Settlement and Subsistence in Early Formative Soconusco

El Varal and the Problem of Inter-Site Assemblage Variation

Richard G. Lesure
Editor and Principal Author

UCLA Cotsen Institute of Archaeology Press

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Cotsen Institute of Archaeology
University of California, Los Angeles

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This book is set in 10-point Janson Text, with titles in 26-point Didot.
Edited by Daril Bentley
Designed by William Morosi
Index by Robert Swanson

Library of Congress Cataloging-in-Publication Data
Lesure, Richard G.
Settlement and subsistence in early formative Soconusco : El Varal and the problem of inter-site assemblage variation / Richard G. Lesure editor and principal author.
p. cm.
ISBN 978-1-931745-78-9 (trade cloth) -- ISBN 978-1-931745-79-6 (trade paper)
1. Indians of Mexico--Mexico--Soconusco Region--Antiquities. 2. Varal Site (Mexico) 3. Soconusco Region (Mexico)--Antiquities. 4. Excavations (Archaeology)--Mexico--Soconusco Region. 5. Salvage archaeology--Mexico--Soconusco Region. I. Title.

F1219.1.S6L47 2009
972'.75--dc22

eBook ISBN: 978-1-938770-26-5 2009041190

Dedicated to:

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And to all those archaeologists who have
puzzled over its use and importance
in Formative-period Mesoamerica

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Contributors

Michael Blake
Department of Anthropology
University of British Columbia

David M. Carballo
Department of Anthropology
University of Alabama

Brendan J. Culleton
Department of Anthropology
University of Oregon

John Dietler
SWCA Environmental Consultants, Pasadena

Jelmer Eerkens
Department of Anthropology
University of California, Davis

Alina Gagiu
Graduate of the University of California, Los Angeles

Michael D. Glascock
Archaeometry Laboratory
University of Missouri Research Reactor (MURR)

Douglas J. Kennett
Department of Anthropology
University of Oregon

Richard G. Lesure
Department of Anthropology
University of California, Los Angeles

Hector Neff
Department of Anthropology
California State University Long Beach

Tomás Pérez Suárez
Centro de Estudios Mayas
Instituto de Investigaciones Filológica
Universidad Nacional Autónoma de México

Isabel Rodríguez López
Graduate of Universidad Nacional Autónoma de México

Virginia Popper
Fiske Center for Archaeological Research
University of Massachusetts at Boston
and Center for Materials Research in Archaeology and Ethnology
Massachusetts Institute of Technology

Stuart Tyson Smith
Department of Anthropology
University of California, Santa Barbara

Thomas A. Wake
Cotsen Institute of Archaeology
University of California, Los Angeles

Acknowledgments

During the last 15 years, numerous people have contributed to the investigations at El Varal and the subsequent study of the material remains. Lorena Mirambell (as president of the Consejo de Arqueología of the Instituto Nacional de Antropología e Historia) and Carlos Silva Rhodes (regional director for INAH in Chiapas) were especially helpful in facilitating the salvage permit for work at the site. I would like to particularly acknowledge the energy, dedication, advice, and support of John Clark, director of the New World Archaeological Foundation (NWAF). He has helped to promote this work at every stage, from inception of the fieldwork to publication more than 15 years later.

The fieldwork through Phase 3 was funded by a dissertation improvement grant to Lesure from the Rackham Graduate School of the University of Michigan. The remainder of the fieldwork and support throughout was provided by the NWAF. Tomás Pérez Suárez was an enthusiastic and dedicated excavation companion. During the course of the fieldwork, Julia Cigarroa Nava opened her home in Mazatán to us. Jilberto Santos Galicia facilitated our work in the *ejido* of Efraín Gutierrez. Gonzalo Vásquez Alvarez kindly agreed to let us work on his land and helped us in innumerable ways throughout the project.

The years of laboratory work have involved financial support from various institutions as well as hard work by a great many people. I would like to particularly acknowledge Scott Waugh, who as Dean of Social Sciences at UCLA provided significant support for different aspects of the work over more than a decade. The NWAF and the Cotsen Institute of Archaeology at UCLA were also important sources of funding for analytical work. Michael Blake obtained the radiocarbon dates (Chapter 12) with funds from the Social Sciences and Humanities Research Council of Canada. Isotopic analyses of shells (Chapter 13) were funded by a grant from the NWAF. The geochemical analysis of sherds was supported by the institutions at which the work was conducted [the MURR lab at the University of Missouri, Kennett's ICP-MS lab at California State University (Long Beach), and Stuart Tyson Smith's residue analysis lab at the University of California (Santa Barbara)], as well as by research funds from the UCLA Division of Social Sciences and the UCLA Academic Senate.

I would particularly like to thank the students have worked so hard on materials from El Varal over the years: Natalie (Smith) Henrich (ceramics, M.A. thesis), David Carballo (geochemical analyses of ceramics, M.A. thesis), Angela Sims (vertebrate and crustacean remains, undergraduate honors thesis), Alina Gagiu (shells), and Isabel Rodríguez López (ceramics). Tom Wake (director of the Zooarchaeology Laboratory of the Cotsen Institute of Archaeology) trained Angela Sims, closely supervised all aspects of her work, and provided considerable advice concerning the interpretation of faunal evidence. His dedication to zooarchaeology and to the training of students has helped significantly in moving this book along to a final publication.

The illustrations in this volume have involved considerable effort on the part of numerous people, as well as financial support from the UCLA Division of Social Sciences. I would particularly like to thank Maddy Bray, Tria Ellison, Eric Gutiérrez, Mac Marston, and Isabel Rodríguez for their invaluable help. Finally, I would like to thank my wife, Paola Demattè, for all her encouragement and support. Her hometown of Belluno proved a wonderful place to initiate the writing of this manuscript in the summer of 2002.

Part I

Archaeological Investigations at El Varal

CHAPTER 1

Site Assemblage Variation in Early Formative Soconusco

RICHARD G. LESURE

The rise of settled agricultural villages is one of the more poorly understood topics in the archaeology of ancient Mesoamerica. Unlike, for instance, the Near East—where detailed evidence is available from the Epi-Paleolithic through various stages of the aceramic and ceramic Neolithic—critical gaps confound understandings of Archaic to Formative developments in Mesoamerica. Reconstructed Archaic settlement systems are largely hypothetical, and links between Archaic and Formative sequences elusive. Early ceramic times are better understood, but the legacy of Archaic lifeways in the Formative has not been worked out in any detail. Although it is understood that the appearance of ceramics does not mark the emergence of a fully formed and subsequently unaltered agricultural lifestyle, the texture and tempo of organizational transformations in different parts of Mesoamerica remain to be explored.

The problem of organizational change associated with the shift from wild to domesticated resources provides theoretical orientation to what is at heart a report of excavations at the Early Formative site of El Varal on the coast of Chiapas, Mexico. Investigations at El Varal were conducted in 1992 as a salvage operation after the site was partially destroyed during wetlands drainage operations sometime the previous year (Clark, Lesure, and Pérez Suárez 1993). The "problem orientation" prompting the fieldwork was thus a practical one: the salvage opportunity. However, a relevant intellectual problem rapidly emerged. The pottery assemblage at the site exemplified a previously observed pattern of assemblage variation between Early Formative sites along the Pacific Coast of Chiapas and adjacent areas of Guatemala.

In crude terms, vessels at sites within the estuary were about 70-percent neckless jars (tecomates), whereas vessels at contemporaneous sites a few kilometers inland were 70-percent open dishes. El Varal, it rapidly became clear, fit the "estuary" pattern. Although this pattern has long been known, its implications have never been explored in detail. A flurry of archaeological investigations along the Chiapas coast during the last 25 years—particularly the Mazatán Early Formative Project (directed by John Clark and Michael Blake), of which the El Varal investigations formed a part—provides a comparative context for exploring the larger significance of El Varal.

Ironically, given that the Varal work was a salvage operation peripheral to the research goals of the Mazatán Project this will be the first monograph to emerge from that work. [Several dissertations have been completed: Clark (1994a), Lesure (1995), and Hill (1999).] The book contributes concretely to our

knowledge of Early Formative Soconusco, particularly to understandings of subsistence patterns and the relation of human communities to the landscape. In terms of Mesoamerican archaeology more generally, the Varal work helps to shed light on organizational transformations involved as Archaic hunter-gatherers became Formative villagers.

I would be pleased if this volume had in addition relevance to theoretical work on the interface between specialized production and the organization of hunter-gatherer settlement and subsistence systems. However, it is perhaps more a "consumer" than a "producer" of theoretical insight in that domain. My comparative aspirations are also, however, directed to the "meta-theoretical" domain of archaeological reasoning. The work at El Varal took place when explanation and interpretation in Anglo-American archaeology were portrayed in absolute terms as opposing each other across a philosophical chasm. Since that time, a sense of rapprochement between what seemed like incompatible approaches has developed—in no small part due to the inspiring work of Wylie (e.g., 2002). However, if we are now willing to contemplate the interpenetration of explanation and interpretation it remains far from clear exactly how one goes about putting them together.

The current volume can be read as a report from (so to speak) the trenches in that larger effort. The specific "problem orientation" that frames the analysis is a productive one because it seems so amenable to classically processual "explanation," yet pushing just beneath the surface quickly reveals dilemmas long identified by interpretivists. The production of this volume has thus constituted an experiment in how it might be possible to draw analytical and rhetorical tools from both camps.

Still, a little of that goes a long way. I have kept meta-theoretical commentary under tight control (confined to brief passages in Chapters 1 and 18, each of which also address serious substantive concerns). This chapter provides background to the problem of inter-site assemblage variation in Early Formative Soconusco, reviews the history of previous research on the topic, and charts an agenda for the volume.

The basic idea developed over the course of the volume (with syntheses particularly in Chapters 14 and 18) is that El Varal was not a permanent habitation site. Instead, it was an estuary outpost maintained by people residing several kilometers inland. They visited the site in significant numbers particularly in the dry season, and at least some stayed for weeks or even months. The production of salt was a particular focus of their activities, but it was far from the only one. Occupants also collected a variety of wild foods, for consumption at the site itself but probably also for transfer to inland villages.

The Setting: Environment in Soconusco

The name *Soconusco* derives from that of the Aztec tributary *Xoconocho*, an important source of cacao in Postclassic Mesoamerica (Lowe, Lee, and Martínez 1982:43–52; Gasco and Voorhies 1989). It is a useful unit with which to consider human settlements in all prehispanic periods because its boundaries delineate a distinctive geographical province (Voorhies 1989:2). The region comprises a narrow strip of the Pacific Coast of Chiapas, sharply delimited inland by the rise of the Sierra Madre escarpment.

From south of the modern town of Pijijiapan, Chiapas, the Soconusco extends 240 km to the southeast—ending just across the modern Mexico–Guatemala border from Chiapas. The high rainfall of the region feeds numerous rivers that, descending from the mountains, cut deeply through the piedmont, meander across a short coastal plain, and feed an estuary system protected from the ocean by a sandy barrier beach. The adjacent northwestern portion of the Chiapas coast is much drier than the Soconusco, and indeed there is significant variation within the Soconusco itself. As one travels southeast, the coastal plain widens and rainfall increases. In Guatemala, an expanded coastal plain marks the end of the Soconusco (Lowe, Lee, and Martínez 1982:55–62; Voorhies 1989:4).

In Soconusco, biotic communities tend to run in strips parallel to the ocean. Although these different communities are characterized by distinctive mixes of flora and fauna, the parallel structure means that a range of resources was readily accessible to ancient hunter-gatherers. Descriptions of the communities and their resource potential for humans have been assembled previously by Coe and Flannery (1967:11–15), Voorhies (1976:18–23, 1989:3–4), and Clark (1994a:58–80). The following brief overview is drawn from these sources. The beach forms a linear barrier between the interior wetlands and the ocean, punctured primarily at the mouths of rivers.

Lands affected by tidal action can extend as far inland as 19 km (Voorhies 1989:3). In these wetland systems, the tidal influx of saltwater is offset by

the continual input of river-borne freshwater—creating gradients of salinity from points of tidal inflow to those areas closest to the sources of freshwater. Permanently inundated stands of red and white mangrove crisscrossed by natural canals are characteristic, but variations in topography and drainage conditions lead to an interfingering of other biotic communities. Stands of *madresal* (black mangrove) appear on seasonally inundated but still saline lands. Salt flats known as *playas* are also only seasonally inundated. Their high salt content leaves them virtually devoid of vegetation (Coe and Flannery 1967:14).

Rivers entering the estuary system feed lagoons or terminate in freshwater swamps (Voorhies 1976:22–23; Michaels and Voorhies 1999:42). Although there is considerable movement of fish between upper and lower estuaries, variations in salinity would have structured the subsistence strategies of human groups reliant on wild foods. Voorhies, in her work on preceramic hunter-gatherers of the Soconusco, has explored this issue in greatest detail—particularly in regard to the distinctive biotic communities of shallow brackish-water lagoons within the overall estuary system (Voorhies 1976, 2004).

Virtually all rainfall occurs between mid-May and mid-October, leading to sharply defined wet and dry seasons. The input of water has dramatic effects on the estuary system. Salinity decreases in lagoons (Voorhies 2004:12). Water levels also increase. Around El Varal, in an estuary segment known locally as the Pampa Cabildo, waters can rise by 2 m in the rainy season (Clark 1994a:64). One result is seasonal flooding in savanna zones dominated by grasses and low trees along the margins of the estuary, as well as in abandoned river channels further inland. Along old river channels, water once fingered its way well into interior forests. Today, most such forests have been cleared for agriculture. In Mazatán, seasonally flooded lands of the interior are known as *chahuites*. They could have provided a succession of subsistence opportunities during the dry season, first as a source of aquatic foods and then as choice locations for an extra agricultural crop when surrounding lands were completely dry (Clark 1994a:76).

The wild resources of the Soconusco were diverse and abundant, as records of travel in the region before the 1960s make clear (Alvarez del Toro 1990:Chapter 6). Important foods for early inhabitants would have included fish, mollusks, shrimp, crabs, reptiles, and mammals—as well as a plethora of fruits and other less well-documented plant products (Lowe, Lee, and Martínez 1982:62–71; Clark 1994a:Table 2). Many of the important wild foods (particularly the aquatic) are thought to have been readily available year-round, but there has been little detailed research on the life cycles of specific species or on issues of scheduling or risk associated with their human exploitation.

Three potentially significant periodicities are the seasonal availability of shrimp, sea turtles, and migratory waterfowl (Voorhies 1976:23–26; Voorhies, Michaels, and Riser 1991; Michaels and Voorhies 1999:48–49). It is possible that there are other natural periodicities still not well understood. Seasonal changes in salinity certainly affect fish populations (Voorhies 1976:26). In Mazatán, local residents say that the ark shell (*Anadara grandis*) is available in September—whereas marsh clams and crabs are harvested in December (Clark 1994a:63–64).

The parallel structure of the beach-mangrove/savanna-forest formation is broken up by the obliquely running rivers, which terminate in various ways upon meeting the estuary system (Figure 1.1). The result is considerable variation in the width of the estuary strip and (just inland of the estuary) an alternation between freshwater swamps and better-drained zones of savanna and tropical forest. For example, in the Acapetahua area studied by Voorhies mangrove formations extend 9 km inland. Converging rivers feed several open lagoons of varying salinity. To either side of this segment of coast, however, herbaceous swamps abut the upper estuary and the mangrove zone is more restricted (Voorhies 1976:Figure 2).

To the southeast of Acapetahua, Hueyate Swamp stretches along the coast for about 30 km—and on the other side of it is the Mazatán zone. Here, the major river is the Coatán—which empties directly into the ocean. Although Hueyate Swamp extends inland for 15 km or so, the estuary system in the vicinity of the Coatán is just 3 km wide. It is currently associated not with a lagoon system but a delta of the Coatán, a zone of rich agricultural soils dissected by *chahuite* channels (Clark 1994a:49:Figure 9). Other areas of the Soconusco in which early occupation has been studied are the Pajón area northwest of Acapetahua, the Cuauhtémoc zone between the Suchiate and Cahuacán Rivers, and the Lower Naranjo River southeast of Mazatán in Guatemala.

A final area of importance for the present study is the Jesus River region (the Río Jesus) immediately southeast of Soconusco in Guatemala. Local characteristics of estuaries in the Naranjo, Pajón, Río Jesus,

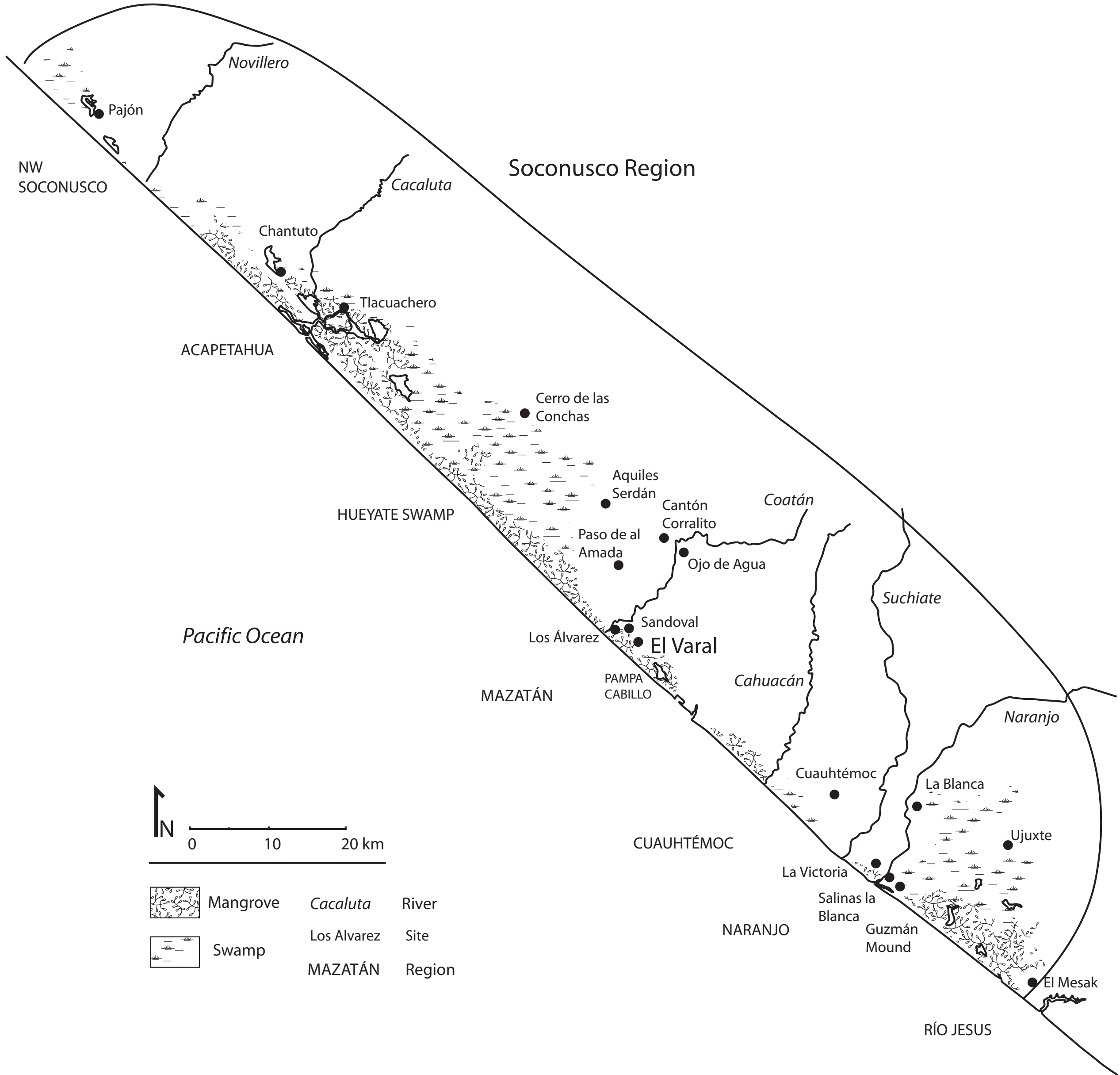


Figure 1.1. Map of the Soconusco region showing areas and sites cited in the text.

and Cuauhtémoc areas are described respectively by Coe and Flannery (1967:11–15), Paillés (1980:3–16), Clark and Pye (1995:48–66, 140–151), and Rosenswig (2005). Many of the patterns characteristic of the Soconusco seem also to hold for coastal areas further into Guatemala and even El Salvador (Arroyo 1994, 1995; Neff et al. 2006).

The contemporary agricultural potential of the Soconusco coastal plain is considerable, and the region was similarly productive in ancient times. Nevertheless, one additional climatic pattern that strongly affects non-irrigation agriculture in the region is a sharp drop-off in rainfall from the slopes of the Sierra Madre to the coastline. Indeed, the rainfall differential between foothill and seashore locations less than 40 km apart can reach 200 cm per year (Lowe, Lee, and Martínez 1982:55–62). The rainy season is also distinctly longer in the foothills than on the coast.

One result is that lands 20 km or more inland can provide two or even three crops a year without irrigation, an opportunity unavailable closer to the estuary except through use of seasonally flooded *chahuite* lands (Clark 1994a:72–82). Further, for people dwelling immediately beside or in the estuary a general scarcity

of salt-free soils capable of supporting crops is compounded by a lack of water (for drinking and for crops) during the dry season. In sum, within the Soconusco optimal settlement locations for agriculture and the exploitation of estuary resources are different. A change in settlement focus apparent over the course of the Formative in the region seems to derive from gradual reformulation of subsistence strategies toward an emphasis on agriculture production over wild aquatic foods.

Variation and Instability in Estuary-Lagoon Systems

Although aquatic fauna were broadly similar all along the littoral zone of the Soconusco, variations in salinity resulted in spatial and temporal variation in resource structure. The most significant factors were inputs from freshwater rivers and the location, form, and permanence of outlets to the sea. Clark (1994a:63) suggests that relatively small sea outlets in the Mazatán area result in lower salinities in the estuary and certain limitations in resources (shrimp, mollusks, ocean fish) relative to the Acapetahua and Naranjo areas. Voorhies' (2004:9–14) distinction among estuaries, lagoons, and freshwater formations (marshes, swamps) proves useful for understanding spatial variation in resources within regions.

Estuaries follow old river courses and are thus most characteristically perpendicular to the coast. Lagoons form in areas protected by active and inactive beaches. They are often parallel to the coastline, and (with narrower mouths than estuaries) are somewhat protected from daily alterations in water level and salinity. However, not all lagoons are identical. In the Acapetahua area, only the more saline currently support large populations of marsh clams (Voorhies 2004:7, 126). Freshwater marshes lack the shrimp, some of the fish, and many of the shellfish found in estuaries and lagoons but provide other resources—such as cattails (Voorhies 2004:8, 403).

Resource structure also varies over time. Two long-term processes have been important on the Chiapas littoral during the Holocene: rising post-glacial sea levels and a seaward progression of the coastline through the deposition of river-borne sediments (Voorhies 2004:16–22). The first process was dominant until sea levels reached essentially modern ones about 4000 B.C. The second, witnessed by remnant barrier beaches inland from the modern coastline, has been dominant since that time. The coastal estuary system itself probably resulted from the flooding of river channels by rising sea waters. Voorhies (Voorhies et al. 2002; Voorhies 2004:96–97) documents a shift in shell species (from lagoon species to those more characteristic of estuary mouths or marine conditions) at the earliest known Soconusco shell mound, Cerro de las Conchas.

Because the lagoon exploitation dates from before sea level stability, Voorhies postulates that the shift in species orientation might be evidence of destruction of a lagoon system in this area by marine transgression. Sometime in the last 6,000 years that situation reversed itself, in that Cerro de las Conchas today sits beside a freshwater lake and marsh—the crucial long-term process being seaward progression of the coast.

Such millennial-scale processes are of obvious interest to the archaeologist, but it will be important to bear in mind that these aquatic ecosystems were inherently unstable and dramatic changes at particular locations may be best explained by more short-term fluctuations. Archaeologists record anecdotal evidence of such changes. In the Mazatán area, an inland segment of the Coatán River broke its banks in the twentieth century and shifted to a new channel. People in the estuary describe a massive die-off of marsh clams some 40 years ago that Voorhies (2004:126) suspects was related to changes in lagoon salinity.

Residents in Pajón described to Paillés (1980:83) how several decades previously the Novillero River shifted course and entered a local lagoon system, causing the disappearance of shrimp and other species favoring high salinities. Of considerable interest to the current volume is the ephemeral nature of lagoon systems. They typically persist for less than a millennium before they meet one of various fates, including silting and plant encroachment that lead to seasonally inundated pampas or dry land (Voorhies 2004:20). Clearly, processes at a variety of spatial and temporal scales need consideration in any attempt to explain changes in wild resource exploitation at particular sites.

Early Settlement in the Soconusco

The earliest known human settlement in the Soconusco dates to the Middle and Late Archaic, locally termed the Chantuto A (5500–3500 cal B.C.) and Chantuto B

Table 1.1. Archaeological phases in the Soconusco, 5500 to 650 B.C.

Period and Phase	Calendar Years (B.C.)
Middle Formative:	
Duende	850–750
Conchas	1000–850
Early Formative:	
Jocotal	1200–1000
Cuadros	1300–1200
Cherla	1400–1300
Ocós	1500–1400
Locona	1700–1500
Barra	1900–1700
Archaic:	
Chantuto B	3500–1900
Chantuto A	5500–3500

After John Clark (2007 personal communication).

(3500–1900 cal B.C.) phases, respectively.[1] With the appearance of ceramics about 1900 cal B.C., changes in material culture followed each other apace—allowing division of the Early Formative (1900–1050/1000 cal B.C.) into six phases, valid at least in the zone from Hueyate Swamp to the Río Jesus area (Table 1.1).

The subsequent Middle Formative (1050–400 cal B.C.) begins with the Conchas phase of 1050/1000–850 cal B.C. and the fluorescence of the large center of La Blanca along the Naranjo River. The Late Formative, peripheral to the concerns of the present volume, dates from 400 cal B.C. to A.D. 200. It is not necessary to review what is known of all of these periods and phases here [instead, see Blake et al. (1995), Clark and Pye (2000), and Love (2007)]. This section concentrates instead on changes in general patterns of human organization. It is useful to distinguish settlement-subsistence systems from political organization because changes in the two domains occurred at different rates.

1. I use calendar years throughout the text, subsequently dropping (except where required by context) the mnemonic "cal" used in this chapter. Readers comparing the current volume to previous works should use caution because many published discussions of early settlement in the Soconusco use uncalibrated radiocarbon years as the basis for phase designations. The basic reference on early Soconusco chronology is from Blake et al. (1995), although those authors use only uncalibrated dates. Further discussion of Archaic chronology with attention to calibration is provided by Kennett and Voorhies (1996) and Voorhies et al. (2002). Calibrated ranges for Early and Middle Formative phases of the Soconusco are provided by Clark and Cheetham (2005) and John Clark (personal communication, 2007).

Settlement-Subsistence Systems, 5500–850 B.C.

Systemic transformations in settlement and subsistence organization proceeded at a more stately pace than changes in political organization, perhaps half a millennium as opposed to a century or two. We can also characterize these features of human life in the Soconusco with much greater temporal depth than is possible for political organization.

The Archaic is known from Cerro de las Conchas (adjacent to Hueyate Swamp) and a few finds in the Mazatán region, but the biggest data set comes from the Acapetahua Estuary through the work of Voorhies and her colleagues. Most known sites are shell middens, probably once islands beside or in lagoons of the upper estuary. Voorhies [2004; see also Michaels and Voorhies (1999)], using Binford's (1983) terminology, interprets these as locations for specialized procurement and processing of upper estuary resources by logistically organized hunter-gatherers. The marked and undisturbed bedding of the deposits suggests collection of large numbers of shellfish during short episodes, punctuated by abandonments.

The lack of evidence of structures (except in a single stratum at Tlacuachero) and an extremely limited range of tool types support the claims for special-purpose locations rather than base camps. The best-documented activity at the sites was the harvesting of marsh clams (*Polymesoda radiata*), whose shells form the bulk of the deposits. Shrimp, which currently swarm in the lagoon during the dry season, could also have been an attractive resource for collectors (but see my comments on shrimp in the discussion of hypotheses in Chapter 18). Although no evidence of shrimp survives, the depth and extent of the clam shell deposits are consistent with the idea that small groups of collectors produced for larger numbers of people.

Voorhies (2004) postulates that the primary residential bases of these Archaic visitors to the estuary were inland, on the coastal plain. From that location they could access a variety of resources across biotic communities from coastline to piedmont (Kennett et al. 2006). The interior coastal plain was also, as noted previously, the best part of the coastal strip for growing crops. Phytoliths and pollen document the presence of maize in Archaic sites of the Acapetahua area, including the shell mounds and the one known inland residential base (Vuelta Limón). Disturbance taxa indicate that forest clearance increased gradually over time, as one would expect if food production were becoming more

important (Jones and Voorhies 2004:342–343). Coring in multiple locations along the coast of Guatemala reveals a less directional picture of forest clearance in the Archaic, prompting Neff et al. (2006:305) to identify an extensive strategy of land use in which small groups exploited resources in one region (until returns declined) and then moved on.

Oxygen isotope analysis of shell from Tlacuachero and Cerro de las Conchas offers direct evidence of the seasons in which Archaic peoples visited the estuaries (Kennett and Voorhies 1996; Voorhies et al. 2002). Although collectors were operating at both sites at all times of the year, they tended to favor the dry season—when shrimp as well as shellfish would have been available. At Tlacuachero, the later of the two sites, there is an intriguing hint of changes in site use after 2100 B.C.—with a switch to exclusively wet-season collecting. Kennett and Voorhies (1996:700–702) speculate that this shift signals growing scheduling conflicts as the dietary importance of domesticated plants increased. Unfortunately, the latest shell layers at the site have been disturbed by subsequent shell quarrying and it is thus impossible to monitor behavioral changes immediately before cessation of specialized marsh clam harvesting.

One issue for contemplation here will be the emphasis on *dry-season* harvesting during the later Early Formative occupation of El Varal (see Chapters 13, 14, and 18). Some unmistakable sherds of the Barra phase mixed into ceramic levels at Tlacuachero and the absence of markers from the rest of the Early Formative raise the intriguing possibility that the Archaic adaptation in the Acapetahua estuary continued into the incipient Early Formative (Voorhies 1976:Figure 57; Lowe 1978:346).

The Barra phase (1900–1700 B.C.) is known primarily from the Mazatán area, whereas the subsequent Locona and Ocós phases are well documented throughout the southeastern half of the Soconusco. The later Early Formative (1400–1050/1000 B.C.) is divisible into the Cherla, Cuadros, and Jocotal phases in the corridor from Hueyate to Río Jesus. It is also known in northwestern Soconusco at Pampa el Pajón. Settlement patterns from 1900 to 1050/1000 B.C. are best worked out in the Mazatán and Cuauhtémoc regions (Clark 1994a; Rosenswig 2005), although survey data are also available from the Naranjo and Río Jesus areas (Coe and Flannery 1967; Pye 1995; Love 2002).

Maize has been documented from the earliest Formative in Mazatán, and maize, beans, and avocados were the most commonly identified taxa in Early Formative macrobotanical samples studied by Feddema [1993; see also Blake et al. (1992a:141, 144) and Clark (1994a:229–234)]. It appears that several domesticated species were cultivated at inland villages of the Early Formative. Maize has also been documented at sites in the estuary (Coe and Flannery 1967:71–72). In contrast to the Archaic, Neff et al. (2006:307) find likely evidence of forest clearance by humans during the Early Formative in all three coastal Guatemalan study regions—suggesting intensified cultivation of crops.

Stable-isotope analyses of human bone from early Soconusco sites complicate the subsistence picture for the Early Formative. Blake et al. (1992b) reconstructed dietary patterns in the Acapetahua, Mazatán, and Naranjo areas from the Late Archaic to the Postclassic with stable-isotope analysis of human bone. Of particular interest is the potential of such studies to assess the dietary importance of maize at different points in time. Those initial Soconusco results were puzzling, in that they were so strongly patterned by region rather than by time—even though they spanned some 3,500 years (Ambrose and Norr 1992; Blake et al. 1992a:Figure 7, 1992b:Figure 2; Chisholm et al. 1993). Chisholm and Blake (2006) provide an update on that study, including a refined set of human samples and numerous runs on possible human foods. Still, the dietary picture provided by the stable-isotope data seems at this point not fully reconcilable with other sources of evidence.

Two Archaic samples from the Acapetahua region suggest significant reliance on maize, unless the results can be explained by consumption of marine foods (Blake et al. 1992:145–146; Chisholm and Blake 2006:167). Human bone samples from the Early Formative instead yield low carbon values not consistent with a diet based on maize. Chisholm and Blake (2006:166) suggest that Early Formative diets were based on a mixture of terrestrial and estuary foods, with meat a significant component. The abundance of maize among the macrobotanical remains might be reconciled with this picture if the plant was at this time primarily used for beverages such as beer rather than as a dietary staple (Smalley and Blake 2003).

A shift *away* from maize cultivation at the beginning of the Early Formative—one possible interpretation of the stable-isotope data—would be inconsistent with the interpretive construct proposed for El Varal in Chapter 18. Given that there is still work to be done harmonizing the different categories of available evidence, I take the position that the Early Formative is likely to

have involved some type of intensification of cultivation relative to the Archaic—although I do not intend to rule out another significant step toward reliance on maize as a staple in the Middle Formative (Blake et al. 1992a, 1992b; Love 1999; Rosenswig 2006).

Specifically, I am inclined to relate increased sedentism in the Early Formative to the concerns of cultivation—particularly the tending of gardens and fields into which significant labor had been invested. The following points can be cited in support of this position. First, at a large scale there is what in archaeological terms appears to be simultaneity (1800 ± 100 B.C.) in the transition to the Early Formative in numerous parts of Mesoamerica. The transition occurred in the semiarid highlands and in the coastal lowlands. In all cases, the transition seems to have been marked by the adoption of ceramics and greater sedentism. For most areas, scholars have also argued that a greater reliance on agriculture was involved (e.g., Flannery 1986).

In all of these cases, including the Soconusco and the coastal Pacific Lowlands more generally, the subsequent trajectory of population growth resembles the demographic signature observed of transitions to agriculture worldwide (Bellwood 2005). Neff et al. (2006:306) draw attention to the demographic success of the Early Formative adaptations on the Pacific Coast. Second, there is evidence from the Soconusco itself, including the prevalence of maize in Early Formative macrobotanical samples (Feddema 1993); an increased importance of grinding stones, including *manos* and *metates*, in comparison to the Archaic [based on Clark (1994a), Voorhies (2004:384–386), and unpublished data from Locona-Cherla Paso de la Amada]; and evidence of forest clearance [suggesting some type of intensification (Neff et al. 2006)].

Still, it is clear that the Early Formative adaptive shift in the Soconusco was not centered solely on agriculture. If the settlement system proposed by Voorhies [2004; see also Kennett et al. (2006) and Michaels and Voorhies (1999)] for the Archaic is correct, the transition to the Early Formative involved a shift of settlements *away* from the best locations for agriculture. Although there were settlements in foothill areas of the Soconusco by Locona or Ocós (Ekholm 1969), the most significant population concentrations appear to have been immediately inland of the estuary.

Villagers of the Early Formative cultivated maize, beans, and avocado, but they also ate plenty of estuarine fauna. Although intensive processing of marsh clam was abandoned, Early Formative villagers probably ate a greater variety of estuary fauna than their Archaic predecessors (Blake et al. 1992a, 1992b; Kennett et al. 2006; Neff et al. 2006). The most likely explanation for the settlement system is that it resulted from a compromise between access to arable land and to the wild aquatic resources of the estuary (for elaboration on this point, see Chapter 18).

Between 1700 and 1500 B.C., a new type of estuary site arose to replace the Archaic shell mounds. (I postpone for the moment discussion of a second distinctive estuary pattern currently known only from the later Early Formative of the Río Jesus region.) The prime characteristic of the more common Early Formative estuary pattern is a ceramic vessel-form assemblage dominated by tecomates. These estuary sites have been understood to derive from sedentary *specialized* communities that produced estuary resources for exchange with villages inland of the estuary. In this view, the estuary sites were part of complex settlement systems whose inland components included large villages (reaching dozens of hectares in extent) and smaller hamlets or farmsteads (Clark and Pye 2000:231, 236–237).

Recent studies of ceramics and lithics have documented changes in material culture that signal gradual reformulation of Archaic lifeways during the Early Formative. These include expansion of the vessel-form repertoire (Clark and Gosser 1995), a decrease in the frequency of fire-cracked rock (Clark 1994a:243, Rosenswig 2006:Figure 4), a shift in emphasis among grinding stones from mortars and pestles to *metates* and *manos* (Clark 1994a:235; Pye 1995:198–203; Rosenswig 2006:Figure 3), and changes in *metates* toward more efficient grinding and larger volumes of product (e.g., Clark 1994a:236). Although the possibility that the "specialized" estuary sites should be viewed within a framework of changing Archaic lifeways—as locations for logistically organized collecting, for instance—has been mentioned (e.g., Blake et al. 1992a:141), it has not been seriously explored. By 1300 B.C., political life was centered at towns 10 to 15 km inland (Cantón Corralito and Ojo de Agua). A shift toward greater emphasis on agriculture was probably underway by that time.

The Middle Formative Conchas phase (1050/1000–850 B.C.) corresponds to the rise of the major regional center of La Blanca in the Naranjo region and is best known from that area and the Cuauhtémoc region. Mazatán and Río Jesus, the regions to either side of this zone of intense Conchas focus, appear to have suffered dramatic depopulation during this time (Blake and

Clark 1999:64; Clark and Pye 2000:241–242). Political processes were most likely the cause of these changes. At Pajón, in northwestern Soconusco, there is in contrast substantial continuity from late Early Formative to early Middle Formative (Paillés 1980).

A key point for the initial Middle Formative in the southern half of the Soconusco is that the spatial scale of processes underlying settlement organization expanded. One result is that interpretation of the settlement system becomes more of a challenge because it requires coordinating local sequences in several different study regions. The rise of La Blanca continued the late Early Formative pattern from Mazatán of large centers located 10 to 15 km from the ocean.

Faunal remains, however, document a drift away from the estuary focus (dogs were an important food)—and several investigators concur in identifying a substantial further step toward maize-focused subsistence (Blake et al. 1992a, 1992b; Love 1999; Rosenswig 2006). Reorientation of the settlement-subsistence system away from the estuary toward areas of maximum agricultural potential was completed by the end of the Middle Formative, with the rise of major centers (e.g., Izapa and Takalik Abaj) about 30 to 40 km from the sea in the lower piedmont.

The fate of the "specialized" estuary sites during this reorganization is obviously of considerable interest. Relevant sites in Mazatán and Río Jesus were abandoned about 1000 B.C., but because most other sites in the two regions were also abandoned it is not possible to infer much here concerning the more general fate of Early Formative patterns of estuary adaptation. At Pajón, outside the political orbit of La Blanca, there was substantial continuity in a tecomate-focused assemblage through 600 B.C.—implying a continuity of economic activities (Paillés 1980).

The same appears to apply in the vicinity of La Blanca, although the data are not as well published. Shook and Hatch (1979:147–148) investigated the Carlos Mound in the Naranjo estuary and note briefly that the fill "consists of only utilitarian pottery (tecomates and jars) of the Conchas Phase." Coe (1961) notes that the tecomate was the most common vessel form in both Ocós and Conchas assemblages at La Victoria, but he was writing before recognition of significant inter-site variability and does not provide specific counts or percentages. The rest of the material culture assemblage reported by Coe does not seem impoverished in the manner of the Carlos Mound.

Political Organization, 1900–850 B.C.

Sociopolitical organization of the Soconusco Archaic is unknown except for what we might assume based on generic comparisons with other logistically organized collectors. A detailed model of political transformations in the Mazatán area during the Early Formative, however, has been developed by Clark and Blake (1989, 1994) and elaborated by Clark [1994a, 1997; see also Clark and Pye (2000) and Clark and Cheetham (2005)]. It is not yet clear what portions of the Mazatán model can be generalized to other parts of the Soconusco, but given the relatively fine temporal scale of systemic change it seems wise to assume that future work will reveal spatial variation as well (Love 2007; Rosenswig 2007). Currently, the most important observation to be made on spatial scale is that the sizes of integrated political units increased during the Early Formative until by Middle Formative times the La Blanca polity of the Naranjo area had a dramatic impact throughout the southeastern half of the Soconusco (Love 2007:288–289).

According to the model developed by Clark and Blake, the earliest Formative (1900–1700 B.C.) was characterized by generally egalitarian villages in which, nevertheless, competition for prominence and renown were pervasive. Analyses of material culture patterning, especially the well-made and highly decorated Barra ceramics, provide the primary support for the claim of spiraling social competition (Clark and Gosser 1995). Emergence of larger-scale political units—hierarchical in structure, apparently with hereditary transmission of power and privilege—was rapid after 1700 B.C.

The Mazatán area for the subsequent three centuries was characterized by a network of small chiefdoms. Evidence placing these developments in the Locona phase include a two-tiered settlement hierarchy (Clark and Blake 1994), public works in the form of a large ball court at Paso de la Amada (Hill and Clark 2001), and high-status residences raised on platforms at Paso de la Amada and San Carlos (Blake 1991; Clark 1994a; Lesure 1997; Lesure and Blake 2002; Blake et al. 2006). Changes underway in the century after 1400 B.C. seem to involve population dislocations and probably political turmoil. At the large site of Paso de la Amada, a flurry of platform construction was followed by near abandonment.

The final 250 to 300 years of the Early Formative (1300–1050/1000 B.C.) seem to have been characterized by a new scale of political integration. Clark (1997) proposes that much of the Mazatán region was controlled by

a single center during this time; first Cantón Corralito in the Cuadros phase and then Ojo de Agua during the subsequent Jocotal phase [on recent work at Corralito, see Cheetham (2006)]. Dramatic changes in material culture align Mazatán with the contemporaneous Olmec style of the Gulf Coast. Three stone sculptures from the central Mazatán area now removed from their original contexts are assigned by Clark and Pye (2000:226–227) to the late Early Formative based on stylistic comparisons with the Gulf Coast and the observation that Mazatán was largely abandoned in the early Middle Formative. Particularly important is the Alvaro Obregón fragment from a standing male figure in a costume that included the "paw-wing" motif pervasive in Olmec art of the late Early Formative (Clark and Pye 2000:Figure 6).

Beyond the observation of increasing scale and hierarchy, the character of social and political organization at this time remains to be worked out—including the nature of the relation between elites of the Mazatán region and the Gulf Coast. Clark (1994b, 1997) suggests that some people from the Gulf Coast resided in Mazatán and that relations of economic and political control were exercised by a Gulf Coast center (probably San Lorenzo) over Mazatán. The careful but as yet largely unpublished work of David Cheetham is making the idea of a group of immigrants from the Gulf Coast in residence at Cantón Corralito increasingly plausible.

The clearest feature of initial Middle Formative political organization is the further expansion of scale in southeastern Soconusco. The 25-m-high pyramid mound at La Blanca (now destroyed) was one of the largest constructions in all of Mesoamerica at this time, and the coalescence of the new sociopolitical unit drew distant populations to its center by enticement or coercion (Love 1999, 2002). Ambitious platform construction at La Blanca did not correspond to a greatly expanded sculptural tradition, although a few pieces are known from the site (Love 1999:Figures 8 and 9). Instead, low-relief sculptures on large boulders provisionally dated to this time appear at otherwise unprepossessing sites along the coast of Chiapas and at locations farther inland (Navarete 1974; Clark and Pye 2000).

Clark and Pye (2000:242), pointing to the regularity of spacing of known monuments and an association with outlets of mountain passes, suggest that the sculptures "marked way stations or rest stops along a trade route" linked ultimately to the Gulf Coast and the major Olmec center of La Venta. After 600 B.C., large centers with pyramidal structures proliferated in the Soconusco and neighboring regions. Love (1999) documents a trend toward formality and exclusivity in the arrangements of ceremonial spaces in major centers of the Guatemalan coast from the Middle to Late Formative.

El Varal in Spatial and Temporal Context

El Varal is located in the Pampa Cabildo, just under 4 km southeast of the Coatán River and 2 km directly inland from the ocean. Clark's (1994a:Figure 9) reconstruction of biotic communities in the Mazatán area places the site in a vegetated and seasonally flooded pampa zone of the Coatán estuary in proximity to a salt flat. Evidence (see Chapters 3 and 5) indicates that the site was originally an island in a lagoon, although the immediate vicinity was inundated only seasonally.

Occupation of the Vásquez Mound at El Varal dates from the latter part of the Cuadros phase through the entire Jocotal phase. For much of this time, the occupants of El Varal would probably have been within the political orbit of a thriving inland town at Ojo de Agua—some 15 km inland along the Coatán River. The occupation documented by our excavations thus corresponds to a period of expanding scale in the political organization of southeastern Soconusco, when reorientation of the settlement-subsistence system toward the best agricultural lands was at an incipient stage.

Based on our surface collections at the second (Martínez) mound at El Varal, occupation at the site stretches back to the Locona phase. We found no Cherla-phase diagnostics and no uncontestable examples of the low bolstered-rim bowls characteristic of the Cuadros phase. It is thus possible that the site was abandoned for a hundred years or more during the middle of the Early Formative, but without further work at the site we can only speculate.

Clark's (1994a) survey focused on the opposite bank of the Coatán from El Varal. Nevertheless, several sites with Early Formative occupations are known from the immediate vicinity of our site. Just 600 m away is Mz-99, whereas Mz-100 is a few hundred meters farther (and at 1.5 km distance is Sandoval). All of these are small estuary mounds with Early Formative occupations (Clark 1994a:Figure 19). The Alvarez site, investigated by Ceja (1974, 1998), is 2.8 km distant. The details of to what extent these sites were in use contemporaneously remain to be worked out, but one suspects significant overlap. Certainly, any with Jocotal occupations must have been occupied contemporaneously with El Varal.

Beyond the observation that similar sites a short walk or canoe ride from El Varal were in use at the same time, significant unknowns remain concerning the nature of Early Formative activities on these small anthropogenic islands of the Soconusco estuaries.

Inter-site Variation and Attempts to Understand It

Assemblage variation in Early and Middle Formative Soconusco has been recognized for more than three decades. To characterize what is known of this phenomenon, I briefly describe its manifestation in the archaeological record. I then move on to a history of interpretive themes. The review does not consider the new evidence to be presented in this volume, but does include three previous works on El Varal (Lesure 1993; Smith 1997; Carballo 2001) because they help chart the development of our thinking on the site.

Empirical Patterns

The most obvious assemblage characteristic suggestive of site-to-site variation in social practices is the mix of ceramic vessel forms, particularly the relative frequencies of tecomates and dishes. Tecomates are deep vessels with restricted rims and no necks (Figure 1.2). They

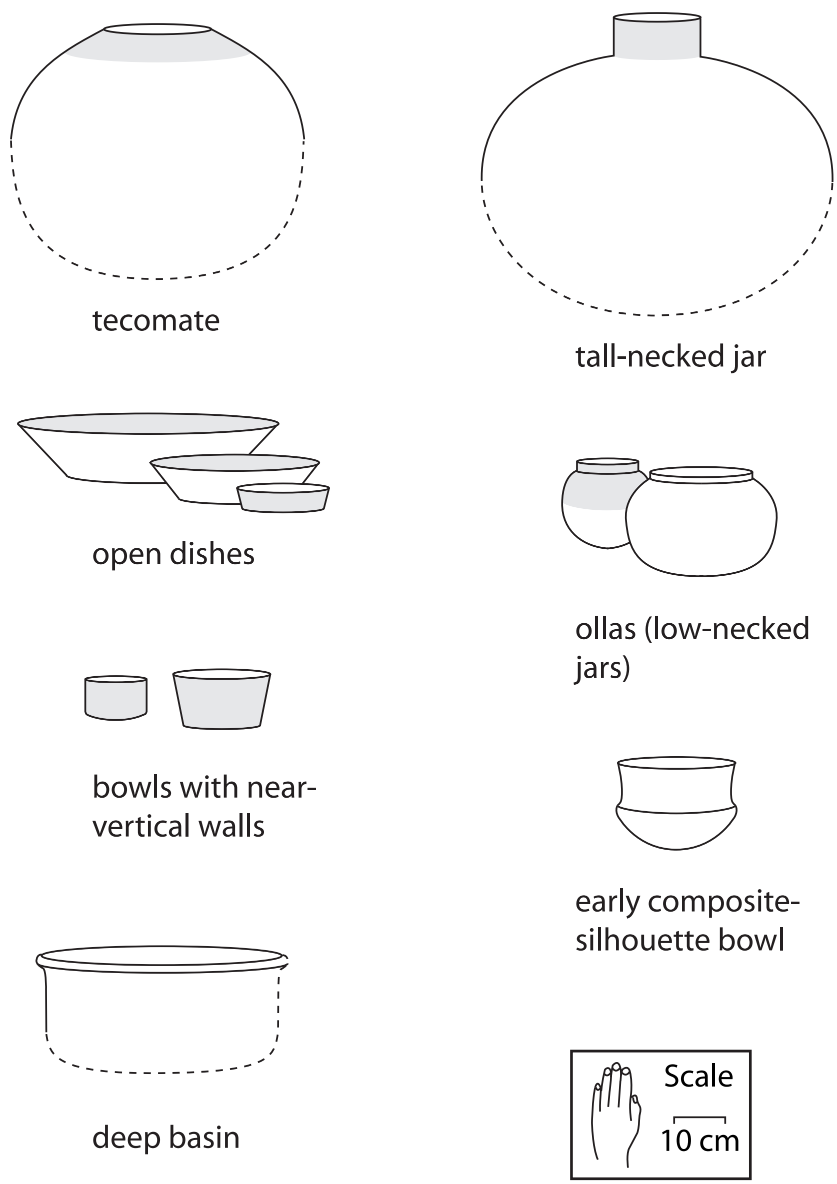


Figure 1.2. Vessel forms at El Varal.

are not slipped or burnished in the interior but can be globular or subglobular (teardrop shaped) in overall form. Dishes are open vessels with (usually) flat bases, maximum diameters at or near the rim, and slipped and/or burnished interiors.

Tecomate-dominant assemblages (60 to 90 percent tecomates) appear at sites in or adjacent to the estuary, whereas dish-dominant assemblages (50 to 80 percent dishes) tend to occur on savanna lands (a few kilometers inland). In this volume we occasionally refer to the former as an *estuary pattern* and the latter as an *inland pattern*, but in truth this set of terms represents overly static shorthand. Some sites close to the estuary actually have an "inland" pattern. More problematically, the assemblages at some sites changed from "estuary" to "inland"—and El Varal is one such site.

It is therefore preferable to designate the pattern to be examined as a contemporaneity of dish-dominant and tecomate-dominant assemblages. A third assemblage type (mentioned briefly previously) is dominated (70 to 95 percent) by crude, deep, vaguely conical jars. Pye (1995) believes they were used in the production of salt. Because they resemble nothing with which I am familiar from the Mazatán region, I have decided to refer to them as "Mesak jars"—after the site from which they are reported. The designation "jar" is based on their height relative to diameter; the mouths are unrestricted.

Although late Early Formative Soconusco is best known for its tecomate-dominant assemblages through the work of Coe and Flannery (1967), Paillés (1980), and Shook and Hatch (1979), dish-dominant assemblages were probably more common—at least in the Mazatán and Naranjo areas. Mesak-jar–dominant assemblages are the most limited in distribution.[2] Given that turning a few spadefuls of earth is sufficient to accurately classify a site as dish dominant, tecomate dominant, or Mesak-jar dominant, it is tempting to take these categories very seriously.

Certain site characteristics correlate with the dish-versus-tecomate distinction. At sites where tecomates dominate, investigators report extensive evidence of burning throughout the deposits [including in formal hearths or ovens (Pye 1995)]. Design details of these features vary among tecomate-dominant sites. The sherd-lined hearths at Pajón (Paillés 1980), for instance, have not been reported from southeastern Soconusco. Where dishes dominate, hearths and ovens of any form are less common [though see Blake (1991) and Rosenswig (2005:148)]—and excavators do not record pervasive evidence of burning.

Sites with mainly tecomates are mounds dozens of meters in diameter and 3 to 8 m high. Upon excavation, they turn out to derive from tell-like accumulations of occupation debris rather than from major construction events. The accumulation of occupation surfaces and refuse dumps was rapid [several meters of occupational deposit can correspond to a single ceramic phase (e.g., Shook and Hatch 1979:151)]. Depositional environments at sites with mainly dishes were more varied. In some cases, occupation was extensive and apparently dispersed. At Paso de la Amada, for instance, identifiable mounds are smaller and lower than in the estuary—but they typically derive largely from purposeful construction events rather than from the accumulation of occupation debris (Lesure 1997a). These general depositional patterns suggest that sites with mainly tecomates were islands in the estuary, whereas dish-dominant sites were on dry land. The extensive burning associated with tecomate-dominant assemblages, however, is probably an important clue to the activities that characterized those sites.

Evidence of burning includes the sherds themselves. Pots appear to have been burned during their use-lives and after breakage (Coe and Flannery 1967:30, 81; Smith 1997:32–33). It seems likely that they were used for cooking. As Coe and Flannery (1967:81) point out,

2. Previously reported sites fall into this classification as follows. References are to works with at least some data on ceramic vessel forms. For the initial Early Formative (1700–1400 B.C.): (1) *dish dominant:* Paso de la Amada (Ceja 1985; Clark 1994a; Lesure 1998), Altamira (Green and Lowe 1967), San Carlos (Clark 1994a), Chilo (Clark 1994a), Aquiles Serdán (Clark 1994a), Cuauhtémoc (Rosenswig 2005), and probably La Victoria (Coe 1961), and (2) *tecomate dominant:* Los Alvarez (Ceja 1974; Lowe 1977), Sandoval (Guzzy and Cuevas 1985; Cuevas 1991; Clark 1994a:111–113), and apparently El Mesak (Pye 1995). For the late Early Formative (1400–1000 B.C.): (1) *dish dominant:* Paso de la Amada (Lesure 1998), San Carlos (Lesure 1993), Cuauhtémoc (Rosenswig 2005), (2) *tecomate dominant:* Salinas La Blanca (Coe and Flannery 1967), Navarijo (Shook and Hatch 1979), Pajón (Paillés 1980), and of course El Varal (Lesure 1993; Smith 1997; and Carballo 2001), and (3) *Mesak-jar dominant:* El Mesak (Pye 1995). For the initial Middle Formative (1000–650 B.C.): (1) *dish dominant:* La Blanca (Love 2002) and Cuauhtémoc (Rosenswig 2005) and (2) *tecomate dominant:* Carlos (Shook and Hatch 1979:147–148) and Pajón (Paillés 1980).

the design of the tecomate would be an efficient one for prolonged boiling or steaming.

Despite frequent reference to specialized production of estuary resources at tecomate-dominant sites, there has been relatively little work on the physical remains of items conceivably cooked in tecomates. Coe and Flannery (1967) remain one of the best and most widely available sources. Mineralized maize cobs and negative casts of cobs in numerous levels at Salinas La Blanca suggest that agricultural products were consistently available. The faunal assemblage was dominated by estuarine fish, mollusks, and several species of crab—although deer, iguana, and turtle were present. For other brief reports on subsistence remains at tecomate-dominant or Mesak-jar–dominant sites, see Paillés (1980) and Pye (1995).

Information on subsistence remains from dish-dominant sites is similarly scarce. Sources from the Mazatán area are Blake et al. (1992a), Feddema (1993), Clark (1994a), and Wake and Harrington (2002). Rosenswig (2005:144–157, 2006:19–20) reports on faunal remains from Cuauhtémoc. The most important point to make here is that attention to subsistence remains leaves the *content* of tecomates far from obvious. One's crude impression is that there are more broken tecomates than debris from items that could potentially have been tecomate content.

Inter-site variability extends to artifacts other than pottery vessels. Sites with all three vessel-form patterns appear to contain a full array of domestic artifacts. Variation again takes the form of differing frequencies rather than of presence versus absence. At sites with mainly dishes, many varieties of vessel form and decoration are reported. Tecomate-dominant assemblages give the impression of a narrower range of forms and decoration, but it is not always clear to what extent this is a product of sample size (Lesure 1993:215).

More clear-cut are differences in the relative frequencies of obsidian flakes and ceramic figurines. Both are common at sites with mainly dishes and rare where tecomates dominate. Grinding stones, including mortars and pestles as well as *metates* and *manos*, are present at all sites. Pye (1995:90, 259–270) found striking numbers of pumice abraders and worked sherds in Mesak-jar–dominant deposits at El Mesak. Except for Clark and Lee's (1984) obsidian study and Lesure's (1993) early work on El Varal, there has been little attempt to quantify inter-site differences beyond vessel-form inventories.

A Brief History of Social Interpretation

Two significant interpretive themes have been intertwined in discussions of early inter-site variation in the Soconusco. The first is the attempt to understand productive processes at estuary sites, generally focused on the question of what was cooked in tecomates. A second theme is the effort to use inter-site variations as a basis for inferences on economic and political organization.

At the tecomate-dominant site of Salinas La Blanca in the Naranjo area, Coe and Flannery (1967) did not identify any pattern of inter-site variation. They proposed that tecomates were used for ordinary cooking activities, particularly the steaming of tamales (leaf-wrapped maize dumplings). Inter-site variations in vessel-form distribution were identified during the 1970s, first in Mazatán and then in the Naranjo area. In Mazatán, investigations at Los Alvarez and Paso de la Amada revealed dramatic contemporaneous variation in the Locona and Ocós phases. Ceja (1974, 1998) postulated that the inhabitants of the tecomate-dominant estuarine site of Los Alvarez had been primarily fishers and collectors, whereas people at the dish-dominant inland site of Paso de la Amada were primarily agriculturalists—more complexly organized than their estuarine compatriots.

To support the claim of greater complexity, Lowe (1977, 1978) and Clark and Lee (1984) pointed to evidence of community planning, platform construction, and craft specialization at the inland site. In Lowe's (1977:210) interpretation, then, inter-site variability of the initial Early Formative had both an economic and a political dimension: "The sharply divided ceramic-form distribution pattern, coupled with community-type differences, strongly suggests widely separated social classes resulting from or related to varied subsistence activities." Shook and Hatch laid out a similar scheme for the Naranjo region.

> The sites close to the Pacific Ocean on the estuaries, lagoons, and salt flats were occupied by small colonies of working class people primarily for the production of salt. They may have been controlled and administered by a socio-political system emanating from a center established further inland. [Shook and Hatch 1979:147]

Their prime evidence for inter-site variation derived from a comparison between Conchas-phase La Blanca and the estuarine Carlos Mound. The inhabitants of the latter site, "being basically workmen assigned to the task of salt-making, would not have had the full

inventory of cult objects that is found at their capital" (Shook and Hatch 1979:148). The authors were well aware that their model of Formative economic and political organization diverged sharply from that of Coe and Flannery.

