brasil , *Cesalpinia echinata*	red
Pitahaya , *Acanthocereus Pentagonus*	carmine
Moro , *Crescentia cujete*	blue
Conacaste, *Enterlobium cyclocarpum*	black
Mamon , *Meliccoca bijuga*	black

To this list, Miksicek would add tecomasuche (*Cochlospermum vitifolium*) which has brilliant yellow inner bark which could be used as a dye.

If there was indeed a textile industry, cotton may not have been the only fiber utilized. The ceiba or pochote (*Ceiba pentandra*) produces a light, silky, easily woven fiber, and ceiba fiber (or kapok) was used to make beds (cf. Fowler 1981:726).

In terms of the hypothesis that the inhabitants of Cihuatán were involved in commercial production of some product that is virtually invisible archaeologically, cotton growing and the production of cotton products for local and export purposes has the most circumstantial support. Certainly cotton products were prominent in the earliest postconquest *tasaciones* for the San Salvador province and it is noted that the workers (Indians) were accustomed to growing cotton and weaving a wide variety of cotton textiles.

If an extensive trade or exchange network existed, products other than cotton would also have been involved. The 1538 - 1548 *tasaciones* mention salt, wax, chili, honey, turkeys, quail, fish, *alpargatas*, maize, and beans as tribute products. Achiote, balsam and various hardwoods such as *brazileño*, *cedro*, and mahogany could have been traded. Copal for the incensarios of Cihuatán would have come from Honduras and/or Guatemala. Coconuts, other palm products, pineapples, liquidambar or sweet gum, oak acorns, mushrooms, pine products, oak for firewood and charcoal, izote or yucca, and maguey may have been obtained directly or by trade. All are described as being used by the Pipil in early documents.

Factors in Variability of Production

Documentary and historical evidence offers numerous examples of the kinds of factors that could have affected agricultural and other production in Precolumbian times. Colonial and modern records are dotted with accounts of volcanic eruptions and their disastrous consequences, earthquakes, floods, variation in expected rainy or dry seasons, and plagues of insects. Without drawing direct analogies to the Postclassic period in the Paraíso Basin of El Salvador, we can nonetheless note that these factors must have operated prior to the conquest, and that years of scarcity and plenty would have been known. The historical disasters seem to have been fairly localized, although earlier volcanic eruptions had wide spread and long-term effects (cf. Sheets 1979a).

A few examples of the kinds of factors that could have introduced uncertainty into production will suffice to make the point that we cannot assume a uniform subsistence base over time for any locality. Lange (1984: Table 3:2) lists 48 cases of Central American volcanic activity in historic times. Feldman (1980) lists 87 cases of earthquake struck communities in Central America as reported in documentary evidence concerning damage to churches between 1671 and 1821. San Salvador was nearly or completely destroyed by earthquakes in 1575, 1594, 1719 and 1798. In 1788 there was no harvest in Usulután because of the eruption of San Miguel volcano (AGI, Audiencia de Guatemala, Legajo 971).

The *Gazeta de Guatemala* for 1797-1802 has numerous entries about plagues of insects (primarily *chapulín* and *langosta*) in various parts of El Salvador. These infestations can sometimes be traced through a cycle for a single locality from the entries. For example, in 1802, of the 32 pueblos in Chalatenango, *langostas* were active in 22 pueblos and 10 pueblos had completely lost their crops. That same year, crops were lost to *langostas* in San Salvador and to *chapulines* in Sacatecoluca and Cojutepeque, among other places. In 1798 the *añil* crop of San Vicente suffered because the rains failed (*Gazeta*, Tomo II, numero 87, folio 304).

Since we have no reason to believe that these events are unique to postconquest El Salvador, we need to consider possible adaptive strategies that could have counteracted variations in production. Two such mechanisms are considered here, and others undoubtedly operated as well.

The first concerns trade or exchange, a topic introduced above. If regional trade existed for no other purpose, it would minimally serve as a resource averaging and buffering mechanism. Indeed, some aspects of trade may have been maintained to provide the framework for redistribution of goods in the face of uneven production over time.

The second mechanism is storage of basic resources for a period of perhaps 2 to 5 years. Archaeological evidence from Cihuatán does not as yet allow us to estimate the size of storage facilities. Bruhns (1950a:54) feels that rooms 2 and 4 in an architectural unit NW-1 served that function. In San Dieguito, structures tend to be more isolated; their eroded condition precludes identifying occupational remains with any degree of certainty, but we postulate a small storage building adjacent to Structure 15-2.

Three notes in the *Gazeta de Guatemala* for 1801 and 1802 concern storage strategies for the San Salvador area; one of these insists that storage facilities that could provide food stuffs for a 2 to 5 year period were essential if one was to survive the bad years. One strategy argued for oven-like granaries that have only a bottom opening through which to extract the grain as needed. The other strategy involved the construction of special storage buildings placed upon a non-cemented base of dry masonry or large and small rocks. The grains were said to keep best if packed in hot, dry sand (*Gazeta*, Tomo V, numero 231, folios 597-598 and 601; Tomo VI, numero 275, folios 218-219). The problem, if not these solutions, must have been Precolumbian.

In addition to naturally caused fluctuations in productivity, human actions would have provided further uncertainty.

Summary

Archaeological botanical evidence suggests that the modern local forest remnants provide useful analogues to the Early Postclassic environment at Cihuatán. The man-land relationship would not have been static. Rather, human activity would have produced a variety of microhabitats that undoubtedly shifted through time. Plant communities would also have responded to the many environmental disruptions that occur with some frequency in Central America.

Botanical remains from archaeological contexts gives firm evidence that corn, beans, and squash were cultivated. Other economically valuable plants tentatively identified are cotton, cacao and cashew. Flotation evidence suggests much of the wood used at the site was not procured locally. We have argued that the cacao was probably imported from an area that better meets the ecological requirements of that plant. A commercial cotton industry has been hypothesized for Cihuatán and environs.

The ecological and botanical research in this project has contributed an exceedingly valuable body of data to the joint endeavor which strengthens and complements the archaeological influences.

CHAPTER 8

A PRELIMINARY LOOK AT INTRASITE VARIABILITY

The 1979 research was initially motivated by an interest in studying intrasite variability at a major Postclassic center. Although it is presumptuous to claim that the available data base allows us to pursue the initial research goal with desirable rigor, we nonetheless want to marshall the data at our disposal and make a beginning. We do this by reviewing the available data and then comparing selected aspects of the archaeological record from the different excavations. Since the whole is not known, and indeed the site is not even fully mapped, it might be more appropriate to call this a subunit study.

The idea that intrasite variability is an appropriate research focus for this site rests on several factors. Prior knowledge about Cihuatán indicates that it was a complex regional center. It is unusually suitable for spatial analysis since it is unencumbered by modern urban sprawl or other forms of development that drastically change the landscape; also, the archaeological remains appear to be confined to the Early Postclassic period.

Drawing on analogies to complex societies as well as on ethnohistorical and archaeological information, certain rather general assumptions about the nature of socioeconomic differentiation expectable in a Postclassic regional center on the southern Mesoamerican periphery can be formulated and the archaeological test implications identified. We assume that socioeconomic differentiation can be depicted on an elite/nonelite continuum with the expectation that the polar ends of the continuum will be more easily identifiable archaeologically than the intervening gradations. Elite parts of the site would be characterized by evidence of greater control of labor and resources than nonelite sectors as expressed in size and complexity of construction and distribution of scarce and/or high status goods. Elite sectors might also exhibit limited or restricted access to certain spaces. Full and/or part time craft specialization is postulated; the sector of society to which the craftsmen belong would depend upon the craft.

These rather broad expectations were assessed and evaluated by reviewing certain categories of information for which comparative data were available from different part of the site. Distributional evidence and clusters of associated elements of limited spatial occurrence are of fundamental importance.

We want to avoid dealing directly or in any detail with the question of whether or not Cihuatán can be regarded as an urban center. Our hesitancy to enter this debate has two facets. On the one hand, archaeological views of urbanism are far from unanimous in their verdict of how it is to be identified; on the other, the data base for Cihuatán is not yet firm enough to argue specifics. Cihuatán certainly has a large areal extent and, apparently, a fairly short occupation.

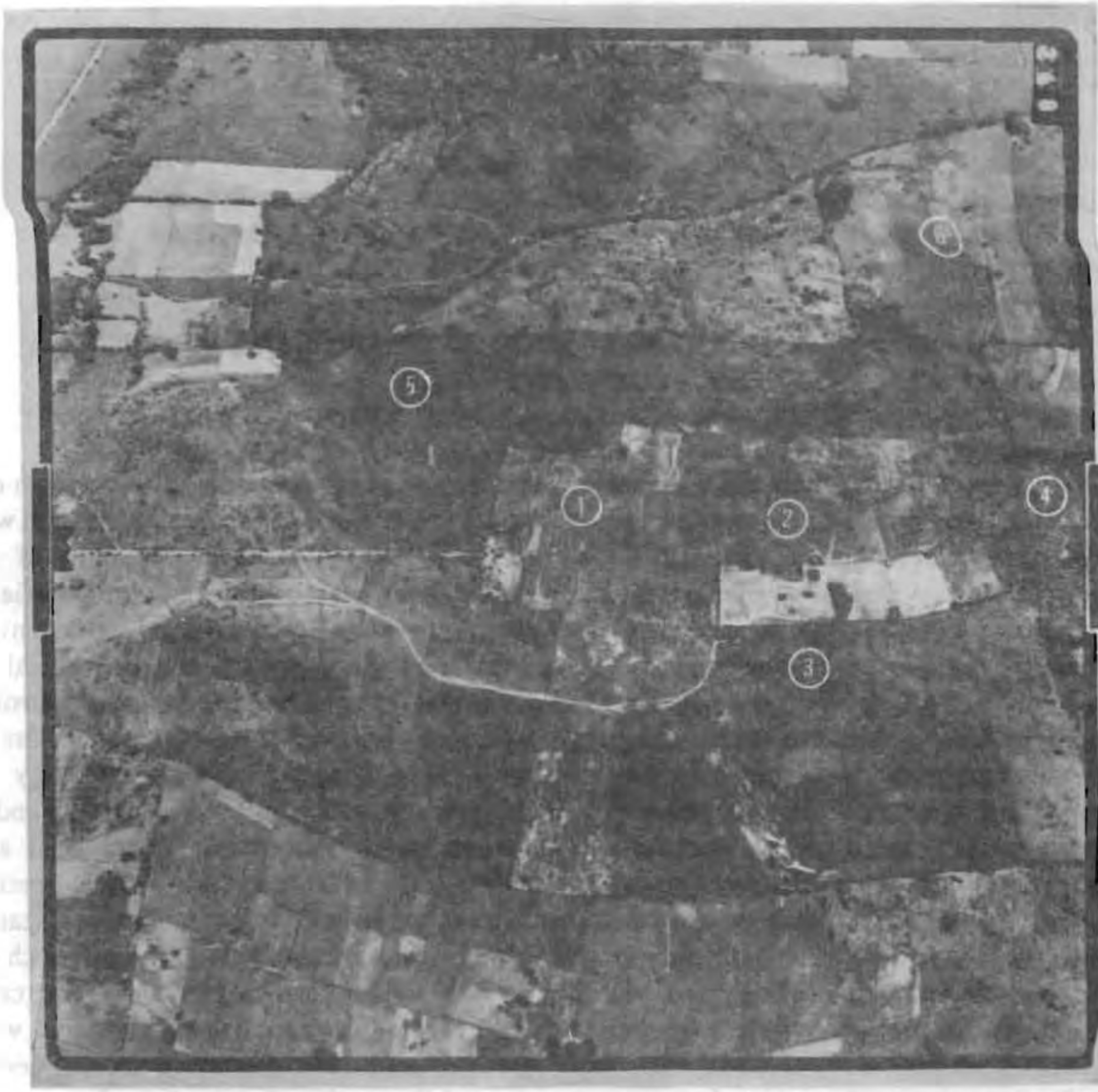


Plate 30. Air Photo of the Site of Cihuatán

1. Western Ceremonial Center
2. Eastern Ceremonial Center
3. South Zone
4. Slopes to the Acelhuate River
5. Location of NW-1 and NW-3
6. San Dieguito

The diversity and number of habitation structures is difficult to estimate at the present time.

The overall research strategy is essentially inductive with an interplay between inductive and deductive reasoning. Since the evidence is rarely unambiguous in terms of supporting a single hypothesis or inference, alternatives are presented and, when appropriate, a best-fit inference is favoured over others. Although the available data base is far from ideal and the preliminary inferences drawn here must be subjected to further testing, it nonetheless seems worthwhile to attempt a holistic view of this site.

Spatial Coverage: The Data

There is, as yet, no single, integrated site map, nor have we attempted to produce one. Distributional evidence comes from Cecil (1982), Bruhns (1980a), Fowler (1981), and our own survey of San Dieguito. The results of Cecil's survey, by far the most extensive survey effort to date, are presented in his MA thesis as individual maps for each 100 square meter (or 1 hectare) unit at a scale of 2 1/2 cm to 10 m. Height of features is not given. An 8" x 11" map locating the grid units (reproduced here as Figure 40) is based on a topographic map from the Instituto Geográphico Nacional, San Salvador.

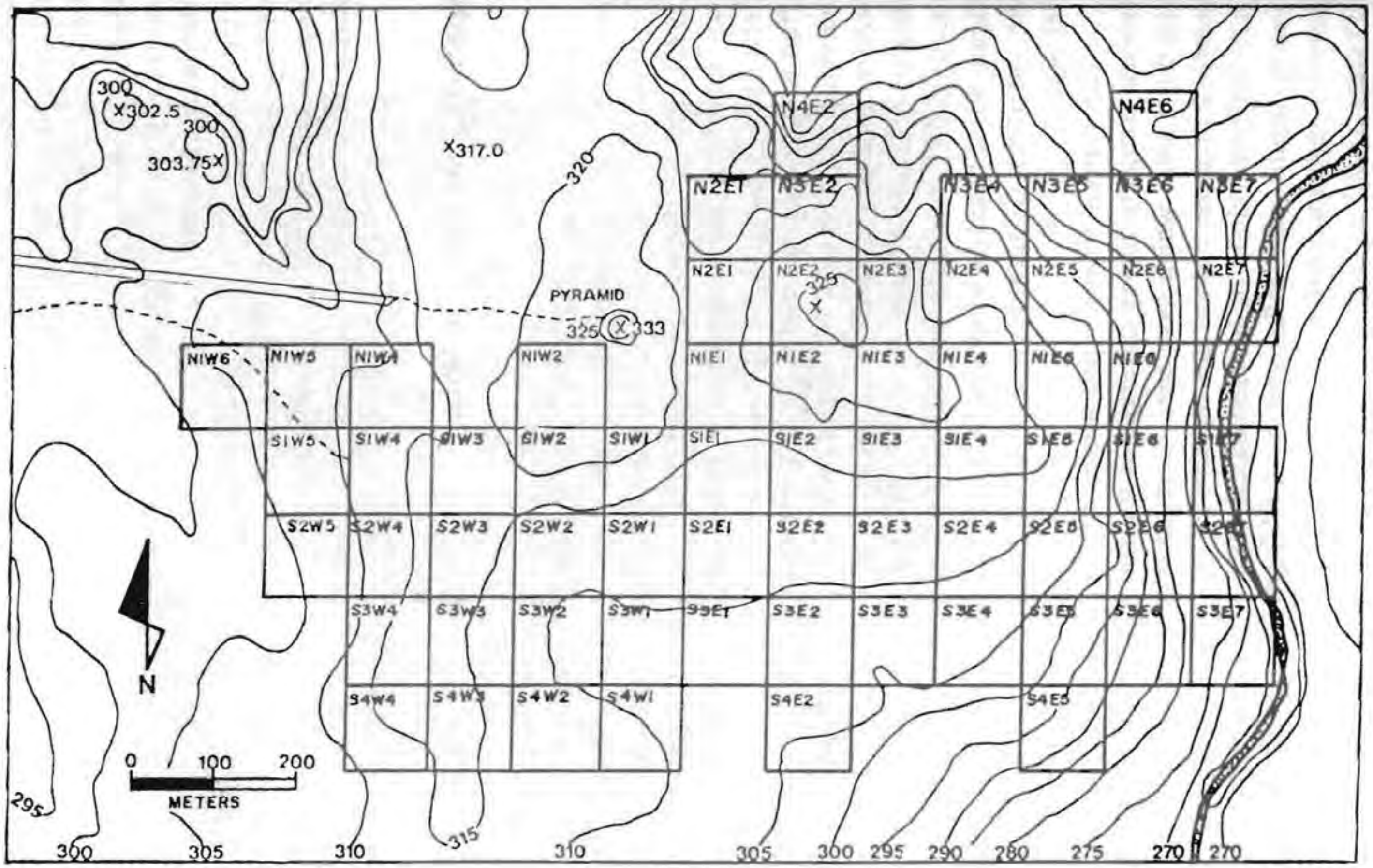
The various sources cited above do not provide complete survey coverage of the site and those areas which have been surveyed or recorded in some fashion are represented by very different kinds of archaeological data. Survey results were influenced by land use patterns, vegetation cover, and other variables affecting visibility. In all surveyed areas, the actual archaeological remains are undoubtedly under represented in available data. Substantial areas remain unsurveyed and the absolute limits of the site have not been accurately determined in any direction. Unsurveyed areas (some of which are known to contain house platforms, stone fronted terraces, and other features such as check dams) include the area between the northernmost extension of Cecil's survey and San Dieguito, the area between San Dieguito and the river, the area from San Dieguito west to the Troncal del Norte, the zone south of Cecil's survey, the valley floor, and virtually the whole west side between the known sectors of the site and the Troncal del Norte. Some of Fowler's random survey units (shown in Figure 40) are located in these areas, and we gained an impression of the distribution of features from simply walking over the area.

Concepts of the overall size of the site and its limits have changed over the period of archaeological investigations. Fowler (1981:40-45) feels the site covers at least 375 hectares (see Figure 4). Bruhns (personal communication) feels it is premature to estimate site size. The relationship of archaeological remains east of the Acelhuate (cf. Haberland 1964) to Cihuatán has not been established, and should these be included, estimates of the areal extent of the site will undergo another enlargement.

Spatial Models

We begin with two very generalized and simplistic spatial models used heuristically for the purpose of providing a framework for looking at the entire site. At our present state of knowledge we lack the data that would allow us to choose between these alternatives, and in any event we expect the archaeological reality to be more complex. Really satisfying spatial models would incorporate regional as well as site-specific information.

Two models considered here focus on the number of major zones to be identified within the site. At first glance, the two appear to be



REPRODUCTION FROM CECIL 1982 WITH PERMISSION OF THE AUTHOR

Figure 40. Location of Cecil's Grid Units

genuinely competitive in the sense that both could not be true, and it should be possible to choose one over the other when enough information is available.

The first model proposes a two-fold division of the site: core vs. periphery. The second is a tripartite division of the site into center, intermediate zone and periphery. Fowler might be seen as favoring the first alternative when he says "The ruins of Cihuatán can be divided into two distinct zones: a nuclear zone comprised of monumental public buildings and elite residential structures and the surrounding 'domestic zones'" (1981:32). However, he sees this as a minimal kind of differentiation, and feels that future research will undoubtedly produce finer subdivisions of the site (personal communication).