For the Naranjo area, Shook and Hatch (1979:147) emphasized salt making as the principal activity of estuary inhabitants—although they allowed that a "secondary purpose" might have been the harvesting of fish and mollusks for food and perhaps the collecting of shells for the making of ornaments and tools and/or for lime making. Paillés (1980:83–87), in her report on Pajón in northwestern Soconusco, gave further consideration to the question of what resource or resources might have been the focus of collection activities. By the time she wrote, the basic empirical patterns had become clear. Her suggestions concerning harvesting activities at tecomate-dominant sites (the production of fish in various forms or otherwise shrimp, shellfish, pottery, or salt) continue to be pertinent.

Three further excavation projects at tecomate-dominant sites were carried out from the mid 1980s through the early 1990s. Pedro Guzzy and Marta Cuevas explored the Sandoval site in Mazatán (Guzzy and Cuevas 1985; Cuevas 1991). Arthur Demarest led explorations in various tecomate- and Mesak-jar–dominant mounds at El Mesak in the Río Jesus region. The El Varal work followed in 1992. None of these excavations has been well published until now, but data from this work have formed the basis for recent discussion of Early Formative inter-site variability in Soconusco.

In his initial interpretations of Sandoval, Clark emphasized the mutual dependencies between inland and estuary communities (Clark 1991:18). Such intraregional productive specialization was, Clark (1994a:111) pointed out, the organizational context favorable to the emergence of chiefs as managers of distribution [in Service's (1962) early model]. Thus, the appearance of specialist production for exchange at estuary sites might be integral to the emergence of social inequality. Clark did not attempt to definitively identify the productive tasks carried out at specialized estuary sites. He and other members of the Mazatán Early Formative Project have essentially endorsed the list of possible productive activities assembled by Paillés (Blake et al. 1992a:141; Clark 1991:18, 1994a:65, 113; Clark and Pye 2000:236–237).

The discovery at El Mesak of a third site assemblage pattern has been particularly important. The issue, touched on only briefly by Pye and Demarest (1991), forms a primary focus of Pye's (1995) dissertation. Pye, like Clark, follows Lowe in imagining community-level specialization in subsistence production between estuary and inland settings—although she emphasizes the implication of exchange in foodstuffs between sedentary communities as contrasted with an Archaic pattern in which people moved between distinct resource zones. Pye ascribes a shift at El Mesak from tecomate-dominant to Mesak-jar–dominant assemblages to changes in productive emphasis from aquatic fauna to salt [Pye 1995:302; see also Clark and Pye (2000:237)]. Pye's argument that Mesak jars were used for the evaporation of briny water in the production of salt is convincing.

Three studies of materials from El Varal, and a fourth study looking at Soconusco tecomates from the perspective of the Southern Gulf Coast, have helped shape the approach taken in this volume. Lesure (1993) pointed out that the sharp estuary-versus-inland difference in relative frequencies of tecomates and dishes could derive from a superabundance of tecomates in the estuary or an abnormally high number of dishes at inland sites. The first case would imply some type of economic specialization involving tecomates as tools, whereas the second might be termed a political model in which dishes [seen as tools of social advancement after Clark and Blake (1994)] were produced in excess at centers of power. Lesure, however (like others before him), favored the idea that inland assemblages should be regarded as "normal." Inter-site differences derived principally from an excess of tecomates in the estuary.

Lesure has supervised two UCLA master's theses on El Varal materials. Natalie Smith (now Henrich) analyzed about half of the excavated pottery (Smith 1997). She followed Lowe and Clark in viewing tecomate-dominant sites as communities that specialized in production for exchange under the political orbit of large inland villages. Beyond her ceramic database (incorporated in the analyses of Chapter 9), Smith's most significant contribution was an extensive consideration of possible productive activities. She first identified a set of empirical criteria to be accounted for (estuary location, necessity of steaming or boiling in restricted-mouth vessels, and a productive process that did not yield significant amounts of archaeologically visible debris).

She concentrated on subsistence items that might have been produced for exchange with inland sites. One intriguing suggestion was that the product was solid rather than liquid in form, in that plausible transport

containers are absent (Smith 1997:34). Smith went on to evaluate the relative likelihood of a variety of resources. No plant resource could be identified that would have been restricted to the estuary and potentially subject to intensified production. Smith also ruled out salt because of the inappropriateness of restricted-rim vessels for rapid evaporation of liquid. This text significantly revises that position.

The two potential products that fared best, in Smith's estimation, were shrimp and fish. Shrimp enter the estuary system in great numbers in the dry season, and today they are typically boiled briefly before drying (Voorhies 2004:147–157). One million pounds per year were being produced in Chiapas estuaries for trade during the 1940s (Linder 1944:79). A drawback to the shrimp argument is that one would expect a fairly open design for the boiling vessel because time in the water is brief and because if many batches are required accessibility of content would facilitate production (as in the case of salt, this issue will be revisited).

An alternative is some type of fish product. The immediate drawback to this line of argument is that smoking, drying, and salting appear in contemporary Chiapas (Linder 1944) and elsewhere to be the most common techniques for preserving fish destined for trade. Such practices would not apparently require tecomates and should yield numerous fish bones at the point of origin. There are, however, methods of producing fish that would involve tecomates and (in some cases) prolonged boiling. Paillés (1980) mentions "fish cheese" without going into details. Pye (1995:303) suggests a fish sauce or paste such as that widely traded in the ancient Mediterranean.

Smith (1997:36–37) notes that fermented fish concoctions are documented for ancient Rome and modern Asia. They sometimes involve disintegration of the bones, but the product is liquid (e.g., Roman fish sauce was traded in amphorae). Smith's memorable final suggestion (identifying the possible product that seemed to account best for her empirical criteria) was what we have come to refer to as the "gefilte fish hypothesis."

> Gefilte fish is a traditional Jewish food. It is made by removing the head and bones of fish and then chopping up the remaining parts of the fish. Any type of fish can be used. Cornmeal and eggs are added to the fish, and the mixture is rolled into balls. The balls are placed into a pot of water *with the bones and head*. The pot is covered and the balls are left in the boiling water for approximately one and a half hours during which time the bones break down and form a thick jelly. [Smith 1997:37]

The idea is not, of course, that the inhabitants of El Varal actually made gefilte fish. It is, rather, that they produced a vaguely similar concoction that involved prolonged boiling, bone absorption, and a relatively solid end product that could have been moved easily inland in perishable wrappings.

An assumption in Smith's study—characteristic of all of our thinking in the mid 1990s—was that specialized production at estuary sites such as El Varal emphasized one basic resource and that a primary analytical goal was identification of that resource. The second UCLA thesis widened the field of possibilities. Because Carballo's (2001) work in revised form is presented in Chapter 16, the discussion here is brief. Carballo brought completely new classes of evidence to the debate in the form of two separate geochemical analyses. Chemical composition of pottery fragments proved consistent with the claim that communities made their own pottery, although some vessels may have moved from estuary to inland sites.

The second study, of lipid signatures of residues from ceramics, was potentially of even more interest—although the sample size was small and degradation of lipids was a problem. El Varal tecomates did not display the coherence of patterning one might expect of a narrow resource specialization. Carballo therefore cast doubt on the idea that intensified exploitation of a narrow range of resources accounted for inter-site assemblage variability. He favored the idea that tecomate-dominant assemblages were essentially impoverished domestic complexes, due to a scenario such as Lesure's (1993) political hypothesis or to occupation of the estuary sites only part of the year.

One result of Carballo's lipid study is that it bumped our thinking on both larger interpretive questions (i.e., what was produced at El Varal and how production was organized) out of something of a rut in which the possible parameters of specialization were conceived quite narrowly. First, the study provided some support for the idea that the inhabitants of El Varal might have had a generalized interest in a *range* of estuary resources. The suggestion was attractive for multiple reasons. It would fit comfortably with the array of subsistence remains actually recovered from the site. It would also ease the pressure to contrive ever-more-elaborate scenarios for removing production detritus of the intensified resource from the deposits.

Second, Carballo's results directed our attention to new possibilities concerning organization. Although Brumfiel and Earle (1987:6) found that specialization in the production of subsistence goods was not significant to political development, claims of just such a link in Formative Soconusco have proven persistently popular. However, widespread claims of specialization might well be misplaced if mobility was a factor in generating inter-site assemblage differences. If inland communities sent work parties out to the estuary to harvest resources on a seasonal or intermittent basis, a scheme developed specifically for understanding wild resource procurement by hunter-gatherers might prove more helpful than an appeal to specialization.

A fourth study that has influenced our thinking on El Varal is Arnold's (1999) work on tecomates and residential mobility in Early Formative Veracruz, with comparative consideration of Soconusco. Although differing in details, the conclusions herein concerning El Varal are similar in spirit to Arnold's (discussed in greater detail in Chapter 18).

Contrary to our exaggerated hopes early in Carballo's residue study, that new source of evidence has not provided the crucial clue that would solve all of the puzzles posed by El Varal. In particular, the possibility of a specific resource focus (and of occupational specialization more generally) must remain on the table. One significant factor has been the questionable strength of existing arguments—such as Smith's (1997), which I enthusiastically encouraged at the time—that would sort among possible products based on the appropriateness of the tecomate as a vessel form.

Such arguments are certainly not irrelevant, but it would seem that intended purpose constrains choice of vessel form rather more weakly than the archaeologist might hope (see Chapters 14 and 18). In particular, I will argue that a significant activity at El Varal involved boiling brine down to salt in tecomates. Those were hardly optimal vessels for the task, although they would have worked well enough. Even so, the choice of the tecomate remains a puzzle that is far from resolved by a claim that these vessels were used to produce salt.

Choice of Analytical Frameworks

The investigation of El Varal yields a clear problem orientation for this book: the goal is to explain patterns of inter-site assemblage variation in Early Formative Soconusco. However, we do not start with a model to be tested. The problem orienting the volume is not derived from a body of anthropological theory but from observations of archaeological patterns. For 30 years, the patterns have been formulated in social terms as "specialization." However, Carballo's (2001) thesis has prompted us to question the soundness of that movement from pattern to social circumstance.

It is certainly tempting to seize upon some theoretical framework [if not specialization, perhaps Binford's (1983) collecting model] that would move us along rapidly in that effort. We could then elaborate hypotheses to be tested in the chapters that follow and would be well protected against any sense that the presentation was too inductive. However, although Carballo's work might prompt us toward collecting rather than specialization those results by themselves are (as discussed in Chapter 16) far from definitive.

Another problem is that entire categories of evidence logically required for any full evaluation of a collecting or specialization model for inter-site assemblage variation are missing. Our data collection strategies were governed by the opportunities and constraints of the salvage situation. Although it would have been possible to rhetorically craft this volume as the testing of a model, that is not in fact what my coauthors and I have done—and the strange absences of relevant data would threaten to make the entire effort appear foolish. Thus, a choice of appropriate analytical framework for the volume needs to be founded on some overarching strategy for translating a material problem (inter-site assemblage variation) into social terms appropriate for anthropological explanation. I first consider that issue, and then move on to choose the two specific approaches (research topics and organizational models) to be drawn on repeatedly throughout the volume.

Interpretation, Explanation, and El Varal

Interpretive archaeologists have not been shy about pointing out the recurring rhetorical subterfuges in processual explanations ostentatiously presented as tests of models (e.g., Hodder 1999:20–29). They offer instead the hermeneutic circle (or perhaps spiral) as more philosophically appealing and closer to the way archaeologists actually reason (Hodder 1992, 1999:30–65). However, individual steps in the hermeneutic—as in, for instance, Hodder's (1992) season-by-season account of his interpretive trajectory at the Haddenham Enclosure—can readily be formulated in terms of the testing of propositions. A

distinction can be made between the analytical procedures of the research process and the subsequent textual reformulation of that process. Setting aside for the moment the issue of presentation, could we intentionally combine hermeneutic and hypothesis-testing strategies at the analytical stage?

In an inspiring 1985 paper on analogy, Wylie seems to be arguing just that. She shows how Binford's testing program can be understood as covering one part of a spectrum of strategies for developing and strengthening social interpretations of archaeological materials. She particularly emphasizes the importance of hypothesis formulation (often downplayed by those championing explanation) because testing (as interpretivists have pointed out) is itself infused with subsidiary inductive argumentation. A general implication of Wylie's discussion is a reminder that interpretive work on archaeological problems is a collective endeavor: with a spectrum of strategies available for strengthening arguments, investigators working in different parts of the spectrum contribute to a larger whole.

This book draws from the following insights. First, procedures of hypothesis testing and hermeneutic strategies are potentially compatible—interpenetrating at different levels of a research program. Second, it is helpful to distinguish between analyses and their subsequent rhetorical formulation and to make deliberate decisions concerning the course each should take. I simultaneously acknowledge Hodder's (1992) call for rhetoric to be true to the actual course of analysis and the clarity of model testing as a rhetorical framework.

Finally, any particular study should be recognized as a fragment of some larger endeavor. This point brings us back to El Varal and the challenge of translating an obvious archaeological problem into social terms. That translation process is, it turns out, properly the subject of this volume. The chapters collected here constitute exploratory work aimed at choosing an appropriate framework for breathing anthropological life into a set of archaeological patterns. The entire volume can thus be regarded as an extended, data-rich effort of hypothesis formulation.

Choosing an Analytical Framework

A drawn-out exploratory effort is particularly appropriate here because our choices among theories have larger implications concerning the neoevolutionary category we select as a frame of reference for thinking about the site and its occupants. El Varal is a Formative site, but it is likely that people there dedicated themselves to the collection of wild foods. To make anthropological sense of what was going on at the site, we thus face a dilemma: regarding the Archaic/Formative transition, do we look "forward" for inspiration to specialization and societal complexity or "back" to models of hunter-gatherer subsistence?

Archaeologists have often pursued such issues by developing idealized models of social, economic, and/or political organization (sometimes framed as societal "types") and attempting to match those against the data of a particular case. There are many problems with such types (Feinman and Neitzel 1984), and a popular alternative approach would view social, economic, or political organization as varying along multiple dimensions—all of which must be monitored independently (e.g., Costin 1991). There seems no particular reason the two approaches need be opposed, and the exploratory efforts undertaken here draw on both. Both are familiar enough to not require elaborate theoretical justification. I introduce them briefly here as providing distinct but ultimately complementary analytical agendas for the study of finds from El Varal. My coauthors and I return to them repeatedly in the chapters that follow (particularly in Chapters 14 and 18).

Research Topics

It is helpful to begin with the second approach, to be pursued here in the form of six broad research topics. Investigation of each topic will generate information useful for weighing hunter-gatherer provisioning versus productive specialization as appropriate theoretical frameworks. It will also provide empirical input for setting key parameters in either framework. Following the spirit of the second approach, investigations in each topic can be pursued independently so that in the end we can survey the full set of results to reach a synthetic understanding of lifeways at El Varal without forcing the site into broad, predefined organizational or evolutionary categories. The topics are as follows.

- *Site setting*. What was the context of the site with respect to habitat variation within the Mazatán region? What resources were available in its catchment?
- *Nature of productive activities at El Varal*. What was produced at the site, and how? What resources were harvested from the estuary? How wide or narrow was the range of resources harvested, and how stable or consistent?

- *Size and nature of the social group at El Varal*. How many people occupied El Varal, and what were their relations to one another?
- *Permanence of occupation at El Varal*. How was the occupation of the site organized across time? Was it a permanently settled hamlet, a seasonal processing station, or something else entirely? How did use of the site change over time?
- *Distinctiveness of activities at tecomate-dominant as compared to dish-dominant sites*. Can typical domestic assemblages be identified in both cases?
- *Nature of economic activities*. How similar or different were economic activities at the two types of sites?
- *Relations between producers and consumers in the Mazatán region*. What was the social unit of production at tecomate-dominant sites? What were the relations between the people who produced the archaeological record at El Varal and those inhabiting inland sites? Is there evidence at El Varal of the type of political dependency that characterizes estuary sites in the schemes of Lowe, Shook, and Hatch?

Organizational Models

The other approach would begin by identifying idealized models of social-organizational arrangements that might plausibly have yielded the inter-site assemblage differences observed in Early Formative Mazatán. With several such models in hand, we could try to assess which was most consistent with evidence from El Varal. Based on the history of interpretation reviewed previously, one obvious source of inspiration for such models is occupational specialization and societal complexity (e.g., Brumfiel and Earle 1987; Costin 1991).

When we consider that most proposed products are wild subsistence resources, a framework based on hunter-gatherer settlement systems would seem an equally viable route toward interpretation. Binford's (1983) paper on foraging and collecting is particularly helpful in relating variability in the organization of wild resource acquisition to patterns of site structure and content. The later chapters of this book consider four organizational models tailored to the general characteristics of the archaeological case at hand—two involving occupational specialization and two inspired by Binford's work on hunter-gatherer settlement systems. The models are as follows.

- *Part-time occupational specialization with year-round residence*. In this model, dish-dominant and tecomate-dominant assemblages were produced by permanently settled communities. The residents of tecomate-dominant sites, unlike their dish-dominant counterparts, were part-time specialists who processed some product available only in the estuary. Specialist households would have produced beyond their own needs, and goods would have been transferred to inland consumers through exchange (for inland products such as maize?) or as tribute (Lowe 1977:210; Shook and Hatch 1979:147–148).
- *Part-time occupational specialization with seasonal residence*. A second possibility is that the occupants of El Varal were specialist producers but resided at the site only part of the year. In this scheme, the occupants of tecomate-dominant sites maintained dwellings elsewhere. Because they would have been camping in the estuary for only part of the year, we would expect a rather different archaeological record than under the first scenario. Still, we would posit the same types of relations of producers to consumers as in the first model (i.e., exchange between households or perhaps tribute).
- *Logistical collecting at estuary field camps*. Binford's (1983) collecting model applies to those hunting and gathering systems based on a general strategy of moving resources to people. Collectors establish relatively stable *residential bases*. Specially organized task groups leave those bases, sometimes for significant periods of time, to obtain specific resources. One type of site generated in such a system is the *field camp*, a temporary center of operations for a task group. The group (a small subset of the entire community) sleeps and eats there while engaged in collecting and processing a specific resource. In this third model, tecomate-dominant sites would be field camps and dish-dominant sites would be analogous to residential bases (although, of course, more permanent than in the cases with which Binford was dealing). As in the second model, we would here posit occupation for part of the year only—by people who were producing for others and whose main residential location was elsewhere. In the collector model, however, producers owe food to others by virtue of their shared group membership. In the specialization models, producer/consumer relations are economic transactions between basic units of production and consumption (such as households) rather than relations of obligation between producers and members of a larger consumption unit.

- *Generalized foraging*. Binford (1983) contrasts collecting with foraging, in which entire groups shift frequently between residential bases. From each base, foragers move out daily to collect various resources—depending on what they happen to encounter. Because one of the main archaeological consequences of a system such as this is redundancy of structure and content between sites, the generalized foraging model is of little direct help in explaining our inter-site assemblage differences. Still, this proves a useful model to have at hand. Two points of contrast with the collecting model are of particular interest. A generalized strategy in which visitors to field camps collected any of various resources they might encounter would constitute a notable departure from the strategy of collecting, as would anything approximating the basic foraging strategy of moving people to resources rather than the reverse.

Organization of the Volume

This volume has two primary goals. First, it is interpretive—tracing an arc from a set of archaeological patterns to "concluding hypotheses" that formulate those patterns in social terms. Second, it is descriptive—providing as full a report of the investigations at El Varal and the materials recovered as possible. Readers interested primarily in an interpretive overview might start with Chapters 14 and 18, and then turn as needed to other chapters (particularly 15 through 17).

The chapters are organized into three sections. The remainder of Part I consists of an account of the fieldwork. Chapter 2 deals with field methods and provides an overview of work carried out at the site. Note particularly the distinction between Phase 3 and Phase 4 excavations. Chapter 3 analyzes the stratigraphy of the two profiles exposed by the bulldozer, presenting a basic classification of deposits (mound core, sandy edges, dump-and-fill, and surface zones) and establishing the first of two internal chronologies for the Vásquez Mound to be used in subsequent chapters (stratigraphic periods).

Chapter 3 also includes an initial set of observations on economic activities (including salt production) and occupation permanence based on stratigraphy and features. The excavations are described in Chapter 4. Note particularly there the insight into formation of the sandy edges gleaned from the N35W0 excavation. Tables at the end of that chapter provide basic information about each excavated lot.

Part II is devoted to the materials recovered from the site and the insight they can yield into the larger problem of inter-site assemblage variation. The first material considered is shells (Chapter 5) because they provide a second internal chronology (shell phases). Important information on habitat and the organization of productive activities is also presented in Chapter 5. The vertebrate and crustacean faunal assemblages are described in Chapters 6 and 7 (fish and crab were important), and a scant set of macrobotanical remains is examined in Chapter 8. Chapter 9 contains a description of the pottery, as well as chronological and functional analysis. Chapters 10 and 11 present artifacts of stone, shell, and ceramic. Chapter 12 concerns radiocarbon dates.

Although the sample size is small, isotopic analyses of shells provide important information on seasonality of occupation (Chapter 13). Chapter 14 considers intra-site assemblage variability at El Varal for the insight it might yield on the larger question of inter-site variation. In the process, the chapter sums up the results of Chapters 3 through 13 and provides an estimate of how many people occupied El Varal. Chapter 14 also provides further discussion on the four organizational models introduced briefly in this chapter. Those models are then referred to repeatedly for the remainder of the volume (Chapters 15 through 18).

The papers of Part III compare materials from El Varal to those of other sites in the Mazatán region. Although the availability of suitable samples limits the possibilities here, these papers are crucial to the inquiry into inter-site variability. In Chapter 15, Lesure and Wake compare Early Formative faunal assemblages from three sites: Cherla-phase Aquiles Serdán, Cherla-phase Paso de la Amada, and Jocotal-phase El Varal. The associated pottery assemblage in the latter case is tecomate dominant, whereas the first two are dish dominant. We also compare Early Formative and Archaic patterns, considering faunal remains in relation to Binford's foraging-collecting continuum. The results of Carballo's master's thesis are presented in updated form, focused on issues of specialization, in Chapter 16. Chapter 17 considers the social organization of salt production and generally sets the stage for the "concluding hypotheses" of Chapter 18.

CHAPTER 2

Field Investigations and Materials Recovered

RICHARD G. LESURE

A SERENDIPITOUS COMBINATION OF CIRCUMSTANCES led to the investigation of the Early Formative estuary site of El Varal in the Mazatán region of Chiapas during the winter and spring of 1992. Working under the auspices of the Mazatán Early Formative Project (1985 to 1995, directed by John Clark and Michael Blake) and with the encouragement and support of the Chiapas Regional Center of the Instituto Nacional de Antropología e Historia, Richard Lesure and Tomás Pérez Suárez conducted salvage operations at El Varal several months after the partial destruction of one of its two mounds. What began as a minor distraction from the primary goals for the 1992 field season [systematic surface survey by Clark (1994a) and excavations at Paso de la Amada by Lesure (1995)] turned into a full-fledged investigation of seven weeks.

Although the destruction wrought by the 20+-m-wide drainage canal through the Vásquez Mound was catastrophic, it provided unique opportunities for the recovery of archaeological information. The two 100-m-long profiles revealed much of the interior structure of the mound and plenty of evidence of Early Formative activities in this estuary locale. In addition, dense trash middens were exposed in the profiles. We collected many artifacts from the bulldozer backdirt, from our own profile cleaning, and from formal excavations into the profiles. The last effort alone yielded a total of more than 50,000 potsherds, all dating to the Cuadros and Jocotal phases of 1100 to 850 B.C. Our permit was specifically for a salvage operation, and beyond mapping and a surface collection we restricted our efforts to the two long profiles exposed by the bulldozer. Those were so long and deep, however, that they were still yielding surprises after seven weeks of investigation.

The Site

El Varal consists of two large mounds, which we termed *Vásquez* and *Martínez* after the landowners as of 1992 (Figure 2.1). The Vásquez Mound is the lower of the two, at about 5 m in height. It is vaguely round in shape, with the corresponding diameter of 90 to 100 m. The Martínez Mound is immediately southwest of the Vásquez Mound. It is 7 m high and oval in plan, with an overall length of 80 m and a width of 50 m. We estimate the total occupied area of the site at 1 ha. However, this represents only the latest occupation. For much of its span of occupation, the site was considerably smaller.

The Vásquez Mound is an entirely human construction, built up gradually over generations. We suspect that the same holds for the Martínez Mound. Occupation at Vásquez is restricted to the Cuadros and

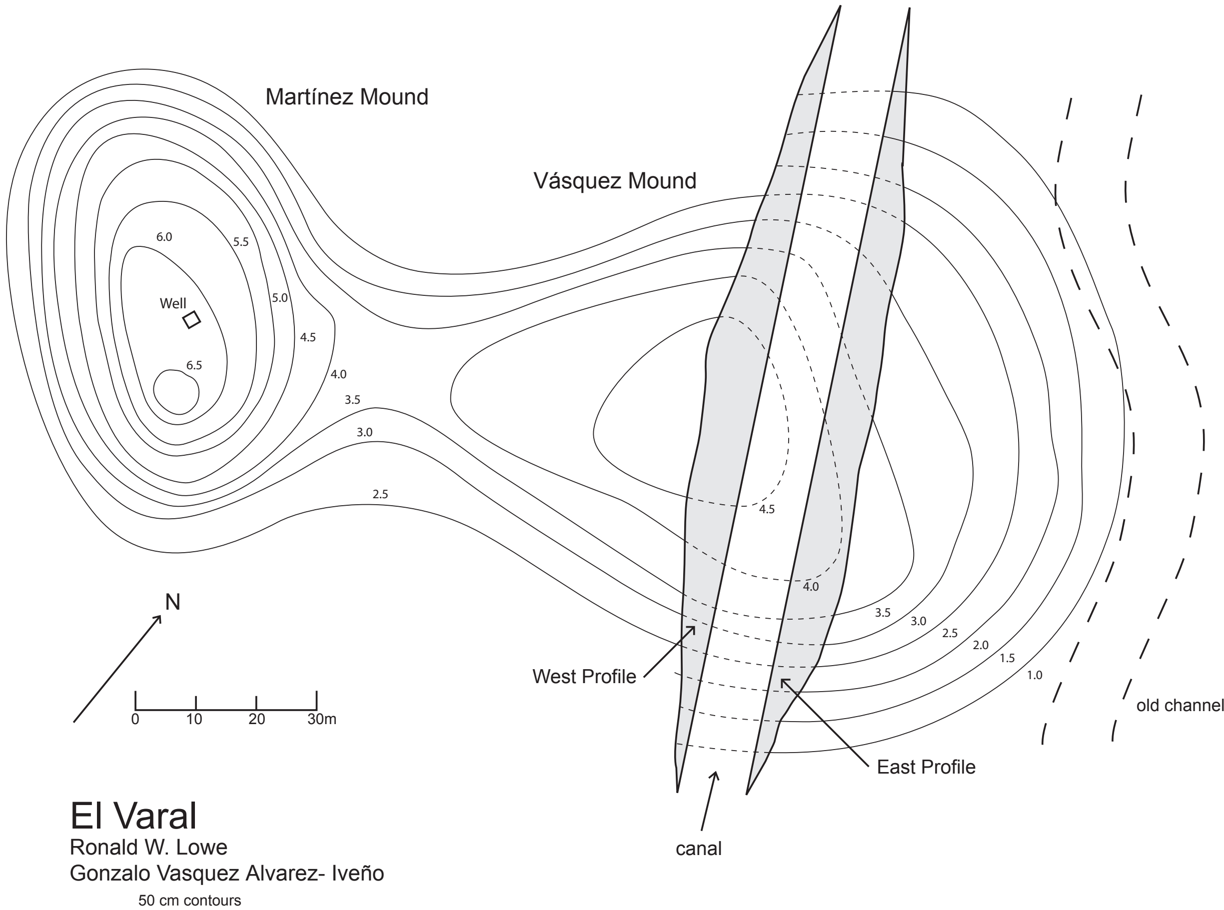


Figure 2.1. Map of El Varal. Contours are extrapolated to reconstruct the form of the mound prior to excavation of the canal.

Jocotal phases. The surface collection of the Martínez Mound indicates that it is more ancient, extending back to the Locona phase. John Clark (personal communication, 1992) points out that the Sandoval site (located just 1.5 km from El Varal) exhibits a strikingly similar pattern, with two large adjacent mounds—the smaller but taller one dating to the initial Early Formative and the larger but lower one restricted to the later Early Formative.

The drainage canal that partially destroyed the Vásquez Mound was apparently dug in the fall of 1991. The bulldozer operators seem to have been curious about the content of the mound because as the canal approaches the site it deviates from a straight path toward the ocean to penetrate the mound. The considerable amount of dirt removed was piled up on either side of the cut along the length of the mound. Those piles, which have the effect of increasing the mound's apparent height, are visible in Figures 2.2 through 2.4. To the north and east of the mound is a linear depression, now silted in and overgrown, that seems to mark an earlier drainage canal. The recent canal may thus have followed an earlier drainage trench.

Field Investigations

In all, we spent about seven weeks working at the site—from February 13 to March 21 and from April 7 to April 18. During most of that time we employed six local workmen from the nearby community of Efraín Gutiérrez to conduct the profile cleaning and excavations.

Our strategy of investigation evolved gradually as our stay lengthened. It is helpful in retrospect to divide our work into five phases. The first (Phase 1) involved collection of materials from the loose dirt removed by the bulldozer and heaped up on either side of the canal cut. This work lasted from our arrival to about February 20. Phase 2 was the cleaning and recording of the profile on the west side of the bulldozer cut (at that point, we had decided to ignore the east side and

Figure 2.2. View looking north from the west profile of the Vásquez Mound, in February, just as the profile cleaning was beginning. Note the original condition of the profile.

Figure 2.3. View of the west profile of the Vásquez Mound, looking south, with the clearing of the profile just beginning. Heaps of dirt removed by the bulldozer are visible atop the mound.

focus only on the west). Profile cleaning and recording was quite time consuming, lasting from February 15 to March 7. Phase 3, targeted excavations in different parts of the west profile, lasted from March 3 to March 21. When we returned to the site in April, we initiated a fourth phase (Phase 4, the Step Excavation) with the goal of obtaining a complete stratigraphic sequence of the mound. This work was conducted from April 7 to April 17. The final phase was a rapid assessment of the east-side profile, conducted from April 11 to April 18.

Phase 1: Collections from the Canal Cut

Only selected diagnostic materials were collected from the dirt removed by the bulldozer. These were treated as surface finds, and not further controlled as to location. Over the past 15 years, this "surface" material from El Varal has been incorporated into the Early Formative types of collections at the New World Archaeological Foundation laboratory in San Cristóbal de Las Casas. We have not made much use of it in the present study, except in illustrations of pottery forms and types. Our

Figure 2.4. View from the canal toward the west profile of the Vásquez Mound, late March, with excavations in N45W0 in progress. Note again the huge heap of dirt removed by the bulldozer. By this time the water in the canal had dried up.

social and economic analyses have focused instead on the abundant material from controlled excavations.

Phase 2: Cleaning and Recording of the West Profile

The two profiles were approximately 100 m long and, in the center, about 5 m high. We selected the west side of the canal as the focus of our activity because this section passed approximately through the center of the mound (Figure 2.1). The canal cut was wedge-shaped in cross section, with sides sloping up from the water to the intact surface of the mound. Just beneath the first few centimeters all along the slope were intact archaeological deposits.

The profile of the cut thus had horizontal as well as vertical dimensions, prompting us to establish a horizontal grid. Each side of the profile was given its own baseline, running along the waterline. These baselines were labeled W0 and E0 on the west and east sides, respectively. These lines established "grid north" (their actual orientation was 30 degrees west of magnetic north). On each side, we set up stakes every 5 m along this line—originating just off the southern edge of the mound at N0W0 (west side) and N0E0 (east side) and terminating just off the northern edge at N110W0 and N110E0. On the west side, 4 m horizontally west of the baseline, we set up a second row of stakes (W4)—establishing grid units of 5 by 4 m. In the central part of the mound, we set up a third row of stakes (W8) to completely encompass the sloping canal cut in grid units.

To clean the sloping profile in a way that would maximize our ability to recover useful information while minimizing further damage to intact archaeological deposits, we cut a series of artificial steps into the western bank of the canal cut (Figures 2.3 through 2.5). The steps, 60 to 100 cm wide, yielded a series of vertical faces that were progressively farther from the water as one moved up the profile. The central part of the west profile required a total of eight steps between the water and the mound surface, yielding nine vertical profiles (Figure 2.6). Steps were numbered 1 through 8, starting at the water.

Lesure drew all vertical faces at a scale of 1:20, noting when possible the manner in which the deposits of one vertical face related to those of nearby faces (see Figure 2.7 for conventions used in these diagrams).

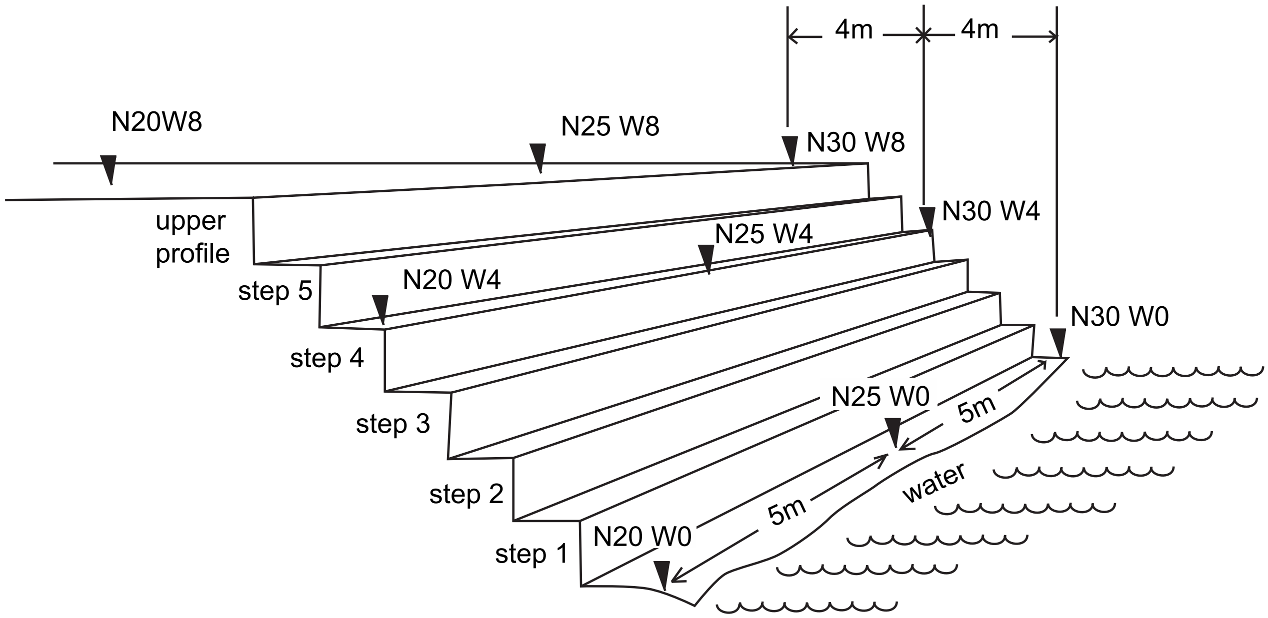


Figure 2.5. Schematic diagram of the stepped profile and grid system of 5- by 4-m units on the west side of the canal cut (illustrative only; does not match actual number of steps in the units indicated).

Numerous selections are illustrated in Chapter 3, but the full profile record (more than 5 m in length) is not reproduced here. Instead, a synthesis of the information recorded from the various step faces is presented as a foldout at the back of the book. When using that figure, it is important to remember that it is a schematic profile that summarizes information from short vertical sections separated horizontally by as much as 8 m. Despite these limitations, the foldouts for the west and east profiles together provide an unparalleled glimpse of the structure of an Early Formative estuary site. The profile and its components are reviewed in detail in Chapter 3.

Phase 3: Targeted Excavations in the West Profile

The profile-cleaning work in Phase 2 revealed that much of the mound was composed of large deposits of secondary refuse full of broken pottery, animal remains, burned earth, and other artifacts. As will be seen in Chapter 3, these were not the only features revealed in the massive profile but were the most obvious and extensive. We decided to target them in small excavations into selected steps of the profile. The idea was to make use of the exposed profiles to select a few dense midden deposits from throughout the mound's history and excavate them very precisely following natural stratigraphy. We also conducted two larger excavations: one to explore a series of possible structure floors (unit N35W0) and the other to sample deposits associated with the final occupation of the mound, in which the character of the assemblage appeared to change significantly (unit N95W0). Deposits were screened through a 5-mm wire mesh.

Control over the excavations was provided by our 4- by 5-m grid units, which were labeled according to the stake in the southeast corner. Within a given grid unit, a particular step (or set of steps) was chosen for investigation. Except for the arbitrary boundaries provided by the bulldozer cut and the steps of our profile cleaning, we followed natural stratigraphy when possible. Each stratum removed was given a *lot* number. The enumeration began with 1 within each grid unit. Thus, to uniquely designate a lot, the full grid designation is required (e.g., N35W4/2 is lot 2 in unit N35W4). Locations of the excavations are shown schematically in Figure 2.6, and more precisely in the foldout profile at the back of the book. Excavations are also described in Chapter 4, along with an alternative nomenclature that facilitates chronological comparisons between Phase 3 and Phase 4 samples.

Phase 4: The Step Excavation in the West Profile

If we had it all to do again, we would make different choices concerning our excavations in Phase 3—taking a less scattered approach and focusing on features other than middens. We actually did, however, have a brief opportunity to "do it again" during our final two weeks of work at the site. At John Clark's sagacious

	W0-4					W4-8				
N0-5	water	1	upper							
N5-10	water	1	upper							
N10-15	water	1	2	upper						
N15-20	water	1	2	3	upper					
N20-25	water	1	2	3	4	5	upper			
N25-30	water	1	2	3	4	5	6	upper		
N30-35	water	1	2	3	4	5	6	7	upper	
N35-40	water	1	2	3	4	5	6	7	upper	
N40-45	water	1	2	3	4	5	6	7	8	upper
N45-50	water	1	2	3	4	5	6	7	8	upper
N50-55	water	1	2	3	4	5	6	7	8	upper
N55-60	water	1	2	3	4	5	6	7	8	upper
N60-65	water	1	2	3	4	5	6	7	upper	
N65-70	water	1	2	3	4	5	6	n. c.		
N70-75	water	1	2	3	4	5	6	n. c.		
N75-80	water	1	2	3	4	5	6	n. c.		
N80-85	water	1	2	3	4	5	6	upper		
N85-90	water	1	2	3	4	n. c.				
N90-95	water	1	2	3	n. c.					
N95-100	water	1	2	upper						
N100-105	water	1	upper							

Figure 2.6. Schematic diagram of west profile of Vásquez mound enumerating steps created in each 5-m unit during Phase 2 investigations. Steps were numbered consecutively, beginning closest to the water and proceeding up the profile. The uppermost phase immediately below ground surface in each unit is labeled "upper" if it was cleaned and "n.c." if it was not cleaned. Boxes in bold indicate locations of formal excavations.

urging, we decided during that time to excavate a continuous sequence of strata spanning the full occupation of the mound. However, because of the sharply sloping strata of which much of the mound was composed no traditional vertical excavation from the mound surface would have achieved such results. Instead, we removed a single step from our profile clearing (the third up from the water)—starting on the northern slope of the mound in N85W0 and penetrating into the center in N55W0. In the final unit, the stratigraphy flattened out and we descended from there toward the level of the water.

In the field, we followed the system initiated in Phase 3 for designating lots sequentially within each grid unit. However, this proved cumbersome and indeed rather illogical for an excavation that crossed between grid units. Subsequent to the fieldwork, we have renumbered these lots. They are here designated by ST, followed by a number from 1 through 47. A concordance with the original lot designations is provided in Chapter 4.

Phase 5: Partial Cleaning and Recording of the East Profile

We recorded the east profile very rapidly at the end of the field season and found that it was structured rather differently from the west side, on which we had focused such effort. There was no time to scrape down the east side in the ambitious manner we had used on the west, and we thus settled for cleaning units of 2 m about every 10 m—although we shifted the placement of some of these to capture interesting-looking features. Each of the 2-m units was drawn by Pérez Suárez or Lesure at 1:20 scale using the system Lesure had worked out for the west side.

These detailed drawings were then transferred directly to a schematic version (see foldout at the back of the book), which was filled out and checked for accuracy in the field on the last two days of work. For reasons we can no longer recall, parts of the east-side profile were not completed and are therefore blank in the foldout. In the last few days of the season, we also

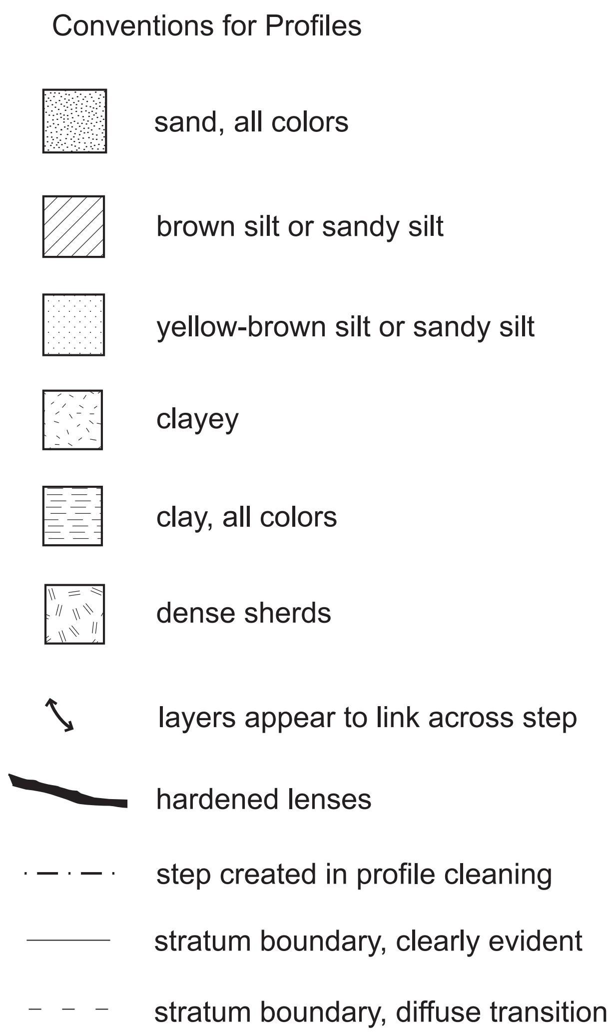


Figure 2.7. Conventions used in the profile drawings of Chapter 3.

recorded in detail a few features on the east side. A short description of our work at El Varal was included in our official report on the 1992 field season (Clark, Lesure, and Pérez Suárez 1993).

Materials Recovered

It seems useful to provide a brief overview of the materials and information recovered from the field investigations, along with notes on where the associated analyses can be found in the chapters that follow. For details, including methods of analysis, see the chapters indicated. Information recovered falls into four basic categories.

- *Stratigraphic data from the profiles*. Information on the stratigraphy of the mound is introduced in this chapter (Phase 2 investigations), illustrated in the foldout profiles, and synthesized in Chapter 3.
- *Materials collected from profile cleaning and bulldozer backdirt*. The main items collected in Phases 1 and 2 were potsherds, grinding stones, and ceramic artifacts. The last two of these classes are considered in Chapters 10 and 11, respectively. The sherds collected in Phases 1 and 2 have not been systematically studied for this volume. They were incorporated into type collections at the New World Archaeological Foundation soon after the El Varal fieldwork and form part of the body of materials analyzed by Clark and Cheetham (2005) to describe the Early Formative sequence for Mazatán. Some representative pieces of that material are used for the illustrations, but actual ceramic analyses throughout the volume refer to excavated materials described in Chapter 9.
- *Excavation records*. Original excavation records (including drawings, lot forms, and field notebooks of Lesure and Pérez Suárez) are located at UCLA, with copies at the New World Archaeological Foundation laboratory in San Cristóbal de las Casas, Chiapas. They are synthesized in Chapter 4.
- *Excavated materials*. Much of the interior of the Vásquez Mound consisted of layers of secondary refuse, and our excavations were designed particularly to recover items from these dumps. This final category is thus particularly important. Items recovered can be differentiated by material and by chronology.

■ *Materials*

➢ *Pottery*. The most abundant find by volume and weight, pottery, is primarily considered in Chapter 9—although see also Chapter 16 and Appendix A. (For synthetic discussion referencing this and all other material, see also Chapters 14 and 18.)

➢ *Stone artifacts*. Stone artifacts (including grinding stones, obsidian flakes, and miscellaneous) are considered in Chapter 10.

➢ *Ceramic artifacts*. Ceramic artifacts (including figurines, masks, worked sherds, and miscellaneous) are described in Chapter 11.

➢ *Shells*. Second to pottery in total volume and weight recovered were mollusk shells. Species identifications are provided in Chapter 5, with some further discussion in Chapters 14 and 15. Chapter 13 is a seasonality study based on shells of one species of marsh clam.

➢ *Other faunal remains*. Other faunal remains included animal bones (Chapter 7) and crab claw or shell

fragments (Chapter 6). In Chapter 15, the Varal assemblage is compared to remains from other sites.

- *Human bone*. Several very fragmentary human burials were recovered. No associated offerings were identified, but because all burials were seriously disturbed in either ancient or modern times it is not known whether anything was originally present. The burials are described in Chapter 3, along with assessments of sex and age by John Clark and Lesure. Unfortunately, no specialized analysis of the bones has been undertaken. They are located in the New World Archaeological Foundation laboratory in San Cristóbal.
- *Macrobotanical remains*. A large number of sediment samples were collected for flotation, but due to budget and time constraints only a few were ever processed (see Chapter 8). The remaining sediment samples are stored at the New World Archaeological Foundation laboratory in San Cristóbal.
- *Charcoal samples*. Michael Blake submitted several charcoal samples from El Varal for radiocarbon dating (see Chapter 12)
- *Miscellaneous materials*. Miscellaneous materials include samples of hardened lenses encountered during profile cleaning or excavations, samples of burned earth, and examples of heavily burned and disintegrating sherds. These materials inform the discussion in particular of Chapter 3.

■ *Chronology*

The second obvious approach to differentiation of the finds is to group the collection chronologically. Three schemes are drawn upon as appropriate in the chapters that follow.

- *Stratigraphic sequences*. Most of the excavated lots can be assigned to one of two stratigraphic sequences: one to the south and one to the north of the mound core. These two sequences provide the finest grain of chronological control and are described in Chapter 4. We have used them for the most part in the early stages of analysis, but they do appear here (particularly in the analysis of shells in Chapter 5).
- *Stratigraphic periods*. Based on the analysis of the canal profiles, the occupation of the Vásquez Mound can be divided into four periods: Early, Middle, Late, and Terminal. This periodization is presented in Chapter 3 and is used throughout the volume.
- *Shell phases*. Based on changes in the frequencies of mollusk shells, an alternative division of deposits is proposed in Chapter 5—and subsequently used throughout the volume. The idea is that this division might get at certain behavioral changes with greater precision than stratigraphic periods. These shell phases are also labeled Early, Middle, Late, and Terminal. The first three divide the sequence somewhat differently than is done in the stratigraphic periods approach, but the Terminal shell phase is equivalent to the Terminal stratigraphic period. Tables in Chapter 4 classify each excavated lot by shell phase and stratigraphic period.

In every chronological analysis, we have experimented with stratigraphic periods and shell phases—although space constraints prevent us from presenting the results in each case. See Chapter 14 for more comments on the joint use of these two schemes.

CHAPTER 3

The Structure and Formation of the Vásquez Mound

RICHARD G. LESURE

This chapter synthesizes information collected during the clearing of the west and east profiles of the canal through the Vásquez Mound (during Phases 2 and 5, respectively, of the field investigations). Given the extent of the exposed archaeological deposits (each profile was about 100 m long and, in the middle, 5 m high), the most notable observation is the paucity of features related to habitation. Other topics considered here are the general internal structure of the mound, stratigraphic evidence for the nature of activities conducted at the site, and the history of mound formation. One of the two chronological schemes (stratigraphic periods) used throughout the volume is described, and the issue of salt production is introduced.

Internal Structure of the Mound

The deposits exposed in the canal cut at El Varal can be thought of as falling into four general categories. The uppermost 60 to 80 cm were basically homogeneous in color and texture, although generally divided into a gray uppermost layer underlain by brown sandy silt. The distinction between gray and brown and the overall homogeneity of these layers were probably the result of soil formation and other disturbances during the last 2,800 years. The stratigraphy of this upper zone is therefore resistant to straightforward interpretation in terms of Early Formative activities at the site.

Having so much else to consider, we ended up giving it little attention—even leaving a strip of this upper layer uncleared between N65 and N90 on the west side. This is the *surface zone* (Figure 3.1). Voorhies (2004:61, 97) noted atop Archaic shell mounds layers of similar or greater thickness that were basically homogeneous in color and texture but contained mixtures of pottery from different epochs. She suggested that cultivation of crops atop the mounds might have produced deposits with those characteristics. A similar interpretation seems reasonable for the surface zone at El Varal. The relatively salt-free soils atop the mound have probably been attractive for planting for centuries. Indeed, while we were working at the site the Martínez Mound was cleared by its owner and the brush burned in preparation for the planting of a rainy-season *milpa*.

Directly beneath the surface zone, in the central part of the mound, were deposits approximating the type we had expected to find quite commonly in the profile: a complex stratigraphy of short horizontal lenses and small features apparently resulting from the gradual accumulation of sediments during a lengthy human occupation. (See Figure 3.1 and the foldout at the back of the book. Throughout this chapter, readers will find

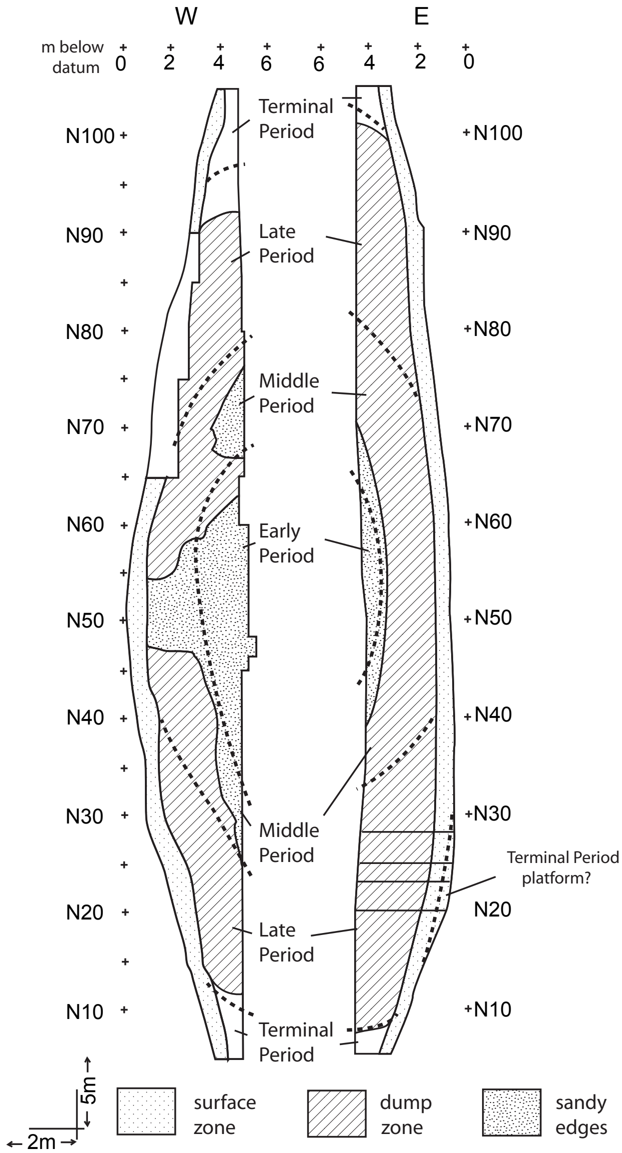


Figure 3.1. Overview of the internal structure of the Vásquez Mound, El Varal. Locations of the four basic categories of deposit in the canal profiles are indicated. (The mound core and sandy edges interdigitate and are therefore combined.) Boundaries between stratigraphic periods are superimposed as dashed lines, although those are little more than guesses in the case of the east profile. Note the vertical exaggeration of profiles.

it useful to refer often to the full foldout profiles.) The surprising thing about this second category of deposit was how little of it we had. It was entirely absent in the east profile, and appeared across no more than 15 m of the west profile from N45 through N60. Nevertheless, in that location it was more than 4 m thick. This area appears to be the central and most ancient part of the mound, the *mound core*.

Instead of gradual occupational accumulation, a *dump zone* dominated both profiles—from N10 through N47 and N58 through N95 on the west side and across the entire east side directly below the surface zone (Figures 3.1 through 3.3). Particularly striking are dense midden layers full of broken pottery, animal bone, shell, and chunks of burned earth. Although the stratigraphy was complex in its details, there was a tendency toward alternation between middens of that type and layers of homogeneous silt with fewer artifacts. During the excavations, I considered these silt layers to be the result of purposeful filling episodes intended to increase the size of the mound and/or stabilize its sides. I now consider them to derive from the dumping of debris generated in salt production. Thus, strictly speaking these are middens just like the layers of dense cultural materials. It is, however, useful to have some simple way of referring to these different types of deposit. We use *midden* for the layers packed with cultural material and *sediment layer*, *salt tailings*, or similar terms for the other deposits.

Overall, the most striking thing about the dump zone was the sharp inclination of the deposits toward the edges of the mound. This was especially evident in the west profile, which passed close to the mound center. In the east profile, which cut far enough toward the edges of the mound to miss the mound core altogether, the situation was more complex. However, in several places the most significant aspect of slope appeared to descend directly into the profile itself. Typical inclinations for dump deposits were 10 to 20 degrees, with exceptional cases ranging from 22 to a high of 30 degrees.

The most plausible way to account for the second and third categories of deposit (the mound core and the dump zone) is to envision a small original mound that rose rapidly in height without expanding significantly in area. Thereafter, lateral expansion proceeded as debris dumped off the summit accumulated at the sides of the mound. It is also possible that there were periods of slowed refuse accumulation or even abandonment, when erosion reworked the mound slopes.

It is perhaps useful to mention and dismiss a scenario that would envision "dumps" having been deposited simultaneously in one (or even a few) massive construction events. The evidence against this idea includes the sloping internal structure of midden deposits (pointing to incremental rather than rapid accumulation), the abundance in the same middens of unusually large sherds (not an expected characteristic of tertiary deposits quarried and transported for use as fill), and the trailing out of midden deposits at their lower edges

Figure 3.2. Step Excavation profile (N78-80) showing orientation of layers and alternation between layers of sediment and layers packed with potsherds and other cultural materials ("middens").

Figure 3.3. Step Excavation profile (N68-71) showing orientation of deposits and alternation between sediment and midden layers. Note the continuation of the sediment layer on the profile of the first step up from the water.

(consistent with periods of exposure and erosion). In sum, the stratigraphy points strongly to an incremental lateral expansion of the mound through the dumping of refuse at the top of the mound.

A fourth category of deposit, the *sandy edges*, appears beneath the dump zone in the central part of the mound—apparently in a ring around the mound core. On the east side, it constitutes the lowest deposits between N40 and N75. On the west side, it appears between N30 and N48 and again between the N68 and N82. These deposits are dominated by lenses of sand of varying degrees of coarseness. Inclining toward the edges of the mound at a more gentle slope than the dump layers (typically less than 10 degrees), these deposits appear to constitute the immediate surroundings of the mound in its more ancient stages.

In the west profile, between N45 and N50 they merge gradually with the deposits of the mound core—suggesting that the mound of this era was no more than an informal bump on the landscape. Toward the modern mound edges in the west profile, between N30 and N45 and N68 and N82, there is a clearer demarcation between the dump layers that constituted the sides of the mound and the more gently sloping sandy deposits that surrounded them.

In the sandy edges, there is clear evidence of water action in the form of finely laminated deposits of sands and silts. Layers of pure sand are also probably water

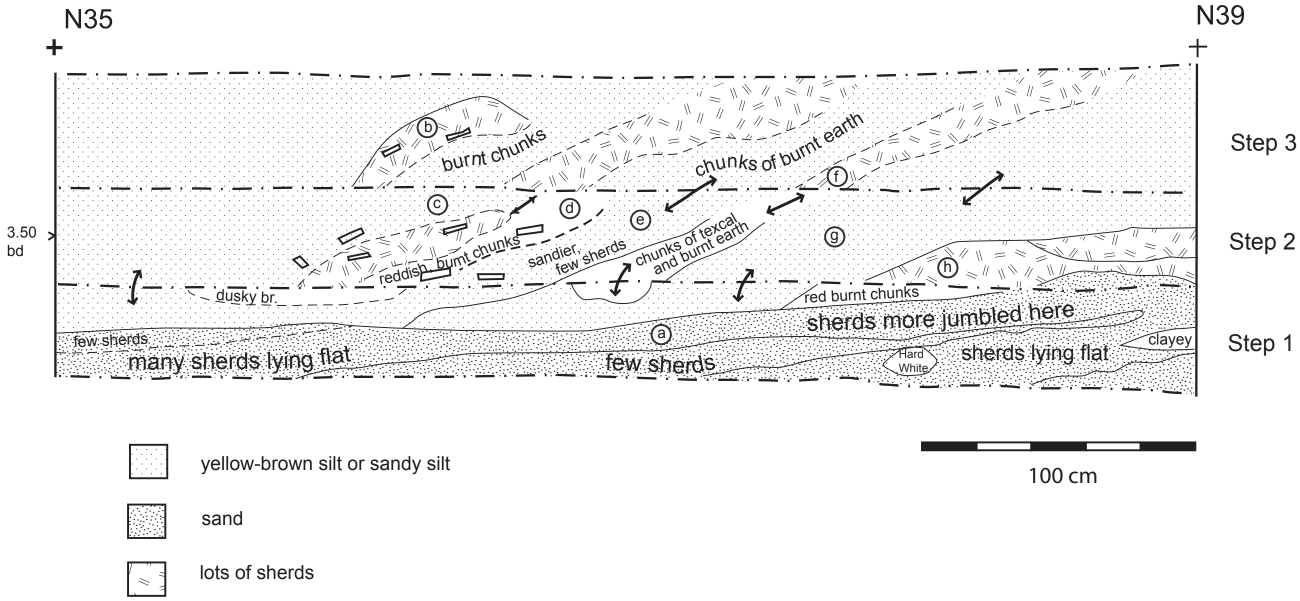


Figure 3.4. Interface between the dump zone (layers b through g) and the sandy edges (layer a and below). In layer a, sherds appear jumbled on the right (immediately beside the mound). Away from the mound, to the left, they lie very flat. Vásquez Mound, west profile, N35-39, steps 2 through 4.

lain. In some cases, they contain layers of sherds lying very flat. One possible source for water-lain deposition in this location is outwash from the mound. The alternation of middens (layers *b*, *d*, *f*, and *h*) and sediment layers (*c*, *e*, and *g*) is evident in Figure 3.4 (a section of the west profile between N35 and N39). The termination of the lower edge of the mound on layers of more ancient sandy outwash is also apparent in the case of layers *g* and *h*. The sand in layer *a* represents outwash from mound deposits ending just out of the diagram to the right. The jumbled appearance of the sherds to the right in this layer, at the base of the mound (potentially still a dump area), and their more flattened appearance to the left (farther from the mound) would seem to support an outwash interpretation.

A second possibility, especially given the estuary context of the site, is that the water might have lapped up from below (i.e., the mound might have been an island during parts of the year). Frequent flooding could explain the concentration of activity that led to a rapid rise of the mound to more than 3 m in height. It was very easy to envision the layers of sherds lying flat in sand (excavated by Pérez Suárez in N35W0) as having formed under shallow water (see Chapter 4). Some of the lenses in this zone grade from sand upslope (closest to the mound) toward clay downslope, away from the mound (Figure 3.5). It seems likely that wave action washed finer particles from the sandy edge deposits immediately surrounding the mound.

A final issue concerning the sandy edges is the extent to which they were areas of activity or even habitation. Some use of these areas when they were free of water seems possible in areas where their slope is gentle, such as between N33 and N41 in the west profile and probably across much of the sandy edges of the east profile. Thin hardened lenses were noted in this zone between N47 and N49E and N37 and N39W. The latter area became the focus of one of our larger excavations (unit N35W0), without yielding much in the way of clear evidence of use. Based on the profiles and that excavation, it seems unlikely that the immediate off-mound areas were habitation zones. However, use for a variety of activities remains possible. The most productive evidence concerning human activities and El Varal is contained in the mound core and dump zone, and the rest of this chapter is primarily devoted to those.

Stratigraphic Periods in the Vásquez Mound

Based primarily on an assessment of the onion-like stratigraphy revealed in the profiles, the occupation of the Vásquez Mound can be divided into four periods: Early, Middle, Late, and Terminal (Figure 3.1). The Early period dates to the end of the Cuadros phase and/or early Jocotal (Chapter 9). Stratigraphically, it corresponds with much of the mound core up through step 5 in units N50W4 and N55W4—and includes much of

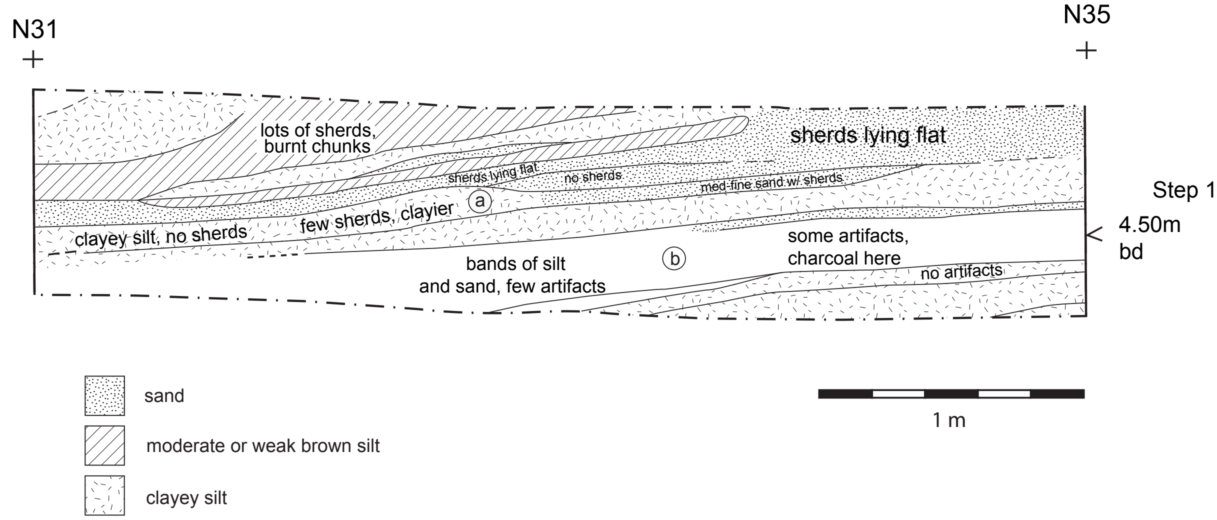


Figure 3.5. Stratigraphy of the sandy edges. Close to the mound (to the right), layer a is sandier and contains more artifacts. To the left, it becomes more clayey—with fewer artifacts. Greater artifact concentrations are also noted to the right, in layer b. Vásquez Mound, west profile, N31-35, step 1.

the southern sandy edges in the west profile (much of step 3 and below in N45W0, much of step 2 and below in N40W0, and much of step 1 in N35W0).

My reasoning here combines arguments from stratigraphy, symmetry, and ceramic analyses. By designating as the northern edge of Early deposits a large Cuadros midden that ascends from step 1 in N65-67 to step 4 in N59 and tracing strata across the mound core to the south, deposits with no thick layers of salt tailings and the highest observed concentration of cemented surfaces are grouped as a set. On the east profile, at least the lower part of the sandy edges should probably also be assigned to this period—but we have no way of linking the strata and no sherd samples from this zone.

The Middle period is still "early" Jocotal. Stratigraphically, it corresponds to the upper part of the mound core (steps 6 through 8 in N50W4 and N55W4), to all remaining portions of the sandy edges not ascribed to the Early period, and to the inner layers of the dump zones up to (in the west profile) the large dumps of salt-making debris that mark both the north and south parts of the profile (centered on N28 to the south and N75 to the north). The inner boundaries in this case follow from the reasoning used to designate outer boundaries of the Early period. The proposed linking of the sediment layers on the north and south sides to mark the end of the Middle period is tentative (i.e., they cannot be definitively connected stratigraphically). The decision is supported largely by arguments of symmetry, considering the lower termination of the sandy edges and the overall extent of the dump zones. It also has the practical result of allowing easy separation of middens corresponding to the Middle and Late periods.

The Late period ["late" Jocotal in date (see Chapter 9)] commences stratigraphically with the thick dumps of sediment on the north and south sides of the west profile. On the west side, middens between N10 and N27 and N76 and N95 are Late. The east profile is again a problem, but based on comparisons between the locations of sandy edges and dump zones in the two profiles we assign virtually all deposits south of N35 to the Late period. On the north side, the large midden centered at N75 initiates the Late period—and Late deposits extend probably to N96.

The Terminal period is identified based on startling changes in the artifact assemblages from the north and south extremities of the west profile rather than on any stratigraphic distinction. The abundance of figurines discovered during profile scraping in N8-N10W0 and N96-N98W0—including in the latter case about a third of a ceramic mask—was the first clue to what turned out to be a transformation from tecomate-dominant to dish-dominant assemblage during the final stage of occupation. The extent of this transformation became apparent during excavation in unit N95W0. In addition to the increase in figurines, it includes a sharply increased frequency of obsidian chips and a complete reorientation of the vessel-form assemblage. Because the deposits corresponding to this period are so limited, it probably represents a brief time just before the abandonment of the site. The designation "Terminal period" is meant to convey that sense.

Habitation Features

As noted, habitation features were rare given the extensive exposure of archaeological deposits. They were not, however, absent. There were post molds of a possible structure, human burials, and intrusive pits. The mound core in its entirety appears to derive from a gradual accretion of occupation surfaces.

Architecture

The nature and number of habitation structures are important issues for the larger question of occupation permanence. The large amount of ceramic material recovered and the presence of mortars and *metates* would seem to indicate a level of labor investment consistent with the construction of substantial permanent habitation structures. Nevertheless, little evidence of such structures was identified in the profiles or during excavation.

The most likely structural evidence was two stains (which may have been post molds) in unit N50W4—on the face and horizontal surface of the eighth step up from the water in deposits of the Middle period (Figure 3.6). One of the possible post molds was cross-sectioned in profile. The other appeared as a round stain in the horizontal surface of that same step, some 80 cm away from the first (not further explored). To the right of these in profile was an intact hearth feature (Burnt Feature 4). Not following these features into the profile by opening an excavation in this area is my biggest regret about the field season. Nevertheless, it seems quite possible that a Jocotal-phase structure stood in this location.

During the profile cleaning, we were drawn much more strongly to the lowermost step of unit N35W0—where a series of thin layers (5 to 10 cm thick and including a thin cemented lens) appeared in profile. Notwithstanding the gentle slope of these deposits to the south (I now understand them to be part of the sandy edges), we thought they might be a series of structure floors and therefore chose that location for excavation. (The results are reported in Chapter 4.) I no longer regard any of those layers as floors.

A third possible post mold appeared at N24 on step 8 in the east profile, approximately 40 cm below ground surface. The black fill had a more recent appearance than that of the two post molds in N50W4 and could have been created by a root.

Subsequent sections describe the cemented lenses that appeared in various parts of the profile. The most extensive cemented surface identified was on the sixth and seventh steps up from the water in unit N55W4. Another extensive cemented surface appeared between N67 and N70 on the east side. Although these might arguably be interpreted as floors of structures, our investigations in those areas did not reveal any post molds or other features that would allow us to identify them as such with any confidence.

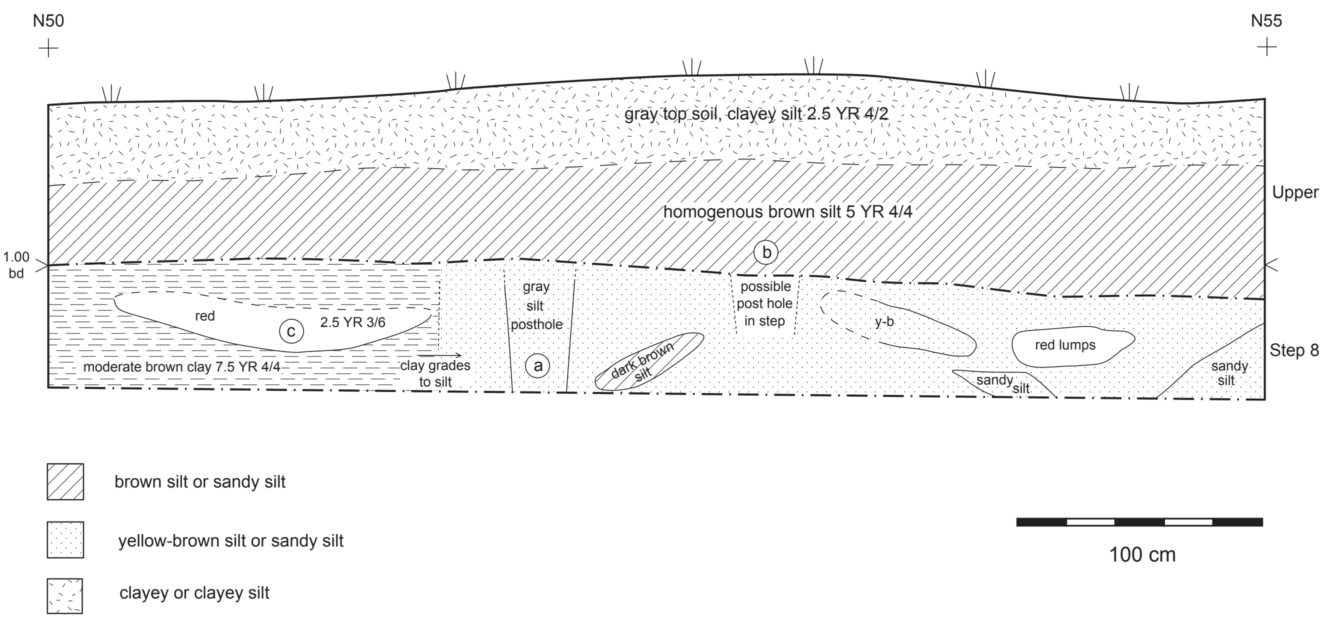


Figure 3.6. Possible evidence of a Jocotal structure: (a) possible post mold cross-sectioned in profile, (b) extrapolated location of round stain on the surface of step 8, and (c) hearth or other burned area. These features appeared at the top of the mound core, directly underlying the surface zone. Vásquez Mound, west profile, N50-55, step 8 and profile face below ground surface.

Human Burials

Parts of three human burials were discovered during the cleaning of the west and east profiles, and a fourth was revealed by excavation. Three points are worth making concerning the set as a whole. First, recovery of all of them was incomplete because of disturbance (Burials 1, 3, and 4) or because a decision was made not to excavate further (Burial 2). No burial offerings were identified, but in each case it is uncertain whether any might originally have been present. Second, the bone was quite hard and appears to have been mineralized—a point relevant to the issue of postdepositional processes at the site. Finally, all burials are from the upper part of the profile or the fringes of the mound and therefore date to the later part of the occupation (Figure 3.7). They are probably all Jocotal in date, from the Late or Terminal stratigraphic periods. It is even possible, but unlikely, that one or more might postdate the Early Formative occupation of the mound.

- *Burial 1.* Lower portion of articulated, extended adult, face up—disturbed first by the bulldozer and subsequently by looters (Figure 3.8). Oriented with the head to the northwest. Located in unit N45E4, approximately 110 cm below ground surface between N49E6 and N49E7. Skeleton intact only from the pelvis to the feet, but loose bone lying about suggested that it had originally been complete. Sex and age unidentified. Late or Terminal period.
- *Burial 2.* Bones of a human foot discovered during profile cleaning in N80W4, more precisely between N82W3 and N83W3. Approximately 90 cm below ground surface. Because it extended directly and deeply into the profile, we decided not to disturb it further. Sex and age unidentified. Late or Terminal period.
- *Burial 3.* Lower portion of articulated, extended, robust adult male, facedown—disturbed in antiquity. Located in unit N95W0. Discovered during excavation in lots 8 and 8A. Oriented with the head to the northeast. The intact left femur is 42 cm long. Loose bone discovered above the burial during excavations probably belongs to the same individual. For further description, see discussion of excavation in unit N95W0. Late or Terminal period. (Field designation: Burials 3, 3A, and 4.)
- *Burial 4.* Middle portion of articulated juvenile (sex unidentified) in an unusual position, probably on back with legs tightly flexed above torso (Figure 3.9). Much of the body was disturbed by the bulldozer, and the precise position and orientation are uncertain. Located in unit N15E4 close to N19E6, approximately 140 to 150 cm below ground surface. Lower vertebrae, pelvis, and proximal portions of both femurs (together with finger and toe bones) were recovered. Sex and age unidentified. Late or Terminal period. (Field designation: Burial 5.)

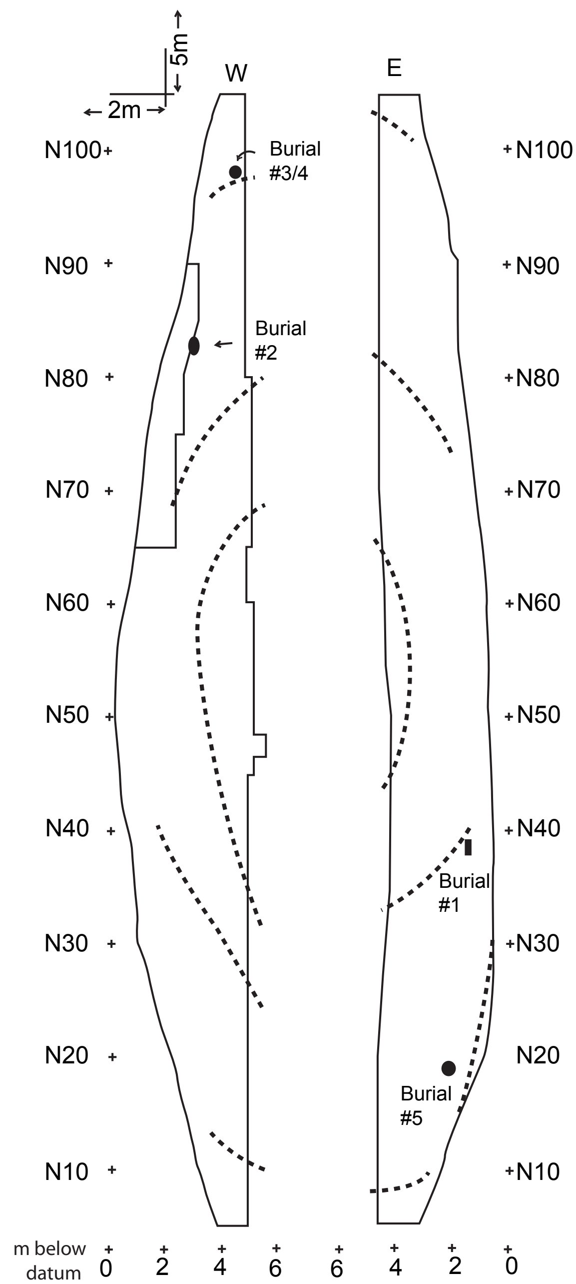


Figure 3.7. Overview of locations of burials in east and west profiles, Vásquez Mound.

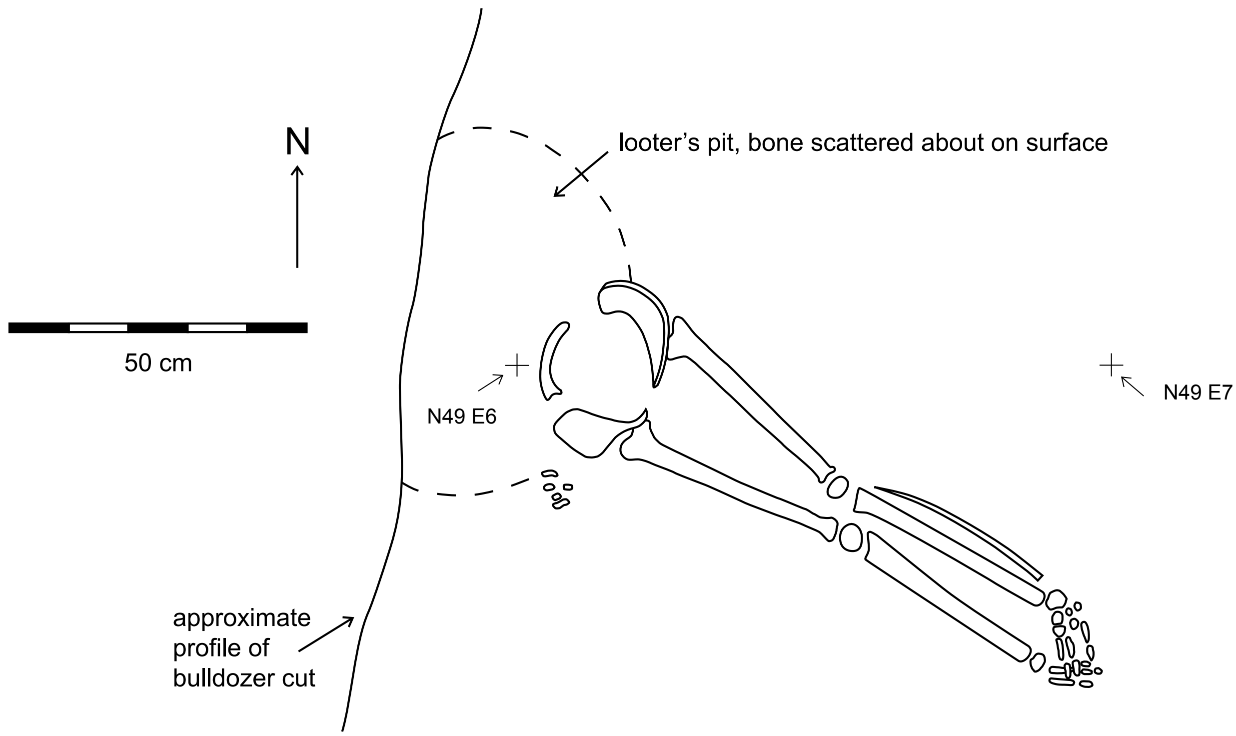


Figure 3.8. Burial 1, Vásquez Mound, east profile.

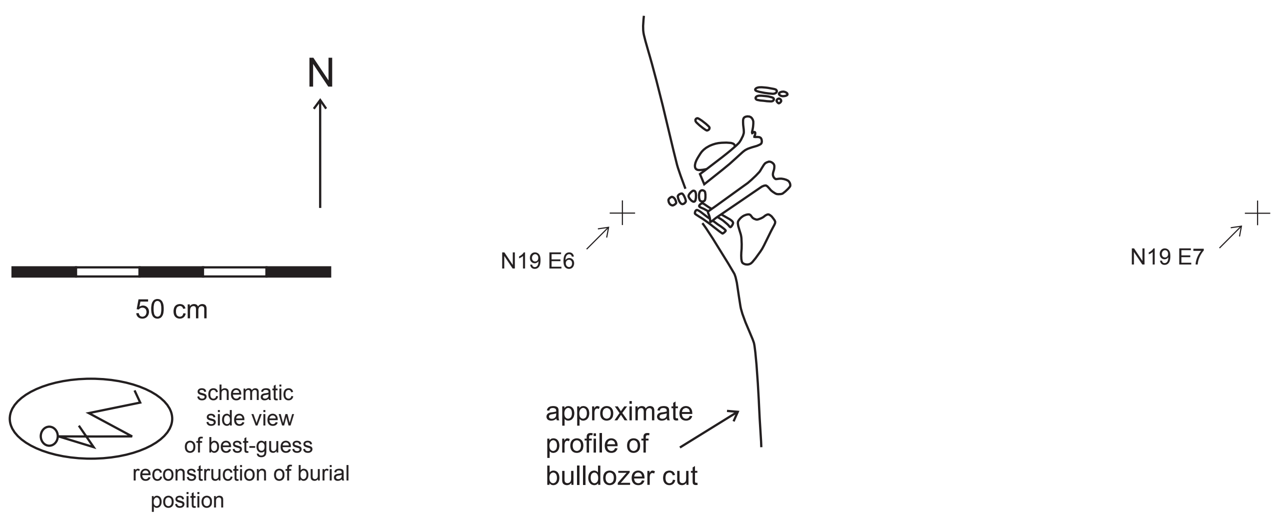


Figure 3.9. Burial 4, Vásquez Mound, east profile.

Intrusive Pits

Eleven small pits were identified in profile. Most were shallow (about 15 to 30 cm in observed depth), but given such shallowness were rather long in cross section (typically 80 to 100 cm). The artifact content of these pits varied greatly. Some, including three of the four observed in the mound core, contained dense deposits of sherds. Of the six intrusive pits noted in the dump zone, half were relatively free of artifacts—whereas the others contained higher frequencies of broken sherds and bits of burned earth. Pits from El Varal seem to be significantly shallower than those at inland sites such as Paso de la Amada, although my experience there is with Locona-Cherla features rather than anything precisely contemporary with Varal. If pits were made for storage, such functions would appear to have been less important at tecomate-dominant El Varal than at dish-dominant Early Formative sites. Pits at El Varal do not seem to have been an important location for the discard of refuse, which was preferentially tossed over the edges of the mound.

Mound Core

The homogeneous surface zone has been disturbed by cultivation and root action, and much of the rest of the profile is dominated by secondary refuse dumps. However, there remains the mound core—apparently formed by the gradual accumulation of occupation surfaces and thus the most likely location for primary deposits. What evidence of habitation is contained in the core? Interestingly, except for the possible structure and associated hearth already described there were few formal features in the mound core—illustrated schematically in its entirety in Figure 3.10 (simply a selection from the foldout profile).

The structure and a few small pits are indicated, but there seem to be no formally prepared floors. The most common features were thin sandy lenses hardened to an almost cement-like consistency. Sometimes such lenses were reasonably flat and extensive (the three largest examples exposed in profile range from 1.8 to 2.5 m in length), whereas in other cases they were small (20 to 30 cm across) or had a dipping or undulating appearance. A close-up of part of the mound core illustrates this variety quite well (Figure 3.11). These appear to be remnants of occupational or erosional surfaces.

The agent of cementation seems to be calcium carbonate or perhaps ash. A sample from the excavation in N35W0 left in vinegar for several days was reduced to loose sediment. A fragment of cemented sediment among sherds was subjected to neutron activation analysis at the Missouri University Research Reactor (MURR) (Chapter 16). The calcium value was extremely high. However, results include only trace elements and we do not know if the calcium was in carbonate form. The lenses seem to mark at most informal occupation surfaces rather than locations of habitation. There is a distinct possibility that they were created by the dumping of tecomate content. In that case, they would relate to productive activity at the site—and the mound core, like the dump zones, would be dominated stratigraphically by the detritus of whatever special task it was that brought people to the site rather than by domestic activities more generally. I thus turn my attention to the stratigraphic evidence of those activities.

Evidence of Productive Activities

Stratigraphic evidence records the pervasive use of fire and allows an estimate of the rate of growth of the

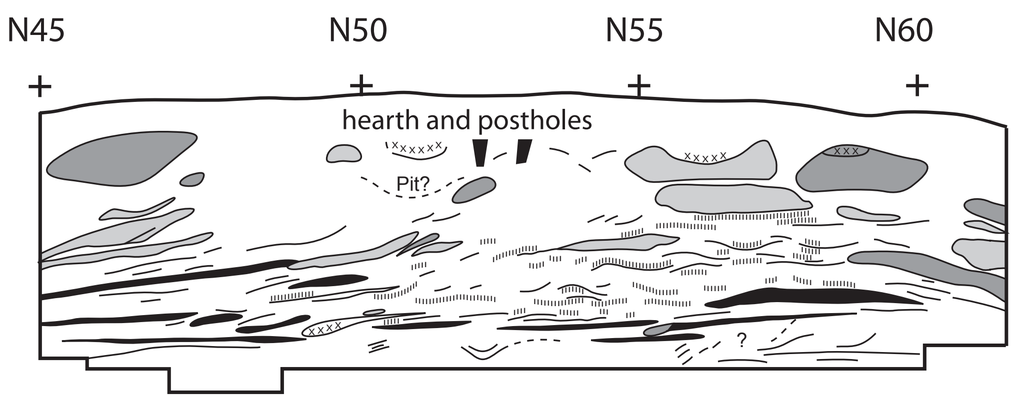


Figure 3.10. Vásquez Mound, overview of mound core. Note that cemented surfaces here are shown as vertical hatching, while loose sand is shown in black.

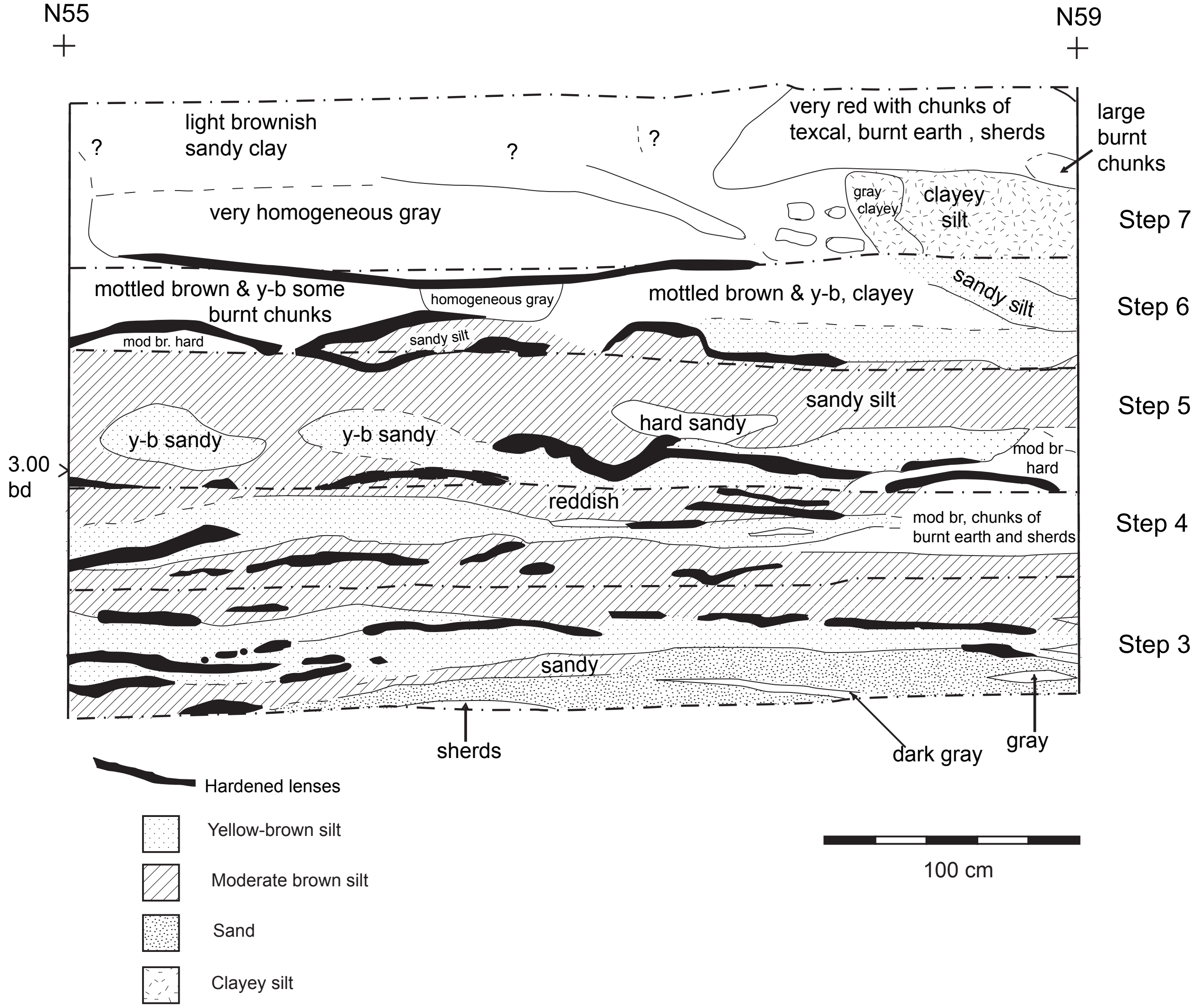


Figure 3.11. Cemented surfaces in the mound core. Vásquez Mound, west profile, N55-59, steps 3 through 7. Note that cemented surfaces here are shown in black.

mound (quite rapid). Although there are numerous classes of evidence to be examined in subsequent chapters, I introduce the issue of salt production here. Indeed, the case for salt as product rests largely on an overall assessment of the stratigraphy and content of the mound (although it is supported as well by the site location).

Pervasive Use of Fire

There is striking evidence for pervasive use of fire at El Varal, but most often this consists of material out of primary context: lenses of charcoal or charcoal-rich deposits, bits of earth burned red or purple (found along with sherds in the midden layers or mixed into the relatively artifact-free sediment layers), and sherds seemingly burned to a crisp (fired orange clear through, purple with their surfaces flaking off in plates, blackened, or occasionally with charcoal adhering to them). Many sherds appear to be burned as sherds rather than as part of their use-life as a vessel (Chapter 9).

Given the pervasiveness of the evidence of burning in secondary contexts, we were surprised to find relatively few obvious intact hearths or other burned features. A careful inspection of the profiles revealed 11 likely cases (Figure 3.12), although some of these could be secondary dumps—especially Burnt Features 8 and 10. There are a few other possibilities for intact burning areas in the profiles. Those are not described here because I believe they are secondary dumps rather than intact features. Seven of the 11 apparently intact features consist of patches or lenses of earth discolored by fire, with no evidence of a basin shape or other internal structure. Three are complex deposits that may or may

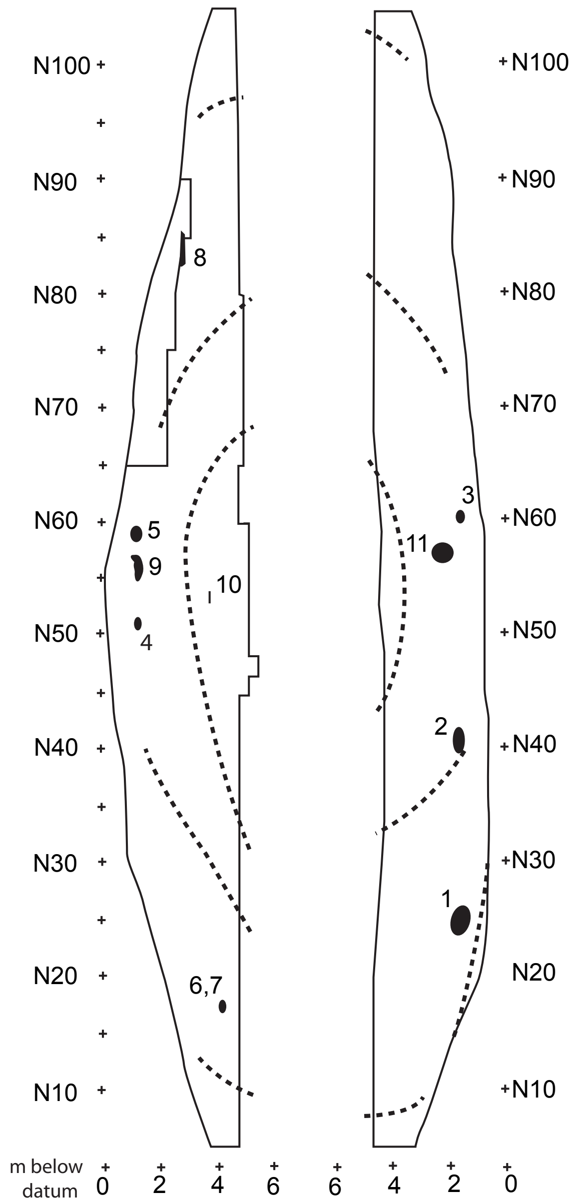


Figure 3.12. Overview of burned features in east and west profiles, Vásquez Mound.

not actually be primary locations of burning. The final feature has, in comparison to the other examples, a spectacular degree of internal structure.

Four summary points can be made concerning burning activity at the site. First, throughout the occupation it seems to have been a common activity that generated significant amounts of debris. Second, if the intact features we found are representative then fires were set in a variety of contexts—from the ground surface, to simple pits, to more elaborately constructed features. Third, there is suggestive evidence for the repeated use of individual features—suggesting that burning was a common activity. Finally, there was a great deal of cleaning and dumping associated with the burning. Burned features were constantly being cleaned out (or even dug up altogether), broken up, and discarded over the edges of the mound.

Burnt Feature 1

Mass of fire-reddened earth, 2.30 m long and 50 cm thick. Thickness may indicate that this was the location of multiple successive fires, in that it seems unlikely that a single fire would affect underlying sediments to that depth. No internal structure observed in the feature in profile or on the surface of step 7. East profile, N23.70-26.00, steps 7 and 8, 0.60 m below surface. Late period. (See Figure 3.13.)

Burnt Feature 2

Mass of fire-reddened earth noticed in recording of east profile in uncleared area of profile. Approximately 1 m long and 40 cm thick. East profile, N41-42, approximately 1 m below surface. Middle or Late period.

Burnt Feature 3

Mass of fire-reddened earth noticed during recording of east profile in uncleared area of profile. Approximately 0.70 m long. East profile, N60-61, approximately 0.70 m below surface. Middle period.

Burnt Feature 4

Lens of fire-reddened earth, 1.28 m long, original thickness uncertain but at least 18 cm. Associated with two possible post molds; could be interior hearth. No internal structure observed. West profile, N50.26-51.54, step 8, 0.80 m below surface. Middle period. (See Figure 3.6, layer *c*.)

Burnt Feature 5

Mass of fire-reddened earth, approximately 0.60 cm long, thickness uncertain, inadvertently damaged during our first hours of profile cleaning. No internal structure observed in profile or on the surface of step 8. Could be a secondary deposit of materials cleared and dumped from Burnt Feature 9, or an intact burning area. West profile, N58.00-58.80, step 8 and uppermost profile face, 0.70 m below surface. Middle period. (See Figure 3.14.)

Burnt Feature 6

Lens of fire-reddened earth, 1.02 m long and 6 cm thick. West profile, N17.40-18.40, step 1, 1.82 m below

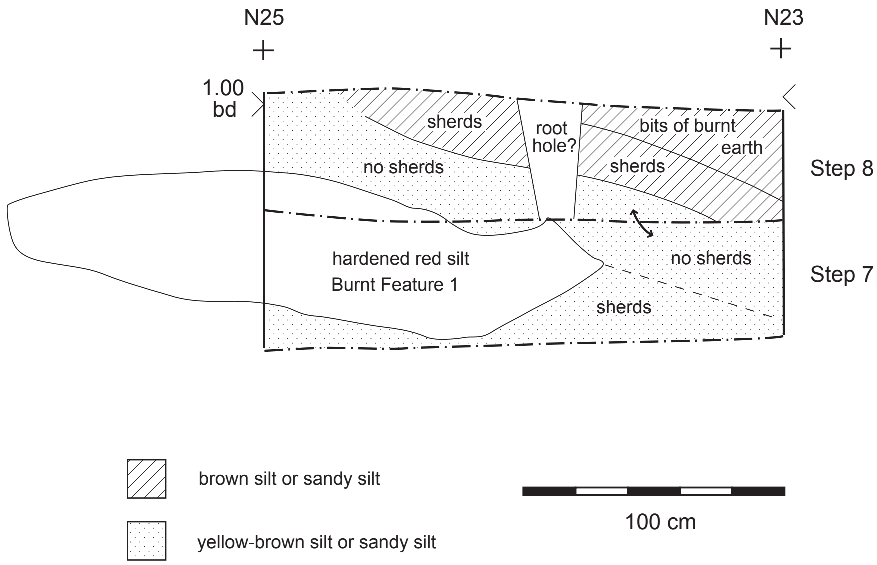


Figure 3.13. Burnt Feature 1.

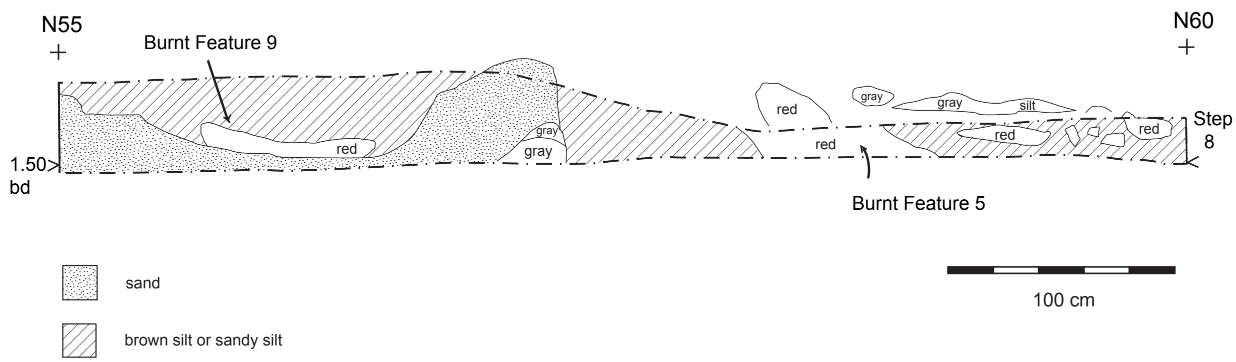


Figure 3.14. Burnt Features 5 and 9.

surface. Close to and overlying Burnt Feature 7. Late period. (See Figure 3.15.)

Burnt Feature 7

Lens of fire-reddened earth, 1.34 m long and 4 cm thick. West profile, N17.54-18.87, step 1, 1.96 m below surface. Close to and underlying Burnt Feature 6. Late period. (See Figure 3.15.)

Burnt Feature 8

Vaguely defined basin-shaped complex (approximately 2.6 m in cross section and 30 cm deep) consisting of deposits of reddish clayey sediments, some containing chunks and bits of burned earth. Toward the center was a smaller deposit, 1.02 m long and 25 cm deep, of a charcoal-rich black sediment with a high frequency of sherds. Atop this was a thin red (burned?) lens. Could represent a complex dump of secondary materials, but the basin-shaped deposits in a profile so full of sharply sloping layers hints that this may be a location of repeated burning and disturbance until the final deposit of the black basin—which again is an intact hearth or a pit filled with ashy debris. Late period. West profile, N82.14-84.80, step 5, 0.56 m below a ground surface possibly damaged by the bulldozer. (See Figure 3.16, top.)

Burnt Feature 9

Basin 1.64 m long and 30 cm deep in a deposit of gray sand. At the bottom of the basin, a 0.8-m-long lens of red earth—probably an intact burning surface. Again,

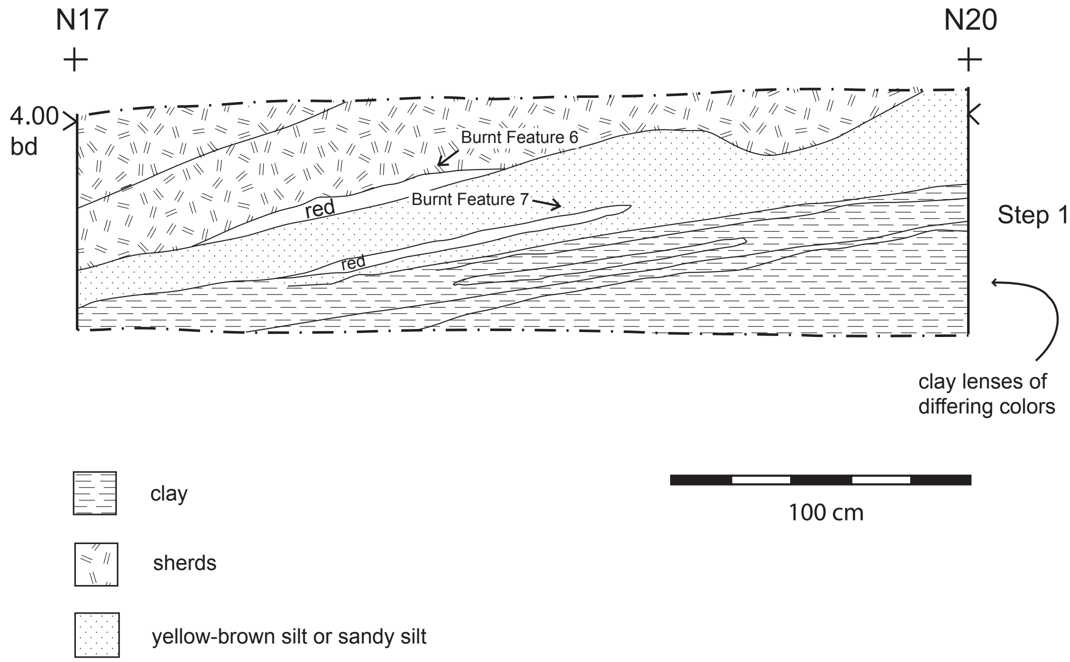


Figure 3.15. Burnt Features 6 and 7.

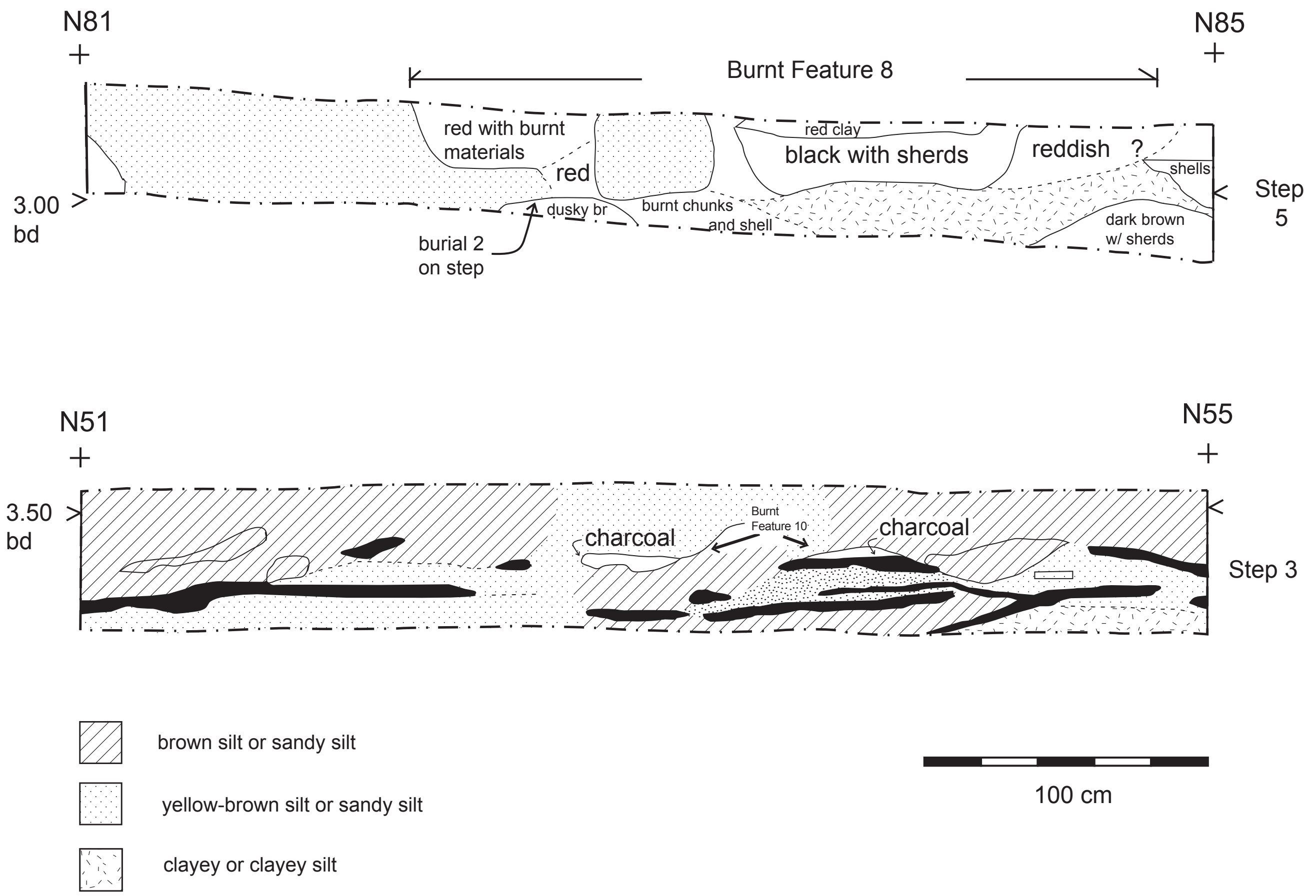


Figure 3.16. Burnt Features 8 and 10.

there is the likelihood of multiple episodes of use. Beneath part of the red lens was a hard cement-like surface at the very bottom of the basin. In addition, the ends of the red lens pinched up in a way that suggests it might have been the bottom of a pit somewhat smaller than the gray basin—the upper walls of which were not identifiable. Middle period. West profile, N50.04-51.66, step 8, 0.90 m below surface. (See Figure 3.14.)

Burnt Feature 10

Two thin but dense lenses of charcoal and a secondary concentration of chunks of burned earth in the mound core. The charcoal lenses, 34 and 44 cm long, could be two small hearths—although, if so the fires would seem to have been less intense than in other areas because they did not discolor the surrounding sediments. Early period. West profile, N52.78-54.50, step 3, approximately 3.36 m below surface extrapolating to top of profile several steps away. (See Figure 3.16, bottom.)

Burnt Feature 11

Pit feature with a complex internal structure discovered in the east bank of the canal during the last few days of the season. Stratigraphically, it would be assigned to the Middle stratigraphic period. Although we were forced to excavate and record Burnt Feature 11 in something of a rush, it provides a tantalizing piece of evidence concerning ancient activities at El Varal. The feature—partially destroyed first by the bulldozer and then by our own profile clearing—consisted of a basin approximately 1.6 m in diameter, significantly deeper on one side than the other (Figures 3.17 and 3.18). The floor and sides had been altered by fire, but the

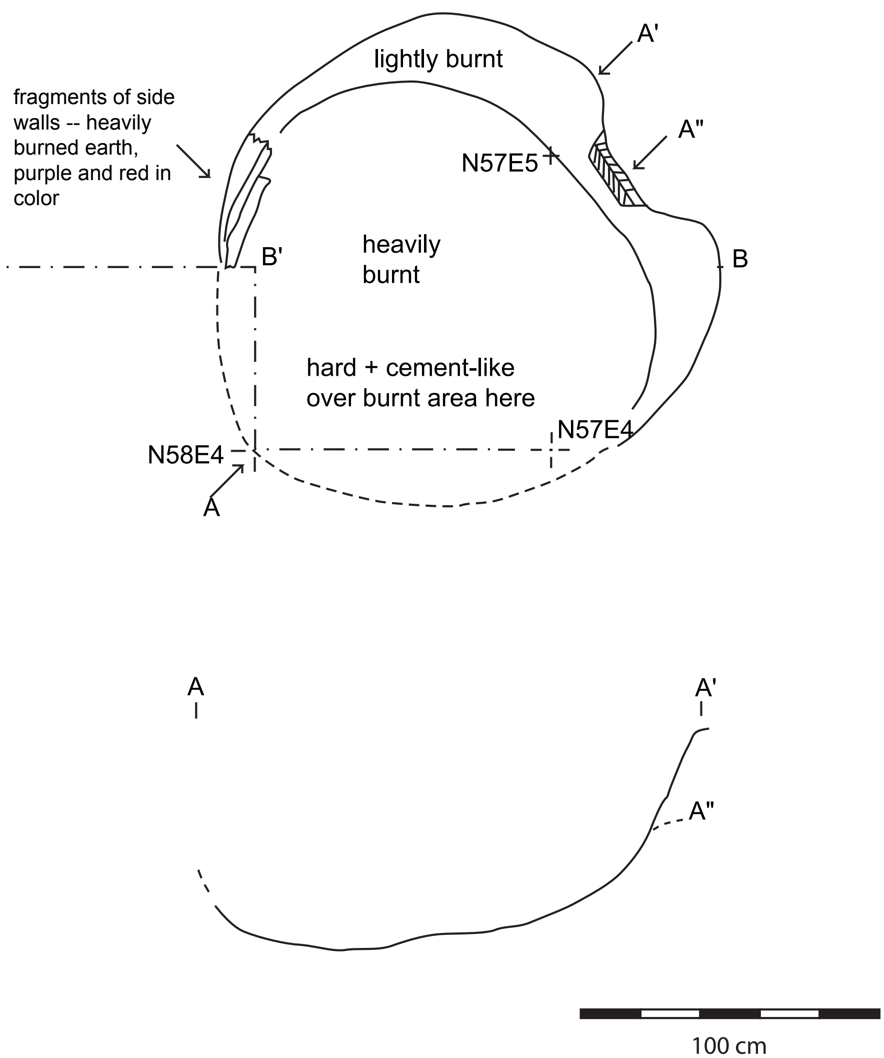


Figure 3.17. Burnt Feature 11.

extent of that alteration differed significantly around the basin. The floor in the deeper part was bright red, indicating heavy burning, whereas the higher part of the floor was noticeably less brightly discolored and the walls preserved along this higher part were quite lightly burned. Only a fragment of the pit wall associated with the deeper part of the basin was intact, and here was located the heaviest burning of all: several successive layers (suggesting repeated firings) burned bright red or purple and hardened so that they came out in large chunks.

Directly opposite the deepest part of the pit was a dip in the burned wall. It seems likely that this dip was open during the firing in the pit, perhaps to add fuel or give access to the content of the pit. At the lower lip of this possible opening in the wall was a superimposed series of thin cement-like lenses. The floor of the basin was also covered by a thin cement-like layer. The cementing seemed similar to that observed in thin surfaces elsewhere in the mound. All charcoal and other debris of the last firing episode must have been cleaned out in antiquity.

The feature was filled instead with the same homogeneous yellow-brown clayey silt that was so pervasive in the profile and that I am interpreting as debris generated in the production of brine for boiling down to salt. The complete 2-m section of profile in which Burnt Feature 11 was discovered is presented in Figure 3.19 so that the stratigraphic context of the feature can be appreciated (although it is important to remember that this is a composite record of the vertical faces of eight steps separated from each other horizontally by 60 to 80 cm). Burnt Feature 11 appears in a zone of deposits dominated by salt tailings. Some 50 cm below the feature, these give way to bedded sands that were probably sloping surfaces surrounding the mound—possibly seasonally inundated. In the lower layers, there is continued evidence of burning (in secondary or tertiary context).

Refuse Middens and the Rate of Mound Accumulation

The content of the middens at El Varal (the layers rich in cultural materials) was quite repetitious. One common find was the detritus of burning, which included chunks of earth burned bright red or purple as well as charcoal-rich lenses. Hardened chunks of green sandy sediment at first taken to be evidence of burning were probably instead quarried from a natural pre-occupation deposit below the modern water table

Figure 3.18. Burnt Feature 11.

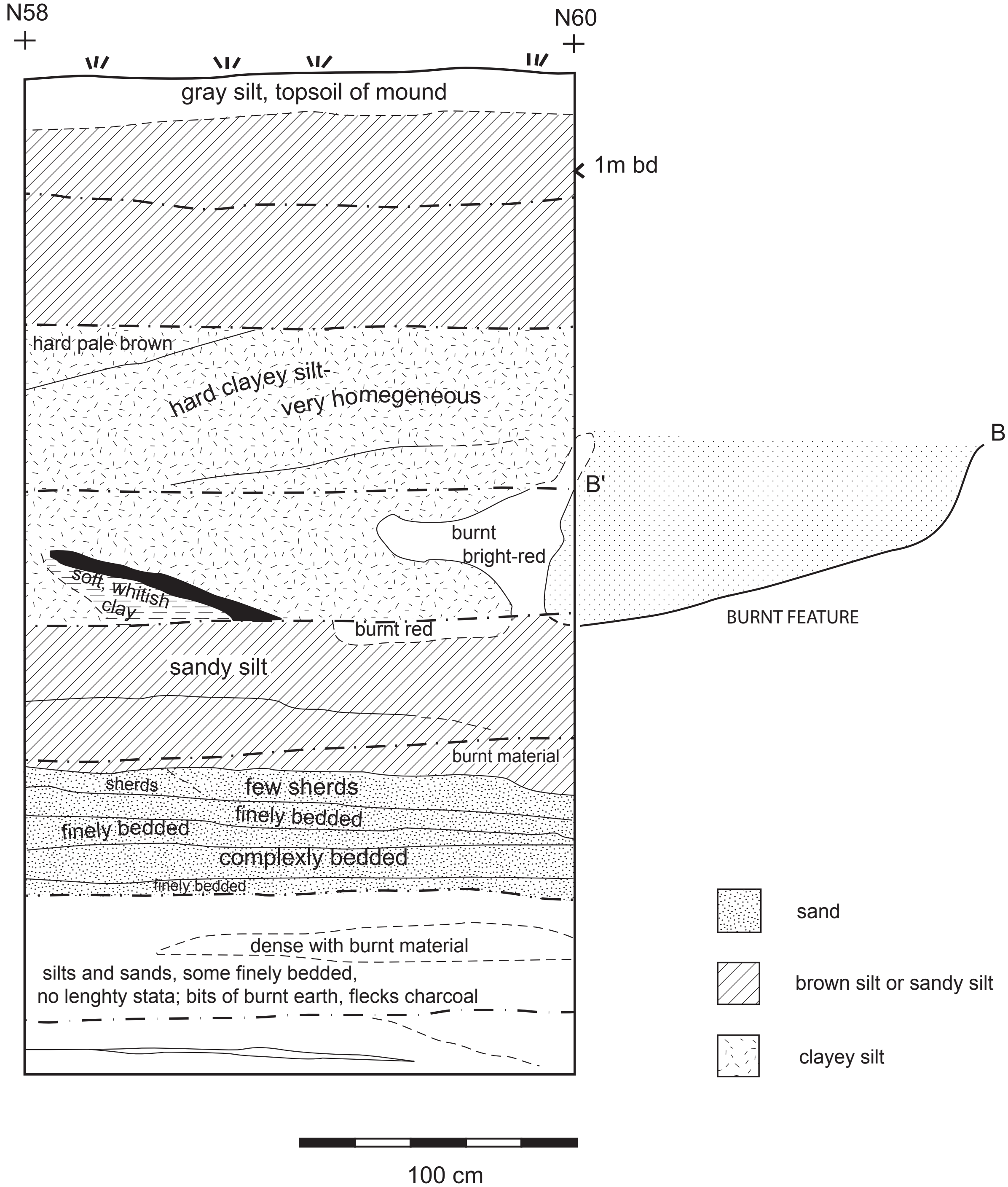


Figure 3.19. Burnt Feature 11 in stratigraphic context.

that our workmen referred to as *texcal*. We ran into this hardened layer only in our small excavation in unit N45W0 (Chapter 4). It is worth noting that the presence of this material in the midden deposits suggests that the inhabitants of El Varal engaged in a fair amount of digging beyond the boundaries of the mound.

Shells were quite common in the deposits, and bone (primarily from aquatic fauna) was also a frequent find. Stone tools included grinding stone fragments (mortars, pestles, *metates*, and *manos*) recovered mainly during the scraping of the profile. Complete *metates* and mortars turned up by the bulldozer were in active

use in the village of Efraín Gutiérrez and we made no attempt to recover them for science. Small obsidian chips were rare but consistent finds in the excavations. Ceramic artifacts such as small human figurines were likewise rare except at the north and south extremes of the mound.

Several assessments indicate that individual midden layers represent no more than a few years worth of accumulation, and many may have been deposited in less than a year. The Vásquez Mound deposits are entirely of the Cuadros and Jocotal ceramic phases, probably spanning no more than 200 to 250 years (Chapter 12). Assuming a 200-year occupation, the mound must have been extended toward the north at an average rate of about .25 m per year. This calculation yields about 1 to 3 years for the deposition of an individual distinguishable refuse layer.

Other evidence supports such results. As mentioned previously, the middens contained large sherds. A rough quantification of this claim is worth mentioning. In Locona- through Cherla-phase assemblages, a few kilometers inland at Paso de la Amada, rim sherds constituting more than 7 percent of the original vessel circumference generally made up 9 to 15 percent of all rims in any given provenience unit—and in no case did this figure rise above 23 percent (Lesure 1995:Appendix B). At El Varal, in contrast, it was common for 30 percent of rims to be large (greater than 7 percent of circumference). The refuse dumps at El Varal seem therefore to have been covered over by further deposition quite rapidly, before their content could be trampled, kicked about, and broken up. A claim that middens were typically sealed by subsequent deposits within a year or so of deposition seems plausible.

The main components of the refuse deposits (broken tecomates, chunks of burned earth, shell, and to a lesser extent animal bone) were consistent finds in deposit after deposit. However, variations in composition raise the possibility that individual dumping episodes might occasionally be identifiable within midden layers. Localized concentrations of chunks of burned earth, broken pottery, or shell would thus mark individual discard episodes within a single midden (Figures 3.2 and 3.3). If I am right to interpret the small lenses occasionally identifiable in refuse deposits as individual dumping episodes, this would provide further support for a short timeframe for the accumulation of many dumps.

Finally, internal stratigraphy of midden layers tended to be in the form of pockets rather than sheets of debris lying flat (although there were exceptions to this high in the profile in our N35W4 and N45W4 excavations). Midden layers were also often loose and unconsolidated. If middens had sat exposed over several years, it seems likely that their structure would have been altered in the intense downpours of the rainy season and the baking sun of the dry season. Indeed, we might expect just the characteristics observed at midden boundaries: compaction and possible erosional surfaces. Such observations suggest that individually distinct midden layers were formed on time scales of less than a year.