From one point of view, what is at stake is the spatial dimension of the residences of the intermediate social classes (if any), of craft specialists and their workshops (if any), and of space devoted to public functions such as markets or reservoirs (if any). From another point of view, the issue is offering the most appropriate interpretation of zones described as having mixed functions.

Whether or not the use of Pipil analogy is regarded as reasonable (and Bruhns for one does not accept this as valid or useful), one would expect spatial differentiation with social, economic, religious and political implications in a site of this size on the southern Mesoamerican periphery during the Early Postclassic. We find the Pipil analogy to be as relevant as others we might select, and all analogy must be used cautiously. Fowler (1981 and 1987) provides an excellent review of Pipil ethnohistory and the documentary sources.

Ethnohistorical documentation for the Pipil indicates three social classes were recognized: nobles, commoners and slaves. These sources also indicate groupings based on descent in which status was partially determined by closeness of relationship to the nobility and particularly to the cacique. Other dimensions of status suggested in the ethnohistorical documentation include associations and occupations. In deducing the spatial correlates of the three-fold class structure, we would assume that slaves would be residentially localized near their noble owners. Therefore, we would expect both slaves and nobles to be residentially localized in the elite central zone. Commoners would be distributed outside the central zone. A two-fold spatial division is not unreasonable, assuming the Pipil analogy to be relevant.

At another level, however, there are indications that actual status markers were considerably more differentiated than the three-fold social class division indicates. Occupational distinctions, gradations in wealth and position in the scale of kin-based relationships offers considerable leeway for differentiations with spatial as well as other archaeological implications. It is not clear that all craftsmen can be identified as commoners or that all spatial evidence of craft specialization would be exclusively localized in nonelite zones. High-status crafts might be localized in the elite zone, as gold working was among the Nicarao (Fowler 1981:894). With several variables affecting the archaeological evidence, it may be that the two apparently competing hypotheses offered above can be reconciled by incorporating them into a multiple level scheme which allows for delineation of variability within the two major zones. Or, it may be found that the two-fold spatial division is either inappropriate or not useful.

A Spatial Tour

In trying to further our understanding of Cihuatán in a holistic sense, we begin with a verbal tour of the site.

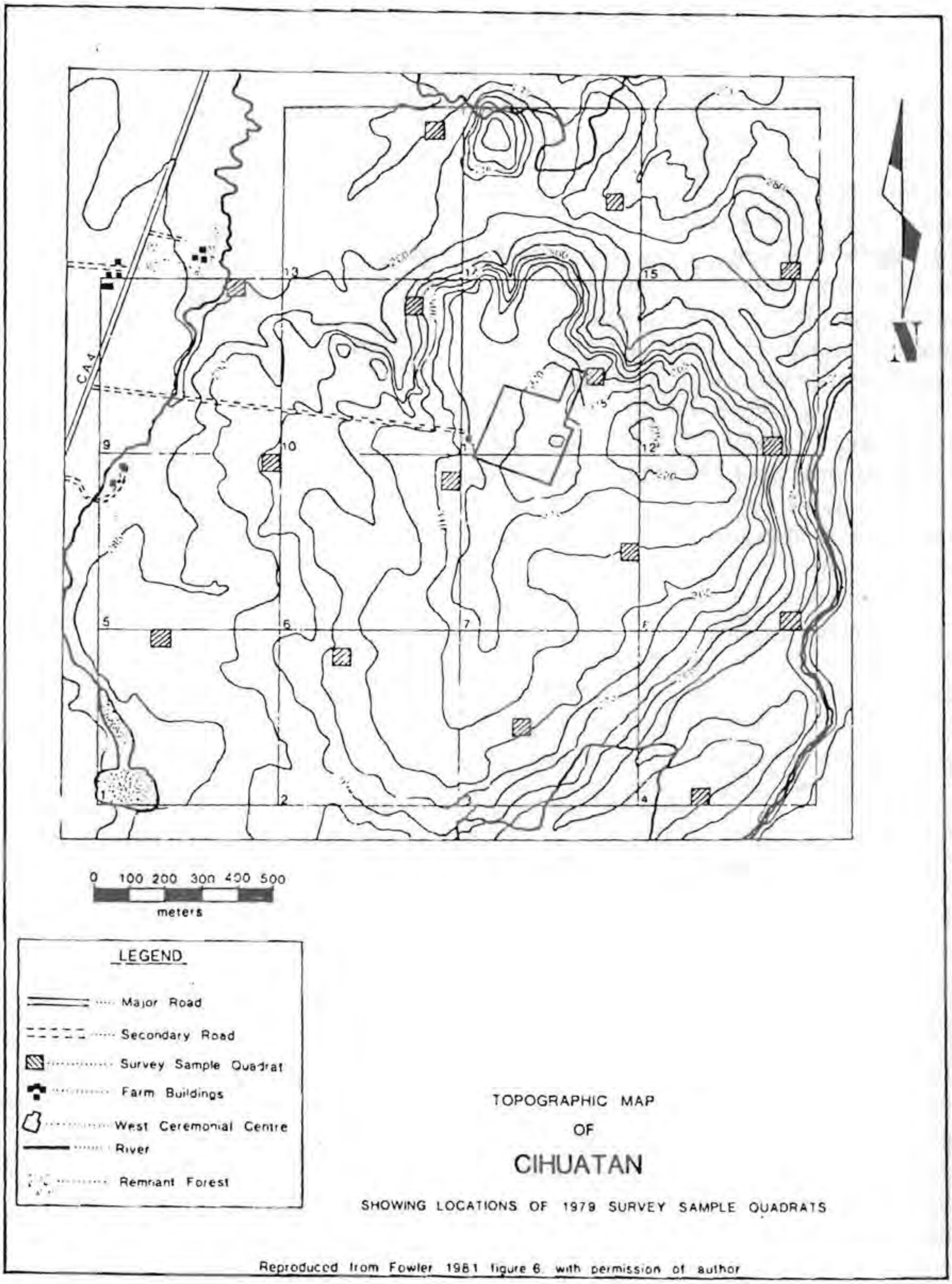


Figure 41. Location of Fowler's Random Survey Units

The Centers

The best known part of the site is the Poniente or Western Ceremonial Center (WCC) (Plate 31). It is characterized by controlled access to its interior precincts. Two ballcourts and the main pyramid (Structure P-7) are the largest structures, but several other platform mounds are regarded as civic/religious structures. A palace complex near Structure P-7 has been investigated by Fowler (1981). All investigators agree that this area of the site had, minimally, ceremonial and elite residential functions.

Knowledge about the Oriente or Eastern Ceremonial Center (ECC) is less extensive. Boggs (1972:51-54) excavated a small mound designated 0-4. Cecil's survey represents the first systematic recording of features for the eastern and southern sectors of the site.

Using Cecil's maps, we attempted to estimate the size of the ECC, to infer something about the nature of its boundaries, to make a gross approximation of the number and range of features. Without additional information about height of mounds and associated artifacts, our discussion is limited in scope and speculative.

The overall size of the ECC and its boundaries are difficult to estimate. There can be no doubt that the mounds and other features placed irregularly around a central plaza group in Cecil's survey unit N2E2 (see Figure 40) can be assigned to the ECC. The central plaza group of four symmetrically placed mounds is located at the highest elevation of the site; the interior plaza (F-1) measures ca. 22 m x 15 m. Other major features include the so-called Acropolis wall (variously described as an earthwork and a modified face of the hill), several mounds of large horizontal dimensions, one of which rises from the Acropolis wall, several smaller mounds, earth terraces and walls. Cecil suggests that the areas between major mounds may have formed a series of plazas. The area covered by this group of 31 mounds (approximately 4.8 hectares) is located in survey units N4E2, N3E1, N3E1, N3E2, N2E1, N2E2, N2E3, N1E1, N1E2 and N1E3 (see Figure 40).

There seems to be good reason to extend the area included in the ECC south into Cecil's S2 tier of units. Several large mounds occur here, including mound SS-71 (in S1E1 and S2E2) with the largest recorded horizontal dimensions of any mound in the entire site (ca. 65 m N-S and ca. 10 to 17 m E-W). Cecil describes a series of "walls" trending roughly E-W crossing the S2 tier of units between S2W2 and S2E1. Bruhns (personal communication) notes these are better called low terraces. Large marshy areas in this southern extension limit the amount of building space. It has been informally suggested by various archaeologists working at the site that markets, reservoirs and public plazas may have been located here. If the ECC is considered to extend to the "walls" in the S2 tier of units, then approximately 36 mounds would be located within its boundaries and the size of the ECC would be larger than 8 hectares. If the ECC extends even farther south, as is arguable, at least 40 mounds would be included.

The question of ease of access to the ECC, and the related question of the nature of its boundaries is difficult to assess. It was not walled, although there are internal divisions that may prove to delimit space adjacent to major mounds. Many of the southern "walls" in the S2 tier of units appear to be terrace facings. However, Cecil (1982:80) describes a long wall (#338) that runs roughly east-west in units S2 E4 and S2E5 as "These long walls were apparently low, maybe held a fence or palisade?" Elsewhere Cecil describes these survey units as domestic or habitation area (Cecil 1980:41). In any event such walls or terraces may have created a barrier to free access.

Cecil's maps show no mounds along the entire east side of the ECC, and a buffer zone ca. 100 m wide may have formed a spatial barrier. On the west side, there appears to be a buffer

Plate 31. Air Photo of the Western Ceremonial Center

1. P-7 (the main pyramid)
2. P-6
3. North Ball Court
4. P-2
5. P-1
6. Northwest corner of walled precincts
7. West wall near P-12
8. West Ball Court
9. P-20
10. Patrimonio Cultural facilities
11. South wall of the WCC
12. East wall of the WCC

zone between the ECC and the eastern wall of the WCC, judging from Cecil's maps, although Bruhns (personal communication) says there are plazas and domestic mounds in this area. The northern limit of Cecil's survey was so close to the northern part of the ECC that the nature of this boundary cannot be estimated.

In general, the ECC appears to form a spatially distinct sector of the site. However the boundaries are drawn, the ECC is at least as large in area as the WCC, and possibly considerably larger. It has more mounds than the WCC, some quite large. The investment of labor and resources to construct the features of the ECC appears to exceed those invested in the WCC. Few hypotheses can be offered about the kind of activities localized in the ECC beyond noting that the diversity of features, the number of large mounds and the well placed central plaza group suggests a combination of civil, ceremonial and elite residential functions. The possibility that markets, reservoirs and other public space is either incorporated into the ECC or adjacent to it needs to be tested.

Evidence for an Intermediate Zone

Expectations about the characteristics that might be found in an intermediate zone include residences, civic-religious structures, specialized workshops, and public space devoted to markets and reservoirs. These would have to occur in some combination of features in order to qualify since we know that single civic/religious structures occur in the peripheral zone. An intermediate zone would presumably be less exclusive with easier access than the centers.

Several parts of the site immediately adjacent to the centers might qualify for intermediate zone status. Investigators have commented on the mixed function of mounds in these areas, referring to possible civic-religious platform mounds among more frankly domestic mounds, or to workshops among civic-religious mounds. For example, a line of eight mounds lies outside of and roughly parallels the west wall of the WCC. Most are assumed to be civic-religious platform mounds but one (Structure P-16) is interpreted by Bruhns (1980a:41-42) as a specialized, indeed commercial, obsidian workshop. Fowler, however, would regard the evidence Bruhns presents for Structure P-16 in support of her hypothesis as better fitting cottage-level production and part-time specialization. Whichever interpretation is favored, mixed functions are seen for this line of mounds.

The area between the line of eight mounds and the west wall of the WCC is Bruhns' favored location for a market. Bruhns tested this area, as we did in 1979. Neither of us came up with artifactual evidence that would confirm or reject the hypothesis that it served as a marketplace.

Depending on how the southern boundary of the ECC is drawn, the area that might be included in the ECC or that is just beyond its southern boundary can be considered for intermediate zone status. A T-shaped mound and at least two other intermediate sized mounds are located south of the walls in the S2 tier of Cecil's survey units. A third area that should be investigated in evaluating the intermediate zone hypothesis lies east of the ECC along the edge of the central massif overlooking the Acelhuate.

Presently available evidence does little more than identify the locations to be more thoroughly investigated. If an intermediate zone is supported by additional testing, it appears that it will be discontinuously located between the centers and the peripheral zone.

The Peripheral Zone

If the presence of an intermediate zone is still quite speculative, we can say with assurance that the peripheral and largely domestic zone is definitely not homogeneous. Structure 12-1 (Excavation Area D) in San Dieguito offers firm evidence that civic-religious functions were extended into the peripheral zones, perhaps in a *barrio* system. Fowler (1981:862-873) has gone so far as to consider a *calpulli* organization for Cihuatán on the basis of ethnohistorical information about the Pipil and analogy to the Aztec *calpulli*.

The overall distribution of the predominantly domestic structures in the peripheral zone seems most directly affected by topography and drainage. Structures are not found in places that are, at the present time, marshy. They are found on the periphery of the central massif and on its slopes as well as on adjacent hills. Flatter land was obviously desirable, and larger areas of flattish land allowed larger aggregations of structures. However, flat land cannot have been the overwhelming concern in choosing building sites since the broad flat plains and/or valley floors surrounding Cihuatán either was not used extensively for construction purposes, or the mounds have been levelled as a consequence of modern agricultural practices. Fowler (1981:74-75) feels that other variables affecting location and patterning of features within the peripheral zone are distance to water and distance to the ceremonial center.

In Cecil's survey, over 1000 features were located in the approximately 73 hectares surveyed. Of these, at least 362 are variously described as house platforms, mounds or platforms. Of these only 30 or 40 can be assigned to the ECC, leaving the vast majority outside of that center. Other features are walls, leveled terraces, pavements, check dams, ramps, and a rock cluster. Some of the features designated as walls cross contour lines, some are internal walls on platform mounds, and no small number are L-shaped. Some or even many of these may represent foundations for structures. Aside from obvious surface features, buried structures undoubtedly exist. Neither the NW group excavated by Bruhns, nor San Dieguito Structure 15-2 could have been confidently identified as structures before excavation.

One area of dense occupation is south and southwest of the WCC in Cecil's grid units N1W4, W5 and W6; the S1 and S2 tiers of units from W3 to W5; and the S3 and S4 tiers in W3 and W4. In a roughly oval-shaped area running ca. NNW to SSE and covering approximately 8 hectares, over 100 mounds were mapped by Cecil. This particular oval-shaped area may be a product of mapping strategies rather than reflecting reality on the ground since the limits of survey are involved in the definition of this area. Nevertheless, this is a dense habitation area located on reasonably flat terrain. Many of the mounds in this area are quite small, being 1-2 m in diameter. Larger mounds are interspersed with the smaller ones, suggesting that house mounds may have had multiple storage or special function structures nearby, but it is difficult to identify planned groups or mound function with any assurance. This eight hectare area has a higher density of structures per hectare (ca 12) than does San Dieguito (ca 9).

A possible exception to the otherwise rather unstructured placement of mounds is the plazuela group excavated by Bruhns (1980a:20-31) in Cecil's units S3W3 and S4W3 which would be at the southeast end of the oval habitation area mentioned above. In this plazuela group, SS-49 stands on the north; strangely enough, this mound has a north-south axis rather than an axis that would place it across the north end of the enclosed plazuela. SS-49 is higher than the other mounds of the group, and this, plus the finding of a foot of a large hollow figure of the sort attached to large censers, suggest it may have functioned as a household shrine. The east and west mounds of the plazuela group, SS-50 and SS-54, appear to have burned, leaving ample evidence of their domestic nature. The badly destroyed SS-53 closed the south end of the plazuela. Another mound south of SS-53 may also have formed part of this group.

In the area south and east of the ECC, at least 200 house platforms and features other than walls were mapped by Cecil. Included here are stepped platforms (P-17 in S3E6, for example), a ramp and other structures that may have had mixed or specialized functions. As the terrain becomes rougher, especially on the slope facing the Acelhuate, the number of retaining walls increases dramatically. Unit N2E6, for example, contains 86 walls. House platforms occur on terraces down the escarpment.

To the northwest of the WCC, Bruhns excavated the NW-1 and NW-3 group located along and behind retaining walls along the upper edge of the western slopes of the central massif. NW-1 is of great significance since it is the best evidence of a domestic grouping for which the function of the various components can be determined. The complex consisted of, minimally, two house platforms (Structures 1 and 3), two store rooms (Structures 2 and 4), and a patio. NW-3, a house platform located upslope from NW-1, may also have formed part of this complex.

Fowler mapped a group of structures in his Quadrant 10 (see Figure 40) located just downslope from NW-1. One large house platform and five smaller mounds of unknown function may represent a more amorphous domestic complex than is seen in NW-1 or the southern plazuela group.

The San Dieguito survey did not give clear evidence of domestic groupings; we suggest that a small unexcavated structure adjacent to Structure 15-2 in Excavation Area B may have served as a storage facility for that structure. Within the San Dieguito Survey Area, Fowler mapped a plazuela group of three house platforms in his Quadrant 15 which is located upslope to the north of Structure 12-51 (Excavation Area C).

The evidence from NW-1, the southern plazuela group, and the plazuela group mapped by Fowler in the San Dieguito area indicate that domestic complexes consisting variously of multiple households, storage facilities, shared space for outdoor activities and/or household shrines should be sought systematically in the peripheral zone, even among the more amorphously placed mounds.

This review of spatial distributional evidence from the peripheral zone reenforces our general impressions of a lavish use of space and an open settlement pattern characterized by room for outdoor activities, gardens, or merely small buffer areas for privacy between domestic groupings.

The Temporal Problem

In assessing density of occupation and estimating population, building sequence and time depth becomes significant. Fowler (1981:75) argues that the "suburban" zones were settled after the areas closer to the centers, offering what is essentially a population expansion model. The WCC or Poniente mounds excavated to date have proven to have almost sterile fill, suggesting that they were built early in the history of the site before there was much cultural debris to be incorporated in platform fill. Bruhns (1980a:36) notes that HP-102 (located on the eastern edge of the central massif) was the only structure excavated by the San Francisco State University team that showed definite evidence of midden fill. The elite palace complex excavated by Fowler (1981) shows clear evidence of rebuilding. Bruhns (personal communication) notes that SS-54 and the west ballcourt also were rebuilt. San Dieguito Structure 15-1 had culturally rich fill in the house platform; San Dieguito Structure 12-1 fill was not sterile, but the frequency of cultural materials in the mound fill relative to fill volume was low. This meager evidence is insufficient for charting the temporal changes in spatial utilization at Cihuatán; further research aimed specifically at internal chronology is needed

Summary

Spatial distribution of constructed features supports the general expectations of greater control over resources and labor in the elite zone, greater variability of features in the central zone and controlled access to elite zones. With regard to the latter point, limited access in the sense of access by authorized personnel might have prevailed much of the time but controlled access in the sense of introducing an audience to witness and thereby validate the activities of the civic-religious specialists must also have occurred. A clear dichotomy exists between the central zone and the outer periphery. Certain intermediate localities do not fit easily into the dichotomized view and these should be further investigated to delineate their characteristics. Direct mapping of a two-fold spatial model based on the Pipil class structure analogy onto the archaeological evidence is not feasible. This does not mean that the commoner/noble plus slave spatial distinctions are false, but that we must account for variability by introducing other factors. The "barrio with site center" spatial model looks promising. Following the presentation of distributional evidence by artifact classes, we will return to the problem of spatial divisions of Cihuatán.

Distributions of Ceramic Items other than Vessels

As one of the most abundant and universally distributed of the artifact classes, ceramics can be expected to provide evidence for evaluating socioeconomic differentiation, as well as modes of production and distribution including degrees of craft specialization. For the present, some of the problems of dealing with multiple systems of ceramic classification are counterbalanced by the fact that the three major collections form aggregates of about the same size. In spite of the acknowledged difficulties, some interesting variations in distributional patterns emerge. In the following sections only those categories of ceramic objects and vessels showing differential spatial patterning are discussed.

Figurines

Three kinds of figurines have been found at Cihuatán -- Mazapan style, wheeled figurines, and the small figurines with solid animal or human heads, hollow bodies and solid limbs.

Mazapan Figurines: The best Mazapan style figurine fragments (N=2) come from the WCC (Fowler 1981: Figure 59a and b). Bruhns found 5 "possible" Mazapan fragments in HP-102. Their known limited occurrence in the WCC and in the fill of a house platform on the eastern periphery of the central massif suggests that these figurines were not widely distributed nor routinely associated with the nonelite peripheral zones.

Wheeled Figurines: The wheeled and other figurines Boggs (1972) describes from Cihuatán were all from "ceremonial" contexts of two caches and the 0-4 structure containing the sacrificial (?) burials of a young woman and a dog. Boggs bases his discussion on two nearly complete zoomorphic wheeled figurines and fragments of 8 or 9 others. He argues that wheeled figurines, some of which seem to represent dogs (?) (see Boggs 1972 Fig. 19), functioned ritually and not as toys. Dog sacrifice recalls the mythological association of dogs with Xolotl, the role of dogs as guides to the underworld, several archaeological examples of dog sacrifice, and Alvarado's 1524 first hand accounts of woman-dog sacrifice in what is today Guatemala (Boggs 1972: Footnote 23).

As excavations have extended beyond the central ceremonial areas of Cihuatán, it has become clear that not all wheeled figurines

(1972: Figure 23) which is said to have come from P-16. The style of the figurines, therefore, does not serve to differentiate among the archaeological contexts in which these figurines may occur.

Boggs illustrates no female figurines, whereas at least three of the San Dieguito torso fragments represent females. Bruhns (1980a:95) mentions the female form. The samples are so small as to be virtually meaningless, but the sex depicted on figurines may prove to differentiate nonelite or domestic contexts from others.

The distribution of these figurines offers more useful leads for evaluating intrasite variability. Aside from ritual caches containing figurines, the centers have produced very few. Fowler (1981:269) reports only 20 fragments (one with vestiges of blue, red and white paint) from his 1978-79 excavations in the WCC. Included are one human head (Fowler 1981: Figure 59c), two bird heads, and the two gingerbread-like Mazapan style fragments noted above. Provenience was not given of these items or the other 15 parts of figurines he excavated, but they are clearly uncommon in his large ceramic sample from elite residential and ceremonial contexts. They appear also to be absent from P-16 and P-22 which Bruhns excavated, and rare in the southern zone. None were found associated with San Dieguito Structure 12-1, the barrio civic-religious structure. This general scarcity of figurines from elite residential zones and ceremonial structures suggests a parallel situation to that of the distribution of wheeled figurines, although small human or animal headed figurines have a wider distribution (see Table 17). San Dieguito domestic structures (especially Structure 15-1 fill) produced a disproportionate number of figurine parts relative to excavations in other parts of the site.

Summary: The Mazapan figurines appear to be scarce and to be limited to elite and perhaps intermediate spatial contexts. Wheeled and other figurines occur in caches but are rare to absent in the ceramic assemblages associated with temple ritual and elite residential areas. Except for the possibility that female figurines may be confined to nonelite domestic contexts, there are no convincing stylistic differences between wheeled or other figurines found in the caches and in domestic trash. Should we be able to strengthen the inferences about the association of figurines with domestic contexts, the relative frequency of figurines associated with "mixed" or intermediate zones may offer one means of evaluating the status of that zone and assessing the function of individual structures. If, for example, larger numbers of figurines denote nonelite domestic structures or trash, then the scarcity of figurines in the southern plazuela group might be considered with other evidence (such as the height of SS-49 which also produced the foot of a figure attached to a large incense burner) as suggesting that this plazuela group should not be considered as pertaining to the same social and economic level of society as San Dieguito.

The function of these figurines is unknown, but two alternatives can be suggested. The first is that they are associated with commoner supernatural beliefs which formed a substratum of folk religion not represented in the more formal religious beliefs and activities associated with the civic religious structures. The second is that figurines were used in diagnosis of illness and curing, perhaps being discarded or buried after use. The latter is not incompatible with their concentration in domestic construction fill. Other alternatives should also be explored. Distributional and other data should, in time, sharpen our perceptions.

"Ceremonial" Forms

Unlike figurines, other so-called ceremonial forms appear to be most commonly associated with central civic/religious structures. Insofar as I am aware, the ceramic representations identifiable as Tlaloc, Xipe Totec or Mictlantecuhtli are largely confined to the central parts of the site, although Bruhns reports a sherd that may have a painted "Tlaloc" eye from SS-50 (cf. 1980: Figure 20a) and two pieces of a "double chambered whistle in the form of a Tlaloc (?) head from HP-102" (ibid:34).

These kinds of ceramic forms are classified as Las Lajas Modeled by Fowler (cf. Tables 18 and 19). The highest frequency of this category (8.45%) is found in association with Structure P-1 (see Table 19). Excavation unit 78-1A in the North Ballcourt had the next highest frequency (3.52%) but the combined frequency from the ballcourt is 1.44% (Table 18). The forms illustrated for Las Lajas Modeled include a jaguar foot, a toad, and a Tlaloc vessel (Fowler 1981: Figure 31).

Large hollow figures representing deities may occasionally occur in nonelite or mixed zones. Bruhns reports something that may be part of a headdress from a large figure from P-22 (1980a: Figure 20b). From San Dieguito Structure 15-1 fill we have a modeled human ear approximately one half size and it is possible that other modeled fragments come from larger hollow figures. Hollow figures were sometimes attached to braziers or censors; Bruhns (1980a:Figure 18b) illustrates a hollow foot that was part of a brazier from SS49.

Incensarios (braziers or censors) come from most parts of the site in which excavations have been conducted, but the highest frequencies are definitely from civic/religious structures in the Western Ceremonial Center. In Fowler's classification, incensario sherds and parts are assigned to Las Lajas Composite (Table 19). Structures P-1 and P-2 (the two platform mounds west of the North Ballcourt) have the highest frequency of this type (13.09% and 21.68% respectively). Large, elaborate, spiked incensarios were concentrated on the steps of these structures, but it is interesting to note that P-1 had the highest frequency of modeled pieces whereas P-2 had more of the incensario fragments, suggesting either that these two adjacent mounds had somewhat different functions, or they reflect unperceived temporal differences. The North Ballcourt, with which P-1 and P-2 are associated, has appreciably lower overall frequencies of both Modeled and Composite categories, although one excavation unit in the North Ballcourt (78-IG at the extreme south end of the east range of the ballcourt) has 9.52% Composite. P-19 outside of the main Western Ceremonial Center enclosure has 5.68% Composite and .75 Modeled. Boggs (1972:Figure 15) illustrates one of the large, spiked forms from Structure 0-4.

Bruhns (unpublished tabulations) lists incensario sherds from SS-49 (N=3), SS-50 (N=1), HP-102 (N=15), SS-118 (N=3), P-16 (N=5), NW-1 (N=15), NW-3 (N=1). The listings include spiked forms, ledge rims and more generic designations. While braziers occur in clearly domestic contexts, Bruhns feels smaller sizes were considered appropriate there.

We found nothing in San Dieguito identifiable as a large, spiked incensario. Two midsections of small, plain braziers with interior flange and applique decoration on the exterior (see Plate 13b) came from Structure 15-1 construction fill as did several heavy ledge rims which may be from braziers. Perhaps eight plain brazier or ledge rim fragments were associated with the southern steps of Structure 12-1; none came from Structures 15-2 or 12-51.

In general, then, the large, spiked censers are significantly associated with central civic-religious structures and, judging from Structure 0-4, other ritual contexts. Some spiked incensarios occur outside of these contexts, but the forms may be smaller. Certain parts of the site such as San Dieguito appear to have fewer censers, and those that have been definitely identified are both smaller and plainer than those found elsewhere.

On distributional grounds we can postulate that large spiked censers, large hollow figures and other coarse ware or the Las Lajas ceremonial pieces represent a specialized ceramic complex associated primarily with central civic-religious structures. This, the most distinctive ceramic complex at the site, exhibits boundary maintaining characteristics by virtue of its limited distribution and strong association with the sacred precincts to which access was limited and controlled.

Outlying civic-religious structures such as the San Dieguito temple appear to share the ceramic assemblage of the adjacent nonelite area rather than that of the central zone.

Ceramics from San Dieguito structure 12-1 have not been described in this monograph since they have not been completely studied. Some impression of the ceramic assemblage needs to be set forth here since this bears on the problem of intrasite variability. Large numbers of ceramic vessels were associated with the south steps, and especially with the margins of the steps. This echoes the situation in the WCC where the steps of the civic-religious structures were littered with pottery. That found on the barrio temple steps, however, was very unlike the Las Lajas ceremonial complex found in the WCC. Although there was at least one large, smooth censer with button style applique at the rim and midsection, most of the pottery represents a limited range of those categories found in the San Dieguito domestic contexts. Tamulasco Plain and Garcia Red were common, but few painted vessels and imports were noted. Nor are there hollow figure fragments, figurines, spindle whorls, or perforated ladles. Interesting enough, our preliminary notes indicate an unusual number of very large vessels; there are also small shallow plates and dishes. It seems that the San Dieguito barrio temple shares the general ceramic complex of the adjacent barrio, and differs significantly from similar structures in the WCC. Of particular interest is the intimation that there may be meaningful subtle differences between the barrio temple ceramic assemblage and that from the adjacent domestic structures. Even if other peripheral zone civic/religious structures are found with the specialized ceramic complex, the San Dieguito Structure 12-1 data will not be falsified. Rather, more complex hypotheses will be required.

Spindle Whorls

The distribution of spindle whorls can be used in evaluating the general proposition that craft specialization existed and more specifically, that textile production was important at Cihuatán. It is assumed that the most important fiber processed was cotton. The two parts of the site that have produced the most spindle whorls are San Dieguito (N=29 in Structure 15-1 fill) and the NW-1/NW-3 complex. For NW-1, Bruhns (1980a) reports six spindle whorls in the patio and one in Structure 1. In her 1986 paper, Bruhns reports eleven spindle whorls were found in the NW-1/NW-3 group: "Most of these were encountered in such a context as to suggest they formed the contents of a single spinning or sewing kit" (Bruhns 1986:308). Bruhns feels this is *not* evidence of cotton processing on a commercial level.

All other occurrences from other parts of the site are either single finds or two or three specimens. From Bruhns' unpublished tabulations, 2 are noted for HP-102 (see also Bruhns 1980a: Figure 36a), 1 spindle whorl and 2 fragments came from SS-118 and 1 fragment from P-16. None are listed for the southern plazuela group. Fowler (1981:453; Figure 70-g) also reports a low incidence of spindle whorls from his excavations. The Southeast Patio of the WCC yielded 2 spindle whorls; another comes from P-1, and one surface find came from Fowler's survey of the area immediately north of the WCC.

Those described or illustrated by Bruhns and Fowler fall within the range of the San Dieguito specimens. The latter group, being more numerous, exhibits greater variation as might be expected. All reported spindle whorls are within the size and weight range expectable for processing cotton. Some of the San Dieguito specimens are so thin and light-weight as to indicate the production of very fine thread.

The obvious concentration of spindle whorls in two nonelite domestic zones suggests to us that cotton processing occurred in those zones, possibly as a form of part-time specialization. Spinners may or may not have carried out all the steps in weaving and textile dying, and we have no way of estimating the extent of sub-specialization for this industry.

Net Sinkers

Like spindle whorls, net sinkers offer a clue to an activity for which we have no direct archaeological evidence – in this case, net fishing. They appear to have a limited but somewhat unexpected distribution. By far the largest single concentration come from the Southeast Patio in the WCC (N=55), with individual specimens from Structure P-2, the North Ballcourt, and a surface find north of the WCC (Fowler 1981:449 and Figure 70a through e). Bruhns (1980a:96-97) reports the presence of both larger and smaller net sinkers. From her unpublished tabulations, one large net sinker is noted for NW-1 and three for P-16. None were found in San Dieguito excavations and none were noted in the survey.

On the basis of present information, the elite residential area produced the most net sinkers and extensive areas in the domestic zone produced none. This in turn raises questions about access to the resources of the Acelhuate and/or Lempa Rivers. If, as was suggested earlier, slaves were localized in the elite zones, we are moved to suggest that net fishing was the task of slaves.

Fired Clay Objects of Personal Adornment

These are rare in all parts of the site. Bruhns found four solid clay objects that may be ear spools (1980a:96; Figure 36d) from NW-1. She also mentions clay beads; an incised clay bead is listed in the unpublished tabulations from HP-102. Fowler (1981:454; Figure 70-1) describes a ring-like object from the North Ballcourt. On present evidence, personal adornment using fired clay objects appears to have been unimportant, but if these possessions were buried with their owners we lack the relevant archaeological context for their occurrence.

Drain Tiles

Drains that functioned as the name implies are known for the Southeast Patio complex in the WCC. Elsewhere, the function of the striated cylindrical tiles is less clear. Bruhns (1980a:94) reports finding 10 pieces of "drainpipe in the NW-1 complex which are slipped dark red", and these are the only drain pipes she reports from her several excavations. From San Dieguito, we have 11 fragments from Structure 15-1 and at least two from Structure 12-1. Some of these, like those Bruhns reports, are slipped red. The NW-1 pipes are ca. 10 cm in diameter whereas those from San Dieguito are ca 14 cm in diameter. Unfortunately, none of the archaeological contexts outside the WCC offer clues to their function in nonelite domestic contexts.

Summary

In spite of the obvious inadequacies of the data and rather drastic problems of sampling and representativeness, the data on ceramic objects other than vessels offers the grounds for present speculation and future testing of hypotheses. Figurines of different sorts appear to show nonrandom clustering that separates temple ritual from ceremonial caches and domestic occurrences. A complex of ceramic objects primarily associated with central temple ritual has been identified, and differences between central and barrio temple ceramic wares have been established. Net sinkers and spindle whorls are differentially distributed, offering insights into the localization of specialized activities.

The Distribution of Ceramic Vessels

In general, the same basic ceramic classification categories occur in all parts of the site. This component of the comparative

Table 18

North Ballcourt Ceramic Frequencies (percentages)

Calculated from unpublished excavation unit tabulations provided by Fowler

	Excavation Units						
	78-1A	78-1D	78-1E	78-1F	78-1G	78-1H	Combined
Number:	652	36	234	958	21	317	2218
Las Lajas Course	6.59		2.13	2.40		0.63	3.29
Las Lajas Composite	2.76		1.70	0.94	9.52	0.63	1.57
Las Lajas Modeled	3.52		1.70	0.42		0.31	1.44
Las Lajas Straited	2.14		7.69	4.27		0.94	3.42
Las Lajas Fillet	0.15		0.43	0.63			0.36
Tamulasco	43.86	61.11	51.28	36.43	4.76	46.37	37.73
Garcia Red	26.84	36.11	27.35	40.50	14.28	18.61	35.61
Quijano White	0.61		2.99	0.94		1.57	1.12
Zancudo Polychrome	1.53	2.77		4.48		6.94	3.38
Jejen Polychrome	1.68		1.28	3.34	9.52	13.56	4.14
Tamoa R/B	4.44		0.85	1.56	61.90	5.04	3.38
Tamoa Incised	1.07					0.31	0.72
Peralta Brown	1.07			0.73		0.63	0.72
Cachinflin Black	0.30		2.56	0.73		2.83	1.12
Nicoya	1.99			0.63		0.31	0.90
Plumbate	1.22			1.98		1.26	1.39
Metallic slipped							1.39
Other/Unidentified	0.15						0.04

78-1A = West range of ball court
78-1D = Extreme north end
78-1E = East range
78-1G = Extreme south end of east range
78-1H = South end of west range
78-1F = South end of east range

exercise does not suffer unduly from the presence of rare or unusual occurrences, and sample sizes are, for the most part, adequate.

Red-slipped Ceramics

As the most unambiguous comparative category, it is worth considering its' distribution in some detail. Bruhns found floors on which there were numerous crushed vessels, especially in the Structures of NW-1 and NW-3. For these, the San Dieguito rim sample seems the most appropriate comparison since it best reflects vessel frequencies. Fowler's samples do not appear to represent such serendipitous assemblages, and indeed 16,718 of the 26,846 sherds he analyzed came from construction fill. The San Dieguito random sample seems more appropriate for comparisons to his collections. For the moment, Bruhns' and Fowler's collections will be considered independently and then comparisons made.

Within Bruhns eight collections for which I have raw data (Table 20), sample sizes range from N-20 to N-7631. Ignoring the smallest sample from SS-53, we see that the lowest frequencies of red-slipped ceramics are from the

Table 19

Ceramic Frequencies (percentages) From Selected Excavations Carried out by Fowler

Calculated from unpublished tabulations provided by Wm. Fowler

	78-1C	78-1B	78-1Y	78-1I	79-1A	78-2A	78-3A	78-2B
Number:	2131	1463	264	15710	1730	1080	1481	1600
Las Lajas Coarse	1.54	0.75	3.40	4.90		6.39	0.54	1.44
Las Lajas Composite	13.09	21.68	5.68	0.75		2.41	0.27	2.62
Las Lajas Modeled	8.45	1.29	0.75	0.20			0.20	0.44
Las Lajas Straited	0.98	1.02	0.75	1.01	0.57	0.28	0.81	0.81
Las Lajas Fillet	0.98	2.32		0.20	2.54	0.18	0.13	2.50
Las Lajas Miniatures				0.03				0.12
Tamulasco	33.78	28.45	51.90	47.84	18.03	64.07	56.98	56.56
Garcia Red	14.59	28.11	17.00	31.22	47.51	22.68	28.15	29.68
Quijano White	0.28	0.41	3.03	0.55		1.29	1.89	3.68
Zancudo Polychrome	7.03	0.13	3.78	2.50			0.27	0.19
Jejen & other Red Poly.	2.81	0.20	2.65	1.99			2.23	0.50
Tamoa Red-on-Buff	7.08	4.70	6.81	2.32	2.19	0.46	2.44	0.31
Tamoa Incised	0.56	0.54	0.37	0.07			1.14	0.12
Peralta Brown	6.52		0.37	0.07		0.27	3.30	0.12
Cachinflin Black		1.10	1.13	1.83		1.48	0.27	0.75
Nicoya Polychrome	0.84	4.20	1.13	0.41		0.18	0.67	
Plumbate	0.89	3.35	0.75	0.24		0.28	0.34	
Metallic slipped		0.07	0.37	0.33				
Other/Unidentified	0.52	1.50		1.84	29.13		0.27	
Naguapate Red				1.64				

78-1C = P-1
78-1B = P-2
78-1Y = P-19
78-1I = Southeast patio
79-1A = Ramp Southeast patio
78-2A = Surface of the North pasture
78-3A = Test pits in 78-2A
78-2B = Surface of the north slope

southern zone: (SS-118:22% and SS-50:25%), followed incrementally by SS-40 (31%) and P-16 (32%). There is a major increase in red-slipped pottery in NW-1 (40%) and NW-3 (49%), suggesting that the red-slipped pottery was more popular in domestic contexts.