All of this should not be taken to indicate that a complete sequence of yearly refuse deposits can be traced along the profile. It was usually possible to trace layers in the west profile on two or more "steps" created in our profile cleaning, indicating that layers had horizontal dimensions (perpendicular to the profile) of at least several meters. It was not possible, however, to match layers between the two profiles (across the canal) over distances of 20 to 30 m. We might thus postulate individual dumps of 5 to 15 m in width. If dumps were created at that scale, the mound probably grew in a haphazard rather than closely planned fashion. There was probably variation year to year in the specific areas used for the dumping of refuse. Thus, even if each midden along the two profiles was the product of a single year of refuse we would still only have a selection of years represented in our sample of middens. In other years, garbage would have been dumped in an area not intersected by either profile.

Sediment Layers as Dumps

Interspersed with the layers of sherds and other cultural debris were layers containing mainly sediment: a yellow-brown clayey silt (10YR4/3), generally homogeneous in both texture and color, and distinctly more compact than the middens. Density of cultural materials was lower than in the case of middens, but cultural materials were never absent and some of the sediment layers contained significant quantities of sherds, shells, or chunks of burned earth. It was striking how consistent and pervasive the appearance of this particular sediment was in deposits throughout the profile. Throughout the history of the mound, some type of consistent process led to the deposition of sediment of very similar composition and color.

Occasionally, the homogeneity of sediment layers was broken stratigraphically by thin lenses of different texture or color that followed the general trend of the surrounding strata. Sometimes these lenses consisted

of clays of distinct colors. In other cases, they appeared identical to the hard cement-like surfaces found in other parts of the profile. The frustrating thing about these lenses is that they were not extensive enough to be traced consistently between the steps of our profile, whereas the larger silt layers in which they appeared to be embedded could be traced across multiple step faces. In the west profile, this pattern was noted particularly in N20-25 and N25-30.

A deposit of the yellow-brown silt in N75-80 of the west profile was thick and homogeneous on a lower step, but in the third step up from the water it appeared to be divided by a series of six thin lenses. On the step above that there was no evidence of those lenses but instead a single lens with a slightly lighter color than the surrounding yellow-brown matrix. In the east profile, a selection from the N18-20 drawing reveals a series of hardened surfaces within what would otherwise appear to be a single silt layer, homogeneous in color and texture (Figure 3.20). On the west side—at the extremities of the mound in N15-20 and N90-95, where several large silt layers pinched out—series of thin clayey lenses were observed (some of these appear in Figure 3.15).

The presence of finer-grained stratigraphy within larger silt layers suggests that the latter were deposited in multiple smaller depositional events closely spaced in time. The following section explores patterns of cementation. First, however, I consider and reject an interpretation of the sediment layers as platform fill—introducing as an alternative the possibility of salt production.

During the excavations and for a long time thereafter, we considered the silt layers interspersed with middens in the dump zone as fill originally intended to stabilize the sloping sides of the mound and/or extend its surface. Given the lack of other evidence for

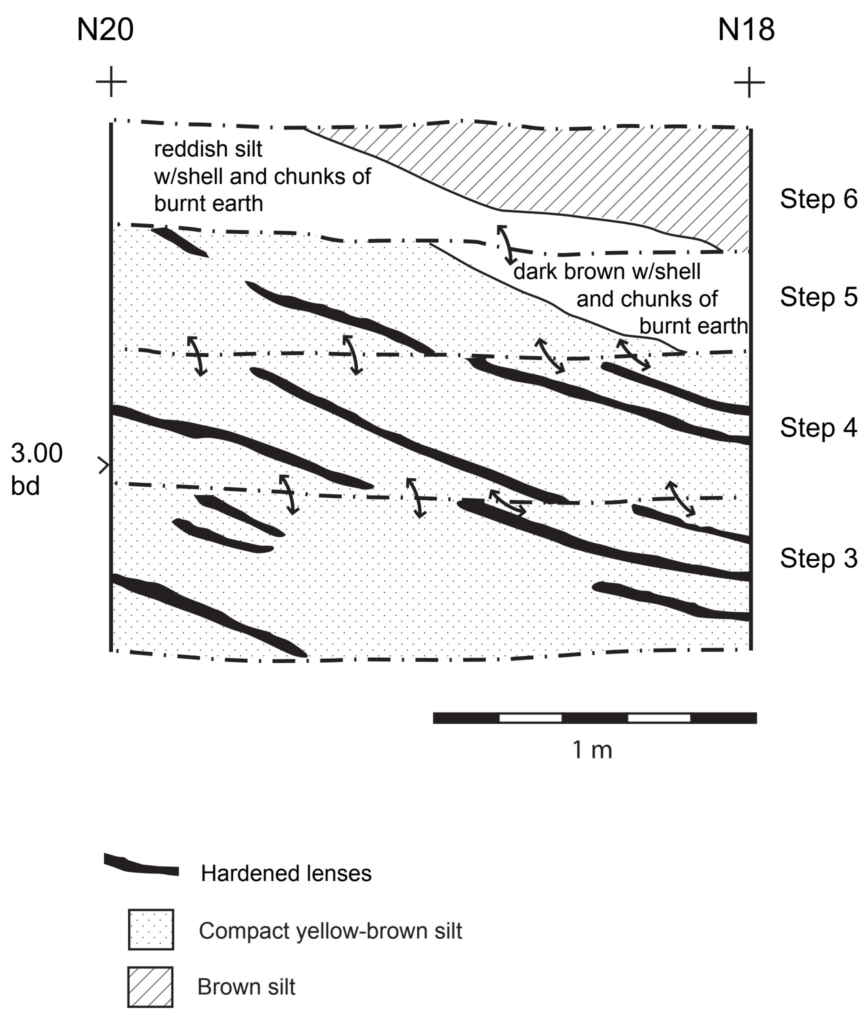


Figure 3.20. Cemented lenses within large homogeneous deposit of yellow-brown silt, the latter interpreted in this chapter as debris generated in the production of salt. Vásquez Mound, east profile, N18-20, steps 3 through 6.

habitation, there were always nagging doubts about this interpretation. Why would such efforts have been invested in what otherwise appeared to be a special-purpose site without permanent habitation? Artifact analyses raised a further puzzle. Sherds encountered by the archaeologist in fill have usually been deposited in one location, and then quarried and removed to another. We would expect them to be more broken up than sherds in a secondary refuse deposit, and indeed such a pattern is observed in Early Formative deposits from Paso de la Amada.

Table 3.1 provides the relevant analyses. Average sherd weight was calculated for individual provenience units of platform fill and trash pits at Paso and excavated sediment layers and middens at Varal using the simple formula of total weight divided by number of sherds (see Chapter 4 for discussion of the Varal excavations). T-tests were then performed on those values to look for significant differences between means. One obvious point concerning the table is that Jocotal sherds at Varal were heavier than Locona-Cherla sherds from Paso. That pattern is partly due to rapid deposition of large untrampled middens at the estuary site. However, Jocotal sherds are also thicker and heavier than their initial Early Formative counterparts. The point of particular interest is that at Paso de la Amada, as expected, layers stratigraphically designated "platform fill" contained significantly smaller sherds than those designated "trash pits"—the latter apparently full of intact secondary refuse. At El Varal, by contrast, there was no significant difference in average sherd weights between sediment layers and midden layers of the dump zone. Such a finding is not consistent with an interpretation of the sediment layers as fill.

Table 3.1. Average sherd weight in different types of deposit at Paso de la Amada and El Varal

Site and Deposit Type	N[a]	Mean of Average Sherd Weight[b] (g)	Standard Deviation	*t* Statistic	*p* Value
Paso de la Amada					
Platform fill	11	7.6	1.4	3.32	0.0034
Trash pits	11	10.3	2.2		
El Varal					
Dump middens	24	27.0	4.8	–0.83	0.43
Sediment layers	6	28.9	5.2		

a. Number of lots for which average sherd weight (weight of sherds divided by number of sherds) was calculated.
b. Mean value of average sherd weight (in grams) among the N lots of each deposit type.

Given all of these problems with the idea that the sediment layers might be platform fill, salt production provides an attractive alternative that would explain why occupants would have transported large volumes of dirt to the top of the mound. Late sixteenth-century aboriginal salt making along the Guatemalan coast involved scraping up salt-laden earth and placing it in wooden troughs (Coe and Flannery 1967:92). Water poured over the earth would trickle out below as brine, which was then boiled and reduced to salt. Andrews (1983:62–63) noted mounds of earth along the Chiapas coast, which he took to be relatively recent waste heaps from this *sal cocida* process. Nance's (1992) excavation of the Guzmán Mound in the Naranjo region of nearby Guatemala appears to document similar practices in the Late Formative. The mound lies beside a salt flat, and the stratigraphy consisted of layers of gray loam alternating with refuse layers containing sherds, burned earth, and charcoal (Nance 1992:29)—strikingly similar to the pattern observed at El Varal.

Hardened Lenses Revisited

Thin cemented lenses similar in color to the surrounding matrix (light brown, yellow-brown) appeared in various contexts. In the mound core, they sometimes form the bottom of shallow pits. In other cases, they are flat or sloping (Figure 3.11). In general, they seem to be patchy remnants of informal uneven-occupation surfaces. As mentioned previously, identical lenses (sometimes steeply sloping) were occasionally identified in the sediment layers I am suggesting were tailings of salt manufacture. In a couple of cases (including Burnt Feature 11), cemented lenses were observed directly above or below intact patches of fire-reddened earth. However, for the vast majority of hardened lenses no such association was apparent.

It is tempting to propose that cementation resulted from the dumping of calcium-rich liquid from tecomates. In that case, we could tie activities occurring on occupation surfaces in the mound core to those involving hearths and to dumping of sediment from salt manufacture. Such a scheme would seem to help make sense of patterns observed above, in which thin cemented lenses were embedded within the thick and otherwise homogenous layers of salt tailings. The larger layers would have been created over days or weeks as site occupants repeatedly dumped sediment from which brine had been extracted, whereas the cemented layers could derive from the emptying of individual tecomates.

Even if the cemented layers were indeed formed by the emptying of tecomate cooking water, it remains something of a puzzle what specific activity would have generated calcium-rich liquid as a by-product. Santley (2004:205) suggests that deposits of calcium carbonate on the insides of boiling vessels were by-products of salt manufacture at El Salado (Veracruz), but it is not clear how salt production at El Varal would have led to the dumping of calcium-rich liquid. Wouldn't that have involved discarding the salt? An alternative might be that things other than salt were cooked in tecomates. Voorhies (2004:154) documented cemented surfaces created by modern shrimp producers in the Acapetahua Estuary. Water used to cook shrimp was dumped onto clean sand, yielding a cemented surface on which the boiled shrimp could be dried for storage. (For more on shrimp, see Chapters 16 and 18.)

A second layer of uncertainty is added by observing that patterns of cementation suggest that formation processes more complex than any direct equation between behavior and resulting deposit would imply. Within the Vásquez Mound, cemented surfaces seemed to occur in a band across the exposed profiles. In the mound core, cemented surfaces are particularly prevalent. However, with one exception they appear only deeper than 2 m below the ground surface. On the other hand, they are *absent* in the very deepest part of the mound core (the lower 80 cm or so of our profile between N47 and N60). The stratigraphy there, especially between N47 and N55, changed markedly to homogeneous zones of clayey sand—with little evidence of the fine bedding so evident further up in the mound core. Cultural deposits, however, continued at least to the late dry season water table. In sediment layers of the dump zone (i.e., the sedimentary debris of salt manufacture), cemented lenses appeared as close as 90 cm to the original ground surface—a meter or more shallower than in the mound core.

A clear pattern appears if we shift our attention to depth below datum (bd) rather than below surface. From the profile, cemented lenses appeared between 3.20 and 4.40 m bd, with a particular concentration between 3.50 and 4.00 m. Only in the mound core did they occur higher (2.20 m bd). I suspect that there is some relation between cementation and the water table (5.50 m bd in late March of 1992 and significantly higher in the rainy season).

Two other contexts in which cemented layers were identified seem likely to result from natural formation processes. First was cementation in layers of the sandy edges, thought to be covered with lagoon water during part of the year. Second was cementation observed in several instances at Paso de la Amada. In this second case, cementing seemed to depend on the nature of sediments underlying the cultural layers: it was observed in medium or coarse sand but not fine-grained sand. In sum, although it appears that activities at El Varal may have generated calcium-rich encrustations as a by-product the formation processes involved were complex and it does not seem possible to sort among possible behaviors based simply on the presence of calcium carbonate.

Salt Production at El Varal

The canal profiles at El Varal provided a tapestry of evidence consistent with salt production. There is the modern production along the Chiapas coast that yields earthen mounds (Andrews 1983); the record of sixteenth-century practices in neighboring Guatemala, also involving a *sal cocida* process that would have yielded sediment as a by-product (Coe and Flannery 1967:92); and the stratigraphy observed at the Late Formative Guzmán Mound, with an alternation between sediment and midden layers, pervasive evidence of burning, and many large sherds of a limited array of vessel forms.

An Early Formative case contemporaneous with El Varal is provided by Santley's (2004) work at the helpfully named El Salado, located beside a salt spring in the Tuxtla Mountains of Veracruz. The patterns he noted included densities of broken pottery among the highest known from the region; a vessel assemblage dominated by coarse ceramics, among which tecomates are prominent; lack of architectural features, storage pits, or burials; and evidence of burning on the exteriors of pots. If we were to posit that El Varal was a special-purpose (perhaps seasonal) site visited by inhabitants of inland dish-dominant sites specifically for the production of salt, much of the stratigraphic character of the canal profiles could be accounted for. The site is appropriately located, near what is currently a seasonally exposed salt flat (Clark 1994a:Figure 9).

There is one significant drawback to this interpretation: choice of the tecomate as a vessel form instead of the Mesak jars apparently used for salt production at the southeastern extreme of the Soconusco (Pye 1995). Salt production at El Mesak was contemporaneous with that at El Varal, some 70 km away. Further, both sites participated in the same Jocotal ceramic complex—indicating a high potential for diffusion of ideas. Identification of

economic activities at El Varal is far from resolved in this inspection of the canal profiles (Chapters 14, 17, and 18 in particular provide further elaboration).

History and Changing Form of the Mound

During the Early period, the Vásquez Mound was a small extension to the much older Martínez Mound—at least seasonally an island in a coastal lagoon. The sides of the mound sloped off very gently to the south (in the direction of the estuary and the ocean), and rather more steeply to the north. The fragmented stratigraphy and thin cemented lenses that seem to mark centers of activity of this epoch are concentrated at the northern (and highest) part of the mound.

We have no way of knowing how much occupation debris surrounds this early mound under the modern water table, but there seems to have been a particular concentration of activity on the mound itself—leading to a steady increase in height. Toward the end of the Early period, the first large dense midden deposit accumulated from refuse dumped off the northern edge of the mound. Deposits to the south at this time contain plenty of cultural debris, but that tends to be in the form of water-worked lenses of sherds lying flat in sand rather than the jumbled mass of an intact dump.

No strong evidence of residences or other structures dates from this period, and no burials were identified. In addition, none of the heavily burned features known from the Middle and Late periods were found in Early period deposits. Burnt Feature 10, the only intact burned feature from this time, did not alter the color of surrounding sediments. Despite the lack of the intact features, there is considerable secondary evidence of burning (e.g., charcoal lenses, bits of fire-reddened earth) throughout Early period deposits. The vessel form distribution characteristic of "estuary" sites is particularly well marked at this time, as is the scarcity of obsidian and figurines. In sum, the evidence of the Early period points to small-scale occupation or use of this locality (although it should always be remembered that there is another uninvestigated mound at the site). The possibility of seasonal or intermittent occupation would seem strongest at this time.

A change in the process of mound formation—and by implication a shift in one or more cultural variables—took place during the early part of the Middle period. Dumping of refuse from the top of the mound into aggregated discard zones, a practice begun at the end of the Early period, continued now on the south as well as the north slope of the mound. The surface area available for habitation and use of the mound surface steadily expanded. The expanding activity zone and the rapid accumulation of quantities of refuse suggest more frequent use of the mound and/or use by more people.

One possibility for consideration is that the transition to the Middle period marked the onset of permanent occupation at the site. However, that is not the conclusion I come to in a review of the artifact evidence (Chapter 14). No burials can be assigned to this time, but our most likely structure can. Burnt Features 3, 4, 5, 9, 11, and possibly 2 were Middle period and indicate a significant level of activities involving fires—with some of those set near the center of the growing mound. Importantly, artifact patterns characteristic of the Early period were unaltered—with low frequencies of dishes, obsidian, and figurines.

The Late period began with the dumping of large amounts of sediment on the north and south sides of the west profile. A significant deposit on the south side of the east profile might also have been associated with these. The coincidence of these layers suggests the possibility of an increasing scale of salt production—an idea elaborated in Chapter 14.

The mound was quite large by that time. Dozens of people could have inhabited its upper surface. The mound had also developed a complex form. The fact that the east profile is as long as the west profile (even though it misses the mound core) suggests something of a fan of deposits out in this direction away from the ancient core. In addition, if my apportionment of east-side strata between Middle and Late periods is anywhere near correct, there was a significant expansion of the mound southeast during this time. Indeed, the east-side profile does not peak in the middle (about N50-55)—as on the west side—but instead between N30 and N35. As a result, the east profile is subtly lopsided, with a bulge on its southern surface. John Clark suggested to us in the field that this bulge might mark a small Jocotal platform atop the Vásquez Mound. Unfortunately, we ran out of time before we could investigate that area thoroughly or even complete the profile record in the vicinity. Any such platform would date to the end of the Late period, or more likely the Terminal period.

The four burials seem to date to no earlier than the Late period, but they could all be Terminal. No definitive evidence of structures can be assigned to the Late

period. Burnt Features 1, 6, 7, 8, and possibly 2 are Late and indicate a basic continuity in lifeways from the Middle period. The same can be said for the artifact assemblage and for the stratigraphy in general.

The shift of the vessel form distribution toward dishes and the increased frequencies of obsidian and figurines in the Terminal period thus seem a sudden occurrence—marking a transformation in the use of the site, even if it was only short-lived. We have a large enough sample of Terminal midden deposits from N95W0 to be able to speak of the altered artifact patterns with considerable confidence. Few strata are securely attributable to this period, but nevertheless a consideration of features adds to this portrait of changing lifeways. No burned features are assigned to this period.

The possible platform at the southern end of the east profile would likely have formed the base of a residence or other building. A corner of another low platform was uncovered at the bottom of the excavations in N95W0. There seems to have been a significant social transformation at El Varal at the end of the Jocotal phase. Here is a second transition point (after the Early-Middle transition) at which one might choose to place the onset of permanent occupation at the site (explored in Chapter 14). Certainly, if one chooses an earlier point for the appearance of full-time residence one is faced with accounting in some other way for the Terminal-period shifts.

Initial Results on Research Topics

Stratigraphic study of the canal cut through the Vásquez Mound yields insight into several of the research topics identified in Chapter 1. These are discussed in the sections that follow.

Site Setting

The mound was probably an island, at least during the rainy season. For development of this point, see Chapters 4, 5, and 14.

Nature of Productive Activities

The use of fire was recurrent and pervasive throughout the Early through Late periods. Fires were set on the upper surface and sloping edges of the mound. They were laid on the ground surface in simple pits or in more elaborately constructed fire pits or kilns. A single feature could be used multiple times, with the debris of burning being cleaned out and dumped over the edge of the mound. Production of salt by boiling of brine would account for the pervasive burning and for the large quantities of pottery and the deposits of sediment apparently quarried from the vicinity of the mound and transported to its upper surface. The issue of salt production is given additional consideration in Chapters 14, 17, and 18.

Size of the Occupation

Occupants of the site must have been numerous enough to generate substantial quantities of debris and to transport significant amounts of salt-laden sediment to the surface of the mound, all leading to a lateral expansion of approximately 25 cm per year. Still, it is possible that relatively few producers could have generated such debris in the production of salt using the methods suggested here. The issue of population size is revisited in Chapter 14.

Permanence of Occupation

The overall rarity of evidence of structures points toward lack of permanent occupation, although there are grinding stones—and in the Late and/or Terminal periods, burials. The general absence of structures is particularly important. Traces of any perishable structures in the surface zone (the upper 90 cm or so of the deposits and the likely location of Late or Terminal buildings) might well have been destroyed by root action and cultivation of crops over the last 3,000 years.

Another important observation on permanence is the possibility of change in the occupational status of the site. Two points of change in the nature of activities can be identified. First, there is the shift from Early to Middle—marked by the onset of dumping. Conceivably, that could mark a shift to a more permanent occupation (the one identified structure does date to the Middle period)—but a more likely possibility is a shift in the size of the group and in the scale of activities.

A more convincing point for identifying permanence would be the shift from Late to Terminal. At that point, the vessel-form assemblage changed dramatically. Two small platforms suitable for residential structures are both Terminal in date (one is in the east profile, indicated in Figure 3.1, and the other is described in Chapter 4 under discussion of N95W0). There are no identified Terminal burned features, raising the possibility that salt production was abandoned.

CHAPTER 4

Excavations

RICHARD G. LESURE AND TOMÁS PÉREZ SUÁREZ

Formal excavations were carried out during Phases 3 and 4 of the field investigations, as described in Chapter 2—largely with the goal of sampling midden deposits from throughout the occupation of the mound. All excavations were in the west profile (their locations are shown in the foldout at the back of the book). The Phase 4 Step Excavation was to the north of the midpoint of the mound core, whereas Phase 3 investigations were conducted in the north and south.

Except for units in N35W0, N45W0, N55W0, and N95W0, the excavations involved removing small volumes of archaeological deposit already pretty well exposed in our profile cleaning. Stratigraphic insights on larger interpretive themes of this volume were relatively few. We have organized the discussion encyclopediacally by phase of the investigations (see Chapter 2) and by provenience unit. The excavation units previously cited and a few others yield some stratigraphic information beyond the discussion in Chapter 3: there is reference to the sandy edges in N35W0 and N45W0; cementation in N35W0, N45W0, N80W0, N75W0, N70W0, and N55W0; the mound core in N55W0; and habitation features in N95W0.

Most of the excavated lots can be considered part of one of two stratigraphic sequences: the Step Excavation (ST) and Phase 3 South (P3). The N95W0 lots postdate those of the ST, and we have added a set of those to that sequence—although there is a gap between the two. There are multiple gaps in the Phase 3 South sequence. All lots were screened through 5-mm mesh unless otherwise indicated in the following discussion.

Phase 3 Investigations South of the Mound Core

N15W0

Chosen to sample a dense midden deposit from late in the occupation of the mound (Figure 4.1). Located at N16.5-17.5, W0.9-1.7 on step 1. Lot 1 was compact, clayey, and yellowish brown (10YR5/4). It is probably the sedimentary debris of salt making. Lot 2 was lighter in color and less compact, with a significant number of shells. It may be debris generated by a combination of activities. Lot 3, a dark-colored (7.5YR4/2) uncompacted lens packed with cultural debris, derives from refuse accumulation at the southern base of the mound.

The same applies to the underlying lot 4, distinguished from lot 3 by its reddish color (5YR4/4). A black/red distinction between lots 3 and 4 appeared clearer to the eye than suggested by our Munsell readings, a situation we often encountered when trying to describe what we were seeing. Excavations terminated at the bottom of lot 4 atop a compact yellow-brown layer sloping gently

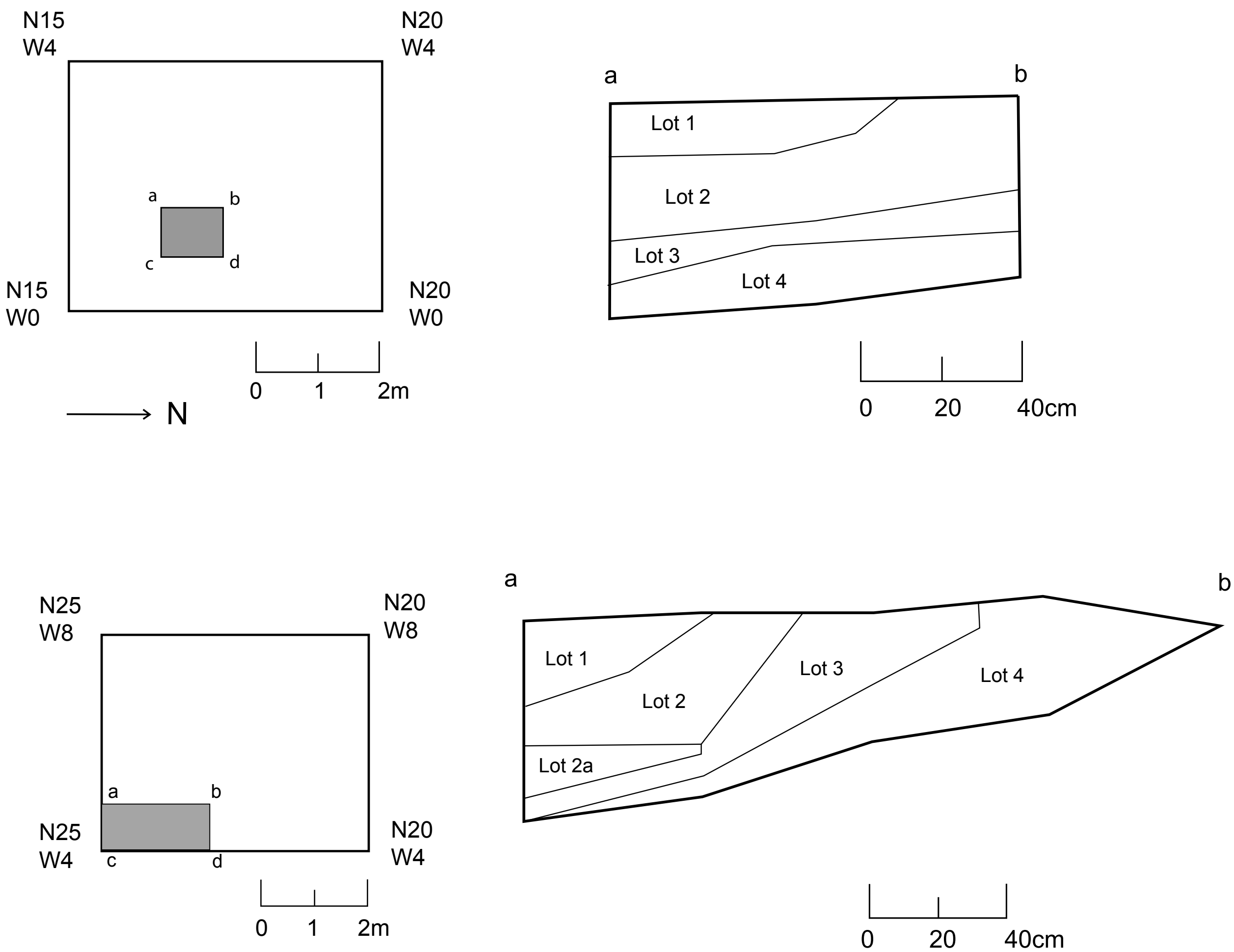


Figure 4.1. Top: excavations in N15W0, showing the location of the excavated unit (left) and a schematic profile of lots 1 through 4 (right). Bottom: location and schematic profile of lots for excavation in N25W4.

to the south, apparently another layer of sediment from salt making. Stratigraphic period: Late.

N25W4

Chosen to sample a dense midden of shell (Figure 4.1). Excavations were continued below that to recover more of a sherd sample from this epoch of the occupation. Located at N25.0-27.0, W4.0-4.9 on step 5. Lot 1 was a small deposit, origins uncertain, removed to clear off the surface of the shell lens. Lots 2 and 2A were uncompacted, dark in color (7.5YR3/2), and full of shells. Lot 2A was the very bottom of the shell deposit removed in its entirety as a flotation sample. The two lots derive from refuse dumped from the surface of the mound of this epoch.

Varying concentrations among the shells, and a tendency for like species to appear together, suggest that the midden is composed of numerous discrete dumping episodes—each perhaps consisting of the remains of single meals. Lot 3 is a continuation of the midden deposit, more yellow in color (10YR3/3) and with fewer shells. The abundant cultural material declined dramatically in lot 4, which turned out to be homogeneous and relatively compact, moderate brown in color, with small chunks of burned earth and hardened green *texcal*. It seems a mixture of the various types of debris generated in salt making and perhaps other activities. Stratigraphic period: Late.

N35W4

Designed to sample two thick midden deposits high in the profile of the mound. Excavations began in step 7 (lots 1 and 2) at N35.0-36.4, W6.1-6.9. They continued into step 6 (lot 3) at N35.0-36.4, W5.1-6.9. Excavations were then continued in the immediately adjacent step 5 (lots 4 through 8) at N35.0-38.5, W4.0-5.1. Lot 1

was a narrow wedge of earth above the midden, of uncertain origin. Lot 2 was a homogeneous moderate brown in color and packed with sherds that in pockets had a jumbled appearance but more generally assumed a uniform slope to the south, as if they had settled flat along a sloping surface of the mound.

There were occasional concentrations of shell or particularly high concentrations of sherds, suggesting that the midden was formed from numerous dumping episodes. Based on the varying patterns of sherd orientation, the midden may well have accumulated over multiple years. Alternatively, it might have been deposited during a rainy-season use of the site. Lot 3 was a continuation of the same midden deposit, grading toward the bottom of the unit to a lighter color with fewer sherds. Lot 4 was part of the same thick midden as lot 3. Because it was located one step down from lot 3, the precise stratigraphic relations between the two are difficult to define and they should be lumped together for analysis.

Underlying lot 4 were two layers (lots 5 and 6) of homogeneous, compact, yellow-brown sandy silt (10YR5/4) with few sherds. To the eye, the lower lot 6 appeared more yellow than the upper lot 5—although the Munsell readings were the same. Both were probably the sedimentary by-product of salt production. Beneath lot 6 lay another thick midden excavated in two superimposed lots (7 and 8). A thin lens of yellow-brown silt observed in the western part of the unit provided the basis for separating lots 7 and 8.

Both lots derive from cultural debris (including sherds, chunks of *texcal*, and burned earth) dumped along the edges of the mound. Stratigraphic period: Middle. (If the two large sediment layers at N28 and N75 date to the same epoch, as we have assumed in defining the Middle/Late distinction, this unit is positioned sometime before the end of the Middle period. Alternatively, if the mound grew outward to the north and south at precisely the same rate those two sediment layers would be of different date and the N35W4 lots would correspond more closely to the Middle-Late transition in the Step Excavation (perhaps ST-14 through ST-17). The shell content of these layers appears most friendly to this latter interpretation, but the issue cannot be resolved stratigraphically. "Middle" is a reasonable period designation.)

N45W4

Sample from a single thick midden appearing at the top of the profile on step 8 (lot 1) at N45.0-46.5, W7.15-8.0 and step 7 (lot 2) at N45.0-46.5, W6.2-7.15. Both lots contained a dense concentration of sherds and chunks of burned earth in a homogeneous moderate brown silty matrix characteristic of this part of the profile, where colors appear to have been leached. Stratigraphic period: Middle.

N35W0

Chosen to explore the finely stratified layers of what we now refer to as the sandy edges. Located at N36-40, W1.85-2.50 on step 2 (lots 1 through 6; the rectangle *a-b-c-d* in Figure 4.2), and expanded to W1.20-2.50 in step 1 (lots 7 through12) after removal of step 2. We opened a relatively large unit because we thought that some of the lenses seen in profile might be occupation surfaces or even structure floors. It now appears that these are mainly outwash and lagoon-edge deposits beside the mound. There may be occupation surfaces in the sequence, but there are no formal structure floors and this zone was seasonally inundated.

The deposits all slope gently off to the south and east. The first few lots appear only in the southern part of the unit (Figures 4.2 and 4.3). Layers removed in lots 1 through 3 represent dump deposits sitting atop sandy edges associated with earlier episodes of mound accumulation. Lot 1 was the lowest part of a dense concentration of sherds appearing in the profile above step 2. A jar neck with the most striking fire serpent motif recovered at the site came from this lot (Figure 9.16). Lot 2 consisted of fine, loose sand containing abundant sherds lying flat with a gentle slope to the south. Lot 3 was a homogeneous pale brown (10YR5/2) silt—perhaps the debris of salt making, but probably reworked by slope wash or lagoon waters. Lot 3 rested atop lot 4, a layer of pure sand 3 to 8 cm thick that appeared throughout the southern 3 m of the unit and that marks the full transition to sandy-edge deposits.

The tendency from this point down in the unit was for series of thin layers alternating between sand and silt. Lots 2, 4, and 6 were composed of a pure, loose sand such as one finds at beaches. The alternating sand/silt sequence appeared to be related to density of cultural materials, with artifacts common in sandy layers and much scarcer or absent in silt layers. The extension of individual layers throughout the unit varied. Below lot 7, the stratigraphy became extremely complex—and fine laminations were identifiable in the deposits. Water action appears to be a significant formation process in all of these cases, although variation in the texture of the deposits suggests fluctuating depositional conditions

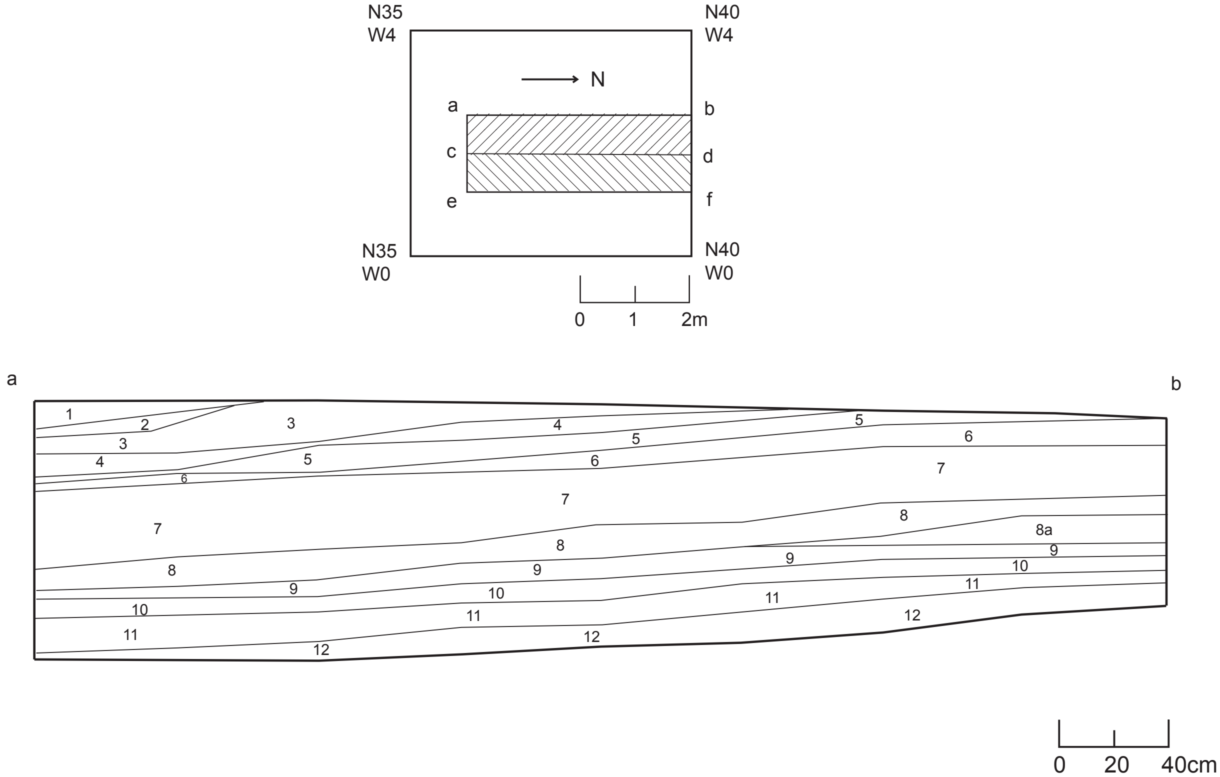


Figure 4.2. Location and schematic profile of N35W0 lots.

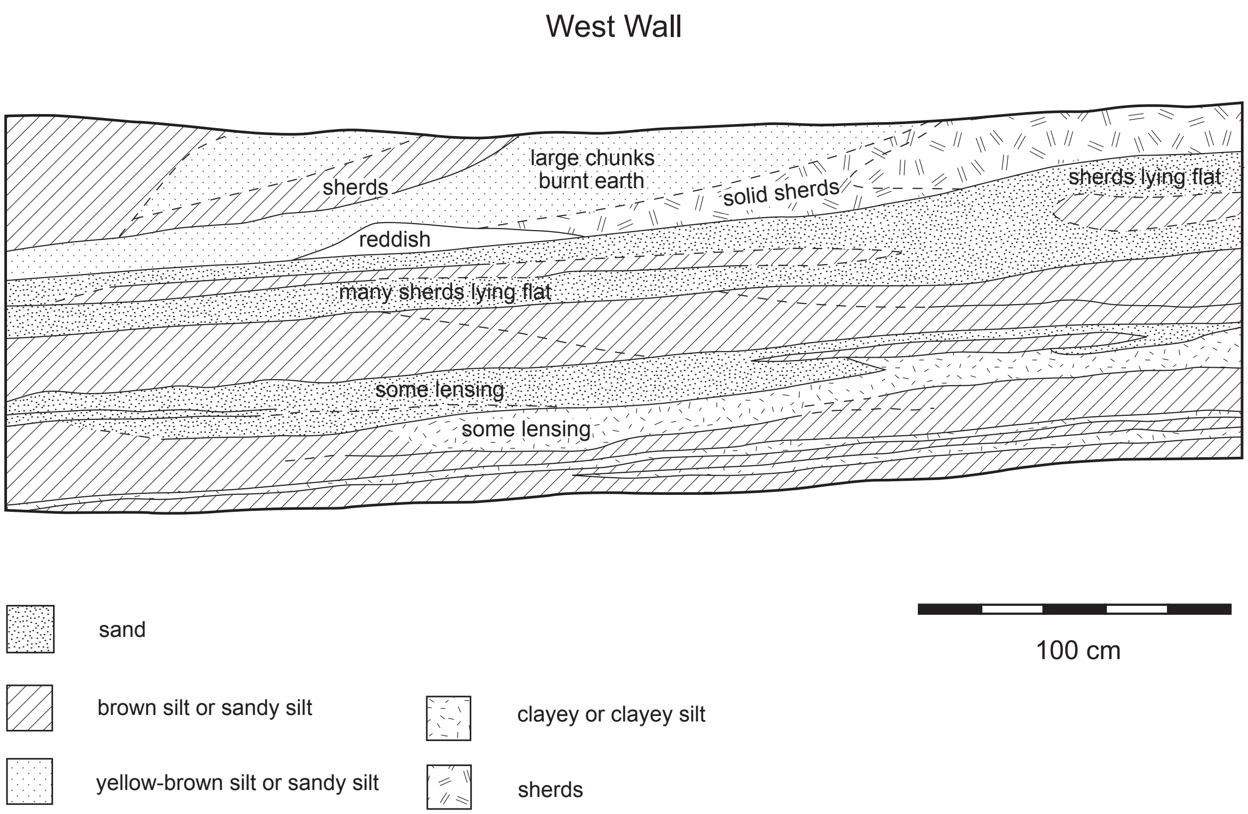


Figure 4.3. Profile of excavations in N35W0. Note that the upper portion of the profile includes the face of the step above that excavated. This profile aligns at its base with that shown in Figure 4.2.

and/or changes in debris being generated by human activities on the mound. It is likely that the area around the mound was seasonally inundated and that some of these layers represent accumulation in standing water.

Lot 4 consisted of sherds (and bits of burned earth) lying very flat and closely packed in a matrix of loose sand. Deposition in standing water is a distinct possibility here. Lot 5, below, was a thin layer of sandy compact silt containing chunks of red, gray, and green earth; probably *texcal*; and burned earth. The underlying lot 6 was similar to lot 4, with generally quite large sherds lying close together and very flat in a matrix of loose sand (Figure 4.4).

My preferred interpretation of the formation processes involved here was sketched out in Chapter 3: the sand layers (lots 4 and 6; also 2, above) look like beaches because they *are* in a sense beaches. They are sediments washed of fine particles by wave action in open water (a lagoon; see Chapters 3, 5, and 14). The intervening lot 5, never washed by tidal action, would derive from sediments settling in standing water. If the reasoning is sound thus far, we might have seasonal depositional units here. The sand layers might correspond to early rainy-season rise of estuary waters. Those are the strata that have high concentrations of sherds.

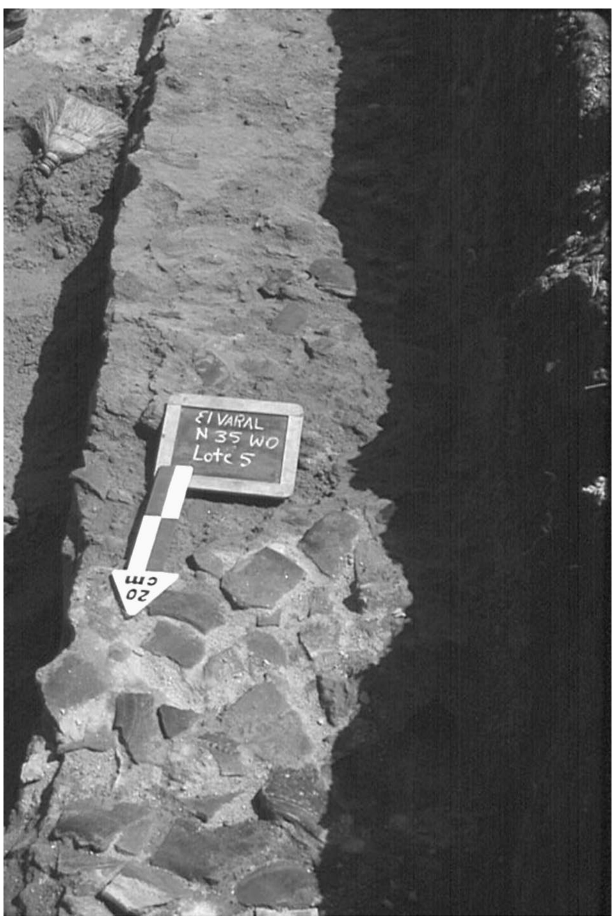


Figure 4.4. Concentration of sherds lying flat in sand in N35W0, lot 6 (foreground). (The "lote 5" label in the photo is misleading.)

The silt layers, with few artifacts, would correspond to full inundation in the late rainy season and early dry season. Dry-season conditions would have generated little deposition by water transport (although wind would be an alternative possibility). Compaction observed in silty layers was probably enhanced by sun baking in late dry-season conditions. The stratigraphic sequence here suggests human occupation in the late dry season and early rainy season. All of this seems consistent with the isotopic data from shells (see Chapter 13). However, this pattern of alternation between sand and silt (with different concentrations of artifacts) was not as clear in other parts of the sandy edges (such as the lowest levels of N35W0 and N45W0).

Layers 4 through 6 were 5 to 10 cm thick. The underlying lot 7, excavated in the expanded unit, was by contrast unusually thick for this portion of the profile (20 to 30 cm). It is similar in texture, compaction, and overall appearance to layers of salt tailings in the dump zone. Cultural materials were markedly less dense in lot 7 than in the lots above it. Fine laminations were first observed below lot 7 in lot 8, a 12-cm-thick layer containing many thin lenses of sand and silt. The silt lenses (1 to 3 cm thick) were compact, and popped off in chunks as we ran our trowels underneath them along the underlying sandy layers. Sherds appeared particularly abundant in the sand and scarce in the silt. If these represent alternating seasonal deposits, overall annual deposition was less at this time. At the bottom of lot 8 was a thin lens of silt without artifacts. In much of the unit, it rested atop a 1- to 2-cm-thick sandy concreted lens (Figure 4.5) such as those described in Chapter 3 for other parts of the profile. The concretion and a few centimeters of clayey silt beneath were removed as lot 9.

Beneath lot 9, the deposits became more clayey. Lot 10 was a 6- to 8-cm-thick layer of brown clayey silt (10YR5/2) with fine laminations and a low density of cultural materials. The underlying lot 11 was another layer of clayey silt with some sand, distinguished from lot 10 by a reddish appearance (10YR3/3). About 12 cm thick, it contained flecks of charcoal but little in the way of sherds. Some fine laminations were visible upon inspection of the profile. The final excavated lot was 12, about 10 cm thick. It was a clayey layer full of bits of charcoal with few sherds.

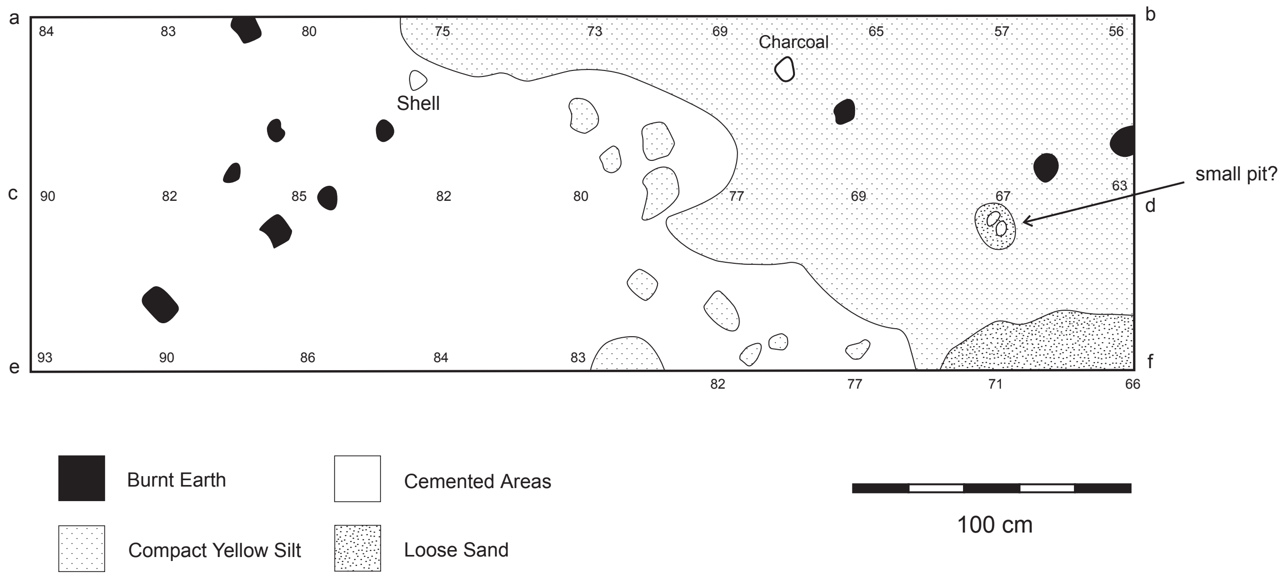


Figure 4.5. Plan of N35W0, lot 9, showing extent of cemented area. Note the abundant fragments of burned earth.

We had been interested in uncovering this layer because we had noticed the charcoal and thought it might be an intact burning feature. It now seems more likely that these are water-lain deposits. Inspection of the profile revealed details of the depositional sequence in this lot not noticed during excavation. The charcoal appears in at least two thin layers, each of which is part of a larger depositional set. In each case, a layer of brown sandy silt is overlain by a thin clayey lens full of charcoal.

N45W0

Chosen to sample some of the earliest deposits of the mound, beginning at the base of the sandy layers that slope off to the south and appear in the large Phase 3 excavation in N35W0. The entire sequence here can be considered part of the sandy edges, and it is possible that all of these layers consist of outwash from primary locations of cultural activities (Figure 4.6). The unit was located at N46.5-48.5, W1.1-1.9 on step 1 (lots 1 through 3)—extended to W0.9-1.9 (lots 4 through 6) once the step had been excavated away (in Figure 2.4, this is the unit under excavation at the right-hand side of the picture).

Water appeared at the base of lot 6. Lot 7 was a shallow penetration beneath the water table in a reduced unit (N47.5-48.5, W0.9-1.9). The unit was excavated in arbitrary levels varying from 15 to 20 cm. The stratigraphy is divisible into four general units. The uppermost unit (lot 1 and upper lot 2) consists of finely laminated lenses alternating between sand and silt (yellow or reddish, 2.5Y4/2, 10YR4/3, 10YR3/3). Lot 1 contained a lens of concentrated charcoal 3 to 5 cm thick. The strata here slope off to the south and east and are clearly outwash. Densities of cultural material were low here and in all lots below these.

The second stratigraphic unit (lots 2 and 3) was a 40-cm-thick layer of brown sand and clay (10YR3/3) that appeared heterogeneous and without bedding. It included chunks of *texcal* and flecks of charcoal. The depositional processes are uncertain, but this could be a layer of salt tailings. Lot 3 ended at the base of step 1, at the lowest level to which we had scraped the profile. At this point, we expanded the unit to a 1-by-2 and continued. The third stratigraphic unit (lots 4 through 6) represented a return to complex laminated deposits consisting of thin layers of reddish sand or sandy silt interspersed with lenses of brown clay or clayey silt.

Basic colors varied from 2.5YR4/2 or 3/2 to 10YR4/3. These layers again probably represent outwash from areas of primary activities. The north-south stratigraphy was nearly horizontal, but the profiles reveal a slope in the strata toward the canal. We ended lot 6 at the water table. The fourth stratigraphic unit remains poorly understood because we were unable to penetrate it to any significant degree. Lot 7 was excavated in a 1-by-1 unit into water. The first 10 cm or so was a continuation of a clayey layer from the bottom of lot 6. It contained a few artifacts. At that depth, we ran into the cemented, greenish, sandy layer (2.5Y4/2)—discussed briefly in Chapter 3—our workmen referred to as *texcal*.

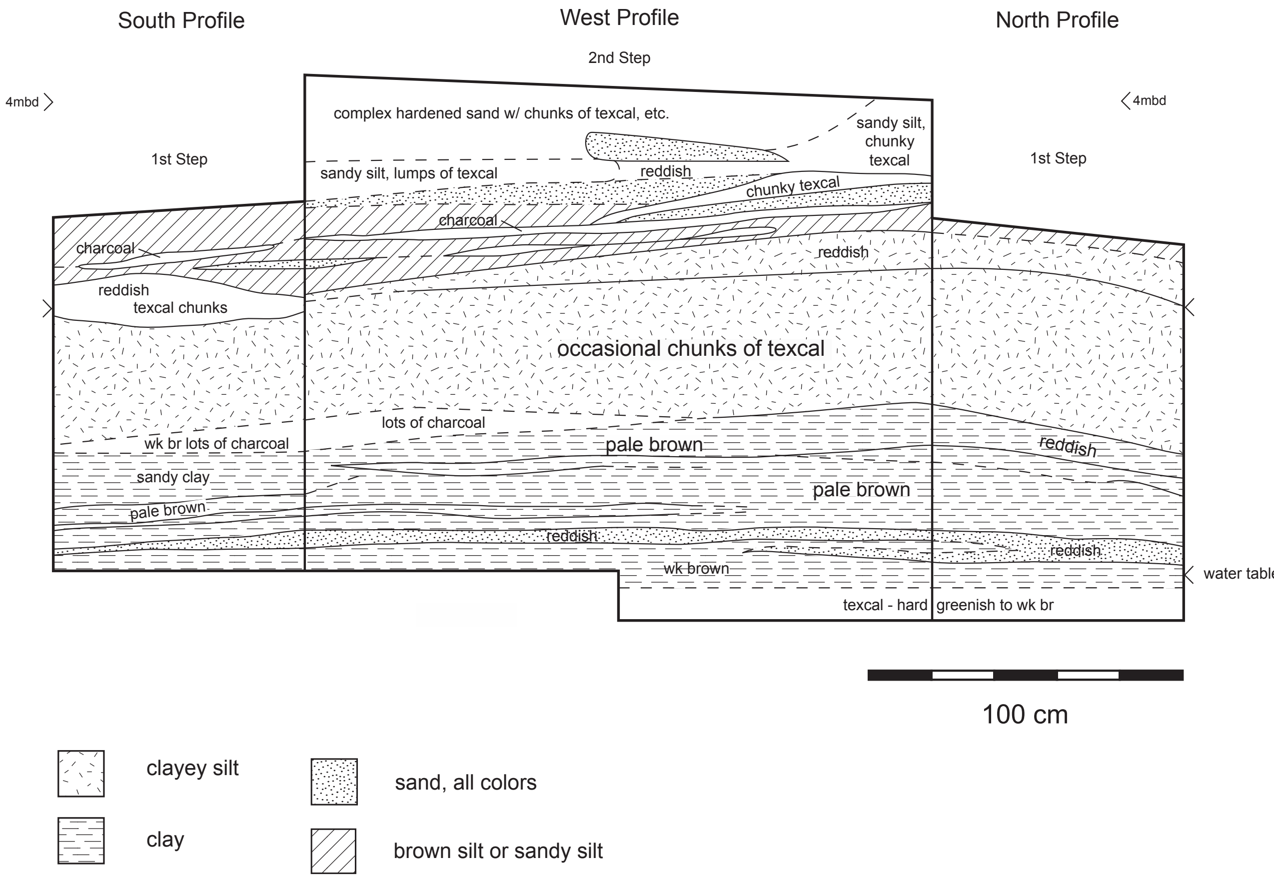


Figure 4.6. Profile of N45W0. Note particularly in the north profile the inclination of layers toward the canal.

Using a pick, we penetrated about 10 cm into this layer—although with great difficulty due to its hardness and the fact that we were operating beneath the water. No cultural debris was recovered (the unit was small). It is possible but not certain that this is a natural sterile deposit underlying the cultural layers at the site, although we really did not penetrate it deep enough to be sure. The cementation is probably the result of natural processes tied in part to the yearly fluctuation of the water table (see Chapter 3 for further comments on cementation). Note that we found small chunks of greenish, sandy, cemented sediment throughout the cultural layers. We believe they arrived atop the mound as part of the sediments from which salt was to be extracted. Stratigraphic period: Early. (These deposits cannot be correlated in a precise way with those of the earliest deposits in lots of the Step Excavation in N55W0. N45W0 lots 4 through 7 are probably earlier than those of N55W0. N45W0 lots 1 and 2 may be later.)

Phase 3 Investigations North of the Mound Core

N60W0 Lots 1 and 2

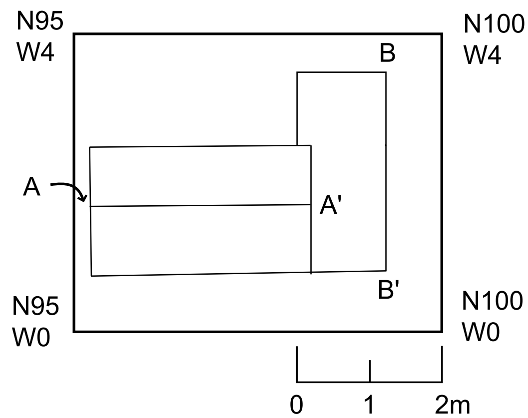
This small excavation sampled an early midden from the northern part of the mound. Its analytical usefulness was eclipsed by the Step Excavation. However, lot 1 derives from the same midden as ST-39 (N65W0/9) downslope to the north from that Step Excavation sample. This midden marks the end of the Early period. Located at N63-65, W1.0-1.8 in step 1. Lot 1 was a brown silt (10YR3/3) with abundant cultural material, including sherds, animal bone, charcoal, and a pestle fragment. Lot 2 was dusky olive (2.5Y3/2) in color. Cultural material, although still abundant, was less dense than in lot 1. In lot 2, we appear to have been entering the types of deposits characterized as sandy edges in Chapter 3. Stratigraphic period: Early. Added to ST sequence as ST-39.1 and ST-39.2.

N80W0 Lots 1 and 2

Removal of a single small pit feature for flotation. Located at N83.3-N84.3 on step 5 and extending only some 20 cm into the profile. The lots removed are part of Burnt Feature 8, described in Chapter 3 (see Figure 3.16). Lot 1 was a thin reddish layer, possibly earth burned in situ. Lot 2 was basin-shaped and black, apparently with a high charcoal content. It may also have been an in-situ burned feature rather than the dumped deposits that constitute so much of the site. No cultural material recovered beyond charcoal. Stratigraphic period: Late.

N95W0

Chosen to sample one of the latest midden deposits at the site. A startling number of figurine fragments recovered from this area during profile scraping suggested significant changes in artifact assemblage, and those suspicions were borne out. Located at N95.2-98.2, W1.7-2.5 in step 2 (lots 1 through 3) and expanded to W0.8-2.5 (lots 4 through 11) in step 1. An L-shaped unit was excavated beside the original one to chase Burial 3. It was located at N3.0-4.2, W2.5-3.5 and N3.2-4.2, W0.8-2.5 and included lots 12 through 20 (Figures 4.7 through 4.9). The stratigraphy in this area



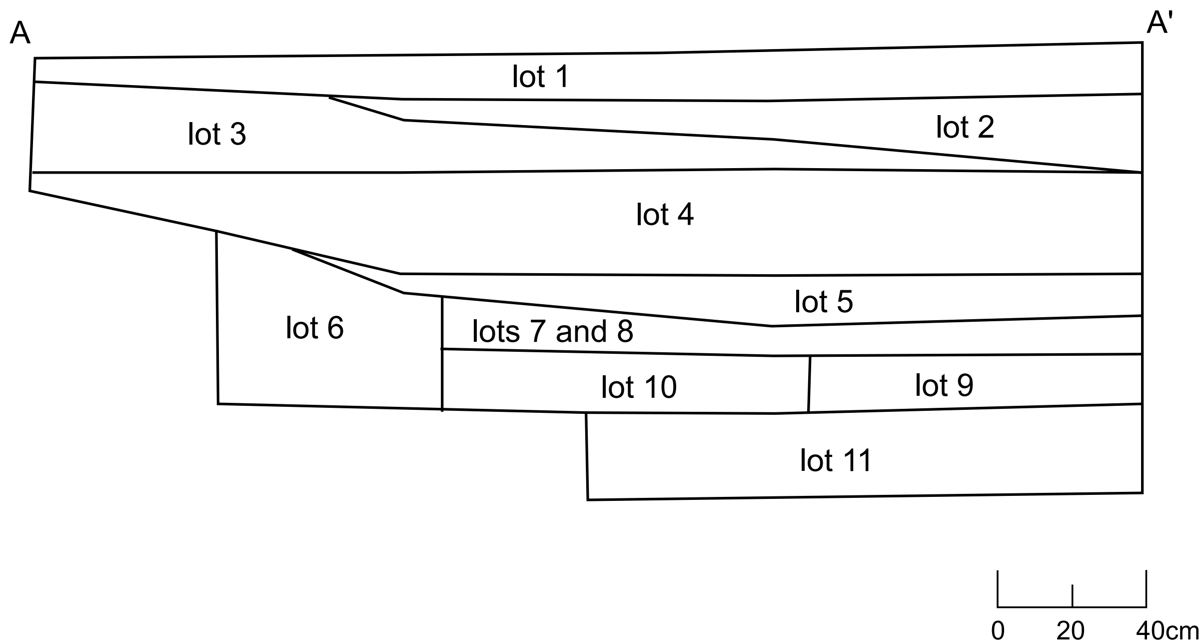


Figure 4.7. Location (top) and schematic profile (bottom) of N95W0 lots.