Turning to Fowler's collections (Tables 18 and 19), the lowest frequencies of Garcia Red are associated with Structure P-1 (14.59%) and Structure P-19 (17%) – the former a civic-religious structure and the latter one of the line of mounds west of the Western Ceremonial Center that may have had mixed functions. Structure P-2, on the other hand, has 28% red-slipped, again emphasizing its distinctiveness from the adjacent Structure P-1 which we first noted in connection with the frequencies of Las Lajas Modeled and Las Lajas Composite. The Southeast Patio elite residential collection has a solid 31% in a very large sample, whereas the adjacent ramp has a higher frequency (47.5%) of red-slipped, thereby falling in the high range of Structures NW-1 and NW-3.

Within the North Ballcourt (Table 18), individual samples are smaller than those from Fowler's other collections. The combined frequency of 35% masks the variation present in the separate parts of the excavations. The highest frequencies are found at the extreme north end and at the south end of the east range. Ignoring the small sample of Operation 78-1G, the lowest frequency is at the south end of the west range.

Fowler surveyed and tested in the areas just north of the WCC, and surveyed an area on the slope still farther north (Operations 78-2A, 78-3A and 78-2B). These are in the nonelite residential zone that one crosses en route to San Dieguito. Red-slipped ceramics in these collections comprise 22% to 29%.

If the San Dieguito rim sample is the most appropriate for comparing to Structures NW-1 and NW-3, then the frequency of red slipped for San Dieguito (43%) is within the high range of that domestic complex, supporting the inference that the highest frequencies are in domestic

Table 20

Ceramic Frequencies from Bruhns' Excavation

Calculated on the basis on unpublished data provided by Karen Bruhns

Site: Number:	SS-49 231	SS-50 977	SS-53 20	SS-118 2929	NW-1 5855	NW-3 4185	P-16 3471	HP-102 7631
Tan	21.64	23.40	60.00	3.51	15.00	16.00	10.00	7.60
Unslipped		0.71		1.00	0.90	2.10	(in Misc.)	2.43
Reds	31.16	24.80	5.00	22.00	40.00	49.20	32.40	35.68
Whites	4.76	13.30		19.00	13.80	4.00	12.70	7.70
Poly/Bichromes	6.92	7.26	15.00	3.58	5.87	9.36	3.65	5.04
Browns	0.43	0.61		4.99				0.70
Blacks	1.73	0.20		0.13				0.13
Orange				0.01	0.17	0.23	0.30	0.18
Usulutan								0.01
Plumbate	3.89	1.02		0.20	0.09	0.07	0.10	0.47
False Plumbate					0.03			
Gray								0.45
Eroded	24.24	26.70	20.00	43.00	16.80	13.54	29.47	34.71
Misc.	5.19	1.53		1.50	6.80	5.16	10.20	4.77

contexts. Against this we have the modest frequencies from Fowler's surveys and testing north of the center, but again, there is the question of what to compare. In the San Dieguito random sample, red-slipped pottery ran 29%, and for reasons explained in Chapter 3, that is a bit high for the total collection. It may be that Fowler's survey and testing results conform to the perceived pattern of high red-slipped frequencies in domestic contexts if one allows for increased loss of finish in surface sherds and considers the nature of the San Dieguito samples.

Elite residential zones and some civic-religious and mixed function structures have middle range frequencies, while some civic-religious structures have the lowest frequencies of this category.

The Plain Categories

Of all ceramic categories, these are the most difficult to compare. There are reasons to believe that the pronounced differences in percentages of unclassified sherds affect this category in significant ways. The few trends observed are as follows.

Fowler's Tamulasco Plain and Bruhns' Tan slipped appear to be most common in residential contexts and less common in association with civic-religious and "mixed" function structures in the centers and in the south zone. The NW-1 and NW-3 residential complexes excavated by Bruhns have significantly less of the plain ceramics than any other residential units including the palace complex in the WCC; they also have less than most of the special function structures.

Fillet applique or "pie-crust" rims, differentiated by all investigators, are absent from most of Bruhns' excavations in the south zone. Small numbers of such rims found at Structures HP-102, P-16 and NW-1 never account for more than .19% of any assemblage. A similar frequency characterizes the San Dieguito collection. Highest frequencies of Fowler's Las Lajas Fillet are found in the WCC (the Southeast Patio ramp, Structures P-2 and P-1) and a survey unit on the north slope of the WCC (78-2B), but all of Fowler's collections except the one from Structure P-16 show minor amounts. This distinctive form should be monitored as having potential chronological significance.

Relative Frequencies of the Combined Major Categories

It was argued earlier that Las Lajas, Garcia Red and Tamulasco Plain in Fowler's scheme account for the majority of the San Dieguito ceramics. The following demonstrates that this is also the case in the Western Ceremonial Center, except for the very low showing of the three combined types in 78-1G which, however, has a very small sample.

Provenience	Combined Frequencies of 3 types
78-1C (P-1)	73.41
78-1B (P-2)	83.62
N. Ballcourt combined	83.42
78-1A	85.86
78-1D	97.22
78-1E	92.28
78-1F	85.59
78-1G	28.56
78-1H	67.49
78-1I (SE Patio)	86.15
78-2A	96.01
78-2B	94.17
78-3A	87.08
79-1A	68.65
78-1Y (P-19)	79.48

For Bruhns' excavations, it is difficult to calculate comparable frequencies for these major categories, but by reversing the procedure and calculating the combined frequencies of categories not belonging to the major categories, a rough approximation can be made:

Excavation	Combined Frequency of Other Categories	Approximate Max. Freq. of Main Categories
SS-49	17.73%	82.27%
SS-50	22.39	77.61
SS-53	15.00	85.00
SS-118	27.91	72.09
HP-102	14.68	85.32
NW-1	19.96	80.04
NW-3	13.66	86.34
P-16	16.75	83.25

which suggests Bruhn's individual assemblages show less variation that Fowler's, but fall within the same range. However, the substantial differences in investigator perceptions about 'eroded' and 'unclassified' sherds must be kept in mind. To accept these calculations of possible maximum frequency of main categories means that one assumes the sherds placed by Bruhns in the 'eroded' category actually belong to the main categories – an assumption that may not be warranted.

Other Categories

Polished brown and black pottery is absent from four of Bruhns' seven units and from four of Fowler's 14 units but present in the San Dieguito collection. Highest frequencies come from a WCC platform mound (Structure P-1) and from the southern zone "mixed" function mound (SS-118).

One of the most surprising differential distributions is the white category. Bruhns' simply calls it white, Fowler calls it Quijano White, and we did not attempt to differentiate it from the white background polychromes for reasons discussed in Chapter 3. However, the highest frequency in Fowler's units is 2.7% in 78-1D in the North Ballcourt. The overall frequency for his entire collection is 0.7%. In Bruhns' collections, on the other hand, frequencies for the larger samples range from 4% to 19% with four of her seven samples having more than 10%. Admittedly, there are perceptual and classification differences involved in the different schemes, but unless Bruhns classified sherds as white that Fowler would classify as Tamulasco Plain in substantial numbers, this appears to represent a significant element of variability within the site.

White background polychromes presumed to form part of the local ceramic complex tend to outnumber red background polychromes in most contexts. Bruhns' Bichrome/Polychrome pottery can be equated with Fowler's Zancudo Polychrome, Jejen Polychrome and Tamoa Red-on-Buff to give a rough indication of the relative frequencies of the minor local decorated categories:

Bruhns' Bichrome/Polychrome		Fowler's Zancudo/Jejen/Tamoa	
SS-50	7.26%	P-1	17.48%
SS-118	3.58	P-2	5.57
NW-1	5.87	P-19	13.61
NW-3	9.36	SE Patio	6.88
P-16	3.65	SE. Patio Ramp	2.19
HP-102	5.04	N.Ballcourt	11.62

and San Dieguito Minor Local Categories	
Random Sample	5.1%
Rim Sample	5.6%

Certain civic-religious structures in the WCC clearly have the highest frequency of these categories. Interestingly, the elite residential unit has less of these than some nonelite domestic structures.

Nicoya or Nicoya-like Polychrome has a limited distribution, but occurs in both elite/nonelite and residential/civic-religious contexts in low frequencies. Plumbate is more widely distributed.

Summary

Although the spiked censers and modeled pieces are meaningfully associated with central residential and civic-religious structures, it is clear that social class differences are not strongly reflected in the ceramic vessels associated with different parts of the site. Even the imported types like Plumbate and Nicoya or Nicoya-like Polychrome found their way to the peripheral domestic zones. The absence of an identifiable ceramic complex that differentiates residential areas belonging to different social classes can be seen in part as reflecting the relative secularization of Postclassic societies in Mesoamerica and its southern periphery. What differences exist between different parts of the site with regard to vessels are matters of degree – not kind. Subtle differences in assemblages as reflected not only in the traditionally conceived classification categories but also in form and size attributes should help refine our understanding of intrasite variability.

It is interesting to note that the highest frequencies of red-slipped ceramics appear to be in nonelite residential zones. On purely subjective grounds, I would select it as the best made of the locally produced ceramics, and on less subjective grounds, much of it required one more production step than was the case for the Tamulasco or tan slipped pottery, thereby making it more costly in terms of manufacturing time. Not unexpectedly, somewhat more of the minor decorated and imported types have been found in the central zone than elsewhere. More useful information about intrasite variability using the evidence of ceramic vessels would come from ordering the data in terms of size and form, but we lack the information to pursue this.

On the basis of mineralogical analysis, we postulated at least two ceramic production systems. The first, pertaining to the numerically dominant vessel categories (Garcia Red, Tamulasco Plain, and Las Lajas vessels in Fowler's scheme) is seen as involving mass production. The second, applicable to minor locally made vessel categories, spindle whorls, figurines and the specialized ceremonial complex, was interpreted as smaller scale production in a number of different centers. We cannot rule out household manufacture of figurines, for example, but we are inclined to view all ceramic production as representing two or more levels of specialization. The distributional evidence does not refute these hypotheses.

Obsidian Working and Use Areas

As a first level approach to the problem of identifying possible locations of lithic production, the relative frequencies of debitage or wastage to other categories can be examined. The notion is that the larger the percentage of debitage or wastage and cores, the more likely it is that we are dealing with a production locale. The overall count of chipped stone pieces would appear to be less significant than the composition of the sample in identifying production areas, but quantity of pieces will help isolate areas of usage and/or production.

This notion is deceptively simple and a number of uncontrolled variables could distort inferences based on it. Production locations for particular structures or complexes showing low frequencies of debitage may have been spatially separated but in the immediate vicinity. If excavations were limited to structures, outside activity areas would be missed. The lithic concentration between San Dieguito Structures 15-1 and 15-2 shows this to be a real possibility. Secondary or postproduction debitage and/or wastage resulting from specific activities might produce debitage frequencies that could be confused with primary production frequencies without fuller analysis. Sample sizes can also distort inferences. Obsidian concentrations might represent disposal areas of hazardous waste rather than in-situ workshop debris.

Bruhns Collections

Fowler included Bruhns' collections in his 1981 analysis of Cihuatán and Santa Maria chipped stone (See Chapter 6). Discrepancies exist in the two sets of tabulations of Bruhns' collections, but these are not of great significance to the arguments advanced here. Using the counts in Bruhns (1980a:Table 2) and calculating frequencies of obsidian pieces in three selected categories, we get the following results for several of her excavation units (SS-49 and SS-53 are omitted because of small sample sizes):

Structure	Obsidian Total N	Blades*	Cores	Debitage
NW-1	1003	92.72%	0.99%	1.89%
NW-3	341	74.48	1.46	18.18
P-16	1558	58.79	0.64	35.81
P-22	204	65.19	2.45	24.01
SS-50	293	93.17	3.07	2.73
SS-118	779	80.06	1.02	15.14
HP-102	937	94.02	0.53	1.06

* Includes blades and blade fragements, but excludes large blades

On the basis of the relative frequency of debitage to other categories, P-16 and P-22 appear most likely to have been the locales of lithic production, followed by NW-3 and SS-118. The very low incidence of debitage from NW-1, SS-50 and HP-102 suggests that lithic production did not occur at these structures. Frequencies of cores and debitage are not strongly correlated. The highest percentage of cores comes from SS-50 which has one of the lower debitage frequencies, while P-16 with a high debitage frequency has one of the lower core frequencies.

The quantity of lithic pieces is a function of, among other things, the extent of the excavations. A ratio of lithics to sherds offers a rough guide both to the relative size of excavation areas and to the quantitative relationship of lithics to ceramics. The latter may be used cautiously to infer whether or not unusual quantities of lithics are involved.

Structure P-22 stands alone in having more lithics than ceramics; its relatively small sample must be considered in evaluating this anomalous situation. The remaining structures can be ordered in ascending order of ratios: P-16, SS-50, SS-118, NW-1, HP-102 and NW-3, with the first structure having the lowest ratio of lithics to ceramics and NW-3 having the highest. Lithic production and/or specialized usage of lithic tools is more likely for the lower ratios.

Structure	N obsidian	N ceramics	Obsidian:sherd ratio
NW-1	1003	5855	1:5.83
NW-3	341	4185	1:12.27
P-16	1558	3471	1:2.22
P-22	204	134	1.52:1
SS-50	293	977	1:3.33
SS-118	779	2929	1:3.75
HP-102	937	7631	1:8.14

For the area west and northwest of the WCC, we can postulate one obsidian workshop (Structure P-16) and a domestic complex (NW-1 and NW-3) in which a medium to low ratio of lithics to ceramics suggests a medium level of involvement in activities requiring obsidian blades that were not manufactured in significant quantities on the premises. The status of Structure P-22 cannot be determined without detailed comparative data from other civic-religious structures.

Structures SS-50 and SS-118 are in the south zone while Structure HP-102 is at the eastern margin of the escarpment overlooking the Acelhuate. Of these, only SS-118 has a significant percentage of debitage (15%), suggesting that if a production locale can be identified at present for the south zone, it is SS-118. However, the debitage percentage is much lower than that for P-16. The lithic:ceramic ratios for SS-50 and SS-118 are quite similar, while HP-102 shows the second highest ratio of lithics to ceramics of the structures being considered. The amount of lithic utilization for SS-50 and SS-118 appears to be somewhat higher than in the NW-1/NW-3 complex.

The HP-102 artifacts come primarily from mound fill, unlike the artifacts from the other structures Bruhns excavated, and Bruhns has noted that HP-102 differs from all other collections in a number of ways (more figurine heads, higher incidence of imported pottery and so on). The higher ratio of ceramics to lithics undoubtedly indicates something about the location from which mound fill was borrowed, and future research in this zone can be expected to provide further enlightenment.

While discussing the southeastern part of the site, it should be noted that Cecil (1982) reports an unusually heavy concentration of obsidian on the surface of survey unit N1E4. The only structures reported for this unit are described as domestic. This would be an area worth future investigation as a lithic production area, perhaps a major workshop.

Fowler's Analysis

Since Fowler was not addressing the problem of intrasite variability, his own data are not organized in a way that allows individual excavations and structures to be analyzed separately. However, the cumulative lithic/ceramic index of 1:2.66 for his own and Bruhns' collections indicates that obsidian was plentiful in the central zone and environs.

San Dieguito

Fowler's analysis of the chipped stone from other parts of the site can be used for a gross, first-level comparison to the San Dieguito lithics included in the loan collection. For this purpose, three major categories are selected:

	Fowler 1981 N=15634	San Dieguito Loan Collection N=9915
Wastage	10.7%	46.0%
Unretouched flakes	88.2	53.37
Retouched flakes	1.53	0.6

Acknowledging that Fowler's 1981 frequencies mask a considerable amount of variability within the component parts of his sample, the gross comparison nonetheless indicates that the San Dieguito collection is significantly different in its composition. Using the criteria set forth above, the high percentage of debitage in the San Dieguito collection suggests that the collection reflects spatially localized production. As noted in Chapter 6, polyhedral core frequency is lower than in Fowler's 1981 tabulations, suggesting that prismatic blade production was less important in the San Dieguito industry. The sheer abundance of lithic remains in the San Dieguito loan collection is impressive. If we combine the totals for Fowler's analyzed lithic collections and those from the San Dieguito loan collection (N=25549), the San Dieguito materials account for 38.8% of the total. To put it another way, the number of lithic pieces analyzed from San Dieguito are equivalent to 63% of the number included in Fowler's (1981) earlier analysis, and the San Dieguito lithics come from considerably smaller excavation areas.

It is impossible to give a comprehensive obsidian:ceramic ratio for the San Dieguito materials because of the history of the collections. A total of 15804 sherds and other ceramic pieces was recorded from Structure 15-1 in the artifact descriptions made in the field. A total of 7852 obsidian pieces were actually counted, but due to time pressures some entries simply recorded approximations of quantity. For those excavation units with detailed counts, obsidian:ceramic ratios were calculated. The results show a great deal of variation ranging from 1:1 in some units to others with several hundred sherds and no obsidian. The overall ratio of obsidian to ceramics for the completely tabulated units of Structure 15-1 (Excavation Area A) is 1:3.28. Structure 12-51 (Excavation Area D) yielded 846 ceramic pieces and 414 lithic pieces (412 obsidian pieces) for an obsidian:ceramic ratio of

1:2.05. This is the lowest ratio recorded for a structure. It is clear that the two San Dieguito structures for which we can make such estimates exhibit unusually low ratios of obsidian to ceramics, which translates into an inference (based on debitage frequency) of significant lithic production and/or usage. This production and/or usage is quantitatively different from the overall pattern in the more central areas.

Artifacts from the San Dieguito civic-religious structure (Structure 12-1) were not included in the loan collections. Artifact descriptions made in the field show conclusively that remarkably little obsidian came from the occupational debris associated with this structure. The pottery from this structure was weighed and the overall composition of the pottery from each unit was described, but detailed counts were not systematically made. Some idea of the scarcity of obsidian can be gleaned from the fact that only 182 pieces of obsidian were found associated with this structure while over 20500 grams of pottery are recorded. On the temple steps, for example, one piece of obsidian was associated with 11800 grams (9 bags) of pottery. In the mound fill, which only had very sparse inclusions of cultural materials, the ratio of obsidian to ceramics (1:3) is higher than for Structures 15-1 and 12-51.

The near absence of occupationally associated lithics at Structure 12-1 appears to be in strong contrast to the civic-religious structures in or near the centers where obsidian is found in significant quantities in association with such structures. Therefore, while domestic structures at San Dieguito appear to have the highest incidence of obsidian at the site, the civic-religious Structure 12-1 has the lowest representation of obsidian.

The concentration of obsidian between Structures 15-1 and 15-2 is one of two lithic concentrations definitely identified at the site. The other, Structure P-16, seems to represent quite a different level of production. Only two excavation unit collections from the San Dieguito obsidian concentration area were included in the loan collections. Field notes indicate dense obsidian debris with a high percentage of debitage and at least two broken bifaces were concentrated in the upper 10 cm of unit 17N 0E. The concentration, measuring ca. 2 m in diameter, was located on a stone fronted terrace south of Structure 15-2. This could either be a production area, or, more likely, a dump from a near-by workshop.