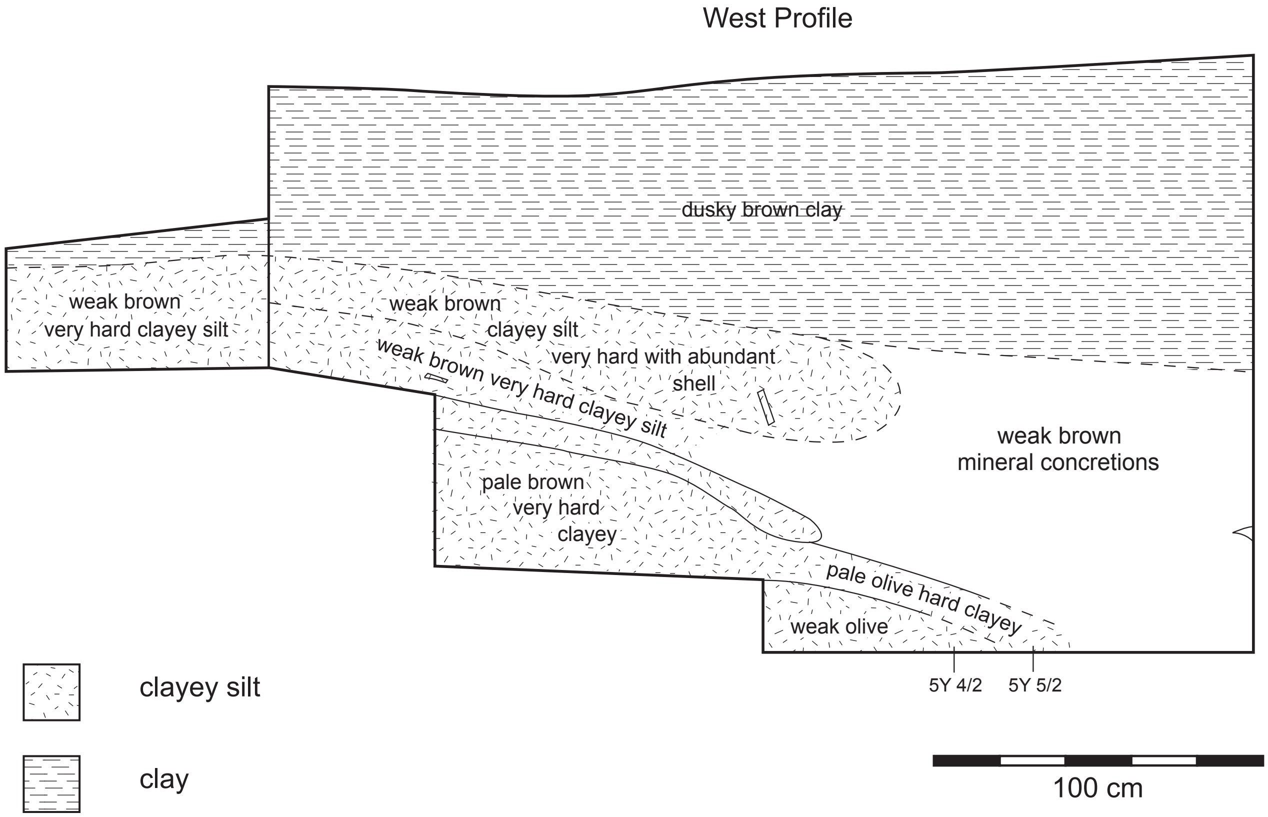


Figure 4.8. Profile of N95W0.

Figure 4.9. Excavations in progress in N95W0. Note again the large mass of bulldozer backdirt in the background.

was much less clear-cut than that within the mound and did not exhibit the onion-like character of layers in the dump-and-fill zone. Unlike our other excavations, the stratigraphic order of lots here does not follow numerical order. The discussion takes them in stratigraphic order from latest to earliest and includes description of two features: the burial and an earthen platform construction.

The latest deposits excavated appeared in the northern extension of the units in lots 12 through 15, all of which appear to be post-abandonment deposits of the last 2,500 years. Lot 12 descended from the modern ground surface to the level of step 2, whereas lot 13 descended an arbitrarily designated 20 cm from there. Both are part of a deposit of organic-rich dusky brown clay (10YR3/2) with very few sherds—the sediment probably deposited during rainy-season conditions through the influx of muddy waters to the estuary. As we descended through two more arbitrary levels (lots 14 and 15), the deposit gradually became less clayey and the number of sherds increased. This layer may have formed from a combination of sediments settling out of rainy-season waters and slope wash down the sides of the mound.

By the bottom of lot 15, we were in a weak brown clayey silt (10YR4/2) with an increased density of sherds. This deposit continued into upper lot 16 and correlated with the first two lots of the original excavation (lots 1 and 2). Beneath this layer was a complex of midden deposits that represents one of the latest at the site. Portions of the midden, however, were doubly disturbed—first by the placement of Burial 3 and then by disturbance of the burial. Both the burial and its disturbance occurred after much of the Terminal-period midden was deposited, and we cannot prove stratigraphically that the burial dates to the Jocotal-phase occupation of the site. That is, however, by far the most probable interpretation (certainly the bone, mineralized to a rock-like hardness, had been in the ground a long time).

Burial 3 was originally an articulated, extended, facedown interment of a robust male (Figure 4.10). The burial pit—which cut through middens in lots 4, 5, 7, 16, and 18—could not be discerned. The matrix

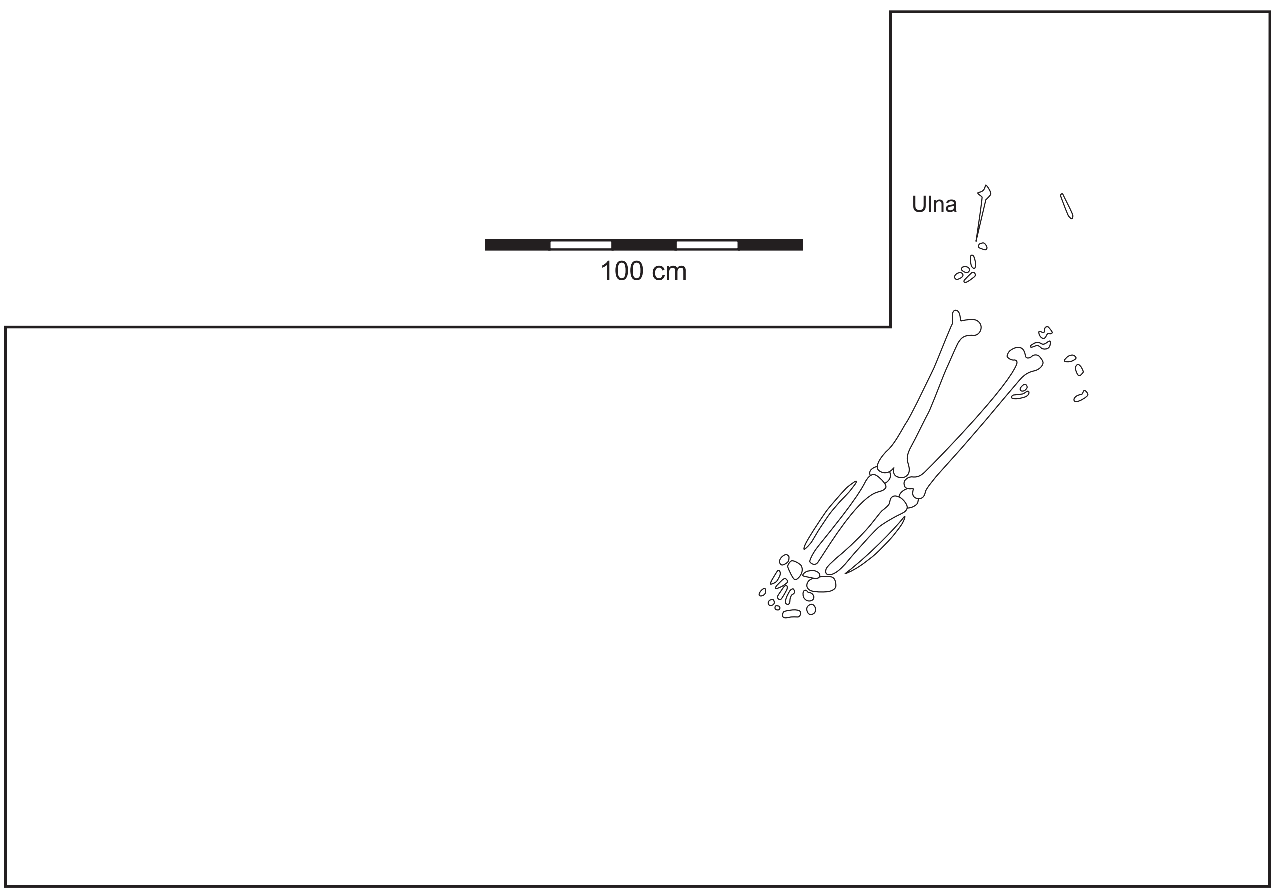


Figure 4.10. Burial 3 in N95W0 at 4.60 cm bd..

immediately surrounding the articulated bone (lots 8 and 8A) was full of the same types of broken artifacts that appeared in the midden. We do not believe that any of these were offerings. During profile scraping, a portion of a ceramic mask was recovered from the zone of burial disturbance—along with a loose arm bone and the figurine fragments previously mentioned. The mask might originally have been a burial offering, but it is more likely to simply have been part of the midden deposit.

After enough time had elapsed for the flesh to have decayed, the burial was disturbed from head to pelvis. Many of the bones had been incorporated into the deposits around, above, and to the west of the feet of the intact bone. The area where most bone should have been was largely empty (Figure 4.11; compare with Figure 4.10). Much of the skeleton was recovered, but vertebrae and cranium were missing (they could have been scattered beyond the excavation unit). A concentration of large sherds lay against the intact femur heads, presumably placed there during the disturbance. A rib fragment near the distal end of the right femur and a few phalanges and a long bone or pelvis fragment below the proximal tip of the same femur indicate that the disturbance cut down very close to the bones left undisturbed.

The disturbance pit, like the original burial cut, was not identifiable—although the distribution of bone suggests that it lay in the northern third of the original unit and the eastern part of the extension (Figure 4.11). The first "floating" bone from the burial (a mandible fragment) was discovered in the screen during excavation of the area of the burial in lot 4 [between 4.08 and 4.36 m below datum (bd)]. More bone appeared at about 4.50 m, and the burial itself was at approximately 4.60 m.

The midden into which Burial 3 penetrated consisted of a clayey silt, pale brown to weak brown in color (10YR5/3 to 4/2), with abundant artifacts heavily encrusted with concretions only partially susceptible to removal by soaking in vinegar. Midden lots include 3 through 5, 7, and 9 through 11 in the original unit and lower 16, 18, and 19 in the extended unit. Because of burial disturbance and an apparent laboratory error in the processing of lots in the extension, only the

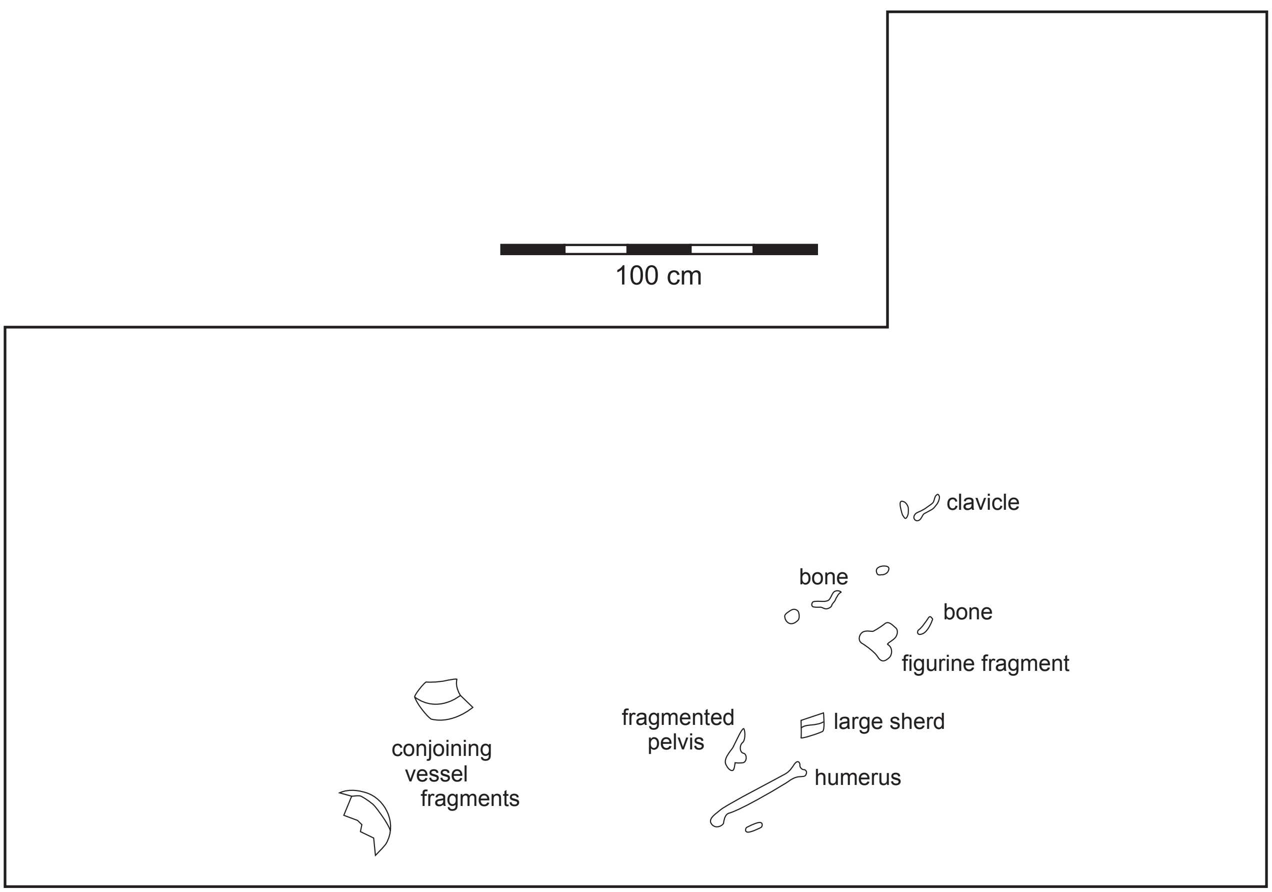


Figure 4.11. Disturbance of Burial 3: scatter of human bones and other artifacts between 4.40 and 4.60 cm bd, above the level of the burial.

original lots through 11 should be considered. There was clearly internal stratigraphy to the midden, with shell common in lots 3 and 4 and absent below them. However, because parts of all midden lots except 3 and 10 were disturbed by Burial 3 these could all be treated as a single analytical unit.

Beneath the burial a reddish clayey layer appeared with a distinct edge and corner (Figure 4.12). In the southern part of the unit, the red layer included the largely unexcavated lot 6. This appears to be part of a purposeful construction, probably a small residential platform from the Terminal period.

Step Excavation of Phase 4

Chosen to provide, with the N95W0 excavations previously described, as close to a complete sequence of mound deposits as we could reasonably collect. Located along more than 30 m of step 3 from N57.0 to N87.5 (Figure 4.13). The 47 excavated lots can be divided into three broad stratigraphic divisions: dump deposits (ST-01 through ST-24), sandy edges (ST-25 through ST-28), and mound core (ST-40 through ST-47). (Lots ST-29 through ST-39 appear to be a complex combination of dumps and sandy edges.) The oldest lot is ST-47, and the youngest is ST-01. ST-47 through ST-39 date to the Early period, ST-38 through ST-17 are Middle period, and ST-16 through ST-01 are Late.

The Terminal-period deposits of N95W0 stratigraphically overlie ST-01. The approximately 8-m gap between ST-01 and the N95W0 excavation contained no significant middens and was dominated by thick deposits of sediment we now consider the debris of salt

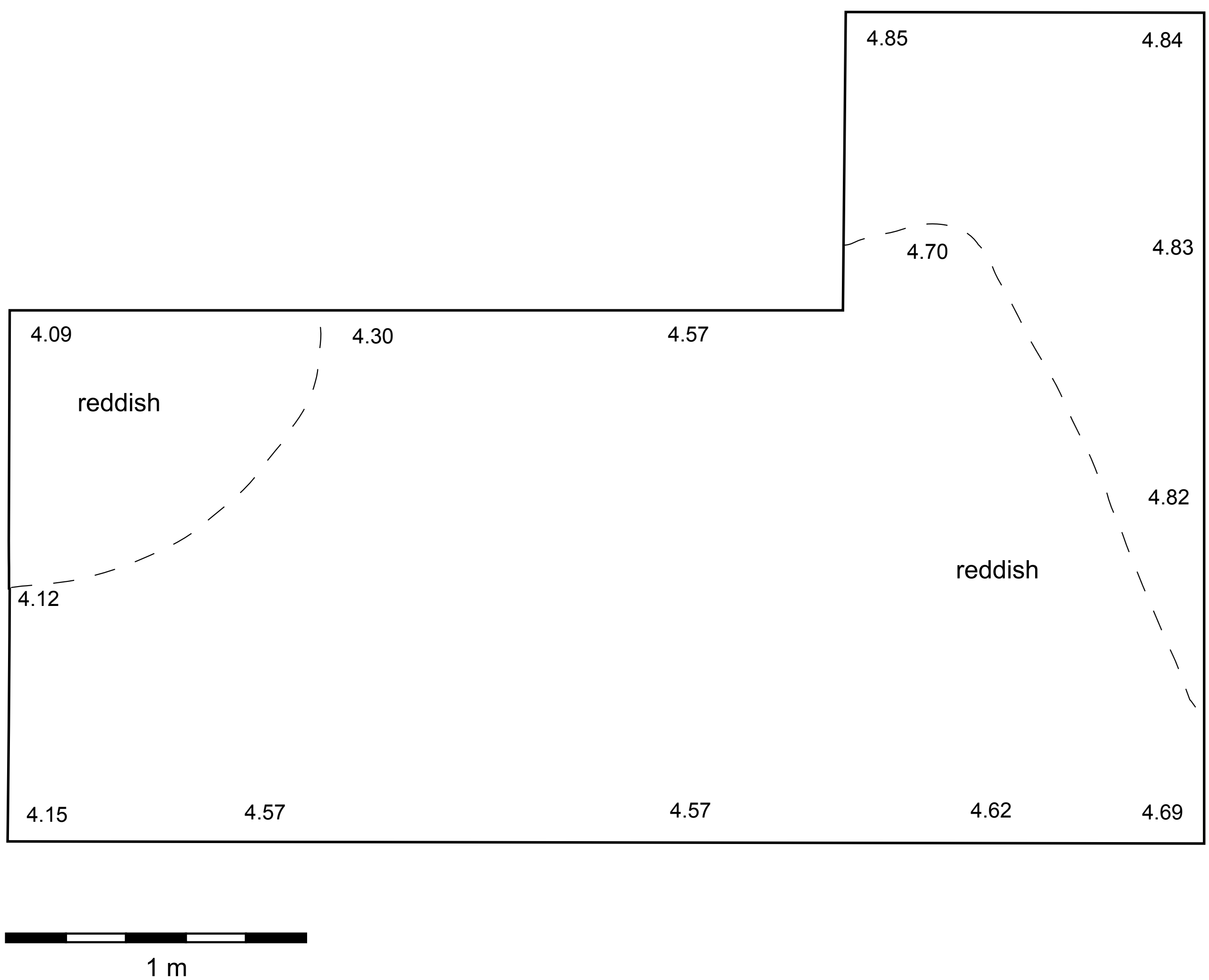


Figure 4.12. Possible residential platform: reddish layers at the bottom of excavations in N95W0, with depths below datum marked.

manufacture and thus the final deposits of the dump zone. We chose not to excavate them due to time constraints and because at the time we considered them analytically uninteresting platform fill. In retrospect, we should have made the extra effort to link the Step Excavation to N95W0. (For more on the lot nomenclature of the Step Excavation, see Chapter 2.)

N85W0

This section of the Step Excavation comprised lots N85W0/0 through N85W0/3, subsequently relabeled ST-01 through ST-04. ST-01 was a small wedge of the large complex of sediment layers, probably salt tailings, between N87 and N95. ST-01 consisted of a very

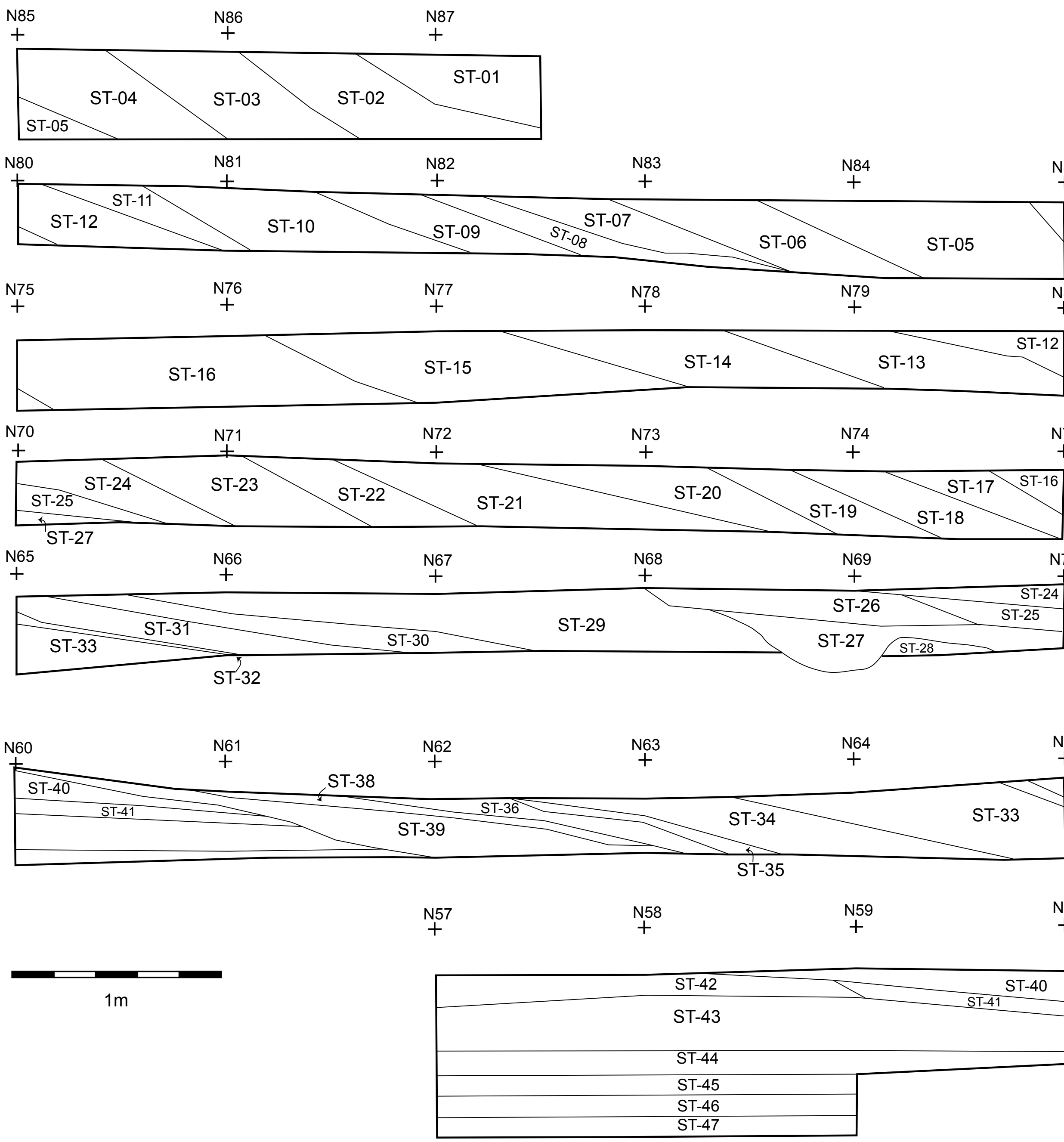


Figure 4.13. Schematic profile of lots in the Step Excavation.

compact light yellowish-brown clay (10YR6/3) with inclusions of chunks of burned earth. Removal of ST-01 left exposed the first of a series of Late-period midden deposits containing material apparently dumped off the surface of the mound. ST-02 consisted of three distinct layers we removed as a single unit approximately 30 cm thick (thickness perpendicular to the slope was estimated for each lot).

First was a thin, dark layer containing charcoal. Underneath were chunks of fire-reddened earth, and below that a layer of extremely dense mollusk shells in a matrix of yellowish-brown clayey silt (10YR5/3) without much evidence of burning. Prevalent species among the shells appeared to change from one part of the midden to another, suggesting multiple dumping episodes. Sherd density was low. The matrix of this shell layer was similar in color and texture to that of the layers we have been interpreting as salt tailings.

ST-03 was another layer (34 cm thick) of compact yellow-brown silty clay containing much shell, including a much higher number of *Amphichaena* sp. than observed in ST-02. The matrix again appeared similar to those we consider salt tailings. In ST-04, we again entered a clear midden deposit (approximately 32 cm thick) that would continue for an additional three lots into N80W0. ST-04 was a dusky brown clayey silt (5YR2/2) with lenses of pale brown clay. It contained many sherds and chunks of burned earth, as well as shell and animal bone. This and the underlying lots through ST-07 derive from refuse dumped off the surface of the mound.

N80W0

This section of the Step Excavation comprised lots N80W0/3A through N80W0/3C, N80W0/4, N80W0/5, N80W0/6A, and N80W0/6B—subsequently relabeled ST-05 through ST-11. ST-05 was a layer approximately 40 cm thick of uncompacted brown silt (5YR4/2) with abundant sherds, shells, and chunks of burned earth. It contained such large numbers of tiny shells of the genus *Amphichaena* that we decided not to collect them. We collected all other shells and took three bags for a soil sample from which the frequency of *Amphichaena* could be estimated. The bottom of the lot was arbitrarily defined along the general slope of the deposits. The underlying ST-06 was therefore part of the same midden. Approximately 20 cm thick, it contained abundant cultural material in an uncompacted matrix of brown silt (5YR4/4)—with fewer sherds than ST-05.

We terminated ST-06 at a thin lens of the yellow-brown silt appearing in the profile of step 3, although we found that this did not continue consistently across the unit. Scraping off that patchy silt lens, we were again atop an uncompacted moderate-brown silt (5YR4/3) with abundant cultural material (22 cm thick). A sharp change in color and compactness to a moderate yellowish-brown (10YR5/3) silt containing many chunks of fire-reddened earth marked the beginning of ST-08 and the end of the thick midden deposit of ST-04 through ST-07. ST-08 is probably debris from salt manufacture. It was 8 cm thick.

Underlying ST-08 was a thin midden layer (ST-09) 10 to 13 cm thick. It was much darker in color (5YR4/2) and less compact than either of the sediment layers between which it was sandwiched and contained abundant cultural material. Underlying this was a deposit of compact pale brown silt (10YR6/2) approximately 50 cm thick, excavated as two lots divided by a faint lighter-colored lens visible on the profile of the step. ST-10 was the thicker of the two lots (approximately 30 cm). It had generally few artifacts but was not entirely homogeneous, containing one small lens of darker sediment with sherds and some patches of cemented sediments. The underlying ST-11 also contained cemented patches, with little cultural material. It appeared to have a higher clay content than ST-10, and was difficult to screen. Both of these layers turned out to be much less homogeneous than they appeared prior to excavation. It seems likely that they represent multiple depositional episodes, probably multiple dumps of the sediment generated in salt manufacture.

N75W0

This section of the Step Excavation comprised lots N75W0/1A through N75W0/1C, N75W0/2A, and N75W0/2B—subsequently relabeled ST-12 through ST-16. ST-11 ended atop another midden deposit, ST-12—the transition marked by a sharp color change (to 5YR4/3, moderate brown silt) and an increase in the density of cultural debris. ST-12 was about 24 cm thick and overlay ST-13, another layer of dense cultural debris in a dark (7.5YR3/2) sandy matrix 24 to 28 cm thick. The underlying ST-14 (approximately 32 cm thick) was lighter colored (10YR4/3), with a continued high density of artifacts. Another sharp color and texture change marked the transition to ST-15, a compact pale brown (2.5Y5/2) silt some 50 cm thick.

Cultural material was significantly less dense here than in the overlying midden, but still present. A thin, pale lens of sandy silt provided the basis for switching to ST-16—although the new lot was similar in color

and compaction to ST-15. ST-16, approximately 90 cm thick, was virtually devoid of cultural material. Some cemented lenses were noted. These last two lots probably accumulated through the discard of sediments from which salt had been extracted. Together, they form the large sediment layer that marks the transition from the Middle to the Late period.

N70W0

This section of the Step Excavation comprised lots N70W0/1A through N70W0/1C, N70W0/2, N70W0/3A, N70W0/3B, N70W0/4, and N70W0/5—subsequently relabeled ST-17 through ST-24. At the bottom of ST-16, another sharp transition in color and density of cultural debris marked the transition to a thick new midden. ST-17 was a dusky brown silt (5YR2/2) 12 to16 cm thick, with abundant bits of charcoal and other artifacts—apparently dumped from the mound surface. The underlying ST-18, approximately 18 cm thick, was compact and pale brown. Some cementation was noted during excavation. This is again probably salt tailings, but it did contain cultural debris of moderate density. ST-19, 18 to 25 cm thick, was an uncompacted brown sandy silt (7.5YR4/2) with abundant sherds, burned earth, and lumps of *texcal*.

Yet another sharp change in color and compactness marked the boundary with ST-20, a pale brown silt (2.5Y6/2) with moderate sherd density. It was 12 to 20 cm thick and represents salt tailings and/or slope wash. The underlying midden, some 50 cm thick, was divided arbitrarily into an upper and lower layer (ST-21 and ST-22) along a line following the general slope of the deposits. It was a weak brown sandy silt (7.5YR4/2) with abundant cultural material. At the bottom of ST-22 was a thin, patchy lens of pale brown silt—which we removed together with ST-22 to expose ST-23, a weak brown silt (7.5YR4/2), 30 cm thick, with abundant cultural material. It seems likely that the patchy layer between ST-22 and ST-23 was an erosional surface. ST-23, like ST-21 and ST-22, accumulated through dumping of debris from the mound surface. At the bottom of ST-23, a gradual transition to a lighter-colored matrix marked the transition to ST-24—a layer of light brown sandy silt, 10 to 16 cm thick, with cultural material.

N65W0

This section of the Step Excavation comprised lots N65W0/1A and N65W0/1B and N65W0/2 through N65W0/7, subsequently relabeled ST-25 through ST-32. With ST-25 and ST-26, we moved from the dump-and-fill zone to sandy edge deposits. In fact, the two contemporaneous lots appear to represent a point of flexion at the base of the mound where dump (ST-26) meets sandy edge (ST-25). ST-26 was a black layer some 16 cm thick, with a high charcoal content. Despite a surprisingly low sherd density, it appears to be a midden along the sloping side of the mound. Very little of it entered step 3, but the layer could be traced in a higher step rising rapidly up the profile to the south. ST-25 was a layer of pure sand 6 to 12 cm thick and full of densely packed sherds lying flat.

It appears to be a water-worked deposit in a seasonally inundated zone at the edge of the mound of its epoch. ST-27 was a brown silty sand 10 cm thick, with abundant cultural material. Along the western edge of the unit, the sand did not appear and we descended in a gray fill into what appears to have been a pit. Only a small portion of this feature was present in our unit. Unfortunately, we did not excavate the pit separately from the silty sand into which it descended. Nevertheless, its existence is noteworthy because it documents human activities on the sandy edges. Underlying the ST-27 silty sand was ST-28, a 10-cm-thick layer of fine pure sand with abundant ceramics.

Beneath ST-28 we left deposits clearly identifiable as sandy edges. From ST-29 through ST-39, we appear to have a complex combination of dumps and potentially water-worked edges as the deposits begin to flatten out toward the mound core. ST-29 was a brown, sandy layer 20 to 30 cm thick and containing abundant cultural debris—apparently a refuse dump. The following two lots, each about 10 cm thick and with abundant cultural material, are of uncertain derivation. ST-30 was moderate brown (7.5YR4/2 to 4/3) and ST-31 weak brown (5YR4/2). ST-31 terminated at a transition to a much lighter color—a pale brown similar to the many layers we consider salt tailings. This was ST-32, a thin (4 to 8 cm) layer that could alternatively be an erosional surface.

N60W0

This section of the Step Excavation comprised lots N60W0/3 through N60W0/9, subsequently relabeled ST-33 through ST-39. From this point on in the Step Excavation the stratigraphy became increasingly subtle and complex. Unfortunately, we excavated these deposits in a hurry during the last few days of the field season. We began N60W0 with the well-established template of strongly marked layering ruling our

thinking. It took excavation of two lots, ST-33 and ST-34, before we perceived a slight reorientation of the stratigraphy (ascending diagonally across the unit toward grid southwest) and a shift to a subtle alternation of yellowish-brown (10YR6/3) and moderate brown (10YR4/3) layers without marked texture differences. The brown layers appeared to contain higher densities of artifacts, including chunks of burned earth. It seems possible, but far from certain, that these represent an alternation of occupational and abandonment/erosional deposits. Only in ST-35 through ST-38 did we do a reasonable job of isolating these stratigraphically.

ST-33, excavated as a layer about 28 cm thick, contained a number of these alternating yellow and brown bands—but it was predominantly a midden of abundant cultural material in a moderate yellowish-brown sandy matrix (10YR4/3). The underlying ST-34, some 20 cm thick, was predominantly a light yellowish brown (10YR6/3). ST-35 was a moderate brown sandy silt 4 to 8 cm thick, with chunks of burned earth and containing very few sherds.

The underlying yellowish layer (ST-36) contained only 53 sherds and was only a few centimeters thick. It did not appear along the western edge of the unit. ST-37 was a moderate brown sandy silt about 10 cm thick, with many chunks of burned earth and considerably more sherds. ST-38, beneath, was a 4- to 6-cm-thick lens of yellowish-brown silt with little cultural material. It was difficult to excavate without popping out sherds from the underlying midden. The last lot of N60W0, ST-39, was also the earliest clear dump deposit of the Step Excavation. It was part of the extensive midden that marks and edge of Early period deposits. It was moderate brown in color, 16 to 20 cm thick, and full of cultural material.

N55W0

This section of the Step Excavation comprised lots N55W0/1 through N55W0/8, subsequently relabeled ST-40 through ST-47. Beneath the ST-39 midden, we entered the mound core. The stratigraphy of these last lots was exceedingly complex. Thin lenses of sand or silt often continued horizontally across a mere 20 to 30 cm before petering out. Cementation such as that described in Chapter 3 occurred in patches, horizontal or sloping gently to the north—often with small bits of burned earth as inclusions. Flecks of charcoal were abundant, and there were even a few very delicate mineralized plant parts: grasses and twigs incorporated into the deposits as they formed.

Cultural material was present but not as dense as in the middens further to the north in the Step Excavation. These deposits appear to derive from informal occupation surfaces that accreted slowly over time. ST-40 was a lens of silty sand with patches of cemented sand as well as cultural material, including burned earth in small bits—perhaps as a result of trampling. Underlying ST-40 were two layers that appeared partially contemporary. To the south was a large patch of cemented sand.

Underlying that was ST-42, a hard yellow-brown sandy silt (10YR5/3) with further small patches of cementation and numerous other small lenses of differing color or texture. This layer slopes gently to the north. Where it sloped off, a thin dark layer with more dense cultural material (ST-41) was sandwiched between ST-40 and ST-42. This may have been a small dump deposit that accumulated at the edge of the ST-42 occupation surface. However, it also contains cemented patches. It must have become gradually incorporated into the occupied surface.

Beneath ST-42, a complex stratigraphy of sands, silts, and cemented patches continued. As time grew short in the last two days of excavation, we switched to arbitrary horizontal layers of 10 cm. ST-43 was the first arbitrary layer beneath ST-42. It consisted of silts and sands in thin patchy lenses (10YR4/3). The underlying ST-44 was identical. ST-45, below, consisted of sands and sandy silts in lighter and darker horizontal lenses. Flecks of charcoal were abundant. The succeeding ST-46 was the same, as was ST-47—the final lot excavated.

Progress on Research Topics

Contributions of the excavations to the research topics (beyond those provided in Chapter 3) are modest.

- *The site setting and the nature of productive activities.* The N35W0 and N45W0 excavations provide further evidence of the important role of water in the formation of the sandy edges. Layers probably cemented by natural processes are also described for these units. Cementation in cultural deposits of the mound core and in dumps of salt-manufacture debris is described in discussion of the Step Excavation (N80W0, N75W0, N70W0, and N55W0). The fine-grained stratigraphy of the mound core is described in N55W0 of the Step Excavation.

- *Permanence of the occupation at El Varal*. The excavations in N95W0 produced important information on the Terminal-period occupation of the mound. A burial and a possible residential platform are described in this chapter, and the artifacts analyzed in Chapters 9 through 11 and 14.

Analytical Potential of Excavated Materials

Most excavated materials from El Varal derive from secondary deposits (refuse swept up from its locus of primary use and dumped elsewhere) or from tertiary contexts involving reworking of secondary dumps by natural forces or cultural activities. As secondary refuse, however, the El Varal dump deposits are analytically attractive due to the rapidity with which they were deposited and covered over. They provide a significant sample for exploring economic activities at an early estuary site of the Soconusco and hold out the possibility for study of short-term changes or fluctuations in such activities.

Analyses should take into consideration that we excavated no complete middens. We recovered only small samples of individual dump deposits. The excavated lots described previously are summarized in Tables 4.1 through 4.3. Excavated lots are grouped into two sequences [Phase 3 South (code P3) and the Step Excavation (code ST)] and are numbered in reverse order from latest to earliest, following the system chosen to number the Step Excavation lots in sequence of excavation. As an aid to analysis, lots are categorized somewhat crudely as to deposit type according to previous discussion.

Volumes of excavated lots have been calculated based on plans and beginning/ending depths measured using line levels. The calculations proved challenging given the odd shapes of the lots in slanting stratigraphy, and they should not be considered highly precise (probably ±0.3 m^3, which is of the same order as the actual values in many cases). The volume estimates should nevertheless be accurate enough to help identify broad patterns of artifact density.

Materials excavated at El Varal have been well curated at the New World Archaeological Foundation laboratory in San Cristóbal de Las Casas, Chiapas, since 1992. Given the length of time between excavation and full analysis, the collection is in remarkably good shape. At the time of analysis, in 2003 and 2004, many bags had not been open since processing in the field—and some had not been washed. A few problems, however, should be noted.

The vast quantity of materials (chiefly pottery) recovered in the excavations overwhelmed the field lab we were running, leading to errors in the washing of several bags of sherds. Those have not been included in the ceramic analysis. For reasons we can no longer reconstruct, several small bags of animal bone were not exported to UCLA for analysis. These remain unanalyzed. Finally, we have no bags of shell from excavations in N45W0. We suspect that this is due to missing bags rather than absence of shell, but we are not sure.

Materials from El Varal can be broken down temporally in a variety of ways. For much of the occupation of the mound, the assemblage is broadly homogeneous. One valid mode of analysis would thus be to pool all lots except those from N95W0. The ceramic assemblage in this last unit is so different from those of all other excavations that there will be few circumstances in which it will be appropriate to lump this unit with others at the site. For studies in which an internal chronology is of interest, the four stratigraphic periods identified in Chapter 3 are straightforward and useful. A second division of the deposits into shell phases is described in Chapter 5.

Table 4.1. Phase 3 stratigraphic sequence

Sequence Number	Provenience	Classification of Deposit	Volume Excavated (m^3)	Number of Sherds	Wt. of Sherds (kg)	Stratigraphic Period[a]	Shell Phase[b]
P3-01	N15W0/1	Salt tailings	0.06	87	2.81	Late	Late
P3-02	N15W0/2	Uncertain	0.15	440	12.82	Late	Late
P3-03	N15W0/3	Dump midden	0.08	226	6.46	Late	Late
P3-04	N15W0/4	Dump midden	0.09	256	8.74	Late	Late
P3-05	N25W4/1	Uncertain	0.05	285	7.64	Late	Late
P3-06	N25W4/2	Dump midden	0.11	213	6.06	Late	Late
P3-07	N25W4/2A	Dump midden	0.03	—[c]		Late	Late
P3-08	N25W4/3	Dump midden	0.13	148	5.71	Late	Late
P3-09	N25W4/4	Uncertain	0.19	235	10.86	Late	Late
P3-10	N35W4/1	Uncertain	0.18	392	9.05	Middle	Middle
P3-11	N35W4/2	Dump midden	0.22	—[d]		Middle	Middle
P3-12	N35W4/3	Dump midden	0.79	—[d]		Middle	Middle
P3-13	N35W4/4	Dump midden	0.09	—[d]		Middle	Middle
P3-14	N35W4/5	Uncertain	0.25	594	14.37	Middle	Middle
P3-15	N35W4/6	Salt tailings	0.46	2,056	56.67	Middle	Middle
P3-16	N35W4/7	Dump midden	0.31	503	11.83	Middle	Middle
P3-17	N35W4/8	Dump midden	0.35	1,968	66.84	Middle	Middle
P3-18	N45W4/1	Dump midden	0.53	—[d]		Middle	Early
P3-19	N45W4/2	Dump midden	0.28	—[d]		Middle	Early
P3-20	N35W0/1	Dump midden	0.04	280	7.24	Middle	Early
P3-21	N35W0/2	Outwash midden	0.02	153	4.83	Middle	Early
P3-22	N35W0/3	Salt tailings	0.12	358	8.27	Middle	Early
P3-23	N35W0/4	Outwash midden	0.11	1,236	25.521	Middle	Early
P3-24	N35W0/5	Outwash	0.15	492	14.35	Middle	Early
P3-25	N35W0/6	Outwash midden	0.13	872	23.317	Middle	Early
P3-26	N35W0/7	Uncertain	0.89	1,530	38.717	Middle	Early
P3-27	N35W0/8	Outwash	0.55	606	22.105	Early	Early
P3-28	N35W0/9	Outwash	0.29	139	4.18	Early	Early
P3-29	N35W0/10	Outwash	0.36	109	4.4	Early	Early
P3-30	N35W0/11	Outwash	0.49	441	8.4	Early	Early
P3-31	N35W0/12	Outwash	0.32	137	4.64	Early	Early
P3-32	N45W0/1	Outwash	0.30	348	9.37	Early	Early
P3-33	N45W0/2	Outwash	0.34	245	8.22	Early	Early
P3-34	N45W0/3	Uncertain	0.32	281	7.59	Early	Early
P3-35	N45W0/4	Outwash	0.42	278	6.75	Early	Early
P3-36	N45W0/5	Outwash	0.30	40	0.97	Early	Early
P3-37	N45W0/6	Outwash	0.32	102	1.507	Early	Early
P3-38	N45W0/7	Outwash	0.14	67	1.24	Early	Early

a. See Chapter 3.
b. See Chapter 5.
c. Sediment sample; ceramics not analyzed.
d. Ceramics never analyzed.

Table 4.2. Step excavation stratigraphic sequence

Sequence Number	Provenience	Classification of Deposit	Volume Excavated (m³)	Number of Sherds	Wt. of Sherds (kg)	Stratigraphic Period[a]	Shell Phase[b]
ST-00	N95W0/4+3	Dump midden	1.37	1,785	57.3	Terminal	Terminal
ST-00.1	N95W0/5,7-11	Disturbed midden	2.05	1,899	71.7	Terminal	Terminal
ST-01	N85W0/0	Salt tailings	0.10	—[c]		Late	Late
ST-02	N85W0/1	Dump midden	0.22	285	6.4	Late	Late
ST-03	N85W0/2	Uncertain	0.20	702	15.8	Late	Late
ST-04	N85W0/3	Dump midden	0.18	1,379	23.9	Late	Late
ST-05	N80W0/3A	Dump midden	0.35	2,199	55.4	Late	Late
ST-06	N80W0/3B	Dump midden	0.17	1,450	31.2	Late	Late
ST-07	N80W0/3C	Dump midden	0.12	748	18.0	Late	Late
ST-08	N80W0/4	Salt tailings	0.08	—[d]		Late	Middle
ST-09	N80W0/5	Dump midden	0.10	278	9.4	Late	Middle
ST-10	N80W0/6A	Salt tailings	0.19	—[d]		Late	Middle
ST-11	N80W0/6B	Salt tailings	0.06	—[d]		Late	Middle
ST-12	N75W0/1A	Dump midden	0.18	671	15.4	Late	Middle
ST-13	N75W0/1B	Dump midden	0.21	2,154	51.8	Late	Middle
ST-14	N75W0/1C	Dump midden	0.20	1,563	41.5	Late	Middle
ST-15	N75W0/2A	Salt tailings	0.27	356	8.5	Late	Middle
ST-16	N75W0/2B	Salt tailings	0.33	64	2.4	Late	Middle
ST-17	N70W0/1A	Dump midden	0.07	332	10.6	Middle	Middle
ST-18	N70W0/1B	Uncertain	0.09	196	7.8	Middle	Middle
ST-19	N70W0/1C	Dump midden	0.09	872	21.7	Middle	Middle
ST-20	N70W0/2	Salt tailings	0.13	354	10.6	Middle	Middle
ST-21	N70W0/3A	Dump midden	0.24	—[c]		Middle	Middle
ST-22	N70W0/3B	Dump midden	0.12	837	23.0	Middle	Middle
ST-23	N70W0/4	Dump midden	0.14	643	16.0	Middle	Middle
ST-24	N70W0/5	Uncertain	0.12		18.9	Middle	Middle
ST-25	N65W0/1A	Outwash midden	0.06	1,267	30.4	Middle	Middle
ST-26	N65W0/1B	Dump midden	0.10	219	6.2	Middle	Middle
ST-27	N65W0/2	Uncertain	0.10	770	21.1	Middle	Early
ST-28	N65W0/3	Outwash/inundation	0.06	318	8.9	Middle	Early
ST-29	N65W0/4	Dump midden	0.34	1,592	37.6	Middle	Early
ST-30	N65W0/5	Uncertain	0.11	380	7.6	Middle	Early
ST-31	N65W0/6	Uncertain	0.11	249	5.5	Middle	Early
ST-32	N65W0/7	Erosional surface	0.04	49	1.1	Middle	Early
ST-33	N60W0/3	Uncertain	0.23	692	16.8	Middle	Early
ST-34	N60W0/4	Uncertain	0.14	489	9.9	Middle	Early
ST-35	N60W0/5	Occupation outwash	0.03	37	0.6	Middle	Early
ST-36	N60W0/6	Occupation outwash	0.02	53	1.4	Middle	Early

Table 4.2. *(continued)*

Sequence Number	Provenience	Classification of Deposit	Volume Excavated (m^3)	Number of Sherds	Wt. of Sherds (kg)	Stratigraphic Period[a]	Shell Phase[b]
ST-37	N60W0/7	Occupation outwash	0.08	449	12.3	Middle	Early
ST-38	N60W0/8	Occupation outwash	0.07	183	4.4	Middle	Early
ST-39	N60W0/9	Dump midden	0.20	1,351	37.2	Early	Early
ST-39.1	N60W0/1	Dump midden	0.32	1,206	33.4	Early	Early
ST-39.2	N60W0/2	Uncertain	0.46	486	12.8	Early	Early
ST-40	N55W0/1	Occupation surfaces	0.12	314	7.1	Early	Early
ST-41	N55W0/2	Occupation midden	0.08	463	11.8	Early	Early
ST-42	N55W0/3	Occupation surfaces	0.13	133	3.0	Early	Early
ST-43	N55W0/4	Occupation surfaces	0.64	852	16.4	Early	Early
ST-44	N55W0/5	Occupation surfaces	0.19	680	14.2	Early	Early
ST-45	N55W0/6	Occupation surfaces	0.18	297	5.7	Early	Early
ST-46	N55W0/7	Occupation surfaces	0.30	458	9.8	Early	Early
ST-47	N55W0/8	Occupation surfaces	0.30	829	13.2	Early	Early

a. See Chapter 3.
b. See Chapter 5.
c. Laboratory error: pottery from N85W0/0 and N70W0/3A mixed during washing.
d. Laboratory error: pottery from N80W0/4, 6A, and 6B mixed during washing.

Table 4.3. N95W0 lots

Provenience	Volume Excavated (m^3)	Number of Sherds	Wt. of Sherds (kg)
N95W0/01	0.39	353	6.5
N95W0/02	0.18	155	2.3
N95W0/03	0.38	287	8.6
N95W0/04	0.99	1,498	48.7
N95W0/05	0.46	527	17.5
N95W0/06	0.35	—	—
N95W0/07	0.38	390	14.4
N95W0/08	—[a]	132	3.7
N95W0/08A	—[b]	179	5.1
N95W0/09	0.23	253	9.4
N95W0/10	0.30	286	12.7
N95W0/11	0.68	311	14.0
N95W0/12	0.33	21	0.5
N95W0/13	0.37	40	0.7
N95W0/14	0.38	114	2.2
N95W0/15	0.42	131	1.8
N95W0/16	0.60	181	5.4
N95W0/17	0.31	328	10.7
N95W0/18	0.57	178	5.0
N95W0/19	0.30	178	5.0
N95W0/20	0.44	61	2.1

a. Included with volume for lot 7.
b. Included with volume for lot 18.

Part II

Analysis of Finds and the Issue of Intra-site Variability

CHAPTER 5

Changing Patterns of Shellfish Exploitation

Richard G. Lesure, Alina Gagiu, Brendan J. Culleton, and Douglas J. Kennett

Although El Varal is in no sense a "shell mound," the shells of mollusks and gastropods are common there. In a series of deposits from late in the occupation of the mound, shells outnumbered sherds by a considerable margin. In earlier deposits, sherds were likely to outnumber shells. These two classes of evidence together constitute the bulk of materials recovered from the site. We begin with shells in the presentation of El Varal artifacts because patterns of shellfish exploitation provide the basis for a chronological division of deposits alternative to the stratigraphic periods presented in Chapter 3. The "shell phases" defined here will be referred to repeatedly throughout the remainder of the volume. We use "periods" for stratigraphic divisions and "phases" for shell-based divisions in the hopes of avoiding confusion between the two schemes. Both, however, refer solely to the internal stratigraphy of the Vásquez Mound. Thus, the shell phases are not formal "phases" in the usual archaeological sense (as is, for example, the Jocotal phase).

Shells were identified by Gagiu, and stratigraphic analysis was conducted by Lesure. Information on habitat is provided by isotopic analysis of clam shells conducted by Kennett and Culleton (see also Chapter 13). Most common and consistently represented were four bivalves: the ark shell, *Anadara grandis* (MNI 764); a marsh clam, *Polymesoda radiata* (MNI 287); and two Venerid clams, *Chione subrugosa* (MNI 1,420) and *Protothaca metodon* (MNI 4,727). A diminutive fifth bivalve, *Amphichaena kindermanni* (estimated MNI 24,935), appeared in great numbers in a few Late-period deposits (Figures 5.1 through 5.3). More than 30 other distinct species were identified, mainly from Late-period deposits.

Identifications

Where necessary, shells were first washed of excess dirt. Vinegar proved useful in removing sandy concretions. Dried shells were arranged by lot on a large table and separated based on visual markers. Bivalves were segregated by "right" and "left." For each lot, a minimum number of individuals (MNI) of each species was designated as the number of right or left hinges—whichever value was higher.

Identifications as to species, genus, and family are based on the second edition of *Sea Shells of Tropical West America* by A. Myra Keen (1971). We relied primarily on modern range and physical markers (pattern, size, unique markings, beak position, and hinge size or design) in identification. Coloring was typically washed out after 3,000 years of deposition. Cases in which there is strong resemblance to a taxon described by Keen but

Figure 5.1. *Anadara grandis.*

Figure 5.2. *Chione subrugosa* (left) and *Protothaca metodon* (right).

Figure 5.3. *Polymesoda radiata* (right), *Amphichaena kindermanni* (lower left), *Cerithidea mazatlanica* (upper left), and *Cerithidea valida* (top center).

not all markers appear to match are tagged with a "cf." ("compares favorably").

The modern geographical ranges of several of the species identified do not include the Mazatán region. Keen (1971) reports the northernmost limit of *Polymesoda radiata* as Nicaragua, but the presence of this species in the Soconusco during the Archaic and Formative has previously been established by Coe and Flannery (1967) and Kennett and Voorhies (1996). *Melampus carolianus* is reported by Keen from Costa Rica to Ecuador. The only other possibility in Keen (1971) would be *Melampus mousleyi*. The latter is less conical in shape than ours, with a higher spire. It is also confined to a small part of Baja California.

Keen states that *Tellina decumbens* "seems" to be found only in Panama. The shells we designate cf. *Tellina decumbens* match Keen's description and picture (the pallial sinus touches the anterior abductor scar). Finally, one species of the genus *Anadara* we identify only tentatively as *A. similis*. The species is reported by Keen from Ecuador north only as far as Nicaragua. The other possibility for the shells in question is *Anadara tuberculosa*, which would be in its modern range. Our shell has nodes, as *Anadara tuberculosa* should. However, *A. tuberculosa* is also described as "thick"—whereas our shells seem thin. Further, our shells are elongate and fit the illustration of *A. similis* quite well.

Each taxon was weighed and counted by lot. It rapidly became clear, however, that any use of weights would be problematic because even after washing many shells remained encrusted with sediment. We consider only counts here. Shells are stored at the New World Archaeological Foundation (NWAF) laboratory in San Cristóbal. Gagiu visited in August of 2003, for one month. At the end of that period, the following bags remained unanalyzed: N85W0/0, N75W0/1A, N75W0/2B, N70W0/1B, N70W0/2, N70W0/3B, N55W0/2, N55W0/6, N55W0/8, N35W0/9, and N25W4/3. Most of these were small.

There were no shells from the excavations in N45W0 and N45W4. Shells were also scarce in N95W0 (we found bags only for lots 1, 3, and 4). In addition, no bags corresponded to the following lots: N80W0/6A, N70W0/1A, N65W0/3, N65W0/5, N60W0/4-8, N55W0/3, N35W4/1-5, and N35W0/10-12. It is possible that some bags of shells have been misplaced in the last 10 years. We are especially concerned about this in the case of N45W0.

Two lots, N80W0/3A and N25W4/2, contained huge numbers of *A. kindermanni* shells. All such shells in N25W4/2 were collected during excavation, but the numbers recovered were so great that counting was not feasible in the time available. A sample was counted and weighed. The remaining uncounted shells were then weighed, and an estimated total number calculated based on the count/weight of the sample. During excavation of N80W0/3A, *A. kindermanni* shells were not collected (but all other shell taxa were saved). A sample of matrix was collected with the idea of estimating the original number of *A. kindermanni* based on the frequencies of other taxa.

Estimates were made based on the most common other shells in the sample (*C. subrugosa* and *P. metodon*), and the two results were averaged to estimate the original number of *A. kindermanni*. The estimate is of the right order of magnitude, but it could be off by a few thousand of these tiny shells. Although our MNI values for *A. kindermanni* in these two lots are mere estimates, we have used these values in various analyses (as noted below). It has seemed important to note that very large numbers of the shells were harvested in a few isolated episodes late in the occupation of the mound. Shells modified by humans were separated and placed in labeled bags for further investigation (see Chapter 10).

Because there was considerable inter-species variation in shell size, we devised the following method to estimate meat weights. We use it only to assess the relative distribution of meat weight among the five main shell species. No reliable relation to actual meat weights should be assumed. For each species, at least six valves were selected: two that appeared to be of larger size, two of smaller size, and two that seemed average in size. Plasticine was pressed into each valve, and then extracted and weighed. These were doubled to obtain heuristic meat-weight values for an entire two-valve animal. Averages and ranges were as follows: *A. grandis* 65 g (13.8–132.6 g), *A. kindermanni* 0.7 g (0.4–1.0 g), *Chione subrugosa* 8.6 g (4.2–15.0 g), *P. radiata* 12.4 g (2.6–21.6 g), and *P. metodon* 17.9 g (9.8–27.4 g).

General Patterns

The raw data, consisting of MNI counts of each species by lot, are presented in Tables 5.1 and 5.2. The most striking pattern is the extraordinary variation in numbers of shells from lot to lot, especially in the later part of the sequence. The obvious implication is that deposition of shell did not occur at a constant rate. It seems likely that site occupants engaged in occasional intensive harvesting along with low-level expedient collecting throughout the period of deposition of the Vásquez Mound. Nevertheless, we will also suggest that the character of intensive harvesting changed over time.

A conversion to meat-weight values points up the importance of *A. grandis*. If we discount *A. kindermanni* (which occurs primarily in just two lots), *A. grandis* makes up 10.6 percent of the four most common species by count. However, it contributes 33.8 percent of meat weight. The pattern is even stronger when the deposits are broken down by stratigraphic period (Table 5.3). *A. grandis* dominates meat weight everywhere, except in the Late period—when it is overtaken by *P. metodon*. If *A. kindermannis* is added to Late-period calculations, it contributes 12.7 percent of the meat weight (*P. metodon* falls to 59.8 percent).

The other notable patterns in Table 5.3 are the sharp decline in *P. radiata* after the Early period, the sharp increase in *P. metodon* in the Late period, and the fluctuations in percentages of *A. grandis* and *C. subrugosa*. A useful alternative perspective is provided by considering the density of shells per unit volume for each species (Table 5.4). The densities of *A. grandis* and *C. subrugosa* actually increase steadily from the Early through Late periods. Their decline in percentage in the Late period is the result of the extraordinary rise in the density of *P. metodon*.

Our Terminal-period sample is smaller than the others, derived from a single midden. In addition, in contrast to other lots the shells from N95W0 were eroded and fragile because they had lain exposed a long time or because they were deposited in clay. It seems, nevertheless, that basic patterns continued from the Early through the Terminal period: one species (*P. radiata*) was important early on and dropped out over time, whereas the other three principal species formed a loose triad that increased in importance as *P. radiata* declined.

An analysis of these patterns lot by lot in the two stratigraphic sequences demonstrates that overall patterns are robust (in that they appear in both sequences), and reveals further detail. Characterizing both sequences are the gradual disappearance of *P. radiata*, the appearance of denser shell middens later in the sequence, and in the Late period itself a sharp rise in the importance of *P. metodon* and occasional deposition of vast numbers of *A. kindermannis*. Figures 5.4 and 5.5 show changes in “meat-weight density” by lot, with the principal species first lumped and then split.