If the San Dieguito lithic concentration in unit 17N 0E indicates the proximity of a major obsidian working area, thereby having its status as a workshop supported, several implications follow. Workshops must be seen as diversified in space and probably as diversified with regard to what was being produced. Blade production to varying degrees appears to have been almost universal. Woodworking and other more task-specific tools may represent more specialized production. A detailed comparison of the obsidian collection from Structure P-16 and the San Dieguito 'workshop' could be expected to clarify this point. The San Dieguito case shows that significant evidence relevant to questions of craft specialization are located outside of structures. If problems of representativeness and production modes are of interest to future researchers, these exterior areas must be tested.

Distribution of Ground Stone Artifacts

These artifact classes are not as numerous as either ceramics or chipped stone, nor are they as well documented. Although we assume that the grinding stones are products of specialized manufacture, no one has reported evidence to suggest their manufacture at the site. The main inference to be drawn from their distribution concerns not their manufacture but the localization of their utilization – food processing, for example, in the case of manos and metates.

Celts and other polished stone artifacts are of interest because the stone, if not the finished product, was imported. Their distribution is therefore evaluated to see whether these imports cluster in elite zones or have a more general distribution paralleling ceramic vessels. If these were elite-controlled goods, and if they formed part of the burial complex, their distribution could be misleading in the total absence of burial information.

Manos and Metates

These vegetable processing artifacts are the most numerous of ground stone artifacts. Distributional information correlates to some extent with research tactics of the different investigators and the nature of the areas and structures selected for survey or excavation.

Bruhns (1980a) excavated several burned structures with household contents more or less *in situ*; several grinding implements were associated with floors. Perhaps 6 of the 8 metate fragments she mentions in connection with her excavations were associated with the occupation of those structures. She does not report surface locations of grinding implements, nor were these noted by Cecil (1982) in his survey of the ECC and south and east peripheral zones.

Fowler (1981:408ff) reports a total of 9 manos and 24 metates. Of these, 3 manos and 2 metates came from excavated contexts. All others are surface finds from his survey units 11 and 14 with the preponderance of them coming from the nonelite domestic areas of survey unit 11 just north of the WCC.

Fowler's excavation in the Southeast patio was sufficiently extensive and the resulting collections sufficiently large to indicate that grinding implements are genuinely scarce in this elite residential area which produced only one mano and one metate fragment. Grinding implements are actually better represented in civic-religious contexts than in the elite residential zone. One metate fragment and one mano were associated with P-2, another mano with the North Ballcourt, and one mano with San Dieguito Structure 12-1. Most of the manos and metates, however, appear to be found in domestic contexts outside the WCC – some in structures or patios, but most are surface finds. We suspect that vegetable processing occurred in exterior work spaces as well as in houses or structures.

Unless the excavations in the Southeast Patio missed the food preparation areas (some modern Maya have separate structures for food processing), it would appear that maize grinding was not routinely carried out in this complex. This in turn suggests that any ground maize consumed in the elite residential area was processed elsewhere – perhaps being acquired through a market or tribute system. On the other hand, the relative frequency of grinding implements on the surface of nonelite domestic areas suggests processing at the level of the domestic complex or household. If maize grinding occurred on a commercial or market exchange level, these nonelite zones also appear to be the best candidates for such specialization.

For San Dieguito, 48 metate fragments and eight mano fragments were recorded as surface finds on the survey. Fragments of two grinding slabs (function unknown) were recorded in close proximity to Structure 15-1 and two manos were positioned on the outer edge of the *talud/tablero* construction of Structure 12-1. Of the manos and metates noted in the survey, only two were spatially associated with visible structures.

All zones of the site produced more metates or metate fragments than manos (see Table 21) and this seems curious. The discrepancy is least marked in Bruhns' collections, which have the best contextual data, and most marked for the San Dieguito surface collection.

Table 21

Ground and Polished Stone Distributions

	Fowler	Bruhns	San Dieguito
Manos	9	5	2
Metates	24	8 or 9	48
Other grinding stones			2
Pestles	1	1	
Mortars	1		
Discoidal hammer/grinder	1		
Bolas (pecked stone balls)		2	
Barkbeaters	1		1
Animal figures or sculpture			1
Palettes	2		
Celts	9	1*	2
Incised stone plaque	1	1	
Stone beads	4	1	1
Carved jadeite	1(?)		1
Doughnut stone (digging stick wt?)			1
Pumice abrader	1		

* unfinished

Celts

All celts reported from Cihuatán are made of non-local materials usually described as hard green (not jade or jadeite) or grey stone. Local manufacture or finishing is suggested by Bruhns' (1980a:101) mention of an unfinished celt from HP-102. Three of the nine celts reported by Fowler (1981) were associated with Structure P-1; the other six are "general surface finds." One of the two San Dieguito specimens came from Structure 15-1 fill; the other was noted on survey. In addition to the pieces discussed above, Gloria Hernandez excavated a cache of lithic materials from P-20 (Hernandez 1975). Included in the cache were eight stone celts. Thus, of the 20 celts reported for the site, three were associated with a civic-religious structure, two were found in platform mound fill, eight were found in the cache and the remainder were surface finds. Therefore most of the celts were associated with specialized structures, but ca. 35% are in locations compatible with their usage in nonelite contexts. It appears that celts, like ceramic vessels, were fairly democratically distributed.

Other Categories of Stone Artifacts

All other categories of ground, pecked and polished stone are too rare for their distribution to have meaning (see Table 21 for their tabulation).

The presence of bark beaters is of interest in that it demonstrates clearly that this industry was practiced at Cihuatán. The two Cihuatán specimens are among a relatively small number of bark beaters from Mesoamerica that can be assigned with confidence to the Postclassic. One of the two Cihuatán specimens come from the Southeast Patio (Fowler 1981: 427-430 and Figure 66). The other was a noncollected surface specimen associated with a domestic structure on the apex of San Dieguito hill.

Surprisingly few stone beads are reported in Cihuatán. Of the four reported by Fowler (1981:437-41), only one came from an excavated context in the Southeast Patio. Others were surface finds. The San Dieguito example came from Structure 15-1 fill. One jadeite piece came from San Dieguito.

In an unpublished report on two caches found in the south zone, Bruhns reports a small trapezoid piece of polished light green jadeite lying in a small annular base cup buried in the floor of SS-53. She also reports several polished and unusual stones from the cache in SS-54. A serpentine and a piece of the serpentine plaque and pecked stone balls came from HP-102 (1980a:33-35; personal communication).

The WCC produced more categories of stone tools than did other parts of the site.

Summary

Available evidence supports the core/periphery spatial model at one level of magnitude. Although information at hand does not allow thorough evaluation of the intermediate zone concept, recognition of finer spatial divisions appears to be feasible, and the barrio/site center model may prove to be useful. Sub-units of the site are not homogeneous in their constructional features or associated artifacts. The WCC is clearly different from the ECC, and each exhibits internal variability. The ceremonial ceramic complexes associated with the several excavated civic-religious structures in the WCC show significant differences which may reflect temporal or functional factors. These in turn differ from the palace complex ceramics in the same WCC which are similar to domestic ceramic assemblages in the peripheral zone, albeit with more decorated and imported pieces.

Civic-religious structures in the peripheral zone are characterized in the San Dieguito case (Structure 12-1) by a T-shaped mound with *talud/tablero* construction, and a staircase flanked by balustrades. Associated ceramics are quite different from those found at the nearly identical structures in the WCC, having much more in common with the domestic ceramics in San Dieguito. However, like civic-religious structures in the WCC, Structure 12-1, appears to lack figurines. Residentially associated ceramic vessels, imported obsidian and imported fine-grained stone tools and beads appear to be rather democratically distributed. It is unlikely that the gross distributional evidence for ceramics and obsidian will be overturned by future research since the samples involved are so large, but important differences in assemblage composition and in the distribution of minor types appear to exist.

Infrequent categories of artifacts such as items of personal decoration and the fine-grained stone tools could easily yield different distributional patterns with additional information, especially from burials.

The most convincing evidence for craft localization comes from the peripheral and/or intermediate zones. Spindle whorls implying spinning and weaving are best represented at San Dieguito. Frequencies of obsidian debitage suggest localized production of blades and other tools. Probable obsidian production location are the obsidian concentration area on San Dieguito, Structure P-16, and Cecil's survey unit in the southeastern sector -- the latter noted as having unusual quantities of surface obsidian. Other specialized activities appear to be processing of food products in the peripheral zone and the apparent concentration of net fishing in association with the palace complex in the WCC.

Figurines other than the Mazapan type occur in peripheral domestic contexts and in caches but they are poorly represented in association with central civic-religious structures and the palace complex.

Some interesting variability has emerged in this preliminary and quasi-holistic look at Cihuatán. Keeping in mind that there are undoubtedly crafts for which we have no archaeological evidence, and archaeologically visible crafts for which we lack evidence of production (grinding tools, ceramics), it nonetheless can be argued that most craft production, food production and first stage food processing occurred outside of the core zone.

Differences between the central and peripheral civic-religious structures show that some of these structures in the nonelite zone are architecturally like those in the center but their associated artifacts are more like the adjacent domestic mounds and quite unlike those of the central zone. Overall, Cihuatán shows remarkably few class differences in household furnishings and belongings between those who lived in the palace and those who lived across the swale.

CHAPTER 9

EXCHANGE AT CIHUATÁN

The role of exchange in the evolution of Mesoamerican cultures has attracted growing attention in recent years (Chapman 1957; Rathje 1973; Parsons and Price 1971; Sabloff and Rathje 1974; Sabloff et al 1974; Webb 1978; and Berdan 1978), and this is part of a broader interest in this topic in archaeology (cf. Earle and Ericson, eds. 1977; Sabloff and Lamberg-Karlovsky, eds 1975; Renfrew 1975 and 1977). In the preceeding chapter, certain possibilities for extraregional exchange in perishable goods were discussed – with commercial cotton growing and the production of textiles and dyes being proposed as an archaeologically invisible contribution to the wider exchange networks centered in Cihuatán. Long-distance imports may also be seen in the Plumbate and Nicoya Polychromes, other nonlocal pottery, obsidian, the green and gray stones, jadeite and the effigy metate. Ethnohistorical sources for western El Salvador and adjacent areas of Guatemala suggest localized production of pottery for export as well as extensive trade in archaeologically nonvisible goods such as salt, marine products, woods, textiles, and honey.

Of the several categories of archaeologically visible evidence of long distance exchange, obsidian constitutes the only one for which sources are known and some degree of quantification can be presented. We therefore turn to an analysis of the obsidian imports at Cihuatán in order to establish an empirical basis for one aspect of Cihuatán's involvement in extraregional exchange which is then compared to other similar studies.

Long Distance Obsidian Trade

Obsidian:sherd ratios: Mesoamerican archaeologists have often used obsidian:sherd ratios to give an approximation of the relative abundance of obsidian (cf. Sidrys 1977:100). We use it here as the best comparative measure available to us, but we acknowledge its imperfections. In particular, the obsidian:sherd ratios from different sites can be based on very different sorts of data bases, and their real comparability is unknown. Some of the uncontrolled variables:

- data are compared that derives from archaeological projects of quite different periods; there is some reason to suspect that recovery procedures have not been uniform over time,
- data are compared from archaeological projects having different research goals, recovery procedures and analytical priorities.
- when a single ratio is given for a site, intrasite variability is homogenized and lost,
- overall size and location of reported excavations can affect the size and composition of samples used in calculating the ratio,

- surface and excavated collections are not distinguished,
- object size and breakage patterns are not considered.
- there is an underlying assumption that sherd numbers can be treated as some kind of constant variable between sites.

When large enough samples are involved, some factors are presumably homogenized to a degree and the comparability problems somewhat reduced.

The number of uncontrolled variables involved in calculating obsidian:sherd ratios from different sites for comparative purposes has caused some archaeologists to regard this procedure as invalid or of questionable usefulness. We feel that if used cautiously and with full appreciation of the problems, the technique is useful for exploring how the amount of obsidian at one site compares to the amount at other sites. It is hard to think of other measures that are as easily available or as informative.

A fair degree of variability characterizes the individual collections from Cihuatán. If we had quantified data from San Dieguito Structure 12-1, the lithic to sherd ratio would be exceedingly low, and if we had fully quantified data from the San Dieguito obsidian workshop or dump, as the case may be, the ratio would favor obsidian over sherds by an impressive amount. To use the Cihuatán data for broader comparative purposes, an attempt must be made to produce a ratio that ignores variability for the sake of obtaining a ratio for the site as a whole.

We have attempted to create a general obsidian:sherd ratio by tabulating obsidian and sherds from the three major projects that provide quantified data. The combined totals for ceramics include Fowler's published tabulations, Bruhns' unpublished counts and the field counts for San Dieguito. Combined totals of obsidian are taken from Fowler's tabulations (which include Bruhns' collections) and the San Dieguito obsidian included in the loan collection. The combined total of obsidian is known to be low; however, the samples are large enough that a workable if imprecise approximation is achieved for the site as a whole:

	Obsidian	Sherds	O:S Ratio
Combined Totals	25549	78789	1:3.08

External comparative data is quite uneven. The sample size for Santa María is relatively small. Chalchuapa has a lengthy occupation from Preclassic to Postclassic and obsidian is not differentiated by period in the reports (Sheets 1978). For the Zapotitán Basin, an overall obsidian:sherd ratio for all sites represented in the 1978 collections can be obtained from the ceramic tabulations of Beaudry (1983) and the chipped stone analysis of Sheets (1983). Santa Leticia tabulations are from Demarest (1986: 55 and 210) and those from Quelepa from Andrews (1976:46 and 160-161). Sidrys (1977:102) gives single obsidian:sherd ratios for sites with obsidian sample sizes ranging from 1 to 25,000 pieces of obsidian and with sherd samples ranging in size from 26 to 525,150. Using combined totals of sherds and obsidian for the Salvadoran sites of Cihuatán, Santa María, Chalchuapa, Quelepa, the 1978 Zapotitán Basin collections, and Santa Leticia, and selecting a few other Postclassic sites from Sidrys' list (1977:Table 3:p.102), and taking all of these at face value, the obsidian:sherd ratios can be viewed comparatively by examining the small table on the next page.

However these figures are interpreted, it is clear that Cihuatán and Santa María are closer to each other than either is to any other site. The low ratios for these two sites are significant, especially given the sample size from Cihuatán. Only Chalchuapa has a larger absolute count of obsidian than Cihuatán, and of course Chalchuapa produced much greater quantities of sherds as befits the scale of the project. Thus, one inference to be drawn from these ratios is that Cihuatán and Santa María were exceptionally well provided with an imported material relative to other sites considered. This in turn suggests that Cihuatán was deeply involved in long distance or middle range trade.

	Number of artifacts		
Site	Obsidian	Sherds	O:S Ratio
Cihuatán	25549	78789	1:3.08
Santa María	669	1489	1:2.22
Chalchuapa	3717	515987	1:13.88
Quelepa	596	101227	1:170
Zapotitán Basin Combined Collections	2875	22741	1:7.91
Santa Leticia	949	33013	1:34.78
Zacaleu	–	–	1:268
Zacualpa	310	14100	1:45
Chiquila	1	1206	1:1206
Sarteneja	39	400	1:10
Mayapan	1955	500000	1:256
Tulum	96	12491	1:130

Distance Weighted Trade Index

Sidrys (1977) combines the obsidian:sherd ratio with distance-to-source to give a distance-weighted trade index. He gives one figure for distance to source for each site in his Table 3. It is unclear if obsidian samples were sourced by X-ray fluorescence or neutron activation, if nearest sources were used, or if multiple sources were averaged to get a mean distance.

For Cihuatán, three sources have been identified from technical analysis of 20 specimens at Lawrence Laboratory as is fully reported in Fowler et al (1987). Of the 20 specimens, 12 are from Ixtepeque, Guatemala, seven are from El Chayal, Guatemala, and one is from Río Pixcayá or San Martín Jilotepeque, Guatemala. The fall-off effect of smaller quantities coming from more distant sources is evident.

The first presentation of a distance-weighted TI for Cihuatán uses each obsidian:sherd ratio and approximate distance to each source to give an index that assumes all the Cihuatán obsidian is from that one source. Calculations are made by dividing the distance to source by the obsidian:sherd ratio. The distances used in this case are:

Distance to Ixtepeque	= ca. 80 km
Distance to El Chayal	= ca. 165 km
Distance to Rio Pixcayá	= ca. 200+ km

Using the combined O:S ratio for Cihuatán, and the distances given above, the following trade indices would result if all obsidian was from the single source:

	Trade Index.
Ixtepeque	25.97
El Chayal	53.57
Rio Pixcayá	64.93

The following more realistic presentation assumes that the percentages of obsidian coming from Ixtepeque, El Chayal and Rio Pixcayá (based on the analysis of 20 specimens) are representative of the total Cihuatán collection. A weighted average is obtained:

80 km x 12 specimens	= 960
165 km x 7 specimens	= 1155
200 km x 1 specimen	= 200
	2315

Weighted distance average: 2315 ÷ 20 = 115.76 km

Using a weighted distance of ca. 116 km, and the obsidian:sherd ratio of 3.08, a distance weighted Trade Index of 37.66 is obtained for Cihuatán using the formula:

DistWtTI = WtDist ÷ O:S ratio

In Sidrys' Table 3 only one Postclassic site has a higher TI than the Cihuatán combined total, and it's sample size is quite small. Sarteneja, Belize, has a TI of 47.0. Sarteneja is shown as having 400 sherds and 39 obsidian (an obsidian:sherd ratio of 1:10) and a distance from source of 470 km. The next closest TI is from Cocal 1, Mexico, with 56 sherds, 2 obsidian, a O:S ratio of 1:28, a distance from source of 767 km, and a TI of 27.4. Again, the sample size involved is quite small. The Postclassic site of Zacualpa, which is only 30 km from the obsidian source, has a TI of only .7; it has a larger sherd sample (N=14100). Similarly, Zacaleu is only 55 km from source.

Trade indices for other El Salvadoran sites are roughly calculated by using Ixtepeque as the single source, a distance to source for Chalchuapa of ca. 50 km and for the Zapotitán Basin collections of ca. 75 km (as given in Sheets [1983:210]), and the obsidian:sherd ratios given above. Chalchuapa emerges with a TI of 1.08 and the Zapotitán combined collections with a TI of 9.49. Without source data on Quelepa, a Trade Index can not be calculated for that site.

Cihuatán, then, has an exceptionally high trade index as well as high absolute numbers of obsidian and a low obsidian:sherd ratio. Curiously, this apparent abundance of obsidian is coupled with a high cutting edge/mass ratio as calculated on prismatic blades.

TI and CE/M

A high CE/M ratio is often taken to indicate that importers of a raw material were husbanding a genuinely scarce commodity. Such an interpretation seems inappropriate in the Cihuatán case since other measures imply the inhabitants of Cihuatán were unusually well provided with this raw material. If high trade indices, large absolute amounts of obsidian and high CE/M ratios can co-occur, then factors other than the relative abundance or scarcity of the raw material must be sought to explain the CE/M ratio in at least some cases.