Table 5.1. Shells identified by lot in the Step Excavation*

Sequence Number	Provenience	Stratigraphic Period	Shell Phase	Volume (m^3)	A. grandis	P. radiata	C. subrugosa	P. metodon	A. kindermanni	Rare Shells
ST-00.1	N95W0/3-4	Terminal	Late	1.37	42		112	95	22	a-80, e-30, i, k-2, v, z-2
ST-02	N85W0/01	Late	Late	0.22	46	4	147	1,976	83	a-43, d, g-2, i-4, j-10, k-2, u-29, w, y-3, aa-7
ST-03	N85W0/02	Late	Late	0.20	48	1	66	208	227	a-45, e, h-2, i-7, k-3, l, o, t, u-2, y-2, aa
ST-04	N85W0/03	Late	Late	0.18	10	1	5	7	3	a, h-14, i-25
ST-05	N80W0/03A	Late	Late	0.35	136		182	469	11,490	a-19, h, i-8, n, q, r-8, t, v-2, z-3
ST-06	N80W0/03B	Late	Late	0.17	5	1	6	11	2	a-4, i-2, o, u
ST-07	N80W0/03C	Late	Late	0.12	7	1	6	24	1	k, o-2
ST-08	N80W0/04	Late	Late	0.08	7	1	2	10		i-3, u, v
ST-09	N80W0/05	Late	Middle	0.10	8	2	3	6		a, i, k, t
ST-13	N75W0/01B	Late	Middle	0.21	12	3	41	13		a-2, f-2, i-5, k, o-2, w
ST-14	N75W0/01C	Late	Middle	0.20	25	4	49	26		a, g-6, i-8, o-2, w-2
ST-15	N75W0/02A	Late	Middle	0.27	2	1	8	1		
ST-19	N70W0/01C	Middle	Middle	0.09	14	1	28	2		
ST-21	N70W0/03A	Middle	Middle	0.24	4	4	1			g-4, i
ST-23	N70W0/04	Middle	Middle	0.14	14	4	1	1		a, g-9
ST-24	N70W0/05	Middle	Middle	0.12	23	8	3			d, i, u
ST-25	N65W0/01A	Middle	Middle	0.06	13	7	3			g-118
ST-26	N65W0/01B	Middle	Middle	0.10	1	1				
ST-27	N65W0/02	Middle	Early	0.10	2	4		1		
ST-29	N65W0/04	Middle	Early	0.34	11	49	10	2		a, g-27, n-5
ST-31	N65W0/06	Middle	Early	0.11	1	4	1	1		
ST-33	N60W0/03	Middle	Early	0.23	3	1		2		g, n, o
ST-39	N60W0/09	Early	Early	0.20	2	6	3	2		b, g-2
ST-39.1	N60W0/01	Early	Early	0.32	7	7	7	1		g-11
ST-39.2	N60W0/02	Early	Early	0.46	8	6	10	2		p
ST-40	N55W0/01	Early	Early	0.12	1	3	1			
ST-43	N55W0/04	Early	Early	0.64	4	104	6	1		c, g-4, n-2, p,
ST-44	N55W0/05	Early	Early	0.19	7	11	13	1		g-5
ST-46	N55W0/07	Early	Early	0.30	10	21	7	1		g-212, n-4

* The letters in the last column of this table and in Table 5.2 refer to rare species as follows. The count follows each letter, unless there is only a single shell.

a. *Agaronia propatula*
b. *Anadara bifrons*
c. cf *Anadara esmeralda* or *reinharti*
d. cf *Anadara perlabiata*
e. *Anadara* sp. (cf *A. similis*)
f. *Bulla gouldiana*
g. cf *Cerithidea mazatlanica*
h. *Cerithidea montagnei*
i. cf *Cerithidea valida*
j. *Cyclinella saccata*
k. cf *Dosinia dunkeri*
l. *Melampus carolianus*
m. *Modulus catenulatus*
n. cf *Mytella speciosa*
o. *Natica othello*
p. cf *Noetia reversa*
q. cf *Ostrea columbiensis* or *iridescens*
r. *Ostrea conchaphila*
s. cf *Ostrea conchaphila*
t. cf *Ostrea palmula*
u. *Pitar tortuosus*
v. cf *Polinices uber*
w. *Rhinocoryne humboldti*
x. *Tagelus peruvianus*
y. cf *Tellina decumbens*
z. *Thais biserialis*
aa. *Tivela planulata*

Table 5.2. Shells identified by lot in the Phase 3 South excavations

Sequence Number	Provenience	Stratigraphic Period	Shell Phase	Volume (m^3)	A. grandis	P. radiata	C. subrugosa	P. metodon	A. kindermanni	Rare Shells[a]
P3-01	N15W0/01	Late	Late	0.06	2		1	8	1	g
P3-02	N15W0/02	Late	Late	0.15	27	1	13	138		a-4, e, g, k-3, u-5, aa
P3-03	N15W0/03	Late	Late	0.08	51		12	315		a, e-2, j, k-3, u-6
P3-04	N15W0/04	Late	Late	0.09	66		8	457		e-10, j, k-5, t, u-7
P3-05	N25W4/01	Late	Late	0.05	1		2	8	16	
P3-06	N25W4/02	Late	Late	0.11	19	1	139	859	13,090	a-21, g-10, h, i, m-10, o, q, w
P3-09	N25W4/04	Late	Late	0.19	7		21	36	1	a, i
P3-15	N35W4/6	Middle	Middle	0.46	33	1	402	27		a, g
P3-16	N35W4/7	Middle	Middle	0.31	6		46	5		
P3-17	N35W4/8	Middle	Middle	0.35	4	1	7	1		
P3-20	N35W0/01	Middle	Early	0.04	2	1	8	2		
P3-21	N35W0/02	Middle	Early	0.02	1		3	1		
P3-22	N35W0/03	Middle	Early	0.12						
P3-23	N35W0/04	Middle	Early	0.11	8	1	19	1		s, x
P3-24	N35W0/05	Middle	Early	0.15	1	1	1			
P3-25	N35W0/06	Middle	Early	0.13	7	3	1	2		
P3-26	N35W0/07	Middle	Early	0.89	28	12	6	2		g-2, i
P3-27	N35W0/08	Early	Early	0.55	26	5	10	2		a, g, x

a. See footnote for Table 5.1.

The measure is a weighted density, calculated by multiplying volumetric density (MNI/m^3) by the appropriate plasticine meat-weight equivalent. The intent was to develop a measure to assess levels of harvesting of shellfish. It is obviously rather artificial, and its values have no absolute significance. They are appropriate only in relative terms, for comparisons across time (Figure 5.4) and between species (Figure 5.5). In the diagrams, time goes from right (early) to left (late).

The analysis of total meat-weight density in the Step Excavation (Figure 5.4, top) reveals three episodes in the intensity of shellfish harvesting. Early in the occupation of the mound, harvesting was at a low level compared with later times. Beginning with ST-25, there appears a series of spikes in total meat weight, suggesting episodes of higher-intensity harvesting. These constitute a middle episode. At the end of the sequence, two very large spikes indicate a final episode of even higher-intensity harvesting. The same basic pattern is seen in the Phase 3 South sequence (Figure 5.4, bottom), although the middle episode is less clear due to breaks in the stratigraphic sequence. Thus, we seem to have low-level harvesting followed by moderately intensive harvesting and ending with very intensive harvesting.

It is important to consider whether these shifts can be attributed to depositional factors rather than to social processes. ST-25, the first meat-weight spike of the middle episode, corresponds to a transition from sandy edges (ST-27 and higher) to dump deposits (ST-25/26 and lower). Plausibly, then, some of the rise in meat-weight densities might be ascribed to the appearance of denser concentrations of refuse. We are inclined, nevertheless, to emphasize the importance of human activities. It is noteworthy that dense midden deposits prior to ST-25 (ST-39, ST-39.1, ST-29, and perhaps ST-37) do not represent shell-meat spikes at the level observed from ST-25 on. It seems possible

Table 5.3. Percentage meat-weight contribution of the four most important shell species, divided by stratigraphic period

Shell Species	Early	Middle	Late	Terminal
Anadara grandis	61.1	62.6	26.1	50.6
Polymesoda radiata	29.2	7.0	0.2	0
Chione subrugosa	7.1	25.5	5.1	17.9
Protothaca metodon	2.6	4.9	68.6	31.5

Table 5.4. Density of shells per unit volume excavated (MNI/m^3) for the five most common species, divided by stratigraphic period

Shell Species	Early	Middle	Late	Terminal
Anadara grandis	23.4	45.5	169.3	30.7
Polymesoda radiata	58.6	26.7	7.4	0
Chione subrugosa	20.5	140.3	251.2	81.8
Protothaca metodon	3.6	12.8	1615.5	69.3
A. kindermanni	0	0	8803.5	16.1

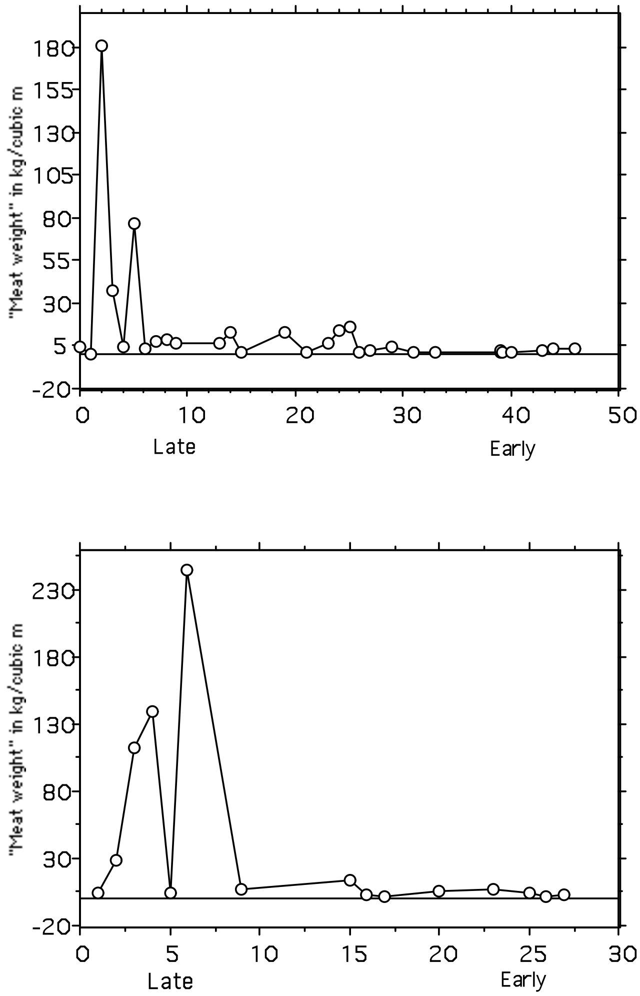


Figure 5.4. Total meat-weight density by lot in the Step Excavation sequence (top) and the Phase 3 South sequence (bottom). Lots along the X axis are in chronological order from Early (right) to Late (left). Note the inception in each sequence of moderate-intensity harvesting (ST-25 and P3-15) and high-intensity harvesting (ST-05 and P3-06).

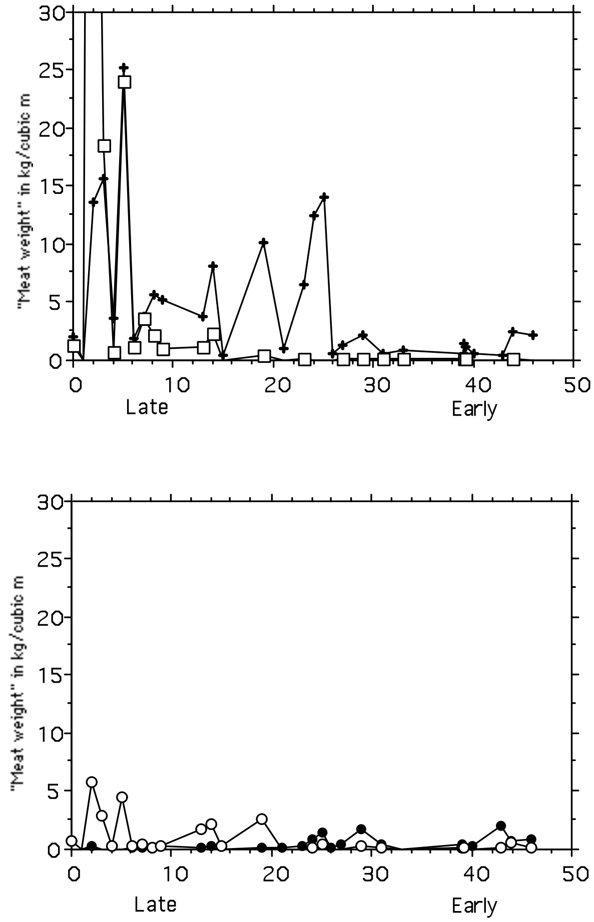


Figure 5.5. Meat-weight density categorized by species for the Step Excavation only. Lots along the X axis are in chronological order from Early (right) to Late (left). Top: *A grandis* (pluses) and *P. metodon* (open boxes). Bottom: *P. radiata* (black circles) and *C. subrugosa* (open circles).

that moderate-intensity harvesting and the appearance of large dump middens had the same behavioral causes.

A scrutiny of meat-weight densities by species (Figure 5.5) reveals further details. Low-level harvesting prior to ST-25 focused on *A. grandis* and *P. radiata*. Moderately intensive harvesting of *A. grandis* began with a spike at ST-25/24 and continued through the rest of the occupation, with only ST-05 plausibly attributable to high-intensity harvesting. Somewhat later, moderately intensive harvesting of *C. subrugosa* began with a spike at ST-19. It also continued in an essentially stable fashion through the end of the occupation. Moderately intense harvesting of *P. metodon* began shortly after that of *C. subrugosa*, with a spike at ST-14. This third pattern, however, did not remain stable. The high-intensity harvesting of the final episode is attributable primarily to the collection of *P. metodon* and *A. kindermannis*, with spikes at ST-05, ST-02, P3-06, and P3-03/04.

Alternative Internal Periodization: Shell Phases Defined

Because the pattern of increasing intensity of shell harvesting is robust enough to characterize both the northern and southern stratigraphic sequences in the mound, we are led to propose a periodization of the Vásquez Mound deposits as an alternative to the stratigraphic periods presented in Chapter 3. Both periodizations prove helpful in exploring behavioral variation over the course of the occupation of the Vásquez

Mound (see Chapter 14). We will refer to this second periodization as *shell-harvesting phases* or simply *shell phases*. *Early* (low-intensity harvesting) corresponds with ST-47 through ST-27 and P3-38 through P3-18. *Middle* (moderate-intensity harvesting) corresponds with ST-26 through ST-08 and P3-17 through P3-10. (ST-26 is stratigraphically contemporary with ST-25 and therefore becomes Middle. Likewise, ST-06 and ST-07 are part of the same midden as ST-05 and therefore become Late.)

Late (high-intensity harvesting) corresponds with ST-07 through ST-00 and P3-09 through P3-01. We also treat the Terminal stratigraphic period as a distinct shell phase for the purposes of other analyses in this volume. Because there is only a single sample of shells from N95W0, we have no knowledge of variability in that period. We thus do not attempt to characterize harvesting patterns in that phase.

The distribution of all species across these new shell phases is outlined in Table 5.5. The high diversity of species in the Late phase is probably a sample size effect. More important are several indications of changing species representation from Early to Late that reinforce the patterns already observed among the five most common species. Only one species other than *P. radiata*, the tiny gastropod *Cerithidea mazatlanica*, decreases from Early to Late. Several others show marked increases, including the olive shell *Agaronia propatula*, the ark clam *Anadara* sp. (cf. *A. similis*), the gastropod *Cerithidea valida*, and *Pitar tortuosus*. Most tentatively identified *A. similis* shells actually occur at the very end of the occupation, in N95W0.

Table 5.5. Frequencies (MNI) of all shell species, categorized by shell phase

Species	Early	Middle	Late	Terminal
Agaronia propatula	2	6	144	80
Amphichaena kindermanni			est. 24,914	22
Anadara bifrons	1			
cf *Anadara esmeralda or reinharti*	1			
Anadara grandis	127	159	432	42
cf *Anadara perlabiata*		1	1	
cf *Anadara similis*			14	30
Bulla gouldiana		2		
cf *Cerithidea mazatlanica*	254	138	14	
Cerithidea montagnei			18	
cf *Cerithidea valida*	1	16	50	1
Chione subrugosa	102	592	600	112
Cyclinella saccata			12	
cf *Dosinia dunkeri*	1	2	14	2
Melampus carolianus			1	
Modulus catenulatus			10	
cf *Mytella speciosa*	12		1	
Natica othello	1	4	5	
cf *Noetia reversa*	2			
cf *Ostrea columbiensis or iridescens*			2	
Ostrea conchaphila			8	
cf *Ostrea conchaphila*	1			
cf *Ostrea palmula*		1	2	
cf *Ostrea palmula*			1	
Pitar tortuosus		1	51	
cf *Polinices uber*			3	1
Polymesoda radiata	238	37	11	
Protothaca metodon	23	82	4,526	95
Rhinocoryne humboldti		3	2	
Tagelus peruvianus	2			
cf *Tellina decumbens*			5	
Thais biserialis			3	2
Tivela planula			9	
Totals	768	1044	30,853	387

Habitat Use

The changes in species representation that occurred through the El Varal sequence appear to be the result of a shift in the preferred habitat for gathering shellfish from a lagoon setting to the ocean beach or estuary mouth. Our conclusions are based on published literature regarding the primary species and on more direct evidence of habitat generated by Kennett and Culleton's isotope studies.

All of the species identified can be found in intertidal, estuary, and lagoon habitats along the Pacific Coast of the Americas. A lagoon focus for shellfish collecting early in the occupation is signaled by the importance of *P. radiata*. This is the marsh clam documented in modern lagoons of the Acapetahua Estuary and exploited in huge numbers there during the Archaic (Michaels and Voorhies 1999; Voorhies 2004:121–129). *C. subrugosa* is reported from lagoons and intertidal mud flats near mangrove areas (Keen 1971; Cantera 1991; Fischer et al. 1995:219).

The other three primary species seem to prefer higher-salinity habitats. Rosalles-Lossener and Dix (1989) describe an episode of paralytic shell poisoning in Guatemala in July of 1987 involving *A. kindermanni*. The shells had been "collected in the intertidal zone or just below the low tide mark on the ocean beach." Shells of *P. metodon* have been reported washed up on sandy beaches (Cantera 1991). *A. grandis* can be collected on sandbars at low tide (Keen 1971). *A. grandis*—along with mussels, slipper limpets (*Crepidula* sp.), and oysters—replaced a shell assemblage dominated by *P.*

radiata in the upper Archaic deposits at Cerro de las Conchas in a shift Voorhies (2004:96–97) ties to an episode of marine transgression.

The assemblage of shells in the upper layers she interprets as deriving from more saline conditions than the earlier lagoon deposits, perhaps near an estuary mouth. The later El Varal assemblage includes oysters but not mussels or slipper limpets. Interestingly, the trio that dominates the later assemblage at El Varal (*A. grandis*, *C. subrugosa*, *and P. metodon*) also appears to have been the primary species exploited a few centuries earlier at Paso de la Amada—several kilometers inland from El Varal. Due to local conditions of soil acidity, the shell at Paso de la Amada was in terrible shape (but we have several sizable bags of pieces at UCLA). After our experience with the well-preserved assemblage from El Varal, it proved possible to assess even the heavily fragmented materials from Paso de la Amada.

Direct evidence of habitat is provided by the isotopic analysis of successive growth rings of *P. radiata*, *P. metodon*, and *C. subrugosa* shells from El Varal. The stable isotopic composition of mollusk shell carbonate records aspects of the aquatic environment during growth (Wefer and Berger 1991). As described elsewhere (Chapter 13), oxygen-isotope ($\delta^{18}O$) values in shell are determined by the temperature and isotopic composition of the surrounding water (Epstein et al. 1951, 1953). Warmer water or inputs of low-salinity terrestrial runoff produce more-negative shell oxygen-isotope values.

The interpretation of carbon-isotope ($\delta^{13}C$) content is more complex, reflecting the composition of available dissolved inorganic carbon (DIC) in the habitat, salinity, and "vital effects" related to growth, reproduction, and other confounding factors (Keith et al. 1964; Killingley and Berger 1979; Krantz et al. 1987; Kennett and Voorhies 1995, 1996). Assuming DIC and salinity as the dominant variables, terrestrial runoff lowers shell carbon-isotope content—with DIC derived from decayed C3 plant matter (e.g., δ^{13} C = –25 to –15‰) and low salinity relative to ocean water. To the extent distinct regimes of temperature and salinity existed between the aquatic habitats exploited by the occupants of El Varal, the shell isotopes should indicate fresher estuarine conditions (with more-negative values) and more saline estuarine/marine conditions (with less-negative values).

In the Soconusco, lagoons vary in salinity over the course of the year as a result of fluctuations in freshwater inputs between rainy and dry seasons. Highest salinity occurs in the later dry season (March and April), and lowest salinity occurs in the wet season (August through December). Kennett and Voorhies (1996) have shown that these fluctuations are registered in the oxygen-isotope composition of successive growth rings of modern marsh clams (*P. radiata*) from the Los Cerritos Lagoon of the Acapetahua Estuary. Rainy-season waters lower the oxygen-isotope values in shell growth rings from a dry season range of –3 to –6‰ (February through June) to about –7 to –10‰ between July and January.

Sampling of successive growth rings reveals those fluctuations in modern as well as archaeological samples and allows inferences concerning seasonality of shellfish harvesting [Kennett and Voorhies (1996), and see Chapter 13 of this volume]. The *P. radiata* shell sampled by Kennett and Culleton from Varal N65W0/4 shows the same pattern as the modern and archaeological shells from Acapetahua (Figure 5.6, Table 5.6; see also Figure 13.2). The oxygen-isotope profile ranges from –10.50 to –3.11‰, corresponding respectively to wet and dry seasons.

Shells of *C. subrugosa* and *P. metodon* were also analyzed, one each from Middle and Late stratigraphic-period deposits (N65W0/4 and N75W0/1B, respectively). We had originally hoped that these would show the same pattern of fluctuating oxygen-isotope values between growth rings observed for *P. radiata*. Instead, values for the two other species are stable—for the most part between –3 and –5‰ (Figure 5.6, Table 5.6). The Middle-period oxygen- and carbon-isotope profiles of three shells from the same stratum clearly indicate that the marsh clam *P. radiata* lived in fresher and more seasonally variable waters than *P. metodon* and *C. subrugosa*. *P. metodon* and *C. subrugosa* exhibit higher and less variable oxygen-isotope signatures (–5.13 to –3.19‰, with one outlier at –1.97‰), indicating that they lived beyond the influence of seasonal freshwater inputs—perhaps at the mouth of the estuarine system or more likely on an ocean beach. The carbon isotopes suggest the same general picture, although the values for *P. metodon* are approximately 2.0‰ less than for *C. subrugosa*. [Offsets of a few per mil are commonly caused by differences in life history between individuals (such as growth rate and reproductive stage) rather than by environmental effects (Krantz et al. 1987)].

The Late-period oxygen-isotope profiles of *P. metodon* and *C. subrugosa* shown in Figure 5.6 have ranges similar to those of their Middle-period counterparts (–5.65 to –3.16‰), again indicating that these clams

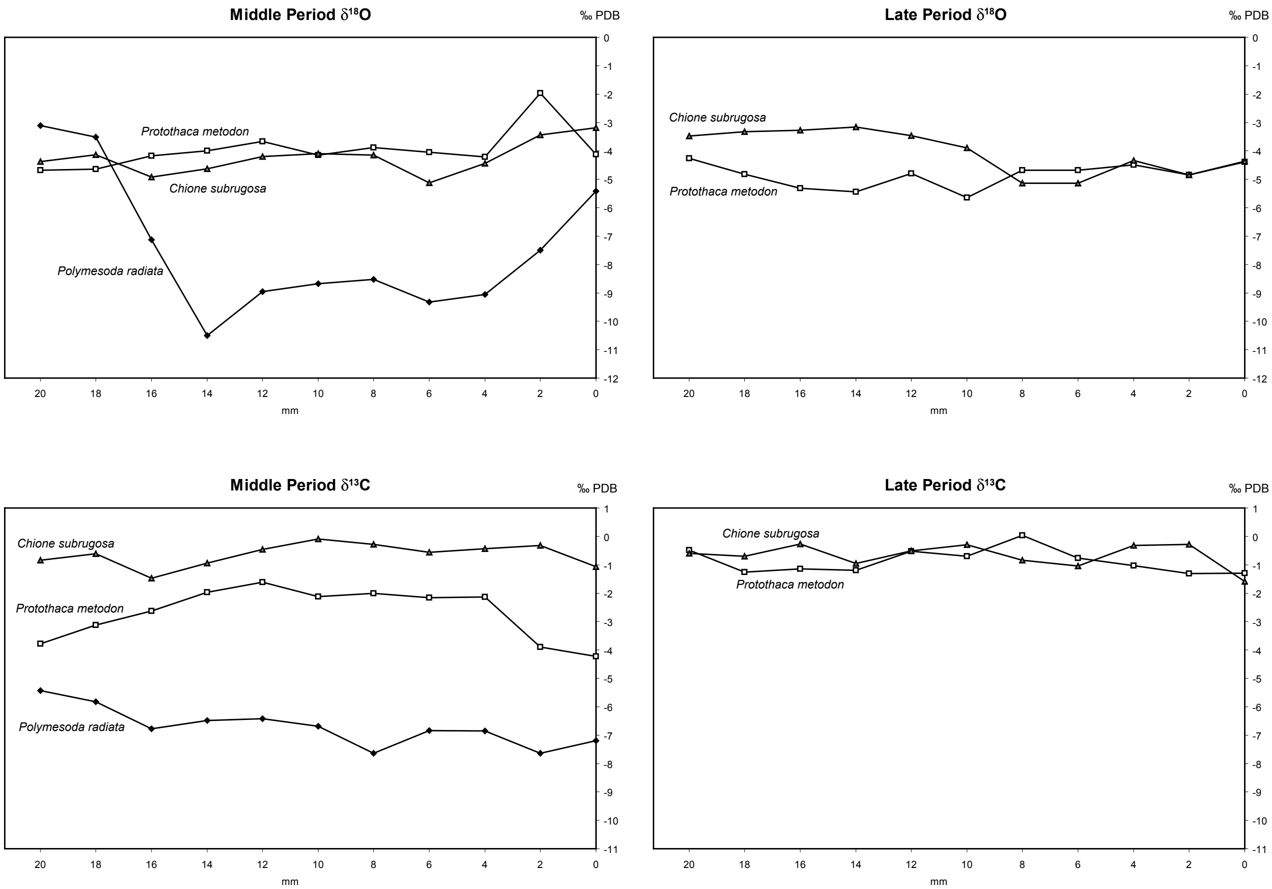


Figure 5.6. $\delta^{18}O$ (top) and $\delta^{13}C$ (bottom) at 2-mm increments along a line perpendicular to the growth rings of five shells from El Varal. Left: P. radiata, C. subrugosa, and P. metodon from N65W0/4. Right: C. subrugosa and P. metodon from N75W0/1B. The different patterns suggest two habitats for shellfish collection.

lived beyond the influence of seasonal freshwater inputs—probably at an estuary mouth or ocean beach. The carbon-isotope profiles are consistent between the species, and the range of values from –1.31 to 0.03‰ matches the range for the Middle-period *C. subrugosa* specimen.

Although the results for *P. metodon* and *C. subrugosa* do not contribute to the seasonality study, they do confirm habitat preferences of the three species gleaned from the literature and clarify the nature of behavioral changes at El Varal. *P. radiata* was the only species obtained from a seasonally inundated estuary, consistent with its present ecology. The *P. metodon* and *C. subrugosa* analyzed for this study were obtained by the occupants of El Varal from a more saline aquatic habitat that exhibited little discernible seasonal change in temperature or salinity, probably an ocean beach. Because these two clams are found in a variety of habitats, the isotopes are useful in narrowing down their actual procurement locale.

We can infer that occupants of El Varal shifted their focus of shellfish collecting from a lagoon setting to the Coatán mouth or ocean beach. The isotopic study also indicates that the Middle and Late shells of *P. metodon* and *C. subrugosa* derived from the same habitat. That, together with the observation that the Middle-period shells were from the same midden as the *P. radiata* shell sampled, help convince us that the occupants of El Varal collected shellfish from two different locations and that what we observe over time is a shift in emphasis from one location to another. The silting up of the lagoon could have been one factor in this change of collecting focus. However, another possibility is overexploitation during the Jocotal phase—leading to a decreased availability of shellfish in the immediate vicinity of the site.

Organization of Activities

Our final topic is whether it is possible to extract further insight into the organization of harvesting activities

Table 5.6. El Varal inter-species isotope profiles

Sample No.	Distance from Edge (mm)	δ13C (PDB)	δ18O (PDB)	Sample No.	Distance from Edge (mm)	δ13C (PDB)	δ18O (PDB)
Protothaca metodon, N65W0/4, ST-29, Middle Period				*Protothaca metodon*, N75W0/1B, ST-13, Late Period			
EVS29 Pm1 A	0	–4.23	–4.12	EVS13 Pm1 A	0	–1.29	–4.38
EVS29 Pm1 B	2	–3.90	–1.97	EVS13 Pm1 B	2	–1.31	–4.84
EVS29 Pm1 C	4	–2.13	–4.21	EVS13 Pm1 C	4	–1.03	–4.48
EVS29 Pm1 D	6	–2.15	–4.05	EVS13 Pm1 D	6	–0.77	–4.68
EVS29 Pm1 E	8	–2.01	–3.88	EVS13 Pm1 E	8	–0.03	–4.68
EVS29 Pm1 F	10	–2.12	–4.15	EVS13 Pm1 F	10	–0.70	–5.65
EVS29 Pm1 G	12	–1.61	–3.67	EVS13 Pm1 G	12	–0.52	–4.79
EVS29 Pm1 H	14	–1.96	–3.99	EVS13 Pm1 H	14	–1.20	–5.44
EVS29 Pm1 I	16	–2.62	–4.17	EVS13 Pm1 I	16	–1.14	–5.31
EVS29 Pm1 J	18	–3.12	–4.64	EVS13 Pm1 J	18	–1.26	–4.82
EVS29 Pm1 K	20	–3.79	–4.69	EVS13 Pm1 K	20	–0.48	–4.26
Chione subrugosa, N65W0/4, ST-29, Middle Period				*Chione subrugosa*, N75W0/1B, ST-13, Late Period			
EVS29 Cs1 A	0	–1.07	–3.19	EVS13 Cs1 A	0	–1.59	–4.36
EVS29 Cs1 B	2	–0.32	–3.43	EVS13 Cs1 B	2	–0.28	–4.84
EVS29 Cs1 C	4	–0.43	–4.44	EVS13 Cs1 C	4	–0.32	–4.34
EVS29 Cs1 D	6	–0.56	–5.13	EVS13 Cs1 D	6	–1.04	–5.14
EVS29 Cs1 E	8	–0.28	–4.14	EVS13 Cs1 E	8	–0.84	–5.13
EVS29 Cs1 F	10	–0.09	–4.10	EVS13 Cs1 F	10	–0.29	–3.89
EVS29 Cs1 G	12	–0.46	–4.20	EVS13 Cs1 G	12	–0.51	–3.46
EVS29 Cs1 H	14	–.0.95	–4.64	EVS13 Cs1 H	14	–0.95	–3.16
EVS29 Cs1 I	16	–1.47	–4.93	EVS13 Cs1 I	16	–0.26	–3.27
EVS29 Cs1 J	18	–0.62	–4.14	EVS13 Cs1 J	18	–0.70	–3.32
EVS29 Cs1 K	20	–0.84	–4.37	EVS13 Cs1 K	20	–0.60	–3.48
Polymesoda radiata, N65W/4, ST-29, Middle Period							
EV2A	0	–7.20	–5.42				
EV2B	2	–7.64	–7.50				
EV2C	4	–6.85	–9.06				
EV2D	6	–6.84	–9.32				
EV2E	8	–7.64	–8.52				
EV2F	10	–6.69	–8.68				
EV2G	12	–6.42	–8.95				
EV2H	14	–6.49	–10.50				
EV2I	16	–6.78	–7.13				
EV2J	18	–5.83	–3.52				
EV2K	20	–5.43	–3.11				

from an analysis of lot-to-lot variation in shell densities. Thus far, we have identified a three-stage transition from low- to high-intensity harvesting—superimposed on a gradual shift in focus from lagoon to ocean beach or estuary-mouth habitat. One question that arises at this point is whether the trend toward higher-intensity harvesting involved a greater emphasis on specialized task groups (groups organized to concentrate on particular activities and share the produce with others). In other words, do the changes in harvesting intensity observed in the Vásquez Mound deposits reflect increasing "specialization" of production or a shift on Binford's (1983) foraging/collecting continuum toward more logistical strategies?

These themes were briefly raised in Chapter 1, and are elaborated in Chapter 14. Our goal here is simply to begin assembling relevant evidence. If there was a shift toward task specialization, across our shell phases we might expect to see increasingly clear patterns of association among the material indicators of any particular activity and decreasing association between the material indicators of different activities. In other words, items related to one specialized task should increasingly be found together—apart from items related to

other specialized tasks. It is important to point out that other formation processes could yield similar archaeological signatures. Change in the spatial distribution of activities or, perhaps more clearly, increasingly rapid deposition of materials could lead to greater variation of content between deposits.

Our analysis of associations among variables centers on the volumetric densities (MNI/m^3) of the four main shell species and the density in kg/m^3 of sherds. The original distributions were in all cases strongly left-skewed. Computing logarithms of the density values produced more normal-looking distributions, and we worked with these derived values. Logarithms cannot be computed for density values of zero. We experimented with two ways of addressing this, first by simply leaving instances of zero density out of any particular analysis and second by replacing zeroes with the density value of 0.1 (slightly smaller than any of our observed densities). The analysis in Table 5.7 uses the first method. The second method produced broadly similar but not identical results. We also tried splitting deposits by stratigraphic periods and by shell phases. In these different versions of the analysis, we were particularly on the lookout for patterns that recurred in one analysis after another.

Correlations among the shell species are outlined in Table 5.7. Density of sherds is also included for comparison because this could perhaps be taken as an indication of the overall rate of artifact deposition in a given layer. The most consistent pattern, across all versions of the analysis, was a tendency for positive correlations among *P. metodon*, *A. grandis*, and *C. subrugosa*. As evident in Table 5.7, this is a tendency—not an absolute pattern. Correlations among these three shells, along with generally less of a correlation with *P. radiata*, help to bolster the idea that two different habitats were being exploited for shellfish.

During the Early and Middle phases, the tendency is for weak to moderate positive correlations between sherds and shells. Roughly speaking, when there were more sherds in a given layer there were more shells. In the Late shell phase, this tendency disappeared in both versions of the analysis (the density of shells was unrelated to the density of sherds). (Because of the very small number of *P. radiata* in the Late phase, including several lots with zeroes, the analysis is particularly volatile in that case. In the other version, the species was uncorrelated with anything else in the Late shell phase.) All of this extends the idea of increasingly focused harvesting of shellfish based on changing densities. Our favored interpretation is that the Late deposits contain a record of occasional ambitious shell-collecting expeditions in which numerous shellfish were harvested, brought to the mound, processed, and the useless remains dumped immediately over the edge. Such a pattern would be consistent with increased "specialization," a question considered further in Chapter 14.

Table 5.7. Correlations between densities of shell species and sherds, categorized by shell phase[a]

Early Shell Phase

	P. radiata	*A. grandis*	*C. subrugosa*	*P. metodon*
Polymesoda radiata				
Anadara grandis	–0.234			
Chione subrugosa	–0.121	**0.585**		
Protothaca metodon	–0.211	0.311	0.518	
Sherds	–0.120	0.388	0.489	**0.724**

Middle Shell Phase

	P. radiata	*A. grandis*	*C. subrugosa*	*P. metodon*
Polymesoda radiata				
Anadara grandis	**0.644**			
Chione subrugosa	–0.287	0.275		
Protothaca metodon	0.399	**0.713**	0.490	
Sherds	0.496	**0.713**	0.146	0.399

Late Shell Phase

	P. radiata	*A. grandis*	*C. subrugosa*	*P. metodon*
Polymesoda radiata				
Anadara grandis	0.343			
Chione subrugosa	0.556	**0.606**		
Protothaca metodon	0.677	**0.843**	**0.868**	
Sherds	–0.753	–0.152	0.154	0.106

a. Values used were the logarithms of the volumetric densities. For the shell species, this was calculated as MNI/m^3. For sherds, weights were used (kg sherds/m^3). Calculations were done pair by pair. Because of zeroes, *N* varies within each table. Significance: underlining means $p < .1$ and bold indicates $p < .05$.

Conclusions

Our findings concerning shellfish exploitation at El Varal can be boiled down to two main points. First, throughout the occupation of the Vásquez Mound site occupants harvested shellfish in at least two habitats: a lagoon with significant seasonal fluctuations in salinity and an ocean beach or estuary mouth setting without such fluctuations. Over the course of the occupation, there was a shift in the primary emphasis of harvesting efforts from the lagoon to the beach. The change in harvesting patterns may have been related to an alteration of habitat (from lagoon to vegetated pampa) in the immediate vicinity of the site or to Jocotal-phase overexploitation of the lagoon

resource base (leading the site occupants to venture farther afield in search of shellfish).

Our second conclusion is that superimposed on this shift in habitat exploitation was a change in the scale of shellfish harvesting. The densities of shells per volume of deposit suggested a three-phase trajectory of low-level, moderate, and intensive harvesting. These form the basis of the shell-phase alternative to the stratigraphic periodization of the mound deposits. A statistical analysis of lot content divided by these three phases provided some evidence for an increase in the segregation of tasks over the course of occupation of the site. Tendencies toward positive correlation between shells and sherds decrease over the course of the occupation. Although these findings are consistent with a shift toward greater task specificity in the harvesting and processing of estuary sources, Lesure's synthesis of the various strands of evidence (Chapter 14) does not reveal any significant change in the organization of production during the course of the occupation of the mound.

CHAPTER 6

Crab Exploitation in Early Formative Soconusco

JOHN DIETLER AND THOMAS A. WAKE

THE 1992 INVESTIGATION OF the Vásquez Mound at the site of El Varal, Chiapas, Mexico, produced a rich assemblage of marine and non-marine fauna. After mollusk shells, crustaceans were the most common faunal remains recovered from this site. The large quantities of terrestrial and aquatic crabs El Varal's inhabitants collected from surrounding lagoon and mangrove habitats indicate that these animals were a significant food source during the prehistoric occupation of the site.

Few crab remains have been recovered from archaeological sites in coastal Chiapas and adjacent Guatemala. Coe and Flannery (1967:77) report 63 crab fragments representing five genera (*Cardisoma*, *Uca*, *Sesarma*, *Goniopsis*, and *Eurytium*) at Salinas la Blanca. The poor representation at that site reflects the fact that screens were not used during the fieldwork. Other investigations report even fewer crab elements despite the use of screens. Voorhies (2004:147, 150) reports only seven crab claws at Cerro de las Conchas. She mentions no crab remains in her investigations at Zapotillo, Tlacuachero, and Campón—despite the strong marine focus evident in these sites' faunal assemblages (Voorhies 1976).

The investigation described here represents the first in the region to recover and analyze a large assemblage of crab remains. Results from Paso de la Amada demonstrate that El Varal is not unique in this regard. Future archaeological investigations are likely to encounter comparable assemblages. With that in mind, the methods used in this analysis are described in detail in the following section.

Methods and Materials

The El Varal crab remains reported here consist of 2,316 specimens identified to at least the order level. These include 2,233 specimens from standard excavation units and 83 specimens from flotation samples. A second collection of 365 crab elements, recovered during the same field season at Paso de la Amada, was analyzed for comparative purposes. Paso de la Amada is located approximately 10 km north of El Varal. These sites are relatively close in age, but only El Varal is situated directly adjacent to coastal resources. As such, the Paso de la Amada assemblage provides an interesting contrast to that of El Varal. All of the non-flotation specimens were collected from excavated samples passed through 5-mm-mesh screens.

Following an initial sort of the El Varal faunal remains, all of the crab remains were identified to the lowest possible taxon by John Dietler. Identifications were made through comparison with reference

specimens from the Los Angeles County Museum of Natural History and selected taxonomic keys (Hendrickx 1995). These reference specimens consisted of modern crabs that were collected in southern Mexico and preserved in alcohol.

In addition to taxonomic classification, the element, portion, side (right or left), and condition (burned or not burned) of each specimen were recorded. The number of individual specimens present (NISP), a simple count of all identified specimens, was recorded for each category. The minimum number of individuals (MNI) for each taxon was calculated using the highest count of the paired elements from either side (left or right) or the number of unique skeletal elements present, whichever was greater. In every case, the most common element was a claw finger. Element size was not used in the calculation of MNI because of the marked asymmetry and sexual dimorphism present in many crab species. Specimen weight was not recorded due to the heavy encrustation present on many specimens. Meat weight could not be estimated due to the lack of published meat weights for the species encountered in this analysis.

Crabs belong to the order Decapoda, meaning that they have ten paired limbs (pereopods). The first pair of limbs (chelipeds) includes the grasping claws (chelae). The claws are generally the most robust portions of the crab exoskeleton. As a result, the claw is the most likely element to survive archaeologically. In many crab genera, the claw also contains the most edible meat. Each claw has three parts: the upper, moveable finger (dactyl); the lower, fixed finger (propodus); and the "palm" (manus)—to which the latter is attached.

The claw fingers are the most numerous elements in these collections. Most claw fingers can be identified and sided based on their curvature and the shape of the proximal attachment point (the hinge). In some genera (e.g., *Uca* and *Callinectes*), the morphology of the claw teeth also informs the side identification process. Other recovered elements include medial segment (carpus) and proximal segment (merus) of the first limb, the distal segment (dactyl) of the walking limb, and portions of the carapace.

Five crab genera, representing three families, are present in the sample. The basic ecology and identifying characteristics of each genus are presented here. The El Varal and Paso de la Amada crab remains include aquatic, semiterrestrial, and terrestrial genera. All of these species are found in estuarine/mangrove systems and require saltwater to breed and moisture over their gills to respire. Portunid crabs such as *Callinectes* and *Portunus* are fully aquatic, and their hindmost (fifth) pair of legs has evolved into paddle-shaped swimming appendages. Their carapaces are characteristically diamond-shaped, with long spines at the lateral apices. These spines extend their broad bodies to widths between 100 and 170 mm (Brusca 1973:267–268). *Callinectes* typically inhabits shallow waters and tolerates both highly saline and freshwater environments.

Two species of *Callinectes* are present in the project area today: *C. bellicosus* (warrior swimming crab) and *C. arcuatus* (arched swimming crab). *C. bellicosus* and *C. arcuatus* are found in estuarine settings along Mexico's Pacific Coast. The local abundance of each species is affected by salinity, temperature, and season (Hendrickx 1984; Arreola-Lizárraga et al. 2003). In the Gulf of California, *C. arcuatus* is present in estuaries on a year-round basis—whereas *C. bellicosus* is only present between May and July (Loesch 1980). *C. arcuatus* ranges from shallow coastal shelves to back bays, but is most commonly found in estuary mouth habitats (Norse and Estevez 1977; Allen 1990:237).

Callinectes claws are narrow, elongated, outward curving, and generally symmetrical (Figure 6.1). They feature strong lengthwise grooves and a prominent pointed hook on their distal ends. Claw teeth are prominent, irregularly sized, and rounded. The proximal end of the dactyl has a blunt downward-curving tab that fits into a corresponding slot in the proximal end of the opposing propodus. The most proximal teeth of the propodus are quite small, and are frequently present in side-by-side pairs. The first tooth of the right dactyl, typically the largest tooth on either claw, has a distinctively broad and pillow-like shape. As a result, right dactyls missing their proximal hinge tab can still be identified when this large first tooth is present.

Distinctive spines identify the carapace and the merus of *Callinectes*. A single large spine is present on the lateral extremes of each side of the carapace, and several anterolateral teeth extend toward the animal's eyes. The side from which a lateral spine is derived can be determined by its anterior-facing curve and the presence of a lengthwise ridge found approximately medially on the dorsal surface. The three small outward-curving spines present on the dorsal anterior margin of the merus allow it to be sided as well.

Unfortunately, the claws of *C. bellicosus* and *C. arcuatus* are quite similar and cannot be distinguished from each other. *C. bellicosus* was identified in the collection

Figure 6.1. *Callinectes* sp. claws in anatomical position, posterior view.

Figure 6.2. *Portunus aspera* claw (left dactyl), posterior view.

based on the morphology of the lateral spine of the carapace and the dorsal ridges of the body of the propodus. Unlike the reference specimens of *C. arcuatus*, the recovered carapace spines lacked a prominent lengthwise ridge on their posterior dorsal margin. Recovered propodus fragments from both species were identified, having irregular beaded ridges on the dorsal surface in the case of *C. bellicosus* and lacking those ridges in the *C. arcuatus* specimens.

Portunus asper (Figure 6.2) is another swimming crab. Its morphology differs somewhat from *Callinectes* and it is typically found in deeper water (Norse and Estevez 1977). The claw is narrower than that of *Callinectes* and has lengthwise ridges rather than grooves. The teeth on *P. asper* claws are uniformly shaped and small.

Ocypodid crabs include terrestrial and semiterrestrial estuary and mangrove-dwelling genera such as *Ucides* and *Uca*. *Ucides occidentalis* (red mangrove crab) is a large (carapace widths up to 84 mm) crab that lives among the roots in mangrove forests (Cabrera Pena et al. 1994; Twilley et al. 1997). *Ucides* claws (Figure 6.3) are shorter and more robust than those of the swimming crabs. Their similar proximal hinge morphology and curvature allows them to be sided in the same manner as *Callinectes*. The distal end of the claw lacks a hook and is even with the small conical teeth. The

Figure 6.3. *Ucides occidentalis* claws in anatomical position, posterior view.

dactyl of a *Ucides* walking leg has a distinctive undulating or ridged texture at the point of attachment and is relatively broad, blunt, and straight. *Ucides* body parts can be identified by their distinctive surface texture and color. Unburned fragments are typically dark reddish brown and feature relatively large round or donut-shaped bumps on their outer surfaces.

Uca (fiddler crab) is a small semiterrestrial crab that occupies mud or sand tidal flats adjacent to lagoons, salt marshes, and estuaries. It emerges from its burrow during low tides to feed and to interact with conspecifics. Male fiddler crabs use a single enlarged (major) claw in mating displays, whereas the much smaller opposing (minor) claw is used to gather food (Brusca 1973; Stillman and Barnwell 2004). Because both claws are thin walled, they are typically highly fragmented in archaeological contexts. Small fragments of *Uca* claws and carapace are identifiable by their thin shell and the presence of small tubercles (rather than teeth) along their edges.

All of the *Uca* claws included in the analysis appear to be major claws from male crabs. Although female fiddler crabs may have been utilized as well, their remains are not preserved in these samples. It is likely that the minor claws were not recovered because their small size allowed them to pass through the screen in the field. Because each animal has only one major claw, MNI calculations for *Uca* differ from the other genera discussed here. Although the claws are sided, they are treated as unique elements. For example, a context that contains two right dactyls and three left dactyls has an MNI of 5 (not 3, as would be the case for other genera).

Two species of *Uca* are present in the sample. Both are relatively small, with carapace widths between 30 and 45 mm (Brusca 1973:265–266). The propodus and dactyl of *U. princeps* claws (Figure 6.4) are long, flat, and thin—and have extremely small teeth. These claws are less curved than those of other genera, and their proximal portions survive less often. As a result, tubercle patterning is important in determining claw portion and side. The highest row of tubercles on both claws is anterior.

The dactyl is thin and laterally curved in a broad S or Z shape, and its lower/inner row of tubercles ends well short of the hinge. The propodus is straight, thicker, and has an inner tubercle row that extends all the way to the hinge. A second species, tentatively identified as *U. mordax* (after Brusca 1973:265), has narrower and

Figure 6.4. *Uca mordax* (left) and *Uca princeps* (right) claws.

Figure 6.5. *Sesarma* sp. claws in anatomical position, posterior view.

smaller claws than *U. princeps*. This species' dactyl is longer than the propodus, rounded in cross section, and hooked at the distal end. The propodus is shorter, straight, somewhat square in cross section, and possesses a single large medial tooth.

Grapsoid crabs include terrestrial and semiterrestrial genera (such as *Sesarma*) that live among mangrove roots. *Sesarma* (marsh crab) is a medium-size crab, with carapace widths between 40 and 50 mm (Brusca 1973:260). *Sesarma* remains were identified in this sample using identification keys (Brusca 1973; Hendrickx 1984). Comparative specimens were not available for this genus. *Sesarma* claw fingers (Figure 6.5) are short and asymmetrical, and narrow sharply

toward their unadorned distal ends. The dactyl curves both outward and downward, whereas the propodus finger is straight. The claw surface is smooth and has faint lengthwise grooves. *Sesarma* claw teeth are small, jagged, and irregular in size. The right claw of the male has two large teeth on dactyl and propodus. All of the claw teeth are located on the anterior claw margin.

Analytical Units

The El Varal crab remains are divided into three temporally distinct units of analysis based on stratigraphic associations of certain mollusk species, as outlined in Table 6.1 and discussed in detail in Chapter 5 of this volume. Temporal patterning was initially examined using the stratigraphic period and shell phase schemas. Because these were found to be very similar, only the latter division is presented here. The analytical units are termed the Early, Middle, and Late shell phases. No Terminal sample was available for analysis. These materials date between 1250/1200 and 1050/1000 B.C. and belong to the later Cuadros and Jocotal phases of the Soconusco archaeological sequence (see Chapters 9 and 12).

The Paso de la Amada materials are older than those from El Varal. Two temporal units are represented here: the Ocós (1500 to 1400 B.C.) and Cherla (1400 to 1300 B.C.) phases. The Cherla sample analyzed here derives from the same three units of Mound 1, lot 11, as the vertebrate remains from the site described in Chapter 15. The availability of samples from these successive periods provides some opportunity to examine changing patterns in resource exploitation. The Paso sample is of particular interest here for the picture it gives of habitat exploitation at an inland site with a dish-dominant vessel-form assemblage. A broader comparison between the Varal and Paso faunal remains follows (see also Chapter 15).

Table 6.1. Crustacean remains by shell phase at El Varal

Shell Phase	NISP	Volume (m^3)	Crab/m^3
Early	931	5.13	181.6
Middle	832	3.56	233.7
Late	470	1.67	281.4
Total	2,233	10.36	215.6

Results

El Varal

The 2,233 crab remains (excluding the flotation samples, which are discussed separately below) from El Varal's Vásquez Mound represent an MNI of 555 crabs from all five of the genera discussed previously (Table 6.2). More than 95 percent of the recovered specimens were identified to the generic level. The assemblage is dominated by *Callinectes* (86.1 percent of NISP), and the remaining four genera together comprise less than 15 percent of the identified specimens. *Uca* (7.9 percent) and *Ucides* (5.0 percent) specimens make up the majority of the remaining crabs. *Sesarma* (0.9 percent) is uncommon at El Varal, and *Portunus* is quite rare—being represented by only one specimen. All of these crabs can be found in estuaries and adjacent mangrove forest habitats like those that surround the study site today.

The relative contributions of the various genera in terms of MNI differ slightly from the NISP totals (Table 6.3 and Figure 6.6). *Callinectes* (76.2 percent), although still dominating the collection, diminishes in importance relative to the other genera. The most significant difference between the two methods of quantifying the recovered specimens is the greater proportion of *Uca* (14.4 percent) in the MNI total, reflecting the unequal recovery of major claws (discussed previously).

Crab preservation was very good at El Varal, and a wide variety of exoskeleton elements was identified (Table 6.4). Cheliped fragments (including claws) constituted 94.2 percent of the identified body parts, and

Table 6.2. Crustacean genus frequencies at El Varal (NISP)

Genus	Early Shell phase		Middle Shell phase		Late Shell phase		Total	
	N	%	N	%	N	%	N	%
Callinectes	804	91.9	686	86.8	343	74.1	1,833	86.14
Portunus			1	0.1			1	0.05
Sesarma	2	0.2	13	1.6	5	1.1	20	0.94
Uca	64	7.3	68	8.6	35	7.6	167	7.85
Ucides	5	0.6	22	2.8	80	17.3	107	5.03
Total	876		796		469		2,128	

Table 6.3. El Varal identified crustacean remains by shell phase

Common Name	Scientific Name	Early		Middle		Late		Total	Total
		NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Swimming crab	*Callinectes* sp.	804	200	686	153	343	70	1,833	423
	Portunus asper			1	1			1	1
Marsh crab	*Sesarma* sp.	2	2	13	9	5	2	20	13
Fiddler crab	*Uca* sp.	64	24	68	38	35	18	167	80
Red mangrove crab	*Ucides occidentalis*	5	3	22	10	80	25	107	38
Crab	Decapoda	56		42		7		105	
	Total	931	229	832	211	470	115	2,233	555

portions of the walking legs (0.3 percent) and carapace (5.2 percent) made up the remainder. Upper (dactyl) and lower (propodus) claw fingers were present in relatively equal proportions, but right elements outnumbered left elements by a margin of 1.13 to 1. This inequality differs by genus within the El Varal assemblage. Right elements are more common in *Callinectes* and *Ucides*, and left elements dominate *Uca*—whereas *Sesarma* had equal proportions of right and left elements. Claw size is often asymmetrical in male crabs, and the larger claw may have survival and recovery advantages over its smaller mate. If side dominance differs by genera in living populations, this may explain the varying inequalities noted here.

Eighteen percent of the sample displayed evidence of burning, primarily in the form of discoloration. This charring may be the result of discarding processed crab remains into a fire, although it is also possible that some crabs were burned during cooking. The burned proportion of *Callinectes* (17 percent) was lower than that of the other genera (25 to 31 percent), suggesting different preparation or discard practices for this crab. Because many specimens were discolored or encrusted due to taphonomic processes, these figures likely underestimate the prevalence of burning.

Crab remains were quite common at El Varal and were present in nearly every excavated sample. The relative proportion of each crab genus varied among the three shell periods, indicating temporal change. A comparison of the north and south sequences from the west profile (3P and ST) indicates that this pattern is robust, characterizing both sequences and standing up to an examination lot by lot.

A total of 932 crab specimens was assigned to the Early shell period (Table 6.3), representing a minimum of 229 individual crabs. *Callinectes* (91.9 percent) dominates the identified genera in terms of NISP during this period (Table 6.2), followed distantly by *Uca* (7.3 percent). *Sesarma* and *Ucides* were both very uncommon during this period, with neither contributing more than five specimens.

Table 6.4. Crustacean elements and sides at El Varal

Element	Left	Right	Not Sided	Total
Carapace, dorsal fragment			1	1
Carapace, lateral spine	56	55		111
Carapace, spine			2	2
Carapace fragment			3	3
Claw dactyl	333	363	1	697
Claw propodus	333	398		731
Claw dactyl & propodus		3		3
Claw manus	4	5	2	11
Claw, whole		1		1
Claw fragment			553	553
Claw and carpus	1			1
Chiliped merus	9	4	4	17
Leg dactyl			6	6
Unidentified			96	96
Total	736	829	668	2,233

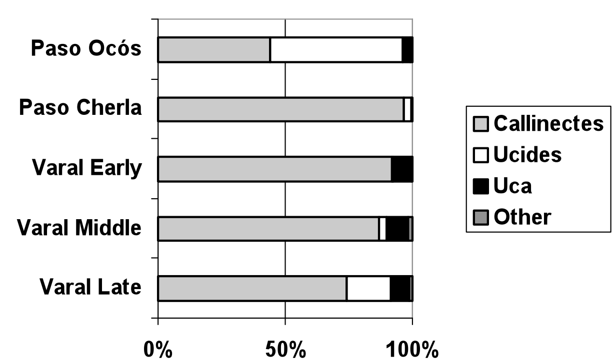


Figure 6.6 Relative contribution of crab genera (NISP) at Paso de la Amada (PA) and El Varal (EV) by phase.

Similar numbers of crab (NISP = 833; MNI = 192) were present in Middle shell period deposits. These proved to be the most diverse contexts at El Varal. All five genera are present, and although *Callinectes* (86.8

Table 6.5. El Varal crustacean remains from flotation samples by unit

Common Name	Scientific Name	N35 W0/08		N70 W0/03b		N75W0/1a		N85 W0/03a		Total	Total
		NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Swimming crab	*Callinectes* sp.	5	1	9	2	7	1	11	2	32	6
Fiddler crab	*Uca* sp.	1	1	9	2			2		12	3
Red mangrove crab	*Ucides occidentalis*							1		1	
Crab	Decapoda	15				21		1		38	
	Total	21	2	18	4	28	1	16	2	83	9

percent) still dominates the assemblage in terms of NISP the relative proportions of the four other genera increased. *Uca* (8.6 percent of NISP, 18.0 percent of MNI) is at its most common in these levels, and the only identified example of *Portunus* was assigned to the Middle shell period.

The Late shell period contained about half as many crab fragments as the other two periods (NISP = 474; MNI = 103), as well as the smallest proportion of *Callinectes* (74.1 percent of NISP, 60.9 percent of MNI). Substantial numbers of *Ucides* remains (NISP = 80) were identified, representing a nearly fourfold increase over the Middle shell-phase total and representing 17.3 percent of the Late shell-period materials.

The density of crab remains (Table 6.1) increased steadily with each shell phase. Although the relative proportion of *Callinectes* decreases over time, the actual density of this genus increases. Thus, it appears that swimming crabs were a dietary mainstay throughout the sampled occupation of the Vásquez Mound. During the Middle shell phase, El Varal people added increased amounts of each of the remaining available genera to their diet. They may have begun to exploit a broader catchment area during this period, extending from mangrove forests (*Ucides* and *Sesarma*) and estuaries (*Uca* and *Callinectes*) to open ocean habitats (*Callinectes* and *Portunus*). During the Late shell period, they eschewed this broad approach in favor of the intensification of mangrove crab gathering. Judging from volumetric densities, harvesting of *Callinectes* was further intensified at that time.

The 83 claw remains recovered from the heavy fraction of the El Varal flotation samples do not differ substantially from the remains that were collected from the standard excavation contexts. The flotation sample is less diverse than the excavation sample, most likely due to its smaller size. The three genera present in the sample were recovered in the same rank order as the excavation units (Table 6.5). *Callinectes* (71.1 percent of NISP) dominates the collection, followed by *Uca* (26.7 percent) and *Ucides* (2.2 percent). The greater proportion of *Uca* in the flotation sample likely results from the brittle yet easily identified nature of fiddler crab claws (compared to the more robust claws of the swimming and mangrove crabs).

Because of the small fragment size of the flotation sample specimens, only 54.2 percent could be identified to the generic level. Somewhat surprisingly, the elements that made up this assemblage did not differ substantially from those found in the excavated sample. The smallest identifiable fragments were detached cheliped and carapace spines and claw tips. Unfortunately, no small mouth parts or swimming legs that might be useful in species identification were recovered. The proportions of the body parts in the flotation sample differed from the excavated sample, with a greater number of carapace fragments (17.0 percent) relative to cheliped and claw fragments (80.9 percent) than was seen elsewhere. Walking leg dactyls (2.1 percent) formed a minor part of the assemblage.

Paso de la Amada

The 365 specimens from Paso de la Amada represent the remains of at least 34 crabs belonging to four genera (Tables 6.6 and 6.7). *Callinectes* (73.8 percent) dominates the identified specimens, although *Ucides* (24.3 percent) represents a sizeable minority of the collection. *Uca* (1.6 percent) is also present, but in very low numbers.

The Paso de la Amada crab remains are highly fragmented, resulting in a high percentage of specimens that could not be identified to the generic level (16.4 percent). As a result, NISP figures are elevated and MNI estimates are depressed in comparison to the same figures at El Varal. The ratio of MNI to NISP at El Varal is 1:4.3, whereas that ratio at Paso de la Amada is 1:11—meaning that more than twice as many specimens were needed at the latter site to identify a single crab individual. The relative frequency of *Ucides* (NISP) is also exaggerated because of this fragmentation. Small fragments of that genus, and to a lesser extent *Uca*, can be identified due to its distinctive surface texture.