One factor to be considered is the social and economic variability within a site. At Cihuatán, the CE/M ratio is somewhat higher for the San Dieguito prismatic blades than for those studied earlier from the WCC by Fowler. This implies that obsidian was more carefully or completely utilized in nonelite than in central zones. However, when Cihuatán is contrasted with Chalchuapa (which has a CE/M ratio of 2.69 cm/gm [Sheets 1978:11]), it is clear that obsidian was generally efficiently used at Cihuatán.

Detailed and comparative data are inadequate for fully evaluating competing hypotheses about the reasons underlying the co-occurence of high trade indices, large absolute amounts of obsidian, low obsidian:sherd ratios and high CE/M ratios. Investigation of evidence for improved efficiency associated with growing commercialization and secularization of the Postclassic relative to earlier periods might be a productive direction of inquiry.

How Much Obsidian?

Having postulated that Cihuatán was heavily involved in the obsidian trade, one immediately wonders what this means in terms of actual weight of obsidian carried to Cihuatán and to the Paraíso Basin during the time that Cihuatán was the primary regional center. Information about specimen weights is not comprehensive enough to be terribly useful, but by again resorting to *if..., then...* kinds of arguments, and by speculating on the conservative side, we can at least establish an approximation for purposes of argument.

Combined totals of obsidian for Cihuatán as used in this report are 25549. A group of 4018 prismatic blades weighed 3970.2 gms, for an average weight per blade of .988 gms. Another group of 90 obsidian pieces weighed 160 gms for an average of 1.77 gm per piece. If we conservatively and arbitrarily assume an average value of 1 gm per piece, the obsidian included in the study sample would weigh at least 25 kg. This average value is undoubtedly low; a 1.5 gm average per piece would give a figure of 38.32 kg. So far, it would appear that all of the obsidian represented in the study collection could have been carried by one or two porters.

The next question is how much of the obsidian from Cihuatán is represented in the study collection, and further, how much of the obsidian that entered the Paraíso Basin during this period is represented. It seems unlikely that our collections contain more than 1% of the obsidian at Cihuatán, and we will not even speculate on the amount that entered the larger consumer zone. However, *if* we have 1% of the obsidian from the site, and *if* we use the most conservative estimate of average weight per specimen of only one gram, *then* some 2500 kgs or two and a half metric tons of obsidian were carried substantial distances. Since all these figures are likely to be low, the sheer physical weight of this import begins to take on impressive proportions.

Sheer physical weight needs to be balanced against the temporal factors of rate and duration of acquisition. If we assume Cihuatán was occupied 200 years, and the rate of acquisition was constant, then, using the lowest and most conservative figure, only 12.5 kg of obsidian would have entered Cihuatán annually. Although we suspect that the rate of acquisition was not constant, and much higher figures could be used in these calculations, we conclude that the annual rate of acquisition need not have been terribly large. To say this does not negate or *disprove the conclusion that Cihuatán was* exceptionally well provided with obsidian relative to other sites, nor does it diminish the cumulative total of obsidian that entered the site.

The Obsidian Sources

The three obsidian sources that have been identified as having produced the obsidian found at Cihuatán are not the only sources available in the southern periphery. There is as yet no evidence that obsidian was obtained from La Esperanza in Honduras. La Esperanza is farther away from Cihuatán than Ixtepeque, but it is competitive in distance from Cihuatán with El Chayal and Rio Pixcayá.

One needs to ask why perhaps 40% of the obsidian that entered Cihuatán (assuming the results of the analysis of the 20 specimens are indeed representative of the total population) came from more than twice as far away as Ixtepeque, the major provider of Cihuatán obsidian, and indeed the major provider of obsidian to western El Salvador since Preclassic times.

It seems doubtful if the answer lies in the physical properties of obsidian from the different sources, although there may have been more artistic and technical reasons for choice of obsidian than we can now see in this case. Rather, the answer seems likely to lie in the realm of the economic and political realities of the Early Postclassic on the southern periphery. A comparison of this situation with earlier ones in western El Salvador is a beginning point for addressing this problem.

Evidence available to date suggests that the Postclassic period differs from earlier periods in two significant ways: there is much more obsidian moving in the exchange networks, and more obsidian sources are contributing this material to sites in western El Salvador. This increase in obsidian trade between Classic and *Postclassic times is generally acknowledged* and specifically documented by Sidrys (1977). For western El Salvador, a comparison of artifact frequencies during earlier periods at Chalchuapa, Quelepa, and Santa Leticia with those from Cihuatán indicate that this area participated in the greater increase in the Postclassic obsidian trade that has been more generally noted for Mesoamerica. Further, Quelepa may have been involved in a different sort of obsidian trade in which finished or near finished products entered the community. At least Andrews reports that no cores were found. Thirteen percent of the reported Quelepa obsidian is described as flakes, some of which are "waste flakes" (1976:161), and this falls closer to debitage frequencies in the Cihuatán WCC than to those from San Dieguito.

Sidrys (1977) suggests that increased transportation efficiency, especially by sea canoes, was a factor in the increased volume of trade. In some areas, dominant regional sites shifted to coastal zones. However, Cihuatán is well inland. Ixtepeque is closer to Cihuatán than to the coast. From El Chayal, the distance is approximately the same by overland or coastal routes. From Río Pixcayá, the coastal route is closer by about 50 km. It would appear that the bulk of Cihuatán obsidian was moved overland, although the Río Pixcayá and El Chayal obsidian may have moved by the coastal route.

In addition to straight line distances and cost of transport, other factors would have been involved in selecting transport routes. In a period as volatile as the Early Postclassic appears to have been, concerns over political alliances, safe conduct of porters through territory, and maintenance of exchange networks through which other goods could move would have been operative. Inclusion of more obsidian supply sources during the Early Postclassic could be due in part to the fact that the much greater demand for this commodity dictated a broadening of the supply base. It could also reflect a political move to protect the Paraíso Basin against having the supply from one source cut off due to political realignments.

Networks

On the basis of the obsidian sources, it is clear that one major exchange network reached into the Guatemalan highlands. It is worth reiterating that the major obsidian exchange system was not oriented toward Honduras, although obsidian from La Esperanza would have been as accessible as that from El Chayal in terms of distance. While obsidian is the most archaeologically abundant and visible import, there are other imported goods at Cihuatán. A minor percentage of these come from the Intermediate Zone to the east and south. Others come from coastal El Salvador. Ethnohistorical sources indicate many perishable goods were being exchanged.

Several questions relating to the economic role of Cihuatán within the Paraíso Basin and in more distant trade relationships arise from our previous arguments. Some can only be phrased as topics for future research; others can be evaluated in a preliminary way.

We need to know whether Cihuatán received the bulk of extraregional imports and served as a redistribution center to other sites in the Paraíso Basin. Alternatively, did other sites have access to imports which were not channelled through Cihuatán? Santa María has a lower obsidian:sherd ratio than Cihuatán, but the considerably smaller artifact sample size is presumably less representative of the total site, now unfortunately inundated, than is the Cihuatán sample. Nevertheless, the very low obsidian to sherd ratio from Santa María suggests that this secondary center, like Cihuatán, was directly involved in long distance exchange. We would expect that sites lower in the site hierarchy were less directly involved in both long distance and intra-regional exchange.

Networks, Markets, and Other Forms of Exchange

The degree to which foreign and local exchange in early state societies were independent of each other,with separate administrative organizations, is a subject of debate. Mesoamerican cases have been variously interpreted (cf. Chapman 1957; Berdan 1978). We do not have evidence that allows us to enter into this debate in a meaningful way. We should note, however, that our underlying assumptions about the total economic system at Cihuatán, and within the Paraíso Basin, allow for a variety of forms of exchange including reciprocal arrangements between households, exchange of subsistence goods between households, exchange of subsistence goods in a local market context where both producers and merchants might have operated, a hierarchy of markets within the region, external traders and merchants, tribute, various redistribution mechanisms through the social system, and politically motivated exchanges to other polities. Further, we assume that part-time specialists existed, and full-time specialists in ceramic and lithic production and presumably other crafts or activities are a real possibility.

Local or short to middle range trade is more difficult to document than long distance trade in hard goods. We can speculate indefinitely about these close-to-home exchange systems, but without further research designed to elucidate this problem, the scale and content of such systems eludes us. The evidence at hand relates to pine and marine product procurement.

Macrobotanical evidence identifies one product that was not available at Cihuatán or in its immediate vicinity. Pine must have come from higher elevations, and probably in considerably quantities. Assuming that pine grew on Guazapa volcano, this seems the most likely source because of ease of transport down the Acelhuate, but the high sierra on the Honduran border could also have contributed pine and pine products. Both locations are visible from Cihuatán. The fact that pine is present in every float sample from Structure 15-1 indicates that subtantial amounts of this wood entered Cihuatán.

Fowler recovered 65 pieces of worked bone from the east alley of the Southeast Patio (1981:442-448). Included are a sea mammal vertebra and the vertebra of a large fish as well as land mammals and bird bones. The sea mammal vertebra and the marine shells used in mortar are firm evidence of ties with the coast.

One kind of intraregional exchange that can reasonably be postulated on the basis of ethnohistorical analogy concerns tribute payment. Of particular interest are the two Pipil tribute lists from the Sonsonate region that appear to be prehistoric. These lists were given to Fuente y Guzmán, who lived from 1643 to 1700, by a priest who obtained them in Sonsonate (Fuentes y Guzmán 1932-33: pt2, bk 2, ch 11:108-110). "They used the typical Mexican vigesimal system of numerical notation [and] ideographic glyphics for various commodities, a glyph for a ruler's name and a place name glyph" (Fowler 1981:575). The caciques of Sonsonate received as tribute such items as "cacao, maize, feathers, straw mats, pottery, gold, silver, and possibly obsidian" (Fowler 1981:884). Sixteenth-century tribute lists also offer many examples of the sorts of goods paid in tribute by different communities, as was discussed briefly in Chapter 7.

Tribute payments would have resulted in a greater concentration and diversity of goods in the primary regional center than would be expectable in the villages, hamlets, and special function sites. The role of secondary centers *vis a vis* tribute receipt is unknown. Tribute was presumably redistributed to some degree. Tribute, then, would have formed part of the overall exchange system in which Cihuatán participated.

Fine grained differentiation of exchange patterns at intrasite, local and regional scales is virtually impossible at the present time due to a supreme lack of relevant information. However it seems important that readers be aware of the preconceptions that guide our thinking and shape the kinds of hypotheses for this and future work.

Contrasting Exchange Systems

Exchange systems have been the focus of much recent work, and several different sorts of exchange systems have been identified. Here we want to contrast the nodal kind of exchange found in Cihuatán as a primary regional center with two other kinds of exchange known for Mesoamerica. Specifically we look at the concepts of trading ports and ports-of-trade (cf Chapman 1957; Sabloff and Rathje 1974; Sabloff et al 1974; Berdan 1978).

Trading ports are internally controlled with port costs generated through user fees. Ports-of-trade are usually regarded as essentially free ports maintained by foreign political and economic powers using a neutral base to dispose of and acquire goods from others also using the neutral base. Berdan (1978) argues that ports-of-trade show more variation than is allowed in the most commonly used model; he notes that Xoconochco, often cited as a port-of-trade, "was unquestionably integrated into the Aztec empire, and its port-of-trade status should be reconsidered" (1978:195). Trading centers of either kind that attracted foreign traders would be likely to have had flexible politico-religious systems that could adjust to and/or not alienate the foreign traders. Some of the archaeological implications of these trading center models include major storage facilities, evidence of foreigners, and perhaps greater diversity in religious expressions. For Cozumel, a focus of recent trading center research, the presence of multiple shrines, particularly the famous talking shrine, are regarded as supportive evidence of politico-religious flexibility.

For Cihuatán, our information is inadequate for recognizing major storage facilities. The only such facilities identified to date are associated with nonelite households. However, larger scale storage facilities may be recognized in the future, perhaps in the south zone.

The presence of resident foreigners at Cihuatán has not been identified. Presently available evidence gives no indication of a foreign barrio, for example. If foreigners resided at Cihuatán, they either used the local ceramic vessels and lived in structures that are indistinguishable for the local population, or, as is not unlikely given the state of knowledge about the site, their quarters have not been investigated. Still, formal and informal surveying of the site has not yet identified any part of the site that seems unusual in surface indications.

Presumably Nahuatl speaking traders would not have been alienated by the religious system of Cihuatán's central zone dedicated to Tlaloc, Xipe and Mictlantecutli. We have no evidence of religious flexibility that would accommodate Mayan or Central American belief systems, but again, future research may prove otherwise. The heavy involvement with Guatemalan obsidian producers must be remembered here.

Without reasonable evidence of foreigners at Cihuatán, without evidence of the level of flexibility in political and religious affairs inferred from trading center models, and without evidence of centralized storage facilities, we conclude that Cihuatán does not fit the two trading center models as formulated, but contrasts between the different systems are instructive for evaluating each case of a proposed trading center.

Summary

Cihuatán seems best regarded as a primary regional center which served as the dominant community within the Paraíso Basin during the Early Postclassic. As such, it undoubtedly played a multi-faceted role in the political, economic, social and religious affairs of that region. It also served as a nodal center in larger trade networks. The most archaeologically visible exchange network in which Cihuatán participated was the obsidian trade. We have made the case that Cihuatán was unusually well supplied with this commodity, and that massive amounts of it entered Cihuatán and the Paraíso Basin. However, the archaeologically invisible exchanges that figure so prominently in ethnohistorical documentation must not be forgotten. In particular, we see Cihuatán and its polity as a major contributor of cotton textiles to foreign exchange (as discussed in Chapter 7).

Although we read the available as *not* supporting a view of Cihuatán as multi-ethnic, we need to note first that it is not entirely clear what evidence would count in identifying ethnic diversity. The so-called Oaxaca barrio at Teotihuacan offers one model, but presumably ethnic diversity can be expressed archaeologically in a number of ways. Second, as should be abundantly clear, our control of the total picture at Cihuatán is very incomplete. Third, Bruhns has, on several occasions, noted that she regards the notion that Cihuatán was multi-ethnic as reasonable and plausible (see for example Bruhns 1980a:105).

CHAPTER 10

CONCLUDING REMARKS

Earnest and Demarest (1987) argue that the Paraíso Basin remained outside the main stream developments during the Preclassic period because resources in the basin itself allowed and encouraged self sufficiency. Except for the Ilopango disaster, the basin continued to enjoy a wide range of resources. It was presumably the rich resources of the basin, coupled with other push-pull factors such as population pressures in other areas and political efforts to control trade routes, that first attracted the (Chorti?) Maya into the basin, and later fostered its Mexicanization. From Classic times through the Early Postclassic, the Paraíso Basin was not isolated from events on the southern periphery.

Available evidence supports the notion that Cihuatán was the primary regional center of the Paraíso Basin of El Salvador during the Early Postclassic. As such, it presumably occupied the pinnacle of a site hierarchy composed of one or more secondary sites, villages, hamlets and special function sites. Santa María, only 16 km from Cihuatán, can be seen as a secondary center almost equal in overall size to Cihuatán but having decidedly less specialized civic-religious/elite architecture than Cihuatán. Beyond this, we know very little of settlement patterns and site hierarchy, but it would be quite remarkable if other smaller sites did not exist as part of Cihuatán's political and economic hegemony. A regional survey and testing program similar to that carried out in the Zapotitán Basin (Sheets, ed. 1983), coupled with distributional studies of reconstructed environments and natural resources, would lay the groundwork for developing a coherent regional perspective on a series of fundamental and interesting questions which we cannot now address.

As a primary regional center, Cihuatán had large walled ceremonial and elite residential precincts (the WCC), a second and even larger elite zone (the ECC), and a large surrounding zone of nonelite domestic dwellings and other kinds of structures. The zones outside of the WCC and ECC are far from homogeneous in their make up, but we cannot as yet understand the variation that we know exists, and we are certain there is more spatial variability than has been charted.

Major status differences seem to be reflected in spatial location and architectural features. We had expected more status differentiation than is yet apparent from our study of portable archaeological objects. However, ceramics found in elite households are very like that found in the outlying nonelite sectors. No segment of the population seems to have been denied liberal access to obsidian tools.

If there seems to have been a fairly democratic distribution of many categories of material objects, we can nonetheless see that the ceramic complex associated with civic-religious structures in the WCC is not duplicated in other parts of the site for which we have information. This ritual ceramic complex was not associated with the San Dieguito barrio temple which was virtually identical to those in the central core architecturally, and yet the ceramic complex associated with it was that of the barrio, not the center.

We must assume that items carrying information about rank, status, occupation, and so on existed that have not entered the archaeological record as now known. To be considered here are both perishable goods and goods that would have been deposited in graves or other places archaeologists have not yet explored. Further information may well provide clearer evidence of status differentiation at Cihuatán. The existing evidence of widespread distribution of certain categories of portable goods will continue to suggest that Cihuatán harboured a fairly secularized society when compared to earlier Mesoamerican standards, but it fits well into the more secularized and commercial Postclassic period.

We had hoped to get reasonable evidence of craft manufacturing and specialization. The obsidian workshop or dump between San Dieguito Structures 15-1 and 15-2 at least offers an example of a spatially discrete activity area. Other obsidian working areas more likely to represent full time specialists may be located in more central parts of the site as we discussed in Chapter 8. Our suggestions about ceramic production and manufacturing depend upon an unusual ordering of the data, and need to be tested in a systematic way; but whether our particular logic prevails on this subject, the possibility of commercial production needs to be more thoroughly investigated archaeologically and mineralogically.

We consider the relationship of the people of Cihuatán to the land and its resources to be of central importance in understanding this site. Building on previous ecological, geographical and botanical work within the area, our project members investigated local plant communities and archaeological evidence of plant remains. From this work we have a much firmer view of the prehistoric environment at Cihuatán with direct evidence of economically valuable plants. On this basis, we have suggested various forms of plant management. It seems likely that valuable trees and plants would have been left throughout the site rather as Folan et al. (1979) suggest for Coba. The open settlement pattern of the nonelite zones would have lent itself to small scattered household gardens. More intensive agriculture of basic food and commercial crops is seen as occupying the flood plain.

We have postulated that cotton would have been a major commercial crop on the basis of macrobotanical remains of cotton seeds, and because the ecological requirements of cotton are met; this locality was a major cotton producing zone before sugar cane became the dominant commercial crop. We further postulate a major cotton textile industry at Cihuatán, with full manufacture including spinning, weaving, and dyeing. Cotton textiles are seen as a major export item. The importance of cotton textiles throughout Mesoamerican as tribute and in exchange is well established. This is as true of western El Salvador as other regions, judging from the ethnohistoric documentation. Dye products could also have been exported.

In considering natural resources, faunal resources have been virtually ignored in this report because no bone was recovered in our excavations and we did not have a faunal expert on our project. Ethnohistorical sources clearly indicate the importance of faunal resources. Deer, rabbit, peccary, tapir, several species of monkeys, anteaters, several large cats, coyotes, foxes, and coati were probably the most important mammals. Numerous species of fish, shellfish and crustaceans as well as numerous species of birds were present and apparently abundant before modern depredations on the native fauna.