The same cannot be said for *Callinectes*. The incidence of burning at Paso de la Amada (13.7 percent) was similar to that found at El Varal. Although the crab remains from the two sites had similar rates of burning, taphonomic conditions at Paso de la Amada favored greater fragmentation (the pattern is noted also among the vertebrate remains; see Chapter 15). Consequently, it is likely that the fragmentation of crab remains at Paso de la Amada occurred after discard rather than as a result of differing crab consumption practices.

Claws dominated the identified body parts (96.3 percent), followed by walking legs (3.4 percent) and carapace fragments (0.4 percent; Table 6.8). Although fewer element types are found at Paso de la Amada than at El Varal, the presence of multiple body parts at this inland site is significant. The recovery of claw, walking leg, and carapace fragments suggests that crabs were butchered on-site—rather than at their coastal procurement locale. Right and left elements, as well as claw dactyl and propodus portions, were present in nearly equal numbers. The crab claws recovered from Paso de la Amada were noticeably smaller than those found at El Varal, particularly *Callinectes* claws. There are several possible explanations for this phenomenon, including differing procurement practices and taphonomic effects.

Temporal change is visible in the Paso de la Amada assemblage (Tables 6.6 and 6.7). Ocós-phase contexts have similar proportions of *Callinectes* (43.9 percent) and *Ucides* (52.3 percent) specimens. Cherla-phase contexts, on the other hand, are dominated by *Callinectes* (96.0 percent). This pattern is even starker when MNI are examined. *Callinectes* is the only genus that contributes to the Cherla-phase figure. *Uca* never appears to have been an important member of the assemblage, contributing less than 4 percent of the NISP during both periods. However, the thin exoskeleton of this genus may be underrepresented in this assemblage due to the aforementioned fragmentation effects.

The surprisingly high proportion of *Ucides* in the Ocós phase is attributable to a single pit feature (Mound 1, F10/E10, feature 15) that contributed nearly all of the phase's red mangrove crab fragments (NISP = 62). Although the pit contained 8 claw and leg dactyls, 15 claw fragments, and 39 other fragments, all of these could have come from a single crab. When these materials are removed from the analysis, the Ocós-phase *Ucides* still outnumber those of the Cherla phase and contribute 10 percent of the phase's NISP. Although our samples are small and our ability to monitor variability is limited, the available data suggest that consumption of crab at Paso de la Amada was more balanced among the three genera during the Ocós phase than in the subsequent Cherla phase.

Table 6.6. Crustacean genus frequencies at Paso de la Amada (NISP)

Genus	Ocós		Cherla		Total	
	N	%	N	%	N	%
Callinectes	58	43.9	167	96.5	225	73.8
Uca	4	3.0	1	0.6	5	1.6
Ucides	69	52.3	5	2.9	74	24.3
Sesarma	1	0.8				0.3
Total	132		173		304	

Table 6.8. Crustacean elements and sides at Paso de la Amada

Element	Left	Right	Not Sided	Total
Carapace, lateral spine	1			1
Claw dactyl	16	18		34
Claw propodus	17	15		32
Claw manus	2	3	1	6
Claw fragment			185	185
Leg dactyl			9	9
Unidentified			98	98
Total	36	36	293	365

Table 6.7. Paso de la Amada identified crustacean remains by phase

Common Name	Scientific Name	Ocós		Cherla		Total	Total
		NISP	MNI	NISP	MNI	NISP	MNI
Swimming crab	*Callinectes* sp.	58	15	167	13	225	28
Fiddler crab	*Uca* sp.	5	2	1		5	2
Red mangrove crab	*Ucides occidentalis*	69	3	5		74	3
Marsh crab	*Sesarma* sp.						
Crab	Decapoda	32		28		60	
	Total	164	21	201	13	365	34

Procurement of Crabs

Capturing crabs is a challenging task—one made more difficult by the deep mud, tangled mangroves, and tidal fluctuation experienced on the Soconusco coast. It is unlikely that the large and diverse assemblage of crabs discussed previously could have been collected entirely by hand. Groups of children could have been relatively successful at catching terrestrial mangrove, fiddler, and marsh crabs (*Ucides*, *Uca*, and *Sesarma*, respectively). The swimming crabs (*Callinectes* and *Portunus*) that dominate the assemblage would have been beyond their reach, however. Like the blue crab (*C. sapidus*) of the American Atlantic Coast, these swimming crabs are most efficiently captured with submerged traps or pots.

A basic crab trap includes an open framework covered with netting. Bait attracts crabs to the trap, and a constricted inward-facing opening or a hinged panel that closes as the trap is raised from the water prevents their escape. A floating marker is used to indicate the location of the trap once it is submerged. The use of watercraft is necessary for the efficient placement and retrieval of these traps. Traps would have been an effective capture method for terrestrial crabs as well. Simple pitfall traps (such as a buried ceramic vessel) can be used to capture fiddler crabs. Nets and hook-and-line rigs are popular but less efficient methods of crab capture.

Trends in Crab Use

Throughout the occupation of the Vásquez Mound, the occupants of El Varal captured swimming crabs (Portunidae)—probably in the lagoon that surrounded the site, although perhaps also in the lower reaches of the Coatán River. These portunid crabs were most likely caught in the lagoon using traps or pots. Exploitation of this resource seems to have increased over the course of the occupation from Early to Late shell phases.

In the Middle phase, they began harvesting mangrove crabs in greater numbers. Exploitation of mangrove habitats—again, based on volumetric densities of identified remains—was further intensified in the Late phase. Crab use in the Terminal phase is unknown. Increasing use of more crab species may be the result of local habitat changes or the inclusion of a broader array of microhabitats in overall foraging activities. The increase of crabs that prefer mangrove habitats in the Late shell-period samples suggests local environmental change. Estuarine succession may have led to the enclosure of nearby lagoonal habitats by expanding mangrove stands. The resulting increase in available non-portunid crabs would have presented a foraging opportunity to the people who lived in the area.

The inhabitants of Paso de la Amada in the Ocós and Cherla phases had access to habitats for catching crabs similar to those of the (Jocotal-phase) occupants of El Varal. Currently, travel to the portunid-rich lower estuary involves trips of more than 5 km from Paso de la Amada. However, *Callinectes* would have been more accessible during the rainy season—when water levels are higher. This would be especially the case if estuaries penetrated farther inland 3,000 years ago.

The pattern of crab exploitation at Paso de la Amada is not stable, and this instability differs markedly from the patterns observed at El Varal. It is possible that greater dietary variability is seen at Paso de la Amada within any particular phase due to its larger population and broader collecting radius. A greater number of individual food collectors who made expedient visits to a wide array of distinct habitats and rapidly returned to their inland village to consume their catch could have produced such a pattern. Because our sample from the large and complex inland site is quite small, it seems wisest to reserve judgment on the implications of variation in that case. The apparently chronological variation seen in this small sample may actually represent context-based differences that occurred within each period. This hypothesis warrants testing with a larger sample.

Crab remains are abundant at El Varal and at Paso de la Amada. Crabs were clearly an important source of food at El Varal. They appear to have been less important, relative to fish, at Paso de la Amada—although this pattern may be the result of taphonomic bias. In any case, crabs remain an understudied data set in the region. This chapter has sought to highlight the potential dietary contribution of crabs and to frame replicable methods for future analyses of decapod assemblages.

CHAPTER 7

Fishing in the Mangroves at Formative-Period El Varal

THOMAS A. WAKE AND DAVID W. STEADMAN

This chapter reports on the vertebrate archaeofauna recovered from the site of El Varal, Chiapas, Mexico. The site of El Varal includes two large earthen mounds (the Vásquez Mound and the Martínez Mound), each containing a mix of midden material and primary occupational debris. Richard Lesure and Tomás Pérez Suárez recovered the faunal assemblage reported here from the Vásquez Mound in 1992. The Vásquez Mound vertebrate archaeofauna collection reported here consists of 1,845 vertebrate specimens identified to at least the class level.

The Vásquez Mound archaeofauna collection reported here is divided into three occupational phases (Early, Middle, and Late) based on stratigraphic associations with certain groups of mollusk species (i.e., shell phases; see Chapter 5). The vertebrate archaeofauna are analyzed by shell phase to examine any changes in resource focus or availability that occurred during the occupation of the site and to understand what aspects of human subsistence behavior can be gleaned from the available data.

Previous research in the region has shown that the Formative-period inhabitants of this area depended on farming and tree cropping for their plant foods (Ambrose and Norr 1992; Blake et al. 1992a, 1992b; Chisolm et al. 1993). They focused primarily on aquatic resources, including estuarine mollusks and crabs and estuarine and freshwater fish, for their animal food needs. Terrestrial vertebrates such as crocodilians, turtles, iguanas, rabbits, and deer were hunted to a lesser extent (Follett 1967; Flannery 1969; Voorhies 1976; Hudson et al. 1989; Pye and Demarest 1991; Wake and Harrington 2002; Wake 2003, 2004; Wake et al. 2004). Birds are mentioned only by Steadman et al. (2003). Analysis of the El Varal archaeofauna will allow further refinement of our understanding of Formative-period subsistence economies at the local and regional scales in the region.

Methods

Angela Sims produced much of the data included in this chapter as part of an undergraduate UCLA honors thesis conducted under the overall direction of Lesure and Wake. Wake instructed Sims in identification techniques and materials, closely oversaw Sims' analysis of fish and crab remains, and performed the identification of all amphibian, reptile, and mammal remains. Wake added and refined many of the previous fish identifications and conducted analysis of the collection based on its division into shell phases (see Chapter 5).

Under the guidance of Wake, Sims sorted the El Varal faunal collection by class in the Zooarchaeology

Laboratory of the Cotsen Institute of Archaeology at UCLA. Each class was then identified individually to limit potential confusion. Data were recorded for each specimen, including skeletal element, side, portion, weight, and taphonomic characteristics such as fragmentation, gnawing (carnivore and rodent), burning, cut marks, or other obvious modification.

Steadman identified the bird remains at the Florida State Museum. Identifications were confirmed using comparative osteological collections housed there and at the National Museum of Natural History, Smithsonian Institution.

Identifications of the fish, amphibians, reptiles, and mammals were confirmed using comparative vertebrate osteological collections housed at the CIOA Zooarchaeology Laboratory at UCLA, the UCLA Department of Biology, and the Los Angeles County Museum of Natural History. A series of field guides and identification manuals aided identifications and provided habitat information (Alvarez del Toro 1977, 1983; Jantzen 1983; Vannini 1989; Emmons 1990; Robins 1991; Rojo 1991; Iverson 1992; Fischer et al. 1995a, 1995b; Linares 1996; Ried 1997; Bussing 1998).

The El Varal archaeofauna collection was measured using NISP (number of individual specimens present) and MNI (minimum number of individuals) counts per analytical unit (Table 7.1). The NISP measure is a straight count of all identified bone specimens representing a given taxonomic category. The MNI is a derived determination of the minimum number of individual animals represented in the sample at hand. MNI determinations here are based on the greatest number of paired elements from either side (left or right) of a given taxon or on the number of unique skeletal elements represented, whichever is greater.

Size and age of individual skeletal elements are also used in the determination of MNI values here. For example, when two specimens representing one side of a specific paired skeletal element of a given taxon might suggest the presence of a minimum of two individuals a much larger or smaller specimen representing the opposite side would indicate the presence of another individual animal. Of course, the NISP and MNI measures both have well-known potential biases. NISP is subject to fragmentation effects, among others, and MNI measures are subject to aggregation effects (Grayson 1984; Ringrose 1993; Lyman 1994a, 1994b). Although each of these counts (NISP and MNI) has its inherent problems, viewed together they provide a fairly accurate representation of the relative abundance of the different identified animals present in the overall assemblage.

Table 7.1. Vertebrate remains by shell phase at El Varal

Shell Period	Volume	Vertebrates	Bones/m^3
Early	3.07	360	117.3
Middle	3.65	908	248.8
Late	1.67	605	362.3
Total	8.39	1,873	223.2

ANALYTICAL UNITS

The El Varal vertebrate archaeofauna collection was divided into three temporally distinct units of analysis based on stratigraphic associations of certain mollusk species (Table 7.1; see also Chapter 5). These respective temporal units represent different phases of the Early Formative period in Soconusco and are termed the Early, Middle, and Late shell phases (Tables 7.1 and 7.2). The availability of samples from these successive periods provides an excellent opportunity to examine changing patterns in vertebrate resource exploitation and environmental change at the Vásquez Mound.

RESULTS

The Vásquez Mound archaeofauna collection reported here consists of 2,218 vertebrate bone specimens identified to at least the class level (Tables 7.3 through 7.5). The major vertebrate classes (fish, amphibians, reptiles, birds, and mammals) are all represented in the Vásquez Mound archaeofauna. The overall vertebrate archaeofauna is quite rich, with 55 genera and 45 species representing 42 families identified. The most common class in the shell-phase assemblages is fish (94.6 percent), specifically ray-finned fish (Actinopterygii). Mammals (2.6 percent) are relatively rare (Table 7.2). Birds represent 1.5 percent of the overall archaeofauna. Amphibians and reptiles (1.3 percent), termed *herps*

Table 7.2. Vertebrate class frequencies at El Varal (NISP)

Taxon	Early Shell Phase		Middle Shell Phase		Late Shell Phase		Total	
	NISP	%	NISP	%	NISP	%	NISP	%
Fish	325	90.2	853	93.9	590	97.6	1772	94.6
Herps	10	2.7	10	1.1	5	0.8	25	1.3
Birds	7	1.9	15	1.7	6	0.9	28	1.5
Mammals	15	4.2	30	3.3	4	0.7	48	2.6
Total	360		908		605		1873	

Table 7.3. Identified vertebrate faunal remains from El Varal by shell phase

Common Name	Scientific Name	Early		Middle		Late		Total	**Total**
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	NISP	**MNI**
Requiem sharks	Carcharhinidae	2	**1**					2	**1**
Pacific gar	*Atractosteus tropicus*					1	**1**	1	**1**
Chihuil sea catfish	cf. *Bagre panamensis*			1	**1**			1	**1**
Blue sea catfish	*Sciades guatemalensis*			2	**1**			2	**1**
cf. Blue sea catfish	*Sciades* cf. *S. guatemalensis*	5	**2**	1	1			6	**3**
Chili sea catfish	*Sciades* cf. *S. troscheli*			2	**1**			2	**1**
Sea catfish	*Sciades* sp.	9	**4**	18	**6**	1	1	28	**11**
Sea catfish	Ariidae	157	33	96	19	141	19	394	**71**
Walter's toadfish	*Batrachoides waltersi*	6	**5**	3	**2**	5	**3**	14	**10**
Toadfish	*Batrachoides* sp.	2		1				3	
Toadfishes	Batrachoididae			1				1	
Needlefish	*Strongylura* sp.			1	**1**			1	**1**
Snook	*Centropomus* sp.	11	**9**	35	**17**	8	**5**	54	**31**
Jack	*Caranx* sp.	1	**1**	1	**1**	2	**2**	4	**4**
Pacific bumper	*Chloroscombrus orqueta*			1	**1**			1	**1**
Pompano	*Trachinotus* sp.					4	**1**	4	**1**
Snapper	*Lutjanus* sp.	6	**4**	16	**5**	28	**7**	50	**16**
Mojarra	*Diapterus* sp.	1	**1**	2	**2**	3	**1**	6	**4**
Yellow-fin mojarra	*Gerres cinereus*	1	**1**	1	**1**	2	**1**	4	**3**
Mojarras	Gerreidae	1						1	
Grunt	*Haemulopsis* sp.			1	**1**			1	**1**
Bigspine grunt	*Pomadasys macracanthus*			6	**4**	1	**1**	7	**5**
Grunt	*Pomadasys* sp.	1	**1**	1	**1**			2	**2**
Grunts	Haemulidae	1		7				8	
Weakfish	*Cynoscion* sp.					6	**1**	6	**1**
Croakers	Sciaenidae	1	**1**	1	**1**			2	**2**
Mojarra	*Cichlasoma* sp.	2	**1**	1	**1**			3	**2**
Sea chub	*Kyphosus* cf. *K. elegans*	2	**1**					2	**1**
Mullet	*Mugil* sp.	1	**1**	1	**1**	6	**2**	8	**4**

Table 7.3. *(continued)*

Common Name	Scientific Name	Early		Middle		Late		Total	**Total**
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	NISP	**MNI**
Pacific fat sleeper	*Dormitator latifrons*	2	**1**					2	**1**
Black sleeper	*Eleotris picta*	2	**1**	9	**2**	3	**1**	14	**4**
Sleeper	*Eleotris* sp.			3	**1**			3	**1**
Sleeper	Eleotridae			2				2	
Tuna, mackerel	Scombridae					1	**1**	1	**1**
Bony fish	Teleostei	108		635		355		1098	
Marine Toad	*Bufo marinus*			2	**1**			2	**1**
Toad	*Bufo* sp.	1	**1**					1	**1**
Green iguana	*Iguana iguana*	1	**1**			2	**1**	3	**2**
Black iguana	*Ctenosaura similis*					1	**1**	1	**1**
Green/black iguana	*Iguana/Ctenosaura*	2		1	**1**	1	**1**	4	**4**
Green sea turtle	*Chelonia agassizi*	1	**1**	1	**1**			2	**2**
Sea turtles	Cheloniidae	4		3				7	
Mud turtle	*Kinosternon scorpioides*			1	**1**			1	**1**
Turtles	Testudines	1		2				3	
Reptiles	Reptilia					1		1	
Pied-billed grebe	*Podilymbus podiceps*	1	**1**					1	**1**
Brown pelican	*Pelecanus occidentalis*					1	**1**	1	**1**
Neotropic cormorant	*Phalacrocorax brasilianus*	1	**1**					1	**1**
Yellow-crowned night heron	*Nyctanassa violacea*	1	**1**	2	**2**			3	**3**
Egret	*Egretta* sp.	1	**1**	2	**2**	2	**2**	5	**5**
American coot	*Fulica Americana*	1	**1**			1	**1**	2	**2**
Semipalmated plover	*Charadrius semipalmatus*					1	**1**	1	**1**
Black-necked stilt	*Himantopus mexicanus*			1	**1**			1	**1**
Marbled godwit	*Limosa fedoa*			1	**1**			1	**1**
Whimbrel	*Numenius phaeopus*	1	**1**					1	**1**
Willet	*Catoptrophorus semipalmatus*	1	**1**	3	**3**			4	**4**
Sandwich tern	*Sterna sandvicencis*			1	**1**	1	**1**	2	**2**
Crested caracara	*Caracara cheriwayi*			3	**2**			3	**2**

Table 7.3. *(continued)*

Common Name	Scientific Name	Early NISP	Early MNI	Middle NISP	Middle MNI	Late NISP	Late MNI	Total NISP	Total MNI
White-bellied chachalaca	*Ortalis leucogastra*			1	**1**			1	**1**
Mourning dove	*Zenaida macroura*			1	**1**			1	**1**
Nine-banded armadillo	*Dasypus novemcinctus*	1	**1**	1	**1**			2	**2**
Dolphin	Delphinidae	2	**1**					2	**1**
Human	*Homo Sapiens*	1	**1**			1	**1**	2	**2**
White-tailed deer	*Odocoileus virginianus*	4	**2**	7	**2**			11	**4**
Collared peccary	*Tayassu tajacu*	1	**1**					1	**1**
Cottontail rabbit	*Sylvilagus* sp.	2	**1**	6	**1**			8	**2**
Mice	Cricetidae			1		2		3	
Giant pocket gopher	*Orthogeomys grandis*	2	**1**	3	**1**			5	**2**
Cotton rat	*Sigmodon hispidus*			3	**2**			3	**2**
Large mammal	Large mammalia	1		5		2		8	
Small mammal	Small mammalia			3				3	
Mammal	Mammalia	1		1				2	
Total		360	**104**	908	**114**	605	**74**	1873	**293**

Table 7.4. Identified vertebrate specimens recovered from the heavy fraction of flotation samples (NISP)

Common Name	**Scientific Name**	**Unit/Lot N35W0/8**	**N70W0/3b**	**N80W0/3**	**N80W0/7a**	**Total**
Machete	*Elops affinis*			1	2	3
Swamp eel	*Synbranchus marmoratus*		3			3
Herring	Clupeidae				2	2
Anchovies	Engraulidae				1	1
Congo sea catfish	*Cathorops fuerthii*		2			2
Sea catfish	*Cathorops* sp.		1			1
Blue sea catfish	*Sciades guatemalensis*	1	1	1		3

Table 7.4. *(continued)*

Common Name	Scientific Name	Unit/Lot N35W0/8	N70W0/3b	N80W0/3	N80W0/7a	Total
Tete sea catfish	*Sciades seemani*		1			1
Sea catfish	*Sciades* sp.		11	2	1	14
Sea catfish	Ariidae	8	24	13	14	59
Silversides	Atherinidae	2	4		15	21
Snook	*Centropomus* sp.			1	1	2
Pacific bumper	*Chloroscombrus orqueta*		10	5	72	87
Leatherjack	*Oligoplites* sp.	1			1	2
Snapper	*Lutjanus* sp.	1			5	6
Mojarra	*Eucinostomus* sp.				1	1
Grunt	*Haemulon* sp.	1				1
Bigspine grunt	*Pomadasys macracanthus*				1	1
Grunts	Haemulidae		5		2	7
Drum	*Larimus* sp.				1	1
Mojarra	*Cichlasoma* sp.				7	7
Striped mullet	*Mugil cephalus*				2	2
White mullet	*Mugil curema*		1			1
Mullet	*Mugil* sp.	8	37	9	11	65
Pacific fat sleeper	*Dormitator latifrons*	1	27		8	36
Spotted sleeper	*Eleotris picta*				1	1
Gobies	Gobiidae			1		1
Bony fish	Teleostei	7				7
Large lizard	Iguana/Ctenosaura		4			4
Lizard	Lacertilia				1	1
Rodent	Rodentia, small			1		1
Mammal	Mammal, small		1			1
	Total	30	132	34	149	345

Table 7.5. Total identified vertebrate assemblage

Common Name	Scientific Name	Flotation Sample Heavy-fraction NISP	Excavated Lots NISP	Total NISP
Requiem sharks	Carcharhinidae		2	**2**
Pacific gar	*Atractosteus tropicus*		1	**1**
Machete	*Elops affinis*	2		**2**
Swamp eel	*Synbranchus marmoratus*	3		**3**
Herring	Clupeidae	2		**2**
Anchovies	Engraulidae	1		**1**
Chihuil sea catfish	cf. *Bagre panamensis*		1	**1**
Congo sea catfish	*Cathorops fuerthii*	2		**2**
Sea catfish	*Cathorops* sp.	1		**1**
Blue sea catfish	*Sciades guatemalensis*	3	2	**5**
cf. Blue sea catfish	*Sciades* cf *S. guatemalensis*		6	**6**
Tete sea catfish	*Sciades seemani*	1		**1**
Chili sea catfish	*Sciades* cf. *S. troscheli*		2	**2**
Sea catfish	*Sciades* sp.	14	28	**42**
Sea catfish	Ariidae	59	394	**453**
Toadfish	*Batrachoides waltersi*		14	**14**
Toadfish	*Batrachoides* sp.		3	**3**
Toadfish	Batrachoididae		1	**1**
Needlefish	*Strongylura* sp.		1	**1**
Silversides	Atherinidae	21		**21**
Black snook	*Centropomus nigrescens*		1	**1**
Tarpon snook	*Centropomus pectinatus*		2	**2**
Snook	*Centropomus* sp.	2	54	**56**
Jack	*Caranx* sp.		4	**4**
Pacific bumper	*Chloroscombrus orqueta*	87	1	**88**
Leatherjack	*Oligoplites* sp.	2		**2**
Pompano	*Trachinotus* sp.		4	**4**
Snapper	*Lutjanus* sp.	6	50	**56**
Mojarra	*Diapterus* sp.		6	**6**
Mojarra	*Eucinostomus* sp.	1		**1**
Yellow-fin mojarra	*Gerres cinereus*		4	**4**
Mojarras	Gerreidae		1	**1**
Grunt	*Haemulon* sp.	1		**1**

Table 7.5. *(continued)*

Common Name	Scientific Name	Flotation Sample Heavy-fraction NISP	Excavated Lots NISP	Total NISP
Grunt	*Haemulopsis* sp.		1	**1**
Bigspine grunt	*Pomadasys macracanthus*	1	7	**8**
Grunt	*Pomadasys* sp.		2	**2**
Grunts	Haemulidae	7	8	**15**
Weakfish	*Cynoscion* sp.		6	**6**
Drum	*Larimus* sp.	1		**1**
Croakers	Sciaenidae		2	**2**
Sea chub	*Kyphosus* cf. *K. elegans*		2	**2**
Mojarra	*Cichlasoma* sp.	7	3	**3**
Striped mullet	*Mugil cephalus*	2		**2**
White mullet	*Mugil curema*	1		**1**
Mullet	*Mugil* sp.	65	8	**73**
Pacific fat sleeper	*Dormitator latifrons*	36	2	**38**
Black sleeper	*Eleotris picta*	1	14	**15**
Sleeper	*Eleotris* sp.		3	**3**
Sleeper	Eleotridae		2	**2**
Gobies	Gobiidae	1		**1**
Tuna, mackerel	Scombridae		1	**1**
Bony fish	Teleostei	7	1098	**1105**
Marine toad	*Bufo marinus*		2	**2**
Toad	*Bufo* sp.		1	**1**
Green iguana	*Iguana iguana*		3	**3**
Black iguana	*Ctenosaura similis*		1	**1**
Green/black iguana	*Iguana/Ctenosaura*	4	4	**8**
Lizard	Lacertilia	1		**1**
Green sea turtle	*Chelonia agassizi*		2	**2**
Sea turtles	Cheloniidae		7	**7**
Mud turtle	*Kinosternon scorpioides*		1	**1**
Turtles	Testudines		3	**3**
Reptiles	Reptilia		1	**1**
Pied-billed grebe	*Podilymbus podiceps*		1	**1**
Brown pelican	*Pelecanus occidentalis*		1	**1**

Table 7.5. *(continued)*

Common Name	Scientific Name	Flotation Sample Heavy-fraction NISP	Excavated Lots NISP	Total NISP
Neotropic cormorant	*Phalacrocorax brasilianus*		1	**1**
Yellow-crowned night heron	*Nyctanassa violacea*		3	**3**
Egret	*Egretta* sp.		5	**5**
American coot	*Fulica Americana*		2	**2**
Semipalmated plover	*Charadrius semipalmatus*		1	**1**
Black-necked stilt	*Himantopus mexicanus*		1	**1**
Marbled godwit	*Limosa fedoa*		1	**1**
Whimbrel	*Numenius phaeopus*		1	**1**
Willet	*Catoptrophorus semipalmatus*		4	**4**
Sandwich tern	*Sterna sandvicencis*		2	**2**
Crested caracara	*Caracara cheriwayi*		3	**2**
White-bellied chachalaca	*Ortalis leucogastra*		1	**1**
Mourning dove	*Zenaida macroura*		1	**1**
Nine-banded armadillo	*Dasypus novemcinctus*		2	**2**
Dolphin	Delphinidae		2	**2**
Human	*Homo Sapiens*		2	**2**
White-tailed deer	*Odocoileus virginianus*		11	**11**
Collared peccary	*Pecari tajacu*		1	**1**
Cottontail rabbit	*Sylvilagus* sp.		8	**8**
Mice	Cricetidae		3	**3**
Giant pocket gopher	*Orthogeomys grandis*		5	**5**
Cotton rat	*Sigmodon hispidus*		3	**3**
Mouse	Rodentia, sm.	1		**1**
Large mammal	Large mammalia		8	**8**
Small mammal	Small mammalia	1	3	**3**
Mammal	Mammalia		2	**2**
Total		345	1873	**2190**

(after the term for their study, *herpetology*) in the tables of this report, are the least common vertebrate classes in the Vásquez Mound collection.

Fish remains include bones from 28 genera and 17 species, representing 21 families. Virtually all of the identified fish are ray-finned fish. Only two (n = 2) cartilaginous fish (sharks and rays) specimens are represented in the entire assemblage. The most common fish families in general are the Ariidae (sea catfish), followed distantly by the Centropomidae (snook), the Lutjanidae (snappers), and the Carangidae (jacks).

Amphibians and reptiles are comparatively rare in the Vásquez Mound vertebrate archaeofauna as well, represented by only 25 specimens (Table 7.3). Four herpetological families, including five genera and species, are identified. Turtle specimens, primarily shell fragments along with a few limb bones and vertebrae, dominate the herpetological remains. Iguanas, both black and green, are the next most common reptile species. Three toad specimens represent the amphibians. No snake remains are identified.

Birds are rare in the Vásquez Mound faunal collection, represented by 28 specimens from all three shell phases (Table 7.3). Nine bird families are represented by 15 genera and 14 species. Aquatic species dominate the Vásquez Mound avifauna (n = 23), reflecting the site's location amid the mangroves and estuaries of the coastal zone.

Mammals are relatively rare in the Vásquez Mound faunal collection, represented by a mere 48 specimens from all three shell phases (Table 7.3). Six families, seven genera, and six species of mammals are identified in the Vásquez Mound vertebrate archaeofauna—including marine and terrestrial species. Two dolphin (Delphinidae) bone fragments are identified. The remaining 46 identified mammal specimens represent terrestrial species. Rodents, rabbits, armadillos, and artiodactyls are identified. The most common identified mammals are white-tailed deer (*Odocoileus virginianus*) and cottontail rabbits (*Sylvilagus* sp.). No dog (*Canis* sp.) specimens are reported from the Vásquez Mound.

The general patterns cited previously hold through the three occupational phases of the site, at least in terms of a dominating presence of estuarine fish supplemented by a few terrestrial mammals and turtles. This pattern alters little across the sequence, with estuarine resources slightly increasing in importance relative to terrestrial herps and mammals. The fauna from each respective phase is described and discussed in greater detail in the sections that follow.

Early Shell Phase

A total of 360 bone specimens are identified from the Early shell-phase contexts at El Varal (Table 7.3). Fish (90.2 percent) dominate the identified vertebrate fauna from the Early shell phase in the Vásquez Mound, followed by mammals (4.2 percent), herps (for the most part sea turtles, 2.7 percent), and birds (1.9 percent). (See Table 7.3.)

Fish are the most diverse vertebrate class present in Early contexts at the Vásquez Mound, with a minimum of 13 genera and 5 species of fish identified—representing 13 families (Table 7.3). The majority of fish identified are estuarine-associated species such as sea catfish (Ariidae), snook (Centropomidae), snapper (Lutjanidae), and toadfish (Batrachoididae). (See Table 7.3.)

Sea catfish dominate the Early fish specimens in terms of NISP and MNI, followed distantly by snook. Although most of the fish genera and species identified in Early contexts at the Vásquez Mound can be found in fully marine habitats, they are most commonly encountered in coastal lagoon and estuary habitats along the Pacific Coast of southern Mexico (Fischer et al. 1995a, 1995b). A total of six specimens represent fish most commonly encountered in fresh to slightly brackish water habitats: cichlids (*Cichlasoma* sp., n = 2), Pacific fat sleeper (*Dormitator latifrons*, n = 2), and spotted sleeper (*Eleotris picta*, n = 2).

Reptiles and amphibians constitute roughly 2.7 percent of the Early shell-phase collection. A single toad (*Bufo* sp.) specimen represents the amphibians. Reptiles include sea turtles and terrestrial lizards. The Early shell-phase marine turtle remains include a single specimen identified as a green sea turtle (*Chelonia agassizii*), along with four specimens identified to the sea turtle family (Cheloniidae). Sea turtles can still be found close to the site, although they have been hunted to near extinction over the last 50 years (Alvarez del Toro 1983).

Sea turtles represent a large and potentially high-ranking source of meat and fat. This species is most frequently encountered on beaches when it is nesting. If their presence has any relation to nearby nesting habitats, their seasonally available eggs would also represent a desirable food resource. No freshwater turtles, common at contemporaneous sites in the region (Hudson et al. 1989; Blake et al. 1992a; Wake and Harrington 2002; Wake 2004; Wake et al. 2004), are identified in Early shell-phase contexts at the Vásquez Mound.

One large lizard species is identified in the Early shell-phase deposits: the green iguana (*Iguana iguana*, *n* = 1). Two specimens are identified only as "Iguana" (*Ctenosaura/Iguana*) because they are fragmentary but represent large iguanid lizards. The other large iguanid species in the region is the black iguana (*Ctenosaura similis*). Iguanas are commonly encountered in foliage along watercourses (*Iguana*) or on the ground at the edges of patches of vegetation (*Ctenosaura*) (Alvarez del Toro 1983).

Birds are the least common vertebrate class in the Early shell phase at the Vásquez Mound, constituting 1.9 percent of the subassemblage. Seven genera and species are identified, all represented by single specimens. All of the identified birds in the Early shell phase are waterfowl: pied-billed grebe (*Podilymbus podiceps*), neotropic cormorant (*Phalacrocorax brasilianus*), yellow-crowned night heron (*Nyctanassa violacea*), egret (*Egretta* sp.), American coot (*Fulica americana*), and two shorebirds [whimbrel (*Numenius phaeopus*) and willet (*Catoptrophorus semipalmatus*)]. No terrestrial bird species are reported in the Early shell phase.

Mammals are distantly the second most common vertebrate class in the Early material, constituting roughly 4.2 percent of the overall subassemblage. Six genera and five species representing six families of mammals are identified, most represented by a single individual. The most common identified mammal specimens in Early shell-phase contexts are representatives of the Artiodactyla (the even-toed ungulates): white-tailed deer (*Odocoileus virginianus*) and collared peccary (*Pecari tajacu*). Two specimens each represent cottontail rabbits (*Sylvilagus* sp.) and giant pocket gophers (*Orthogeomys grandis*).

Two vertebra fragments represent dolphins (Delphinidae), certainly an important potential prey item when available. Dolphins do enter estuaries and open lagoons and could possibly get caught in fishing weirs or nets. It is equally as likely that a random dolphin washed ashore and was subsequently exploited.

A single specimen represents the nine-banded armadillo (*Dasypus novemcinctus*). Based on size alone, deer (followed by peccary) were common in Soconusco—and almost certainly the highest-ranked (Alvarez del Toro 1977; Bayham 1979; Broughton 1994) terrestrial prey available to the past inhabitants of the Vásquez Mound.

Middle Shell Phase

A total of 908 bone specimens are identified from Middle shell-phase contexts at El Varal (Table 7.3). Fish (93.9 percent) dominate the identified Middle shell-phase vertebrate archaeofauna from the Vásquez Mound, followed by mammals (3.3 percent), birds (1.7 percent), and herps (mostly turtles, 1.1 percent).

Fish are the most diverse vertebrate class present in Middle shell-phase contexts at the Vásquez Mound. A minimum of 15 genera and 8 species of fish are identified, representing 12 families (Table 7.3). The majority of fish identified are estuarine-associated species such as sea catfish (Ariidae), snook (Centropomidae), snapper (Lutjanidae), and toadfish (Batrachoididae) (Table 7.3). Sea catfish dominate the Middle-phase fish specimens in terms of NISP and MNI, followed distantly by snook in terms of counts and in terms of MNI. A total of 15 specimens represent fish most commonly encountered in fresh to slightly brackish water habitats: cichlids (*Cichlasoma* sp.) and sleepers (*Eleotris picta*, *Eleotris* sp., and Eleotridae).

Reptiles and amphibians constitute roughly 1.1 percent of the Middle subassemblage. Two marine toad (*Bufo marinus*) specimens represent the amphibians. Reptiles include turtles and large lizards. The Early marine turtle remains include a single specimen identified as a green sea turtle (*C. agassizii*), along with three specimens identified to the sea turtle family (Cheloniidae). A single freshwater turtle (*Kinosternon scorpiodes*) specimen is identified from the Middle shell-phase subassemblage contexts at the Vásquez Mound. One fragmentary specimen is identified as "Iguana" (*Ctenosaura/Iguana*).

Birds are represented by nine genera and eight species, constituting 1.7 percent of the Middle shell-phase collection. Shorebirds dominate the Middle bird subassemblage, followed by egrets and herons. The three terrestrial bird species reported for the Vásquez Mound archaeofauna at El Varal [crested caracara (*Caracara cheriwayi*), white-bellied chachalaca (*Ortalis leucogastra*), and mourning dove (*Zenaida macroura*)] are represented in the Middle phase.

Mammals are distantly the second most common vertebrate class in the Middle shell-phase material, constituting roughly 4.2 percent of the overall subassemblage. Five genera and four species representing four families of mammals are identified, most represented by a single individual. The most commonly identified mammal specimens in Middle contexts are white-tailed deer, followed closely by cottontail rabbits (*Sylvilagus* sp.). Two rodent species are represented: giant pocket gophers and the cotton rat (*Sigmodon*

hispidus). The nine-banded armadillo is represented by a single osteoderm.

Late Shell Phase

A total of 605 bone specimens are identified from Late shell-phase contexts at El Varal (Table 7.3). Fish (97.6 percent) dominate the identified vertebrate fauna from the Early shell phase in the Vásquez Mound, followed distantly by birds (0.9 percent), herps (mostly lizards, 0.8 percent), and mammals (0.7 percent). (See Table 7.3.)

Fish are the most diverse vertebrate class present in Late shell-phase contexts at the Vásquez Mound, with a minimum of 13 genera and 5 species of fish representing 12 families (Table 7.3) identified. The majority of fish identified are estuarine-associated species such as sea catfish (Ariidae), snook (Centropomidae), snapper (Lutjanidae), and toadfish (Batrachoididae) (Table 7.3). Sea catfish dominate the Late shell-phase fish specimens in terms of NISP, followed distantly by snapper. Only three specimens represent fish most commonly encountered in fresh to slightly brackish water habitats: spotted sleeper (*Eleotris picta*) and tropical gar (*Atractosteus tropicus*).

Reptiles constitute 0.8 percent of the Late subassemblage. No amphibians are identified. The identified Late shell-phase reptiles include only terrestrial lizards. No turtle remains are identified. Both green iguana (*n* = 1) and black iguana are identified in the Late deposits. One fragmentary specimen is identified as "Iguana" (*Ctenosaura*/*Iguana*).

Birds are the most common non-fish vertebrates in the Late subassemblage, constituting 0.9 percent of the subassemblage. Only waterfowl are represented: egret, American coot, semipalmated plover (*Charadrius semipalmatus*), and sandwich tern (*Sterna sandvicencis*).

Mammals are as rare as reptiles in the Late material, constituting roughly 0.7 percent of the overall subassemblage. The only identified mammal specimens in Late contexts are of mice (Cricetidae)—neither representing food resources. Two fragments identified as large mammal may represent deer.

Heavy Fraction Samples

Bone specimens were recovered from dried heavy fractions of four flotation samples analyzed for botanical remains (see also Chapter 8). These samples are treated separately due to the fact that they represent a very different sampling strategy, and in terms of vertebrate remains tend to bias the shell-phase results discussed here. Nonetheless, the identification of these small fish remains adds several genera and species to the overall identified assemblage at El Varal and strengthens arguments for the presence of relatively open lagoonal waters close to the site (Table 7.4).

The heavy-fraction samples were examined in great detail for the presence of shrimp remains (Voorhies 1976, 2004). None were found. The crab remains recovered from the heavy-fraction samples are discussed in Chapter 6. All of the identified fish bones in the heavy-fraction samples represent the remains of small (less than 15 cm in total length) individuals. The most common identified species (other than catfish) in the heavy-fraction samples—Pacific bumper (*Chloroscombrus orqueta*), mullet (*Mugil* sp.), and silversides (Atherinidae)—are schooling fish. The large numbers and small size of the individuals of these species represented strongly suggests the use of lightweight fine-mesh nets, such as cast or dip nets.

TRENDS IN VERTEBRATE RESOURCE USE AT EL VARAL

Aquatic resources (primarily estuarine bony fish, waterfowl, and a few sea turtles) dominate the El Varal vertebrate archaeofauna overall, as well as each of the three temporal phases identified at the site. Terrestrial resources (including a few terrestrial birds, artiodactyls, rabbits, and iguanas) are present, but these constitute a much lower proportion of the overall vertebrate diet than do fish.

The majority of the identified fish species in all of the El Varal subassemblages are species most commonly encountered in estuarine habitats (Tables 7.3 through 7.5). The few species (*Caranx* sp., *Trachinotus* sp., *Kyphosus* sp., *Oligoplites* sp., *Larimus* sp., *Cynoscion* sp., and Scombridae) identified as potential indicators of more open-water habitats can all be found within broader estuarine systems and are generally rare in the overall El Varal vertebrate faunal assemblage.

Several broad trends can be observed over time in the El Varal archaeofauna. The first and foremost is the continuous dominance of estuarine fish species (sea catfish and a few other snook and snapper species) through each of the three identified temporal phases. The frequency of fish remains in each period represented in the Vásquez Mound collection actually increases through time from 90.2 percent in the Early phase, to 93.9 percent in the Middle phase, to 97.6 percent in the Late phase. The rising frequency of fish

in the three shell phases at the Vásquez Mound mirrors the intensification of mollusks at the site (see Chapter 5). It is possible that locally available highly ranked large quadruped vertebrates were depleted over time.

Sea turtles are present (one individual each) only in the first two phases (Early and Middle phases). They disappear by the Late phase. Artiodactyls and rabbits are present only in the Early and Middle phases, and like sea turtles disappear by the Late phase. Toads (rare) also disappear by the Late occupational phase. Toads are iconographically important in Soconusco and may have been consumed for dietary or ritual purposes (Hamblin 1981; Kennedy 1982; Cooke 1989).

Waterfowl dominate the relatively rare bird remains throughout all three shell phases reported here. Birds in general diminish in relative frequency over time. Terrestrial bird species are found only in the Middle shell-phase subassemblage.

Fishing Strategies at El Varal

The dominance of fish in the El Varal vertebrate archaeofauna begs the question of how exactly these fish were captured and begins to address more interesting issues concerning past human behavior and social organization. Fish can be captured in a variety of ways; some simple, and others more complicated. Some fishing methods also tend to leave more recognizable evidence than others do.

Hooks and Gorges

Many of the predatory open-water and reef species identified in the El Varal archaeofauna will readily bite a baited hook. The archaeological occurrence of fishhooks and gorges is documented from most coastal and riverine areas of the world (Butler 2001; Wake 2001; Voorhies et al. 2002). However, no drop-line hooks, gorges, or trolling rigs were recovered during excavation at El Varal. Therefore, the use of hook-and-line technology in regard to the fish represented at El Varal can be ruled out for now.

Traps

Coastal and riverine peoples throughout the world commonly use mobile fish traps, as opposed to static fish weirs. Traps can be made from wood, basketry, or ceramic vessels. Traps are especially useful in areas where hooks and nets can be snagged on subsurface structures such as rocks and reefs. Wing (2001) mentions the use of fish traps on reefs at various sites in the Caribbean. Although no positive evidence supporting trap use is present at El Varal, their use cannot be completely ruled out—given the overall contribution of reef fish to the archaeofauna from each respective temporal phase.

Tidal Weirs

Cooke (2004) replicated several tidal weirs over the course of his research in Pacific Panamanian estuarine systems. He found this technique of strategically locating static fish-catching stations to be highly productive, leading to a fairly distinctive species composition. It is quite possible that tidal weirs were used in coastal Chiapan estuarine systems because the species composition of the identified fish fauna broadly parallels those recorded in Panama (Voorhies et al. 2002; Wake 2004; Wake et al. 2004). The coastal geomorphology of the marine environments associated with El Varal may have been optimal for placement of weirs. The site is associated with long estuaries and narrow-mouthed coastal lagoons within the Pacific's great tidal reach. More fine-grained research on this question in Chiapas must occur before definitive statements can be put forward.

Nets

Although little positive evidence supporting the presence of nets is present at El Varal, their use presents the most likely explanation for the composition of the fish fauna at the site. The estuarine fish species that constitute the majority of the fish fauna in each respective time period are most easily caught in the numbers seen at El Varal by using nets. The small schooling species so prevalent in the heavy-fraction samples were most likely captured using cast nets or dip nets. Estuarine seines and perhaps gill nets are the most likely candidates for use in capturing the larger fish, given the species present and their distribution in the local marine environment. Beach seines would produce a fish fauna heavier in croakers (Scieanidae), mullet (Mugilidae), and other beachfront species than is seen in any of the three temporal subassemblages at El Varal.

The potential use of large seines has several behavioral implications—the foremost of which concerns the use of watercraft. Some type of watercraft would have been necessary to deliver nets to the more open waters that produced the fauna identified from El Varal. Many of the identified species simply could not be captured

from the shore with beach seines or dip nets. *Watercraft* is a broad term and could include relatively simple flotation devices of bundled reeds, logs, or perhaps open-hulled canoes or balsas.

Discussion

The dominance of fish in all three time periods represented in the Vásquez Mound vertebrate faunal collection is impressive. Terrestrial species were simply not an important part of the vertebrate assemblage at the site. Although reptiles, birds, and mammals are present, they constitute less than 5 percent of the overall collection and less than 5 percent in each phase. The fish and waterfowl genera and species identified at El Varal represent a diverse array of microhabitats, primarily within the locally available estuarine and coastal lagoonal habitats. Few freshwater fish are present, and only four identified genera tend to prefer open water.

The dietary patterns seen at El Varal are broadly similar to those seen in the Chiapas Late Archaic and Formative periods (Voorhies 1976; Hudson et al. 1989; Blake et al. 1992a; Voorhies et al. 2002; Wake and Harrington 2002; Wake 2004; Wake et al. 2004). Local environment is almost certainly the primary variable when comparing vertebrate subsistence systems in Soconusco (Coe and Flannery 1964, 1967). Coastal Chiapas is dominated by estuarine systems amenable to the use of tidal weirs, nets, and crab pots.

The fishing strategies at El Varal probably revolved mainly around net use (and perhaps weirs), whereas a wider array of fishing techniques (including the use of hooks) was employed in Formative-period Chiapas (Wake 1998). Terrestrial resources are not nearly as prevalent at El Varal as they are in other coastal Chiapas sites (Voorhies 1976; Blake et al. 1992a; Hudson et al. 1998; Voorhies et al. 2002; Wake and Harrington 2002; Wake 2004; Wake et al. 2004).

Interestingly, no dog remains are identified at El Varal. Dogs appear during the Early to Middle Formative periods at Paso de la Amada (Wake 2004). However, dogs occur in relatively low numbers at Paso de la Amada and in much lower relative frequencies than they do at later sites in the region. Dogs appear to have been included more commonly in the diet at Middle Formative sites in the region, such as La Blanca (Wake and Harrington 2002) and Chiapa de Corzo (Flannery 1969). Heavy reliance on dogs for food is also seen during the Formative period in the Valley of Oaxaca, the Petén, and on the Caribbean coast (Wing 1978; Flannery 1986; Clutton-Brock and Hammond 1994).

Conclusions

The past occupants of El Varal accumulated fauna from a variety of environments, both aquatic and terrestrial. Fish contributed the greatest proportion of vertebrate dietary protein at El Varal. Reptiles (specifically, sea turtles), although perhaps highly ranked in terms of individual dietary items, were of secondary importance in the Early and Middle shell phases at El Varal. Birds, primarily waterfowl, and mammals (such as deer, peccary, and rabbits) also contributed to the overall diet during the Early and Middle shell phases of El Varal. With the notable exception of dolphins, all of the mammals reported from the Vásquez Mound (deer, peccary, rabbits, giant pocket gophers, and rice rats) are precisely the types of species that could be captured by hunting in garden plots associated with the settlement (Linares 1976).

The identified vertebrate faunal remains, especially fish and birds, exhibit a strong estuarine focus in general. The primary fishing focus appears to have been on light- and heavy-net and/or weir fishing for estuarine and lagoonal fish species such as catfish, snook, and snapper—with other local and open-water species (that often enter estuaries) occasionally captured. The waterfowl could represent expedient capture while traveling to fishing sites or during fish acquisition.

Fishing seems to have been the most important vertebrate food acquisition pursuit at El Varal. This activity intensified over time, with nearly 98 percent of all vertebrate specimens representing fish by the latest occupational phase. Intensification of resource acquisition in general is indicated in the analysis of the mollusk remains from the Vásquez Mound. Intensification of crabbing is supported at El Varal by the absence in Late-phase contexts of other large, highly ranked, and potentially important vertebrate food resources such as deer, peccary, and sea turtle. It is entirely possible that these locally available highly ranked vertebrate resources had been depleted by the Late phase, resulting in the intensification of lower-ranked resources such as the crabs and fish discussed in this chapter.

CHAPTER 8

Macrobotanical Remains from El Varal, with a Comparison to Inland Sites

VIRGINIA S. POPPER AND RICHARD G. LESURE

Five flotation samples from El Varal were analyzed and compared to 26 samples from other sites (each with a dish-dominant assemblage rather than the tecomate-dominant pattern observed at El Varal) excavated by Lesure or Pérez Suárez in the Mazatán region. Materials analyzed all date from the Early Formative, but they are not strictly contemporary. El Varal samples date from the Jocotal or later Cuadros phase. Those from Cantón Corralito are Cuadros, but likely predate the occupation at El Varal. Those from Paso de la Amada and Mz-250 are several centuries older, from the Locona or Ocós phases.

These chronological differences mean that the set of samples analyzed is far from ideal. However, these were the only samples available. Our goal in the analysis was to assess the likelihood of systematic differences in plant utilization between El Varal and sites with dish-dominant assemblages. Such differences, if they could be identified, might plausibly be important in an explanation of Early Formative inter-site assemblage differences in the Mazatán region.

The sites considered lie in three different ecological settings. Clark (1994) describes five environmental zones characterizing the Mazatán region: the littoral zone, swamps, savanna, forested plain, and piedmont forest. El Varal was in the estuary, Paso de la Amada and Mz-250 bordered an abandoned river course in the forested coastal plain, and Cantón Corralito was located beside a river at the edge of the tropical deciduous forest (the inland part of the coastal plain). Given the locations of the sites, one would expect differing plant communities in the immediate vicinity. Further, El Varal was probably not a choice location for growing maize. If it was a special-purpose extraction location, one might expect systematic differences between the macrobotanical remains of El Varal and the dish-dominant sites farther inland.

The results are extremely modest because of the low rate of recovery of botanical remains in all samples. However, the evidence as it stands does not indicate any systematic differences in the plant inventories of dish-dominant and tecomate-dominant sites. In particular, probable maize remains were identified at El Varal. That result is in line with a much more abundant evidence of maize recovered at the very similar site of Salinas la Blanca (Coe and Flannery 1967).

Methods

The sediment samples were floated in Mexico and then submitted to the Paleoethnobotany Laboratory of the Cotsen Institute of Archaeology at UCLA for sorting and identification. Each sample was sifted through a series of nested sieves, yielding four size fractions

(>2.00 mm, 2.00–1.00 mm, 1.00–0.50 mm, and <0.50 mm) in preparation for sorting. Carbonized wood was only removed from the >2.00-mm fraction and weighed.

All other carbonized plant material was removed from the 2.00–1.00-mm and 1.00–0.50-mm fractions and counted or weighed. Material <0.50 mm in size was quickly scanned for whole carbonized seeds. However, none were present. Only carbonized material was considered cultural in this analysis. Plant remains were identified by reference to comparative collections and manuals in the Cotsen Institute's Paleoethnobotany Laboratory.

Results

Few archaeobotanical remains were recovered. The total soil volume analyzed was 35.75+ liters from El Varal (5 samples), 115 liters from Paso de la Amada (only 6 of the 7 samples had recorded soil volumes), 92.25 liters from Mz-250 (6 samples), and 123.25 liters from Cantón Corralito (13 samples). Table 8.1 presents the absolute counts and weights for the recovered carbonized material from the flotation samples. Seed densities ranged from 0.0 to 0.71 seeds/liters, and charcoal densities ranged from 0.0 to 1.07 g/liters.

Table 8.1. Botanical remains recovered at five Early Formative sites of the Mazatán region

Provenience	Recovered Macrobotanical Remains
El Varal (35.75 liters total):	
N35W0/8	0.01 g charcoal 1 unknown plant part
N70W0/3B	0.07 g charcoal
N75W0/1A	1 cotyledon 0.21 g charcoal
N80W0/3	2 cf. *zea mays* cupules 0.01 g charcoal
N80W4/2	2.3 g charcoal
Cantón Corralito (all samples; 123.25 liters total):	1 cf. *zea mays* cupule 3 cf. *zea mays* kernel fragment 1 cf. Fabaceae 4 thick seed-coat fragments 2 unidentifiable seeds 2.81 g charcoal 1 unidentified stem
Paso de la Amada (all samples; 115 liters total):	1 *zea mays* cupule 13.1 g charcoal 1 plant part, parallel sided
Mz-250 (all samples; 92.25 liters total):	6.46 g charcoal 0.24 g nut fragments

Few identifiable remains other than charcoal were recovered from the samples. *Zea mays* (maize cupules and a possible kernel fragment) were found in only four samples. One seed fragment could not be identified as to genus, and based on morphology was placed in the Fabaceae (legume) family. Other fruit and seed fragments too eroded to identify or unknown to the analyst included a cotyledon fragment, thick seed-coat fragments, and nutshell fragments.

The thick seed-coat fragments were approximately 0.4 mm thick and had a grainy texture. The nutshell fragments measured 1 to 1.5 mm thick and had a rough outer surface and an inner surface with bony projections. Seeds too distorted or fragmented to classify to even the family level were placed in the "unidentifiable seeds" category. Identifications that carry some uncertainty are indicated as "cf."

Botanical material that lacked any diagnostic characteristics and could not be positively identified to a known taxon was placed in the "amorphous" category. Amorphous material is typically very porous, possesses minimal vessel structure, and lacks a distinctive shape. The amorphous material was highly vitrified and exploded, suggesting burning under high temperatures. Parallel-sided fragments were also recovered. "Parallel sided" refers to unidentified nut-like fragments where the inner part of the shell is parallel to the outer part. This fragment was 0.5 mm thick and had a porous cross section.

Conclusions

A much larger sample of carbonized plant material would be needed to support a systematic comparison of dish-dominant and tecomate-dominant sites. The most important observation to be made of the evidence reviewed here is that maize (grown in the vicinity or brought to the site) seems to have been consumed at El Varal.

CHAPTER 9

Pottery

RICHARD G. LESURE AND ISABEL RODRÍGUEZ LÓPEZ

The pottery of El Varal has undergone an unusual history of study, due partly to the nature of the sample and partly to progress of research at the New World Archaeological Foundation during the late 1990s. The sample is composed of three subsets: "surface" materials recovered from bulldozer backdirt or from the scraping of the western profile (Phases 1 and 2), excavated materials from the targeted investigations of Phase 3, and the results of the Phase 4 Step Excavation.

The surface materials include most of the largest and best-preserved vessel fragments recovered—the result of our wanderings about the abundant piles of dirt removed from the canal cut. Soon after the excavations, virtually the entire surface collection was incorporated into study collections at the New World Archaeological Foundation laboratory in San Cristóbal. John Clark drew on Varal surface ceramics to work out the Jocotal portion of his general chronological framework for the Soconusco (Clark and Cheetham 2005).

Because the surface materials have been dispersed and well studied, we choose to concentrate here on the excavated collections. Still, we have not succeeded in analyzing all of the ceramics from El Varal even after three attempts: first by Lesure in 1993, second by Natalie Smith (now Henrich) in 1996, and finally by Rodríguez López in the summer of 2003. Lesure's study was partially published (Lesure 1993), and Henrich's work led to her UCLA master's thesis (Smith 1997). After the most recent study season, various lots remain unanalyzed—particularly those in N45W4 (lots 1 and 2), parts of N35W4 (lots 2 through 4), N60W0 (lots 1 and 2), a scattering along the Step Excavation (N60W0 lots 5 and 6, N70W0 lot 3A, and N80W0 lot 6B), and the less productive lots of N95W0 (lots 1 through 3, 6, and 12 through 20).

It is useful to note the distinction between Clark's study of the El Varal ceramics and our own. The former was focused on general patterns in the Mazatán area and beyond. Our emphasis, instead, is on El Varal as a specific case. With the excavated materials, it is possible to look for changes in the pottery assemblage *during* the Jocotal phase. If we had included more surface materials in our study, we would have had to expand the range of forms included in our type descriptions. However, any forms not reported here are rare at the site and known only from finds in dirt removed by the bulldozer.

Typological and Analytical Issues

We propose only one new type (Vásquez Gray). All other pottery types identified at El Varal have been previously described by Coe and Flannery (1967) for

Salinas la Blanca, by Lowe (1967) for Altamira, and by Clark and Cheetham (2005) for the Mazatán Early Formative generally. Clark and Cheetham's scheme considerably revises and simplifies the types of the Cuadros and Jocotal phases. We have followed their lead in most instances. Their most significant deviation from Coe and Flannery (1967) is the lumping of Guamuchal Brushed, Suchiate Brushed, and Teófilo Punctate into Guamuchal Plain. We understand them also to have collapsed Méndez Red-Rimmed and Mapache Red-Rimmed into Mapache Red-and-Buff.

The data set of 2,417 sherds consists of 1,513 rims from the Step Excavation and N95W0 (analyzed by Smith), 613 rims from Phase 3 excavations south of the mound core (analyzed by Rodríguez López), and 291 rims from N95W0 (analyzed by Lesure). Rodríguez López and Lesure each also analyzed part of the material studied by Smith. Sherds were never labeled with individual identification codes, and the overlapping analyses proved difficult to match after the fact. In the end, we have let Smith's results prevail in order to provide consistent categories and measurements throughout the all-important Step Excavation.

Many of the differences among the three observers seem to stem from two basic characteristics of the assemblage. First, surface color varies quite widely due to haphazard original firing, the apparent use of many vessels for cooking, and probably post-breakage burning affecting numerous sherds. With types based fundamentally on surface colors, there was more disagreement in the assignment of sherds to types than one might expect. The gradient from white to gray to black was a problem, as was orange to red. Slipping of a red band around the rim of utilitarian tecomates is given type-level significance, but the slipped band erodes and is sometimes easy to miss. Further, small red-rimmed fragments might be from buff tecomates with red rims or from tecomates slipped entirely red (another type-level distinction).

The second assemblage characteristic that seems to have affected the analysis is a potential for confusion among the rims of several vessel forms. Although the range of forms at El Varal is relatively narrow, neck sherds from jars with tall necks can be indistinguishable from those of deep bowls with near-vertical walls. Both are slipped only on the exterior. Smith seems also to have sometimes confused rim sherds of these with those of slipped tecomates (also unfinished on the interior) or open dishes (typically with interior slip).

Although we follow the literature of Formative Soconusco pottery analyses in identifying types based on surface finish, the Varal assemblage seems to us to have more the character of *sets of forms* that were finished according to one of two general design templates. Those templates allowed for choices of specific colors and decorative techniques. To get at what we see as this more fundamental patterning, we have borrowed from Coe and Flannery (1967) the notion of "tradition." Their traditions were foremost decorative, with formal-functional correlates (a red-rimmed tecomate tradition, a brushed tecomate tradition). We have reversed the emphasis: our traditions are broad formal-functional patterns with associated design templates. That reversal leads to a reduction in the number of traditions to two: utilitarian tecomates and slipped service-and-utilitarian wares. We also identify three exotic types that do not fit within those traditions.