If Cihuatán was as homogeneous as it now appears, and if the Early Postclassic remains across the Paraíso Basin are as homogeneous as they are reported, where does that leave us with regard to evaluating the perennial questions of ethnic identify and linguistic affiliation of these people? How do we regard the major discontinuity between Fogón and Guazapa phases?

We are inclined to accept a massive Mexican or Mexicanized presence in the basin. We are less willing to accept a total population replacement between the Fogón and Guazapa phases. However, if there is a subjugated local population, it appears to be invisible at our present state of knowledge. Here, as elsewhere, the critical temporal period crossing the Classic/Postclassic boundary needs to be isolated for detailed study and greatly improved chronological control.

It is unclear what happened in the Paraíso Basin at the end of Cihuatán's hegemony. Suggestions have been made that both Cihuatán and Santa María were violently destroyed. If these sites represent a major Mexican intrusion into a Chorti Maya population as has been argued, it perhaps is not remarkable that internal strife occurred. One gets the impression from the results of the Cerrón Grande survey that after Cihuatán and Santa María were abandoned, the Paraíso Basin was never again the center of a polity with major centers and extensive external trade. The role of little known sites like Las Pampas and San Francisco needs to be better understood before we conclude that the basin reverted to hamlet-level self sufficiency, although this is quite conceivable. The rich natural resources of the basin must have continued to be valued by post-Cihuatán inhabitants of western El Salvador. It is probably more a question of establishing the nature of man-resource relationships in the later Postclassic and where control of those resources resided than it is concluding that the basin was no longer populated.

The sum total of past archaeological work at Cihuatán has established a first level data base, and given us at least an introduction to various parts of the site. When work can be resumed at Cihuatán, some of the problems raised in our own and other work can be addressed through judiciously planned research designs. Perhaps the largest omission in our understanding of the site concerns the nature and content of the ECC. A unified and accurate site map and a carefully designed survey of the site with full coverage would be invaluable to future investigators. Beyond this, we need much more information on the site distribution, site layout and site content for the Early Postclassic in the Paraíso Basin in order to evaluate questions of socioeconomic hierarchies and production and distribution systems.

Cihuatán presented those of us who participated in the 1979 field project with some interesting methodological problems. Since these have been discussed in previous chapters, we will only briefly mention some of the more memorable ones here.

Having two existing ceramic classifications for the site was initially disconcerting. However, the two views were extremely useful because they encouraged us to explore the factors underlying both systems. In any event, our basic problem orientation was such that traditional classification systems, whether type variety or otherwise, were unlikely to give us the most useful information. Tensions between the two systems were never completely resolved -- either in our own analysis of San Dieguito pottery, or in our attempts to use previously gathered data from other parts of the site in a comparative fashion for exploring intrasite variability. It is still not clear, for example, whether there are significant differences in the spatial distribution of white pottery. Overall, the nature of the Cihuatán pottery assemblage is becoming clearer as research progresses and as different investigators build on the work that has been done.

Different analysts designate remarkably different percentages of their artifact collections as unclassified. The differences are so extreme that it renders suspect straight forward comparisons of frequencies. This is not the only place that genuinely different perceptions affected the way in which ceramics were analyzed and classified by different investigators. Perceptual problems that impact on the primary ordering of data in classifications must first be recognized before they can be dealt with.

What is interesting about the Cihuatán classification problems is that here in a microcosm we have a dramatic demonstration of underlying considerations that are often glossed over when there is only one agreed upon classification system. No single classification system will exhaust the informational potential of a collection. No single classification system will adequately partition collections for all archaeological problems. In this case, we have necessarily sacrificed a degree of comparability (which would have been exceptionally desirable for some aspects of our intrasite variability study), but we have explored form and function in a preliminary way, and this too has great value for studying intrasite variability.

Another methodological consideration has to do with the impact of pragmatic aspects of the research on the degree of our success in achieving the original research goals. Reasons for changing our field plans have been detailed elsewhere. Further limitations on what we had to work with arose from the conditions of laboratory processing of excavated materials at Cihuatán, and the constraints on which part and how much of the excavated collections could leave the country for further study. Thus, the very important collections from the barrio temple (Structure 12-1) have still not been studied in any detail. Most of the figurine heads were not allowed to be exported for study. Working with photographs did not encourage us to undertake a detailed stylistic study of the figurine heads, and yet they are rich in cultural details and merit a full-fledged study.

The most devastating pragmatic aspect of all was the political situation in El Salvador. What was intended as a first season in a multi-year project became the only season. The guardians and families that lived at the site have abandoned it because it is too dangerous to live in such isolation. Individuals we knew have joined the ranks of the dead and lost. It is to be devoutly hoped that El Salvador will enter a new era in which the guardians can return to Cihuatán, and archaeological work can again resume.

Appendix I

GENERAL THIN-SECTION DESCRIPTIONS

Explanation of Notations:

1) Color - the rusty color common to many of these samples is due to iron staining which indicates they are altered/oxidized.

2) Grain sizes and code:

   C = coarse = 0.75 mm

   M = medium = 0.3 - 0.75 mm

   F = fine = 0.3 mm

3) Dominant size - size to temper inclusions that are most prevalent in thin-section.

4) Lineated - refers to temper materials only. All samples show, in addition, lineation of clay and opaque materials (probably organic).

5) Large, "altered" fragments - black or rusty opaque material that is probably altered rock or organic material. These cannot be differentiated in thin-section. These are roughly quantified by relative terms: "few", "many" etc.

6) Phenocryst - refers to large grains of temper material.

Sample Number	Color	grain sizes	dominant size	lineated	large "altered" fragments	phenocrysts fractured/ corroded
1. 65 NP	rust-tan	c-m-f	medium-fine		few	most
2. 80a NP	rust-tan	c-m-f	fine		several	most
3. 80b NP	dark centre with rust-tan edges	c-m-f	fine		few	most
4. 117a NP	red-brown with darker edge	c-m-f	fine-medium		very few	most
5. 117 NP	red-brown with dark edges	c-m-f	medium-fine		few small	some
6. I-12	black centre, rust tan edges	c-m-f	fine	some minor	few	some
7. 1265	dark centre with tan-green edges	c-m-f	fine	some minor	few	some
8. 1200-31	grey with rust-tan edges	c-m-f	fine		few	some
9. 1200-65	grey with rust-yellow edges	c-m-f	fine		few	some
10. 1261-25	dark grey-black with rust-tan edges	c-m-f	fine			some
11. 1300-237	rust-tan to green-tan	c-m-f	fine		very few	most
12. 1066-46	tan-rust with greyer centre	c-m-f	c=m=f		several	most
13. 1069-20	rust-tan	c-m-f	c=m=f		many	most
14. 1260-3	tan-rust	c-m-f	c=m=f		many	most
15. 1290-56	rust-tan	c-m-f	c=m=f		many, smaller	most
16. 1293-67	rust	c-m-f	c=m=f		many	most
17. 1118-231	light grey-green	m-fine	fine			

Sample Number	Color	grain sizes	dominant size	lineated	Large "altered" fragments	phenocrysts fractured/ corroded
18. 1149-13	rust-brown with black centre	m-fine	fine			most
19. 1171-21	rust-tan edges with grey-green centre	m-fine	fine	some minor	few	some
20. 1300-231	black centre with rust-brown edges	m-f-c	med=fine		some	some
21. 1045-24	rust with black edge	c-m-f	med=fine		many, small	most
22. 1095-62	rust-tan	c-m-f	med=fine		few, very rusty	most
23. 1067-3	rust-tan	c-m-f	c=m=f		some rusty	most
24. 1075A-5	rust with light green-grey centre	c-m-f	fine		few	most
25. 1083-7	rust-tan	c-m-f	coarse-med		many, some rusty	most
26. 1085-49	dark rust, darker edges	c-m-f	c=m=f		some	most
27. 1097-3	rust-tan	c-m-f	c=m<f		many	most
28. 1108-41	grey-green with darker centre	m-f	fine			some
29. 1108-56	dark rust-tan	c-m-f	c=m=f		many	most
30. 1118-29	rust tan	c-m-f	m<coarse		some, some rusty	most
31. 1118-275	brown-green	m-f	fine			some
32. 1118-287	rust-tan	c-m-f	c<m=f		some rusty	most
33. 1118-304	rust with green-tan centre	c-m-f	c<m=f		some small rusty	most
34. 1118-339	rust green tan	m-f	fine		some small	most
35. 1132-338	rust tan	m-f-c	medium		few	most
36. 1145-2	rust with dark edge	c-m-f	medium		many	most
37. 1160-22	rust tan	c-m-f	c m f		some	most
38. 1163-135	rusty tan	c-m-f	medium	very minor	some	most
39. 1182-378	grey-green with lighter edge	fine-medium	fine			most
40. 1194-4	rusty tan with grey centre	fine-medium	medium		some	most
41. 1204-23	rusty brown	c-m-f	c=m<f		many	most
42. 1207-13	rusty tan with black-brown edges	c-m-f	medium		some	most
43. 1213-18	very dark, grey to black	c-m-f	medium-fine		few	most
44. 1224-6	rust with green edge	c-m-f	medium		few	most
45. 1229-56	rusty tan with dark edges	c-m-f	fine		same	most
46. 1289-9	tan-green, darker centre	fine-medium	fine		many	most
47. 1287-30	green-tan centre with rusty edges	fine-medium	med=fine		some	most

Sample Number	Color	grain sizes	dominant size	lineated	Large "altered" fragments	phenocrysts fractured/ corroded
48. 1300-49	tan with dark centre	c-m-f	medium		many	most
49. 1320-3	rust-tan	c-m-f	medium		some	most
50. 1320-21	rust-tan	c-m-f	med=fine		many	most
51. 3015-16	rust tan to green	c-m-f	c=m-f		few	most
52. 1300-7	red rust-tan	c-m-f	medium		many	most
53. 1317-2	dark tan with rust tan edges	c-m-f	med=fine		some	most
54. 1020-7	dark brown with tan edges	c-m-f	medium		many	most
55. 1049-7	tan-brown with dark centre and edge	c-m-f	med=fine		few	most
56. 1076-85	tan-brown	c-m-f	medium		few	most
57. 1260-23	rust-tan	c-m-f	c=m=f		many small	most
58. 1300-59	tan-brown	c-m-f	c=m=f		some	most
59. 1258-5	tan-rust with darker centre	c-m-f	c=m=f		some	most
60. 1300-147	rust to rust green edge	c-m-f	fine		some	most
61. 3015-47	tan with dark centre	c-m-f	distribution approximately equal		some	most
62. 1163-16	tan-green, some darker edge	c-m-f	medium		some	most
63. 1284-25	brown-tan with very dark edge	c-m-f	med=fine	some minor	many	most
64. 1118-87	dark centre, tan edges	c-m-f	med=fine		some	most
65. 1229-22	tan-brown	m-f	med=fine		many small	most
66. 3018-63	rust-brown	c-m-f	c=m=f		some	most
67. 1300-229	green-tan, with rust rim	c-m-f	fine-medium	minor	some	most
68. 1132-213	light grey green	f	fine			most
69. 1260-22	rust-brown	c-m-f	fine		some	most
70. 1282-13	rust-green-brown	c-m-f	medium		few	most
71. 3015-83	rust-brown	c-m-f	fine		some	most
72. 3017-25	tan with darker centre	c-m-f	fine	some minor	some	most
73. 1300-272	rust with tan edges	m-f	fine		few	most
74. 1132-38	rust-tan	c-m-f	med-fine		some small	most
75. 1003-2	rust-tan	c-m-f	fine		many	most
76. 1096-3	tan with darker centre	c-m-f	med-fine		some	most
77. 1293-17	tan-green	c-m-f	medium		many	most
78. 1132-331	brown with darker centre	c-m-f	medium		few	most
79. 3012-5	rusty tan with darker centre	c-m-f	medium		some	most

Sample Number	Color	grain sizes	dominant size	lineated	Large "altered" fragments	phenocrysts fructured/ corroded
80. 3015-67	rust edges with darker centre	c-m-f	med-fine		few	most
81. 3011-56	green centre, rust edges	c-m-f	medium		few	most
82. 1302-15	rust with light green ends	c-m-f	fine		few	most
83. 1356-10	rust tan	c-m-f	medium		some	most
84. 1983-130	tan	c-m-f	c-m-f		some	most
85. 1108-15	rust edges with tan centre	c-m-f	medium		some	most
86. 1118-185	rust-tan	c-m-f	medium		some	most
87. 1070-17	rust-brown	c-m-f	coarse	some minor	some small	most
88. 1093-22	tan green with light rust edge	c-m-f	distribution approximately equal		some small	most
89. 1117-7	tan edges with brown centre	c-m-f	coarse		some	most
90. 1089-14	tan-brown slightly darker centre	c-m-f	medium		some small one large	most
91. 1149-5	dark brown edges, rust brown centre	c-m-f	med-fine	some minor	some small	most
92. 1198-20	red rust tan	c-m-f	medium		some	most
93. 1091-23	tan with dark edges	c-m-f	med-fine		some small	most
94. 1045-58	rust-brown	c-m-f	medium		few small	some
95. 1003-8	rust with darker centre	c-m-f	medium		few small	some
96. 1058-107	rust tan	c-m-f	med-fine		rusty-few	most
97. 1041-25	tan brown	c-m-f	medium		few small	some
98. 1039-6	rust-tan with dark centre	c-m-f	distribution approximately equal		some, rusty	some
99. 1118-76	tan-yellow	med-fine	fine		few, rusty	some
100. 1013-3	tan-brown	c-m-f	medium		few	most

Appendix II

SAN DIEGUITO CERAMICS

MINERALOGY OF 100 THIN-SECTIONED SPECIMENS

NOTE: See Chapter 5 for explanation of notations.

	Plagioclase				Amphibole			Pyroxene		
Sample Number	%	An	size range	phenocrysts zoned	%	color	size range	%		size range
1. 65 NP	25-30	38-55	.2 - .8	✓	<<1	most rusty some light-dark green	.05-.1	<1	hypersthene and augite	.2-.9
2. 80a NP	25-30	50-55	.05-1.25	✓	<<1	some rusty	.05-.1	1-2	hypersthene and augite	.1-.3
3. 80b NP	20-25	50-55	.01- .8	✓	<<1	rusty	.05-.2	<1	hypersthene and augite	.05-.5
4. 117a NP	15-20	45-55	.05- .5	✓	<<<1	altered amphibole?	.05-.1	<1	hypersthene and augite	.05-.9
5. 117 NP	15-20	45-50	.05- .6	✓	<<<1	altered amphibole?	.05-.1	<1	hypersthene and augite	.1 -.6
6. 1-12	15-20	35-45	.01- .5	✓	1-2	some rusty	.01-.3	<<1	augite	.05-.1
7. 1265	20-25	45-55	.01- .35	✓	3-5	some rusty some altered?	.01-.2	<<1	hypersthene augite	.05-.1
8. 1200-31	15-20	45-58	.01- .6	✓	3-5	some rusty	.01-.3	<<1	augite	.05-.1
9. 1200-85	25	30-55	.01- .2	✓	3-5	some rusty	.05-.3	<<1	augite	.01-.1
10. 1261-25	5-10	30-35	.01- .15	✓	3	some rusty, altered	.05-.2	<<<1	augite	.01-.1
11. 1300-237	20-25	38-55	.01- .3	✓	5		.01-.2	<1	hypersthene and augite	.05-.3
12. 1066-46	20	38-55	.05- .9	✓	1		.05-.5	<<1	augite	.1 -.5
13. 1069-20	20	35-55		✓	<1		.05-.3			
14. 1260-3	15-20	40-55	.01-1.0	✓	<2		.05-.8	<<1	augite	.1 -.4
15. 1290-56	15-20	40-55	.01- .9	✓	1		.01-.35	<1	hypersthene and augite	.1 -.8
16. 1293-67	15	38-55	.01-1.0	✓	<1		.05-.7	<1	hypersthene	.05-.6
17. 1118-231	1	no measurable twins	.05- .3	✓	<<1	rusty	.01-.1	<<1	augite and hypersthene	.01-.1
18. 1149-13	2	30-50	.01- .2	✓	<1		.05-.15	<<<1	may be one augite grain	.05-.01
19. 1171-21	1	45-50	.01- .4	✓	<<1		.01-.1	?	altered?	.05-.1
20. 1300-231	5	35-45	.01- .9	✓	<<1		.01-.1	<<1	augite	.01-.15
21. 1045-24	10-15	45-55	.01- .25	✓	<<1		.01-.1	<<1	augite	.01-.1
22. 1045-62	15-20	35-48	.01- .6	✓	<1		.01-.15	<1	hypersthene and augite	.05-.1
23. 1067-3	15-20	38-50	.01-1.7	✓	<1		.05-.2	<<1	hypersthene and augite	.1 -.3

	Plagioclase				Amphibole			Pyroxene		
Sample Number	%	An	size range	phenocrysts zoned	%	color	size range	%		size range
24. 1075 A-5	10-12	35-40	.01- .5	✓	<<1		.01-.1	<<1	hypersthene and augite	.01-.15
25. 1083-7	30-35	35-55	.01-1.25	✓	1-2		.05-1.0	1	hypersthene and augite	.0 -1.5
26. 1085-49	25	45-55	.01-1.1	✓	1-2	some rusty	.01-.5	1-2	hypersthene and augite	.1-.5
27. 1097-3	15-20	30-55	.01-1.1	✓	<1	some rusty	.01-.55	<<1	hypersthene and augite	.1-.3
28. 1108-41	5-10	38-55	.01- .3	✓	<<1	brown-green	.01-.1	<<<1	hypersthene	.01-.05
29. 1108-56	15-20	30-55	.01-1.3	✓	1-2	some rusty, altered	.05-.5	1-2	hypersthene and augite	.05-.7
30. 1118-29	30	45-55	.01-.95	✓	2-3	some rusty	.05-1.0	1-2	augite and hypersthene	.1 -.7
31. 1118-275	5-8	30-45	.01- .3	✓	<1		.01-.15	<<1	augite	.05-.1
32. 1118-287	30	35-40	.01-1.25	✓	1		.05-.75	<1	hypersthene	.1 -.15
33. 1118.304	20-25	35-55	.01-1.0	✓	1		.01-.3	<1	hypersthene	.05-.9
34. 1118-339	15	45-55	.01- .4	✓	<1		.01-.2			
35. 1132-338	20-25	35-40	.01-.75	✓	1		.01-1	<1	hypersthene and augite	.05-.7
36. 1145-2	20	35-55	.01-.5	✓	<1		.1-.6	<1	hypersthene	.01-.1
37. 1160-22	20	45-55	.01-1.25	✓	1		.1-.7	1	hypersthene and augite	.2-.8
38. 1183-135	25-30	30-38	.01-1.0	✓	1		.1-.7	<1	hypersthene and augite	-.7
39. 1183-378	10-15	35-40	.01- .3	✓	<1		.01-.3			
40. 1194-4	10	35-40	.01- .2	✓	<1		.01-.2			
41. 1204-23	25	38-40	-1.3	✓	<1	some rusty	.1-.8	<1	hypersthene and augite	-.4
42. 1207-13	35	45-50	.01- .9	✓	1-2		.1-1	1	hypersthene and augite	.1-.8
43. 1213-13	35	32-45	.01- .8	✓	1	some rusty	.1-.4	<1	hypersthene and augite	-.5
44. 1224-6	25	38-45	.01-1.25	✓	1		.1-.4	1	hypersthene and augite	.2-.3
45. 1229-56	10-15	40-55	.01- .8	✓	1		.05-.9	1	augite	.1-.3
46. 1289-9	15	45-55	.01- .9	✓	1		.05-.4	<1	hypersthene and augite	.1-.2
47. 1287-30	8-10	38-55	.01- .9	✓	<1	some rusty	.01-.5	<1	augite	.1-.2
48. 1300-49	30	35-45	.01-1.25	✓	1		.05-.3	<1	hypersthene and augite	.2-.6
49. 1320-3	25	35-55	.01-1.0	✓	<1		.05-.3	<<1	augite	.1-.2

Sample Number	Plagioclase %	An	size range	phenocrysts zoned	Amphibole %	color	size range	Pyroxene %		size range
50. 1320-21	25	48-55	.01-1.25	✓	<1		.1-.6	<<1	augite	.1-.25
51. 3015-16	15	45-55	.01- .6	✓	<1	some rusty	.1-.3	<<1	augite	.01-.15
52. 1300-7	25	48-55	.01- .3	✓	<<1	some rusty	.1-.2	<<1	hypersthene	.1-.5
53. 1317-2	40	38-55	.01-1.1	✓	<1	some rusty	.1-.2	<1	hypersthene	.1-.6
54. 1020-7	30	38-55	.01- .9	✓	<1		.1-.4	<1	augite	.1-.8
55. 1049-7	20	48-55	.01-1.5	✓	<1		.1-.3	<1	augite	.1-.2
56. 1076-85	30	48-55	.01- .9	✓	<1		.1-16	<1	hypersthene	.1-1.3
57. 1260-23	20	48-55	.01- .9	✓	<<1		.1-.4	<1	hypersthene	.1-.6
58.1300-59	35	30-45	.01-1.0	✓	<1	rusty	.1-.9	<1	augite and hypersthene	.1-.8
59. 1258-5	20	45-55	.01- .9	✓	<1		.2-1.25	<1	hypersthene	.1-.4
60. 1300-149	20	48-55	.01-1.25	✓	<1		.05-.3	<<1	augite	.2-.6
61. 3015-47	15	48-55	.01- .8	✓	<1		.1-.8	<<1	augite	.1-.3
62. 1163-16	20	35-38	.01-1.25	✓	<1	some rusty	.05-.3	<<1	augite and hypersthene	.1-.35
63. 1284-25	10	50-55	.01-1.0	✓	<1		.1-.2	<<1	augite	.1-.2
64. 1118-89	15	30-55	.01-1.1	✓	<1		.1-.5	<1	augite and hypersthene	.1-1.0
65. 1229-22	10-15	35-50	.01- .4	✓	<1	some rusty	.05-.3	<1	augite	.1-.2
66. 3018-63	25	40-48	.05-1.0	✓	<1		.1-.9	<1	augite	.2-.9
67. 1300-229	15-20	45-55	.01-1.3	✓	<1	some rusty	.05-.8	<<1	augite	.3-.4
68. 1132-213	10	38-40	.01- .2	✓	<1		.01-.1			
69. 1260-22	12-15	45-55	.01- .9	✓	<1		.1-.3	<1	augite	.1-.3
70. 1282-13	20-25	35-55	.1-1.3	✓	<1	some rusty	.1-.3	<1	augite	.1-.2
71. 3015-83	15	48-55	.1- .8	✓	<1		.05-.2	<<1	augite	.05-.1
72. 3017-25	15	45-55	.1- .8	✓	<1	some rusty	.05-.3	<<1	augite	.01-.1
73. 1300-272	25	38-55	.1- .6	✓	<1	some rusty	.1-.5	<<1	hypersthene and augite	.1-.2
74. 1132-38	20-25	40-48	.1- .8	✓	<1		.1-.5	<<1	augite	.05-.1
75. 1003-2	25	30-55	.01-1.25	✓	<1		.1-.3	<<1	augite	.1-.2
76. 1096-3	30-35	40-55	.01-1.0	✓	1	some rusty	.01-.8	<<1	augite	.1-.5
77. 1293-17	35-40	38-55	.1- .9	✓	<1	some green-brown	.1-.6	<1	augite and hypersthene	.1-.8
78. 1132-331	30	30-45	.05-1.2	✓	<1	some rusty	.1-1.1	<1	augite and hypersthene	.2-1.3
79. 3012-5	30-35	38-55	.05-1.2	✓	<1		.1-.5	<<1	augite	.1-.3
80. 3015-67	25	30-55	.01- .9	✓	<<1	some rusty	.02-.2	<<1	augite	.1-.4
81. 3011-56	25	38-48	.01-1.4	✓	<1	some rusty	.1-.6	<1	augite	.1-1.0

Sample number	Plagioclase %	An	size range	phenocrysts zoned	Amphibole %	color	size range	Pyroxene %		size range
82. 1382-15	20-25	38-55	.01-1.0	✓	<1	some rusty	.1-.5	<1	hypersthene and augite	.1-.5
83. 1356-10	25	45-55	.01-1.2	✓	<1		.1-.3	<<1	hypersthene and augite	.2-.9
84. 1983-130	25	40-50	.05-1.5	✓	<1	some rusty	.05-.7	<<1	augite	.2-.8
85. 1108-15	18	35-55	.01- .5	✓	<1	some rusty	.05-.4	<1	augite	.1-.2
86. 1118-185	20	35-45	.01- .7	✓	<1	some rusty	.05-.4	<1	augite	.1-.7
87. 1070-117	15	45-55	.05-1.5	✓	<1	rusty	.1-.7	<1	augite	.1-.8
88. 1043-22	30-35	45-55	.01-1.4	✓	<1	rusty	.05-1.4	<1	augite	.1-.4
89. 1117-7	20	38-55	.01-1.5	✓	<1		.1-.8	<1	augite	.1-.9
90. 1087-14	30	45-50	.01-1.1	✓	<1-1		.05-.5	<1-1	hypersthene and augite	.1-.6
91. 1149-5	20	45-55	.05- .9	✓	<1	some rusty	.05-.4	<<1	augite	.1-.15
92. 1198-29	28	36-40	.01- .9	✓	<1		.05-.7	<1	augite	.2-.8
93. 1091-23	25	38-53	.01- .9	✓	<1	some rusty	.1-.7	<<1	augite	.2-.8
94. 1045-58	20	35-48	.01-1.0	✓	<<1	some rusty	.2-.4	<<1	augite	.2-.3
95. 1003-8	20-25	40-55	.01-1.2	✓	1	rusty	.1-.8	<<1	hypersthene and augite	.01-.9
96. 1058-107	15-20	40-55	.01- .8	✓	<<1	rusty	.1-.3	<<1	augite	.1-.25
97. 1041-25	35	48-55	.01- .8	✓	<1	some rusty	.05-.5	<<1	augite	.1-.6
98. 1039-6	30	48-50	.01- .9	✓	<1		.05-.6	<<1	augite	.1-.7
99. 1118-76	10-15	38-55	.01- .8	✓	<1	some rusty	.05-.3	<<1	augite	.1-.4
100. 1013-3	15-20	38-48	.01- .9	✓	<1		.05-.4	<1	hypersthene and augite	.1-.2

Sample Number	Rock fragments %	size range	ax	Pumice glass %	size range	shards	Alkali feldspar %	size range	Quartz %	size range	other minerals	Possible source of temper
1. 65 NP	8-10	.2-.5		5	.1-.8		5-10	.1-.3	<<1	micro crystalline	epidote-alteration	dacite pumice
2. 80a NP	5	.1-.5		5-8	.1-1.3		5-10	.1-.3	<<1	micro-crystalline		dacite pumice
3. 80b NP	5	.1-1.2		5-10	.1-.5		10	.1-.3	<<1			dacite pumice
4. 117a NP	5	.1-.5		15	.1-.8	<1	5-10	.05-.5			chlorite alteration	dacite pumice
5. 117 NP	3-5	.1-.9		15	.05-.6	<1	5-10	.05-.5	5	.1-.8	chlorite alteration	dacite pumice ash
6. 1-12	3-5	.1-.6	✓	5-10	.01-.3		15	.01-.5				dacite pumice
7. 1265	3-5	.1-2.0	✓	5-10	.01-.3		5-10	.01-.3				dacite pumice
8. 1200-31	3-5	.1-.4		5-10 (altered)	.01-.3		3	.01-.3	2-3	.1-.3		dacite pumice
9. 1200-85	1	.1-.9		40	glassy matrix		<1	.01-.1			chlorite alteration	ash or tuff (dacite?)
10. 1261-25	1	.1-.3		22-30	glassy matrix		10-15	.01-.15			chlorite alteration	ash or tuff (dacite?)
11. 1300-237	2-3	.1-.6		5-10 (altered)	.01-.2		<1	.01-.3			may be mica alteration?	dacite pumice
12. 1066-46	10-12	.1-1.5		5-10	.1-.5		<1	.01-.1			chlorite alteration	dacite pumice
13. 1069-20	2-5	.1-.5		10-15	.1-2.5		<1	.05-.2			chlorite alteration	dacite-rhyodacite pumice or ash
14. 1260-3	5-10	.1-1.9	✓	8-12	.1-1.2		<1	.1-.2			chlorite epidote alterations	dacite pumice
15. 129-56	10	.1-1.8	✓	8-10	.01-.2		<1	.1-.2			chlorite alteration	dacite pumice
16. 1293-67	5-10	.1-1.5	✓	10-12	.1-2.5		<1	.01-.5			chlorite alteration	dacite pumice or ash
17. 1118-231	3-5	.1-.2	✓	15-20	.01-.6	10-15	10-15	.01-.3	5	.1-.5	biotite .05-.8mm red-tan color	ash or tuff (dacite?)
18. 1149-13	1	.1-.15		40	.01-.3	1	3	.01-.25				ash or tuff rhyodacite?
19. 1171-21	1-3	.01-.5		35	.01-1.25	5	10	.01-.5	2	.01-3	epidote-alteration of pyroxene	ash or tuff rhyodacite?
20. 1300-231	8-10	.1-1.8	✓	15	.01-.8	15-20	3-5	.01-.8			epidote alteration	ash or tuff
21. 1045-24	1-2	.1-.15		15-20	.05-.5		5-10	.01-.25			chlorite alteration	dacite pumice or ash
22. 1045-62	5-10	.1-1.1	✓	10-15	.01-1.1		<1	.01-.1	1	.01-.2		dacite pumice or ash

	Rock fragments			Pumice glass			Alkali feldspar		Quartz			
Sample Number	%	size range	ax	%	size range	shards	%	size range	%	size range	other minerals	Possible source of temper
23. 1067-3	5-10	.1-.2		5-10	.01-1.1		≃1	.01-.1	1	.01-.1		dacite pumice
24. 1075-A-5	5	.1-1.2		35 including altered	.01-.15	1-2	≃1-2	.01-.15				ash or tuff (dacite?)
25. 1083-7	5-10	.1-2.3	✓	8-12	.01-2.1		<1	.01-.15				dacite pumice
26. 1085-49	10-12	.1-2.0	✓	10 including altered	.1-.5		≃1	.01-.3				dacite pumice
27. 1097-3	10-15	.1-1.5	✓	5-10	.1-1.0		<1	.01-.1				dacite pumice
28. 1108-41	2	.01-.1		40-45	.01-.4	5-10	1	.01-.15				ash or tuff (dacite?)
29. 1108-56	10-12	.1-.5		5-10 including altered	.01-.1		<1	.01-1.0				dacite pumice
30. 1118-29	5	.01-1.0		5-8	.05-1.2		<1	.01-.4				dacite pumice
31. 1118-275	5-10	.05-.9		30-35	.01-.15	5	3-5	.01-.1				ash or tuff (dacite?)
32. 1118-287	5	.1-1.25	✓	1-2	.2-2.0							dacite pumice
33. 1118-304	2	.1-.75		2	.1-1						chlorite alteration	dacite pumice
34. 1118-339	1	.1-.2		35	.1-.7		2	.01-.4				ash or tuff (rhyodacite?)
35. 1132-338	1	.2-1.25		10	.1-.8							dacite pumice
36. 1145-2	5	.2-2		10	.1-1							dacite pumice
37. 1160-22	5	.1-.8		5	.8							dacite pumice
38. 1183-135		.1-.7		5	.01-.9							dacite pumice
39. 1182-378	1	.1-.6	✓	35	.05-.2	5%	1	.01-.3				ash or tuff (rhyodacite?)
40. 1194-4	2	.1-1.25	✓	40	.01-	1%	1	.01 .3				ash or tuff (rhyodacite?)
41. 1204-23	1	-.7	✓	15	.01-.9							dacite pumice or ash
42. 1207-13	5	.1-2.0	✓	10	.05-1.25							dacite pumice
43. 1213-18	10	.1-1.0	✓	10	.1-.4							dacite pumice
44. 1224-6	5	.2-1.0	✓	10	.1-1.0							dacite pumice
45. 1229-56	5	.05-2.5	✓	25-30	.05-1.25	8%						ash or tuff (dacite?)
46. 1289-9	10	.2-2.5	✓	10	.05-1.25	same in ax						dacite pumice
47. 1287-30	1	.2-1.0		35	.05-.5	<1%	<1	.01-.2	1	.4-.9		ash or tuff (dacite?)
48. 1300-49	5	.1-1.0	✓	10	.1-1.0							dacite pumice
49. 1320-3	5	.1-1.0	✓	10	.1-1.5		<<1	.3-1.0				dacite pumice

Sample Number	Rock fragments %	size range	ax	Pumice glass %	size range	shards	Alkali feldspar %	size range	Quartz %	size range	other minerals	Possible source of temper
50. 1320-21	5-10	.1-.7	✓	5	.1-.8							dacite pumice
51. 3015-16	5	.1-1.5	✓	5-10	.1-1.25	<1%	<<1	.1-.2				dacite or ash
52. 1300-7	10	.1-2.0	✓	25	.1-1.2	1%						ash or tuff (dacite?)
53. 1317-2	10	.1-1.5	✓	5-8	.1-.8							dacite pumice
54. 1020-7	10	.1-2.0	✓	5	.1-1.0							dacite pumice
55. 1049-7	5	.1-1.5	✓	25 includes altered	.01-3.0	<1%	1	.1-.5				ash or tuff (dacite?)
56. 1076-85	2	.1-.9	✓	20	.1-1.2	<1%	3	.1-.5				ash or tuff (dacite?)
57. 1260-23	5	.1-.6	✓	5	.1-.7							dacite pumice
58. 1300-59	2	.1-1.5	✓	10-15	.1-2.0		2	.01-.2				dacite pumice or ash
59. 1258-5	5	.1-1.5	✓	5-10	.1-1.5							dacite pumice
60. 1300-147	2	.2-1	✓	10	.1-1.25	some					epidote-may be alteration product	dacite pumice or ash
61. 3015-47	10	.1-2.5	✓	5	.1-2.0							dacite pumice
62. 1163-16	5	.1-1.1	✓	2	.1-.75							dacite pumice
63. 1284-25	15	.1-1.5	✓	5	.1-1.0		<1	.01-.5				dacite pumice
64. 1118-87	3	.1-.9		20-25	.1-1.0	some	<1	.01-.5				ash or tuff (dacite?)
65. 1229-22	20	.01-.8		20-25	.01-1.5	some						ash or tuff (dacite?)
66. 3018-63	10	.1-2.0		15	.1-1.5							dacite pumice or ash
67. 1300-229	5	.1-2.0		10	.1-1.0						chlorite-alteration	dacite pumice or ash
68. 1132-213	10	.1-1.5	✓	40	.01-.2	≈10%	<1	.01-.5	<<1	.6-.8	chlorite-alteration	ash or tuff (rhyodacite?)
69. 1260-22	5-8	.1-1.8	✓	8-10	.1-.5							dacite pumice or ash
70. 1282-13	1	.2-1.8	✓	15	.1-1.8		<<1	.01-.5			chlorite-alteration	dacite pumice or ash
71. 3015-83	5	.1-2.5	✓	10	.1-1.5		<<1	.01-.3			epidote-may be alteration product	dacite pumice or ash
72. 3017-25	5	.1-2.2	✓	10	.1-1.5		<<1	.01-.3				dacite pumice or ash
73. 1300-272	2	.1-1.5	✓	10	.1-2.5							dacite pumice or ash
74. 1132-38	5	.1-1.5		5-8	.1-.3		<1	.01-.5	<<1	.5-.75		dacite pumice

	Rock fragments			Pumice glass			Alkali feldspar		Quartz			
Sample Number	%	size range	ax	%	size range	shards	%	size range	%	size range	other minerals	Possible source of temper
75. 1003-2	5	.1-.8		1	.01-.2						chlorite-alteration	dacite pumice
76. 1096-3	2	.1-2.25		3	.05-.9							dacite pumice
77. 1293-17	5	.1-2.2		5	.1-1.9							dacite pumice
78. 1132-331	1	.1-.8		15	.1-1.3							dacite pumice or ash
79. 3012-5	1-2	.1-.9		5-8	.05-1.4							dacite pumice
80. 3015-67	2	.1-2	✓	5	.1-1.2						epidote, chlorite alterations	dacite pumice
81. 3011-56	2	.2-2.1		2	.1-1.9							dacite pumice
82. 1382-15	2	.2-3.8		10-15	.01-1.3	5-10%						ash or tuff (dacite?)
83. 1356-10	1	.2-1.5		15	.1-1.3	2-3%			<<1	.5-.8		dacite pumice or ash
84. 1983-130	3	.1-1.0		15	.1-1.0							dacite pumice or ash
85. 1108-15	1	.1-.4		35	.01-.6	≈2%	2-3	.01-.3	<<1	.1-.3		ash or tuff (dacite?)
86. 1118-185	5-8	.1-1.0		10	.1-1.4							dacite pumice or ash
87. 1070-117	5	.1-1.3										dacite pumice
88. 1093-22	1	.1-.5		10-15	.1-2.0	5%						dacite pumice or ash
89. 1117-7	5-8	.2-.9	✓	3-10	.01-1.3						chlorite alterations	dacite pumice
90. 1089-14	2	.1-1.2	✓	5	.01-1.2							dacite pumice
91. 1149-5	10	.1-1.5		5-10	.05-3.0							dacite pumice
92. 1198-20	3	.1-1.5	5	.1-.6		2	.01-.04		<<1	.4-.6		dacite pumice
93. 1091-23	3-5	.2-2.0	✓	5	.05-2.1						contaminated with blue, small flecks (grains) on surface of slide only-not a constituent material.	dacite pumice
94. 1045-58	5	.1-2.5	✓	5	.01-.4							dacite pumice
95. 1003-8	5	.1-2.0	✓	12-15	.05-1.3							dacite pumice or ash
96. 1058-107	10	.1-1.8		10-15	.05-1.3	[illegible]	<1	.01-.1				dacite pumice or ash
97. 1041-25	5	.2-.9		10-15	.1-1.0							dacite pumice or ash
98. 1039-6	5	.2-2.2	✓	5	.01-1.1							dacite pumice
99. 1118-76	2	.1-.5		30	.01-.7	3%	2%	.01-.2			chlorite alteration	ash or tuff (dacite?)
100. 1013-3	2	.1-.7		15-20 (includes altered)	.01-.1		<<1	.05-.1			chlorite alteration	dacite pumice or ash

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