The shift in emphasis also involves a reduction in the temporal scope of what are referred to as traditions. Although utilitarian tecomates with decorated rims were an ancient pattern in the Soconusco, the complex design template described here was unique to the Cuadros and Jocotal phases. The coherence of most slipped types as color variations applied to a single set of vessel forms is likewise less in different eras, and it may be confined even in the Cuadros-Jocotal phases to sites such as El Varal with limited form inventories. The coherence that leads us to identify a single slipped-ware tradition may have been already breaking down during the Terminal stratigraphic period at El Varal.

Although the vessel-form inventory at El Varal is limited, those limitations may be more the result of the limited temporal span of occupation at the Vásquez Mound rather than of an absolute impoverishment of the assemblage. Although tecomates overwhelm other forms and are followed in frequency by simple flat-bottomed dishes, a variety of other forms are present in low numbers. Opening a large bag of sherds from the site often yielded a surprise or two in terms of formal variation.

The Utilitarian Tecomate Tradition

The utilitarian tecomate tradition comprised the majority of vessels discarded at the site through much of the occupation. Pastes are medium to coarse in texture, with the largest grains typically in the range of 0.5 to

1.5 mm. Inspection with a hand lens suggests that the inclusions are mainly sand grains. Flecks of mica are also common. Paste color varies enormously. Tan, gray, orange, and pink are typical (e.g., 10YR5/2, 10R6/6, 10R7/4, 2.5YR5/6, and 10YR6/3). The surfaces of many sherds are in terrible shape, and often seem to be exfoliating in plates.

The basic form is the tecomate (neckless jar). This restricted-rim form is by definition unfinished inside (scraped or roughly wiped; never slipped or polished). Those identified as utilitarian in addition have unslipped exteriors below a narrow band around the exterior rim (slipped red in the case of Mapache Red-on-Buff). Although not slipped, they are often decorated to an extent that rather belies the "Plain" Clark and Cheetham attach to "Guamuchal." A few rims decorated in this manner have necks and are thus classified as jars, but 99 percent were tecomates.

Rim angle was measured from the horizontal using a goniometer positioned 2 to 4 cm below the mouth, at a point that appeared representative of the upper profile of the vessel. The resulting distribution of rim angles for the entire assemblage is distinctly bimodal (Figure 9.1). That pattern has been previously reported at other Early Formative sites of the Soconusco [e.g., by Lesure (1998), who determined rim angle in a manner consistent with that employed here]. There would appear from Figure 9.1 to be two distinct forms: globular tecomates (rim angle less than about 50 degrees) and subglobular (rim angle greater than or equal to about 50 degrees).

This histogram, however, masks significant temporal change: subglobular tecomates drop out of the assemblage after the Early stratigraphic period. Rim diameters of globular and subglobular utilitarian tecomates are normally distributed and statistically identical (globular: mean 17.76, $n = 392$, $\sigma = 3.67$; subglobular: mean 17.19, $n = 58$, $\sigma = 3.88$; $p = 0.296$). The dimensions observed are similar to those reported by Coe and Flannery: a mean of 19 cm for Mapache and Méndez and 17 cm for Guamuchal. Their Suchiate is larger, at 22 cm—with a range of 18 to 28 cm.

Smith measured sherd thickness just below the lip. Globular and subglobular were also indistinguishable in that measure (globular: mean thickness 1.19, $n = 354$, $\sigma = 0.19$; subglobular: mean thickness 1.15, $n = 57$, $\sigma = 0.18$; $p = 0.160$). Coe and Flannery (1967) report thinner walls for Guamuchal and Méndez tecomates, but they measured sherds further down the vessel profile (Smith 1997:22n).

Among the few available cases for which maximum vessel diameter of globular utilitarian tecomates is known, there is a weak positive correlation between rim diameter and maximum diameter (Figure 9.2). Because these were essentially spherical vessels, maximum diameter should be closely related to original vessel capacity. For globular tecomates, rim diameter seems to have increased with capacity. Given the differing geometry of subglobular tecomates, one might expect a different relationship between rim and maximum vessel diameter. We have both measurements on only one subglobular rim sherd, from an unusually small tecomate with rim diameter of 8 cm and maximum diameter of 21 cm. It lies well off the regression line in Figure 9.2.

Our sense of the material had been that tecomate capacity increased over time at the site, but we have too few maximum-diameter measurements to test that. The correlation in Figure 9.2 suggests an indirect means of

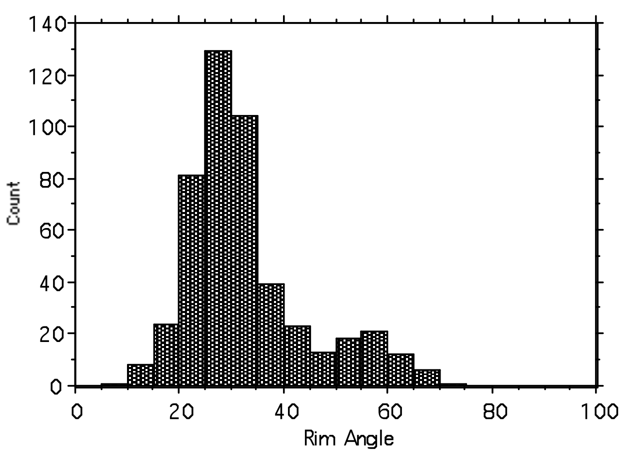


Figure 9.1. Histogram of rim angles in the utilitarian tecomate tradition.

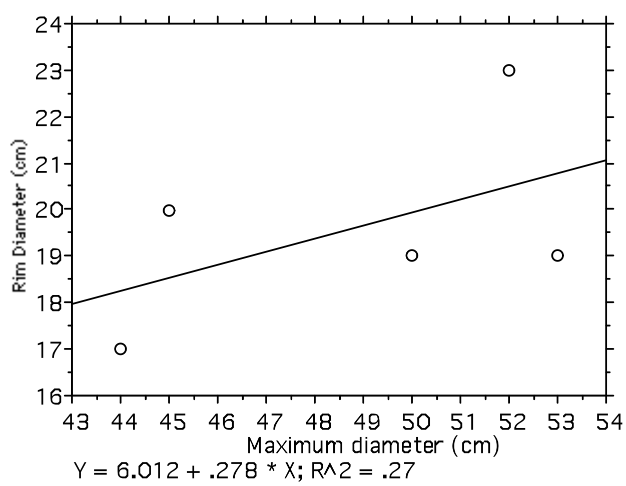


Figure 9.2. Scatter plot of maximum vessel diameter (x) versus rim diameter (y) for globular utilitarian tecomates (with regression line).

looking for changes in capacity: if vessel capacities rose, rim diameters should have risen. The relevant analysis is provided in Table 9.1. Contrary to our expectations, there was no change in the rim diameters of globular tecomates—suggesting stability in tecomate volume.

Although we classify these as utilitarian vessels and believe that one of their significant uses was as cooking pots, it is important to emphasize that the pots were richly decorated. At their most elaborate, tecomate exteriors seem to have been conceived of in terms of five circumferential zones (Figure 9.3). Zone 1 was a band around the rim, extending down from the lip usually no more than 4 cm. Where present, this band was burnished (Guamuchal Plain) or slipped red (Mapache Red-on-Buff). The band was often decorated with one or two circumferential grooves, often one close to the lip and one at or near the lower margin of the zone.

Zone 2 (at its most elaborate) was the convex band described by Coe and Flannery (1967:29) for their type Guamuchal Brushed. The zone was almost always brushed while the clay was wet, to create a roughly striated surface. The orientation of the brushing was diagonal, vertical, or horizontal—and the tool involved was something with multiple bristles (perhaps even a handful of grass). While the brushed surface was still wet, it was often further decorated by simple motifs composed of (from more to less common) jabs or punctations, straight incised line(s), incised arc(s) (an upside-down U), a curving line (like a backward S rotated 90 degrees), and rocker stamping. Specific motifs (often apparently repeated around the vessel) included almost every example described or pictured by Coe and Flannery (1967:29–30, plates 6 through

Table 9.1. Tecomate rim diameters over the four stratigraphic periods

	Mean Rim Diameter (cm)	Standard Deviation	Range	N
Early:				
Subglobular	17.3	3.7	6–26	56
Globular	17.5	4.2	8–28	50
Middle:				
Globular	18.0	3.5	8–28	187
Late:				
Globular	17.6	3.7	10–29	144
Terminal:				
Globular	15.7	4.3	9–21	11
All tecomates	17.4	4.4	9–29	49

Figure 9.3. Guamuchal Plain tecomate rim sherd with numbers marking the zones of decoration present on this vessel. Zone 1: this piece has a single circumferential groove. Zone 2: this piece has a raised band with circumferential brushing and motif code f from Figure 9.4 (single diagonal row of jabs) spaced at intervals, apparently around the entire circumference. Zone 3: diagonal brushing contrasts with direction of brushing in zone 2. Note also the finger punch from the exterior forming a rounded depression. Zone 4: lightly burnished area beneath zone 3.

11). The following list, arranged generally from most to least frequent, is based on Rodríguez López's analysis of a subset of the tecomates and is thus not exhaustive.

1. Single diagonal row of jabs (Figure 9.4f).
2. Arcs linked in a horizontal row (Figure 9.4n). Apparently significantly more common here than at Salinas la Blanca.
3. A horizontal line of jabs circling the entire vessel. This pattern typically appears just below zone 1 and was a characteristic of Teófilo Punctate. [See Coe and Flannery (1967:plates 11h and 12b through e), but see their plate 9g for an exception.]
4. Two parallel, diagonal incised lines (Figure 9.4l).
5. Two parallel, diagonal rows of jabs (Figure 9.4g).
6. Several parallel, diagonal incised lines (Figure 9.4s).
7. A curving line, particularly the backward rotated S described previously (Figure 9.4y).
8. A diagonal row of linked arcs, accompanied by one or more incised lines (Figure 9.4o).
9. A single horizontal arc, accompanied by a pair of incised diagonal lines (Figure 9.4m).
10. A sawtooth pattern formed by diagonal lines (Figure 9.4p).
11. Multiple diagonal rows of jabs (Figure 9.4h).
12. A curving line of jabs (Figure 9.4j).

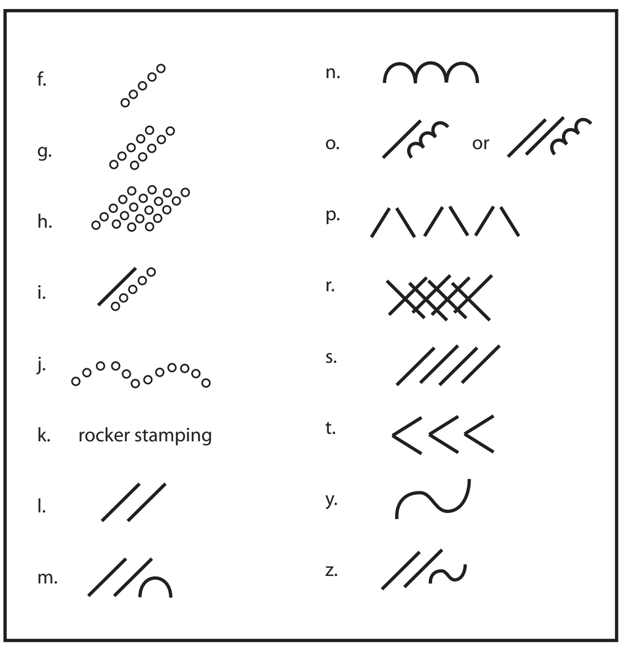


Figure 9.4. Schematic illustrations of motifs on utilitarian tecomates, mainly zone 2. Letters are original codes given motifs by Rodríguez López.

13. Rocker stamping.
14. A curving incised line, accompanied by a pair of incised diagonal lines (Figure 9.4z).
15. A single diagonal row of jabs accompanied by a single diagonal incised line (Figure 9.4i).
16. Cross-hatching (Figure 9.4r).
17. Herringbone incised lines or jabs (Figure 9.4t). Rare at El Varal; apparently much more common at Salinas la Blanca (Coe and Flannery 1967:plate 6).

Zone 3 begins (in the most elaborate versions) at the base of the convex band and extends often to about a quarter of the way down the exterior surface of the vessel. It is again brushed (diagonally, vertically, or horizontally), often in a direction contrasting with that employed on zone 2 (Figure 9.3). Sometimes, zone 3 was the recipient of some of the previously described motifs—but particularly common here are a *separate* set of plastic modifications, all reported as well by Coe and Flannery (1967).

18. Finger punching from the interior (to form a raised bubble) or the exterior (to form a rounded depression) (Figure 9.3).
19. A long fillet of clay attached to the vessel surface, post-brushing. The fillet often curves, and is decorated by indentations.
20. Appliqué and cane impressions forming a crude face (Coe and Flannery 1967).

Zone 4, where present, begins at the lowermost margin of zone 3 and continues to about the middle of the vessel (or down to the base). Its surface is roughly burnished and would be unremarkable were it not for zone 5, which appears in at least some cases (due to breakage we do not know what percentage actually had the full five zones). Zone 5, beginning about the middle of the vessel at the point of maximum diameter and extending to the base, is undecorated—with the surface scraped but not burnished.

The full combination of burnished/grooved zone 1, raised/brushed zone 2 with motifs, contrastingly brushed zone 3 with a different set of plastic decorations, burnished zone 4, and scraped zone 5 was most common early in the sequence—although tecomates were never uniformly five-zoned even then. The scheme was progressively simplified over the course of the sequence until by the Terminal period it appears to have been on the point of disappearing altogether.

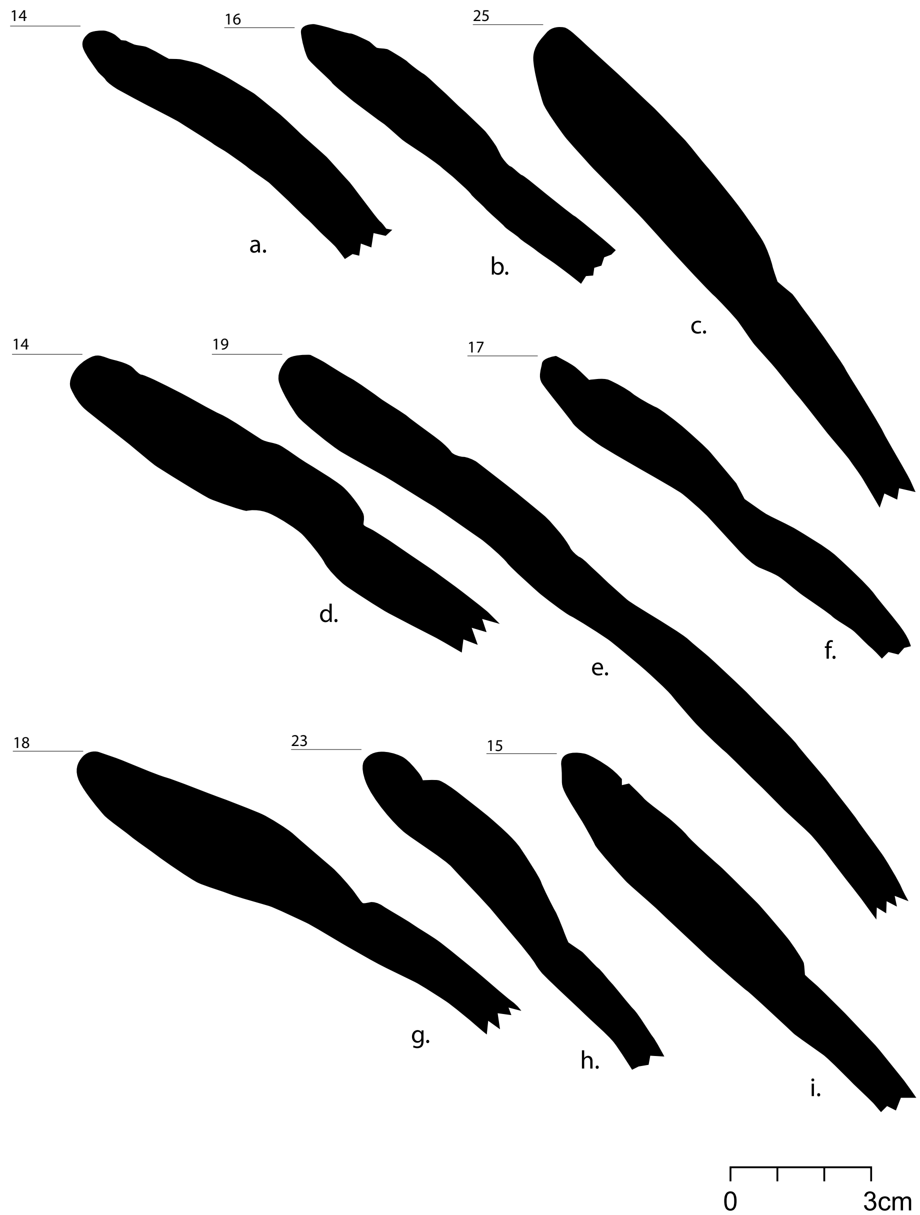


Figure 9.5. Guamuchal Plain tecomate rims with rim band or break in upper wall profile (the original Guamuchal Brushed). On all profiles illustrated, rim diameters are noted where available.

The disappearance of zone 2 was a particularly noteworthy development, captured by Coe and Flannery (1967) in their differentiation between Guamuchal and Suchiate Brushed. There are intermediate versions at El Varal, such as tecomates with a break in the upper rim profile at the junction between zone 2 and zone 3, but no real raised band (Figures 9.5c, g, and i). There are also some pieces with no perceptible break in profile that nevertheless maintained the distinction between zone 2 and zone 3 in the form of a simple groove or differently oriented brushing (Figure 9.6g). There are two types, described in the sections that follow.

Guamuchal Plain

Tecomates and a few ollas decorated in the manner described previously, with zone 1 rim bands well smoothed or lightly burnished but not slipped (Figures 9.5 through 9.7). Pastes are coarse and in a wide variety of colors, from light brown (common) to orange, pink, darker brown, and gray. The identified sample includes 614 rims (99 percent tecomates and 1 percent ollas). References: Coe and Flannery (1967:28–30, Figures 11 and 12 and plates 6 through 9), Green and Lowe (1967:106, Figure 79), Ekholm (1969:36,

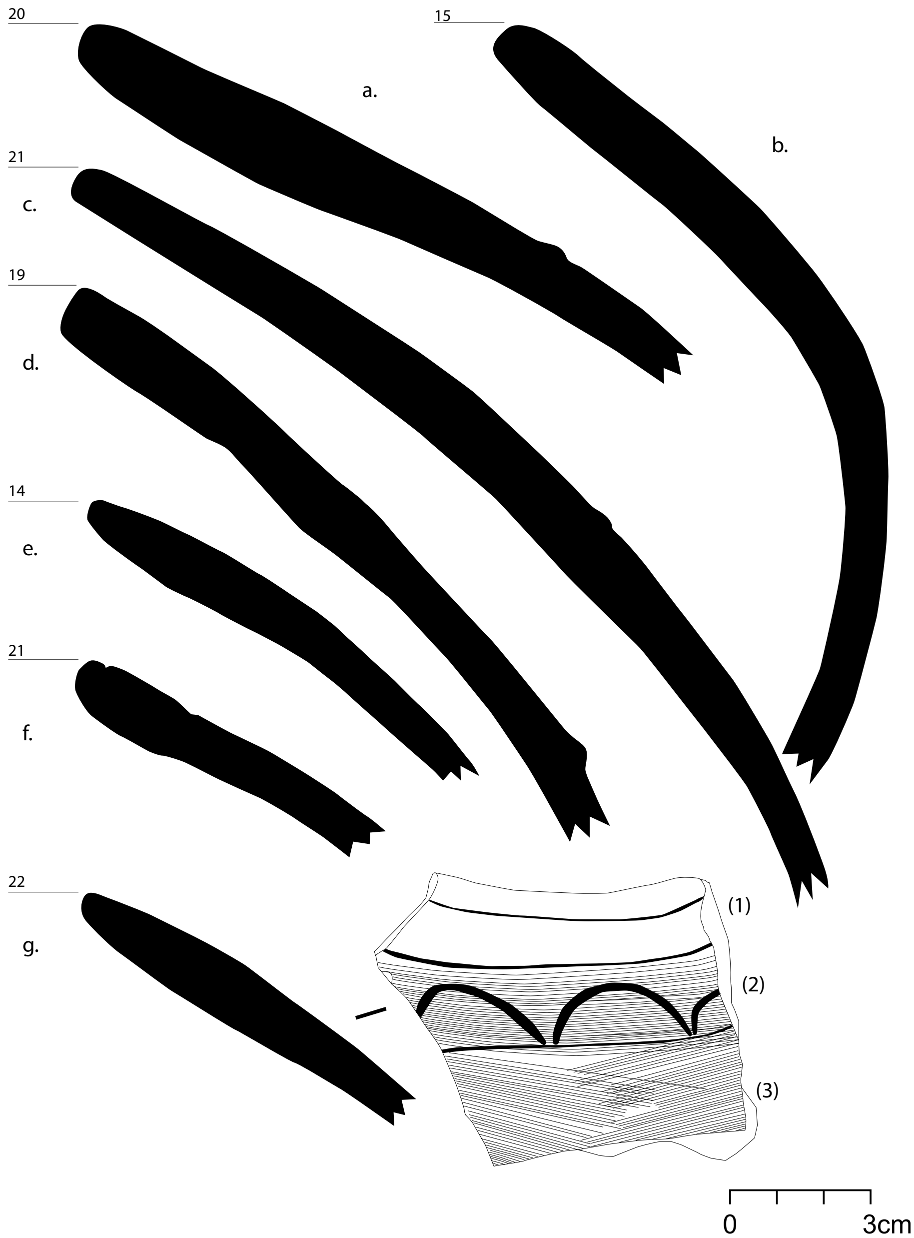


Figure 9.6. Guamuchal Plain tecomate rims with smooth upper wall profiles (the original Suchiate Brushed). The exterior surface of g is illustrated, with the zones described in the text marked. Note the tendency to retain zonal distinctions even when the convex band has disappeared. The lowermost boundary of zone 2 is marked with a groove, and the zone decorated by motif n from Figure 9.4: arcs linked in a horizontal row. Contrasting directions of brushing also distinguish zones 2 and 3.

38–39, Figures 27 and 28), and Clark and Cheetham (2005:322–323, 333, Figures 25a through c and 30a through d, and g). According to our understanding of the reformulated type definition by Clark and Cheetham (followed here), this type now subsumes the Guamuchal Brushed, Suchiate Brushed, and Teófilo Punctate of Coe and Flannery (1967). We regret having taken few photographs for this and the next type, but the reader is referred to the essentially identical material illustrated by Coe and Flannery (1967:plates 6 through12).

Mapache Red-on-Buff

Tecomates and a few ollas decorated in the manner described previously, with zone 1 rim bands slipped red (Figure 9.8). Pastes are coarse and in a wide variety of colors, from light brown (common) to orange, pink, darker brown, and gray. The identified sample

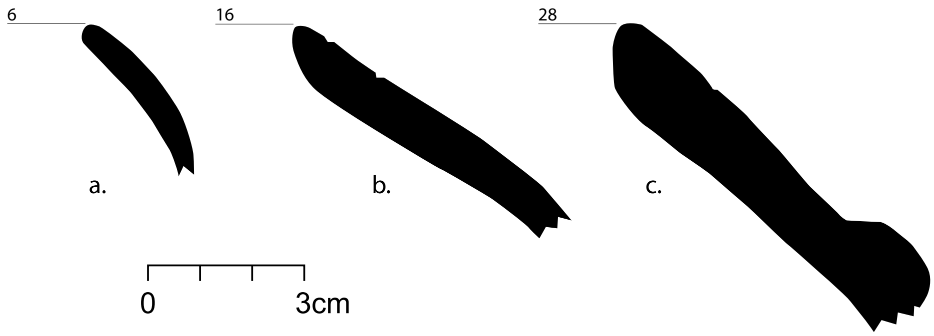


Figure 9.7. Guamuchal Plain rim profiles of rare variants.

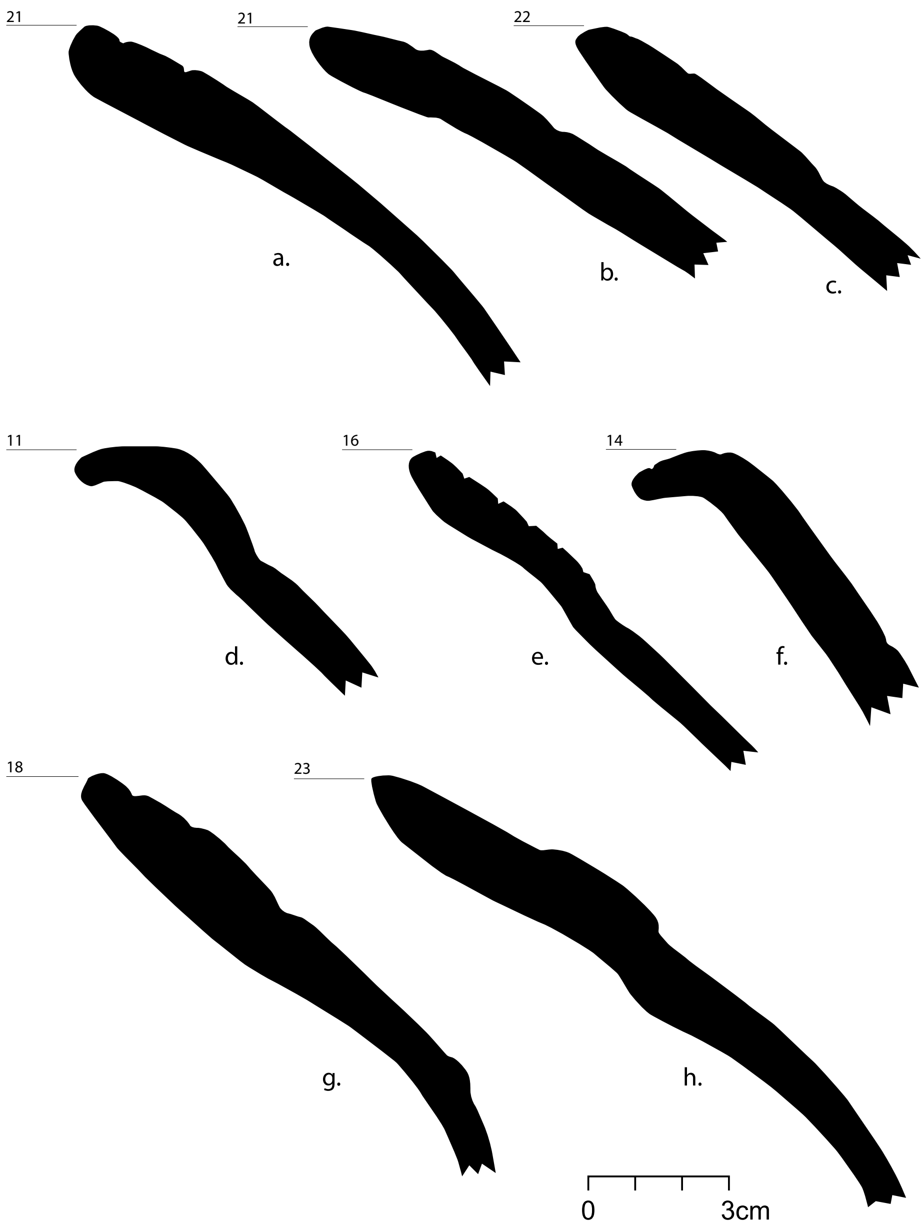


Figure 9.8. Mapache Red-on-Buff tecomate rim profiles (includes Mapache and Méndez types of Coe and Flannery [1967]).

includes 377 rims (99 percent tecomates and 1 percent ollas). References: Coe (1961:50, Figure 16), Coe and Flannery (1967:26, Figure 9, plate 12), Green and Lowe (1967:112, Figure 85), Ekholm (1969:47–48, Figure 37), and Clark and Cheetham (2005:333, Figures 30e through f). According to the reformulated type definition by Clark and Cheetham (followed here), this type now subsumes the Mapache Red-Rimmed and Méndez Red-Rimmed of Coe and Flannery (1967).

The Slipped Service-and-Utilitarian Ware Tradition

The second tradition is slipped and burnished on the interior (in the case of open forms), on the exterior (closed forms), or sometimes on both sides. Each of the different slip colors or color combinations is assigned its own type, but there is a tendency for the main vessel forms to be replicated in each type—as we suggest by grouping these in a tradition. We hasten to admit that the tendency is not perfect. Some types (e.g., Pampas Black-and-White) display a more narrowed formal variation.

Eleven vessel forms can be distinguished. There are five common forms:

1. *Simple dish*. Flat-bottomed open vessels with wall height short in relation to diameter. Sides are outsloping to outcurving at an angle *greater than* 20 degrees from vertical. Rims are usually direct, with rounded lips (see below, Figures 9.9a, c, d, and i)—but are sometimes beveled (Figure 9.9b) or, rarely, modeled in various ways (Figures 9.9g and h). Another rare variant has a thickened rim and flattened, grooved lip (not illustrated). Diameters range from 9 to 55 cm, without any clearly evident modes. The overall configuration of the distribution is consistent with a heuristic division between small (9 to 15 cm, rare), medium (16 to 26 cm, common), large (27 to 43 cm, common), and extra large (44+ cm, rare).
2. *Dishes and bowls with near-vertical walls*. These have sides that slope outward, but with an angle *less than* 20 degrees from vertical (see below, Figures 9.9e and 9.20d through i). Lesure believes that the difference between vertical-walled dishes (height short in relation to diameter) and bowls (height roughly similar to or even greater than diameter) is functionally significant and that it should be possible to tell even broken-up rim sherds apart through patterns of slipping and incised/excised decoration. However, it is clear from areas of overlap in the analysis that opinions of our three analysts diverged significantly here—especially in that vertical-walled bowl and dish rims could also be indistinguishable from those of tall-necked jars (see form 4 in this list). The resulting category of vertical-walled dishes/bowls must consequently be considered something of a jumble in the slipped-ware tradition. We were able to reliably isolate near-vertical-walled *bowls* only in the exotic type Tacaná (not included in the slipped-ware tradition).
3. *Jars and ollas with short, generally vertical and often thick, necks* (see below, Figure 9.10d). Rims are usually direct and lips rounded. Rim diameters and overall vessel dimensions vary considerably, and it is likely that multiple functions were involved. Rim diameters range from 12 to 31 cm, without any evident modes.
4. *Jars with tall necks*. The necks of these jars are often nearly vertical, but sometimes outsloping or incurving (see below, Figure 9.10b). Some were very large vessels, and it seems likely that they were associated with liquid storage or service. Rim diameters range from 6 to 26 cm, with a dramatic but narrow (and arguably spurious) break in the distribution at 16 cm. It does seems possible that there were small- and large-mouthed tall-necked jars. The difference would presumably have corresponded to a distinction in vessel capacity. No significant change in the relative frequencies of these two sizes of jars was observed between stratigraphic periods.
5. *Slipped tecomates*. Tecomates with slipped exterior walls (see below, Figures 9.14g and 9.17a through d) were much less common than those of the utilitarian tecomate tradition. They also seem to have been quite varied in rim angle, rim diameter, wall thickness, and relation between rim diameter and vessel capacity. The distribution of wall thicknesses measured by Smith suggests larger and smaller versions, but our efforts to distinguish these qualitatively produced another area of divergent opinions among our three analysts. We suspect that the smaller ones were for service. Larger vessels might have also had service functions, but liquid storage is also likely.

An additional six forms were rare:

6. *Dishes with rounded walls and often rounded bases*. A heterogeneous category of open dishes of varied sizes and a variety of different rim elaborations (see below, Figures 9.9f and 9.14b). Vessel profiles also vary significantly.
7. *Dishes with everted rims; bases uncertain* (not illustrated).
8. *Dishes with bolstered rims and flat bases*. A Cuadros diagnostic, rare at El Varal (Figures 16.1a, d, e, and g). Potentially confused with deep basins (see form 10 in this list).
9. *Bowls or dishes with rounded bases and a break in the curve of the exterior wall profile*. Orientation of the walls above the break varies, as does rim form, which includes both direct and bolstered (see below, Figure 9.10c). This form appears only in Terminal-period deposits and is significant largely for its corroboration of the very late Jocotal placement for Varal's Terminal stratigraphic period. The rounded bases and break in the exterior profile anticipate the complex silhouette vessels that became increasingly common across Mesoamerica in the Middle and Late Formative.
10. *Deep basins with bolstered or everted rims*. Large, deep receptacles with thick vertical upper walls and unknown lower-wall/base configurations (see below, Figure 9.10a). Lesure was interested in this form because he had speculated that deep basins (with different upper rim profiles) at Paso de la Amada were important in the large-scale food preparation associated with feasting (Lesure 1998). The form was very rare in the Varal excavations, and neither Smith nor Rodríguez López was convinced that it could be reliably distinguished from forms 8 and 9.
11. *Stools or pot rests*. Another rare form known primarily from the bulldozer backdirt, from which we recovered one nearly complete example. Low, sharply concave walls support a round, gently concave, platform 22 to 28 cm in diameter (see below, Figure 9.10e). In some cases, there is a perforation in the center of the platform. (The form would plausibly be appropriate for burning incense, but there is absolutely no evidence of burning on or below the surface. Further, these seem to have been slipped—a trait that would be unusual for a Formative incense burner.)

The basic decorative template in this tradition is quite simple: the primary visible surface (and sometimes secondary surfaces such as exteriors of simple dishes with outsloping walls) is slipped and burnished. Tilapa Red-on-White, "Late Tilapa" Red-on-White, and Pampas Black-and-White are bichrome—the last through patterns of smudging rather than different slips. On a few Tilapa sherds, what appears to be a fugitive orange paint hints at the occasional polychrome (Figure 9.19, upper left). This trait is rare and poorly preserved. We have not tried to incorporate it into a distinct type. All other types are monochrome.

The most common form of further decoration is (post-slip) incised and/or excised lines and motifs, particularly common on the upper interior rims of simple dishes (Figure 9.9i and Figures 9.14e and f). Bowls with near-vertical walls and the necks of tall-necked jars might have exterior incising and excising (Figures 9.12b through e). (As pointed out previously, distinguishing between the two forms was sometimes impossible.) Motifs include some recognizable as "Olmec" (Figure 9.13), linking the occupation at El Varal to themes in expressive culture with wide currency in Mesoamerica during the last centuries of the first millennium B.C. [In our usage, *Olmec* refers to a recognizable art style with associated subject matter—not to any specific group of people. See Lesure (2004:74–75)].

There are seven types in this tradition. These are discussed in the sections that follow.

Siltepec White

Streaky white slip (ranging to gray) over a light brown paste, sometimes with a gray core (Figures 9.9, 9.10, and 9.11). We have included here also pieces with thicker, glossy slips a purist might insist on identifying as a distinct type. Slip is usually on the interior of open dishes, with the exterior scraped or roughly smoothed. Decoration consists of circumferential grooves in dishes, sometimes with line breaks (versions of the "double line break"). There are occasionally more complex motifs on interior bases of the same dishes (Figure 9.11).

This is the most common type of the slipped-ware tradition, with 235 rims. Of those, 83 percent are dishes or bowls, 10 percent are tall-necked jars, 2 percent are ollas, 2 percent are slipped tecomates, and 2 percent are unidentified. Basins and stool/pot rests constitute less than 1 percent each. References: Green and Lowe (1967:112, 114, Figure 86), Ekholm (1969:51, 55, Figures 43 through 46), and Clark and Cheetham (2005:337, Figures 31g and h).

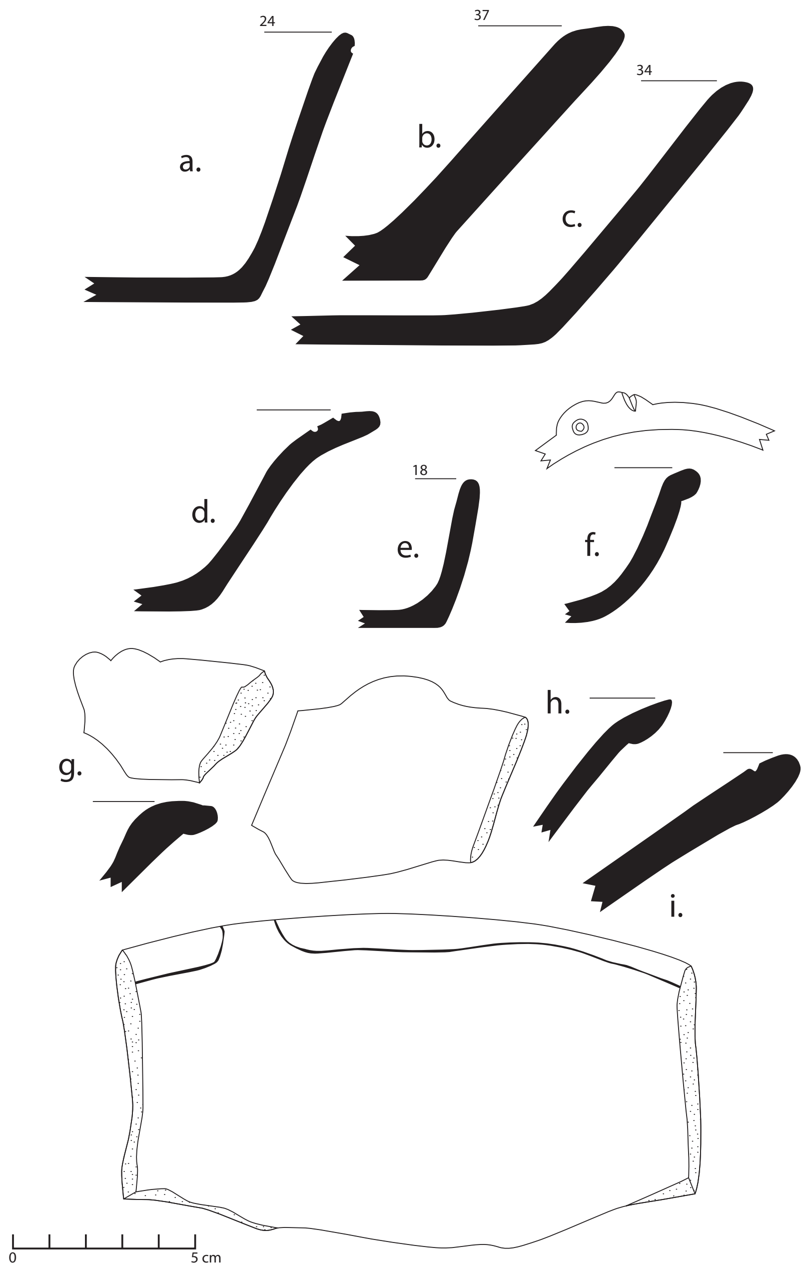


Figure 9.9. Siltepec White rim profiles: (a through d and i) simple dishes, (e) dish with near-vertical walls, (f) dish with rounded walls, and (g and h) simple dishes with modeling on rims.

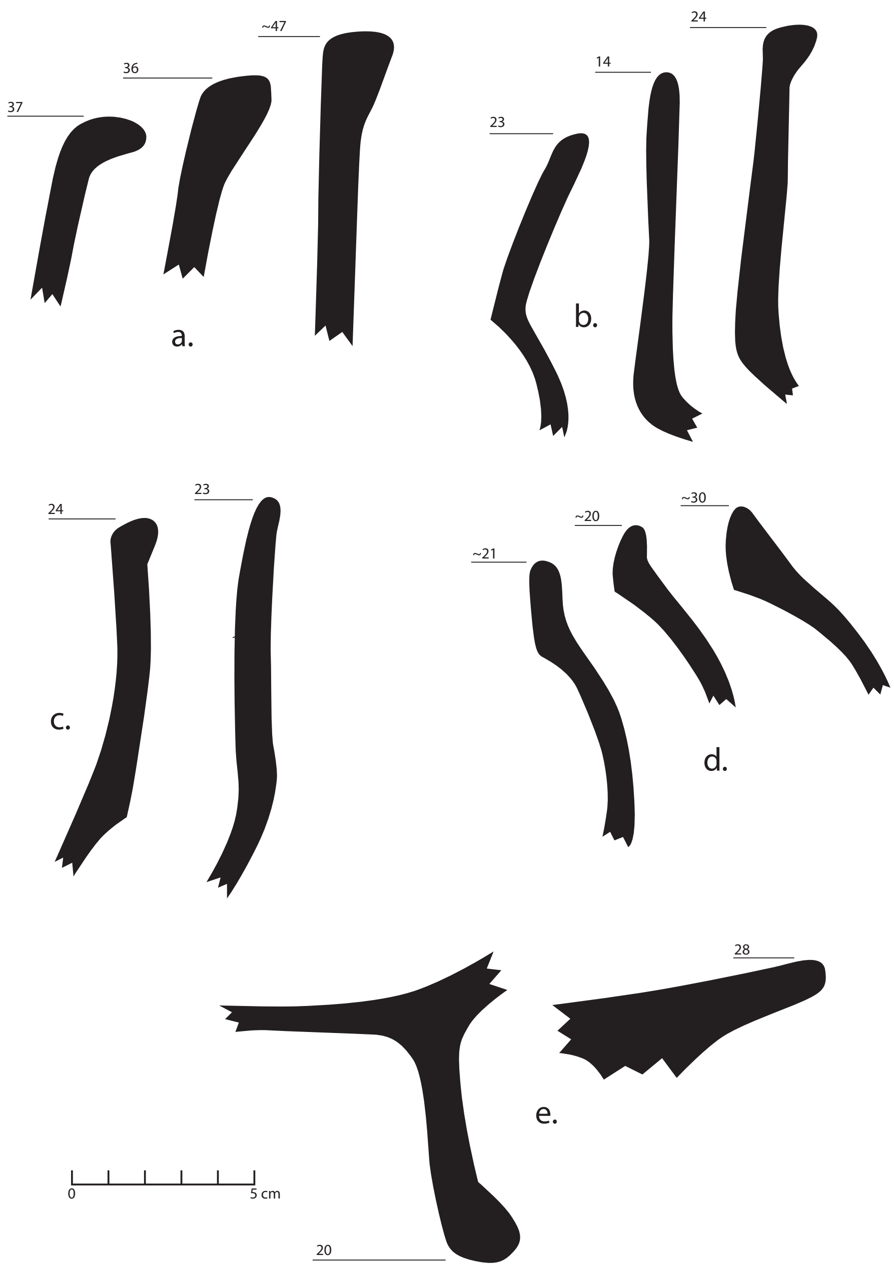


Figure 9.10. Siltepec White rim profiles: (a) deep basins with bolstered or everted rims, (b) jars with tall necks, (c) bowls with rounded bases and a break in the exterior wall profile (early complex silhouette), (d) ollas with short necks, and (e) stools or pot rests.

Figure 9.11. Siltepec White incised interiors of simple dishes.

Culebra Black

Black to gray slip over a typically light brown paste, the black in this case deriving from slip color rather than smudging (compare with the section "Pampas Black-and-White" following) (Figures 9.12 and 9.13, top row). Many sherds ranged decidedly toward gray, and some could arguably have been classified as Siltepec White. Slip is usually on the interior of open dishes, with the exterior scraped or roughly smoothed. Incised decoration (including double line breaks) on the interior upper rims of open dishes was present but more rare than for Siltepec. There was incising or excising on some jar necks or the exteriors of vertical-walled bowls (Figures 9.12b through e).

Of the 182 rim sherds, 75 percent are dishes or bowls, 13 percent are tall-necked jars, 2 percent are ollas, 6 percent are slipped tecomates, and 2 percent are unidentified. Indistinguishable vertical-walled bowls or jar necks make up a little more than 1 percent, and stool/pot rests constitute less than 1 percent. References: Green and Lowe (1967:118, Figure 90), Ekholm (1969:63–65, Figure 56), and Clark and Cheetham (2005:337, Figures 31o through q). The type is equivalent to the Morena Black of Coe and Flannery (1967:32–33).

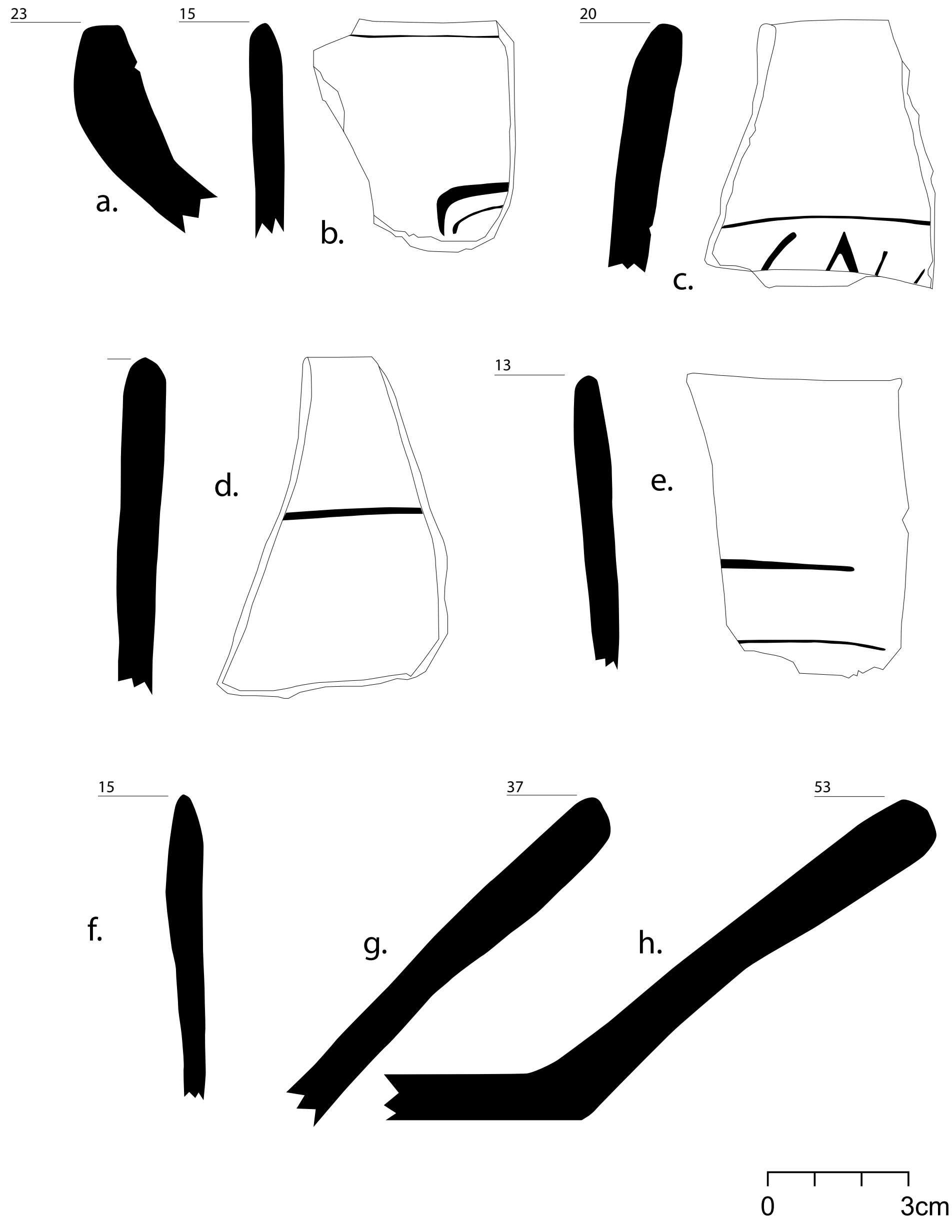


Figure 9.12. Culebra Black rim profiles: (a) ollas with short necks, (b through f) jars with tall necks, and (g and h) simple dishes.

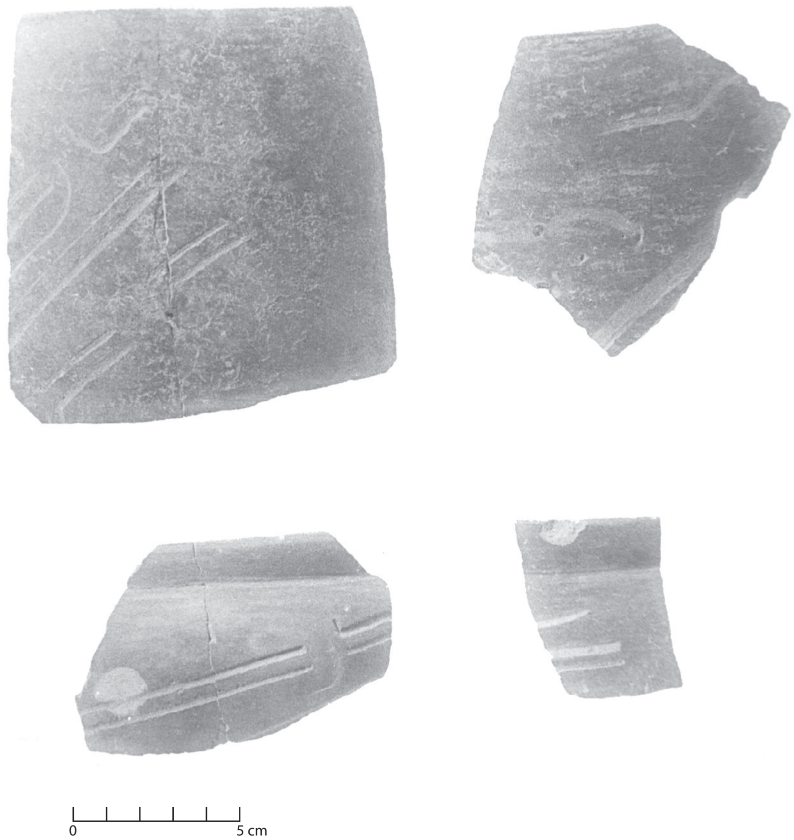


Figure 9.13. Olmec motifs from El Varal. Top row: Culebra Black, probably jars with tall necks (possibly confused with bowls with near-vertical walls). Bottom row: Vásquez Gray jars or ollas with short necks.

Xquic Red

Red slip (sometimes with specular hematite) over a light brown to gray paste, often with a gray core (Figure 9.14). Slip is usually on the interior of open dishes, with the exterior scraped or roughly smoothed. Sometimes only a band around the interior rim of open dishes is slipped (Figure 9.14c). To a greater extent than Culebra Black, the interior rims of open dishes are decorated with circumferential post-slip grooves or more elaborate motifs—including double line breaks, linked arcs, cross-hatching, and patterned excising (Figures 9.14a, c, e, and f). The excisions are particular to this type (Green and Lowe 1967:Figure 89). One tall-necked jar rim and a unique figure-eight–shaped vessel, both from the bulldozer backdirt, had modeled faces (Lesure 2000).

There were 141 rim sherds from excavations. The distribution among vessel forms differs somewhat from the previous two types, with tall-necked jars and tecomates particularly common (there is some worry that the rims of Mapache Red-on-Buff tecomates were sometimes mistaken for Xquic). Of the assemblage, dishes and bowls constitute 54 percent, tall-necked jars 21 percent, ollas and unspecified jars 4 percent, and slipped tecomates 19 percent. Stool/pot rests and unidentified constitute less than 1 percent each. References: Green and Lowe (1967:116, 118, Figure 89), Ekholm (1969:61–62, Figures 52 and 53), and Clark and Cheetham (2005:333–334, Figures 30h through n). The type overlaps with the Pacaya Red of Coe and Flannery (1967:36–37), but those authors do not report the relatively elaborate designs on dish rims.

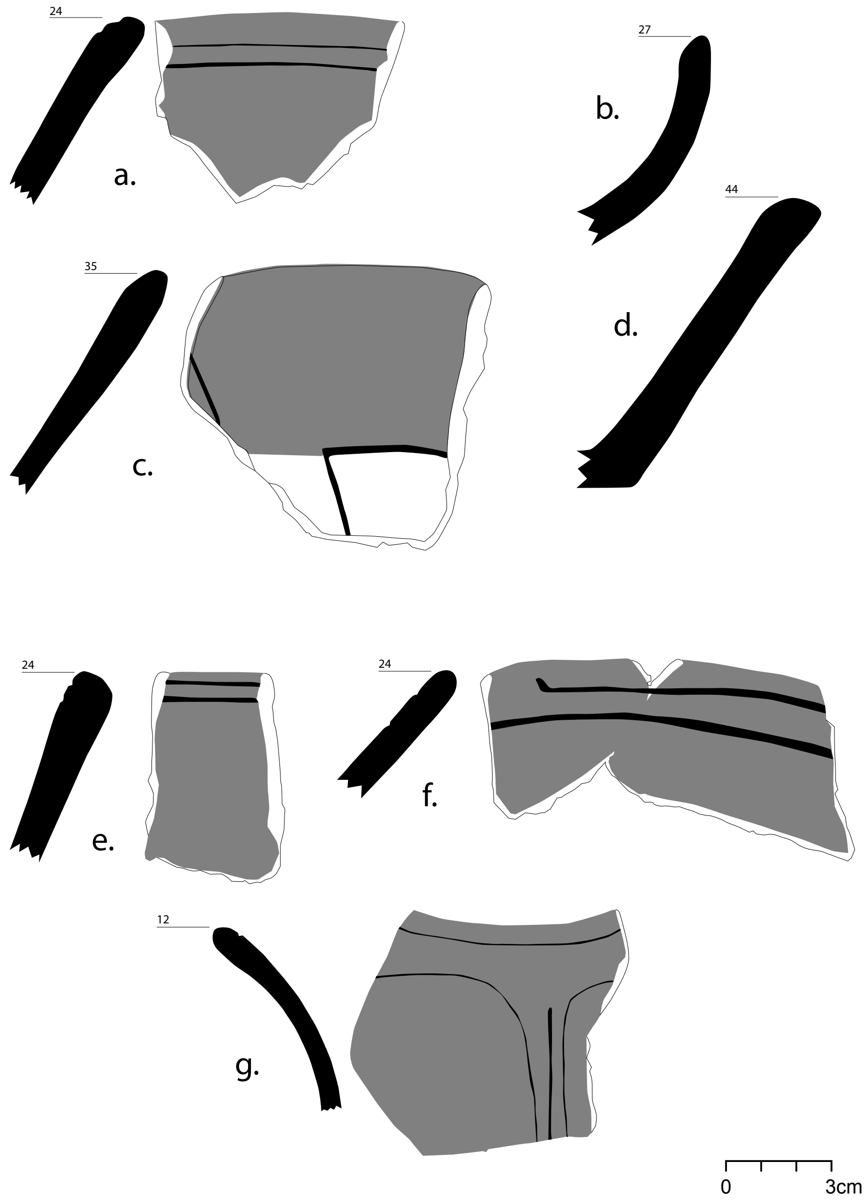


Figure 9.14. Xquic Red rim profiles: (a and c through f) simple dishes, (b) dish with rounded walls, and (g) tecomate.

Pampas Black-and-White

This type comprises almost entirely open dishes, with burnished or slipped-and-burnished interiors and scraped or slipped/burnished exteriors (Figures 9.15 and 9.16). Most of the surface is black, with some areas (particularly the rims) white. That effect was achieved through smudging, as discussed by Coe and Flannery (1967:33). The result is paste colors that tend to vary according to the color of the immediately overlying slipped or burnished surface: dark gray-brown under black surfaces and light brown under white surfaces.

This was a key criterion we used to distinguish Pampas Black-and-White from Culebra Black, in that in the latter case black-slipped areas were underlain by light-colored paste. The Pampas sample constitutes 88 rim sherds. Of those, 97 percent are dishes or bowls, 2 percent are tall-necked jars, and 1 percent is slipped tecomates. References: Coe and Flannery (1967:33–35, Figures 14 and 15, plates 14 and 15), Green and Lowe (1967:108, Figure 80), Ekholm (1969:39–41, Figures 29 and 30), and Clark and Cheetham (2005:324, 337, Figures 25j through l and 31o through q).

Tilapa Red-on-White

Red slip over white, with paste typically light brown (Figures 9.17, 9.18, and 9.19). In open bowls, the red slip was most typically used along the interior rim—but also sometimes for simple interior designs. Tecomates, particularly frequent in this type, had red zones and white zones (sometimes delimited by grooves) or simple

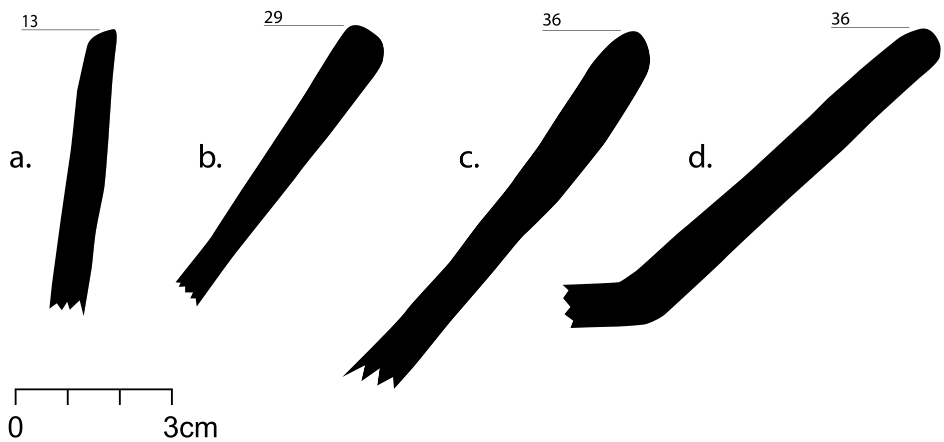


Figure 9.15. Pampas Black-and-White rim profiles: (a) tall-necked jar, and (b through d) simple dishes.

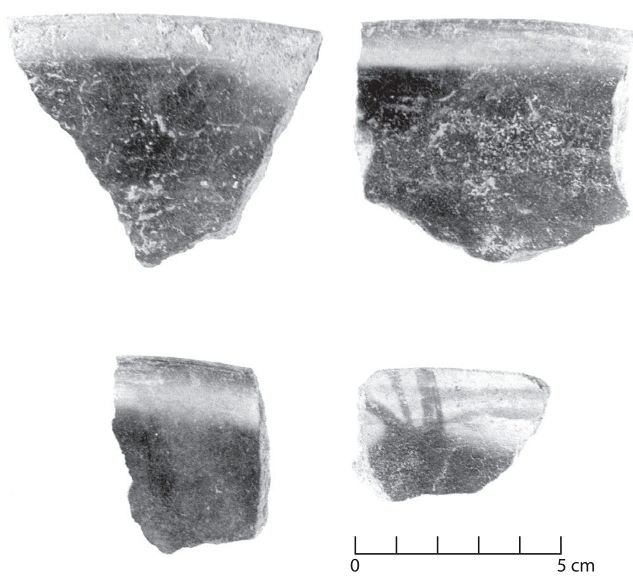


Figure 9.16. Pampas Black-and-White rims of simple dishes showing patterned smudging yielding the characteristic white rim and black interior. Many examples were not as well differentiated.

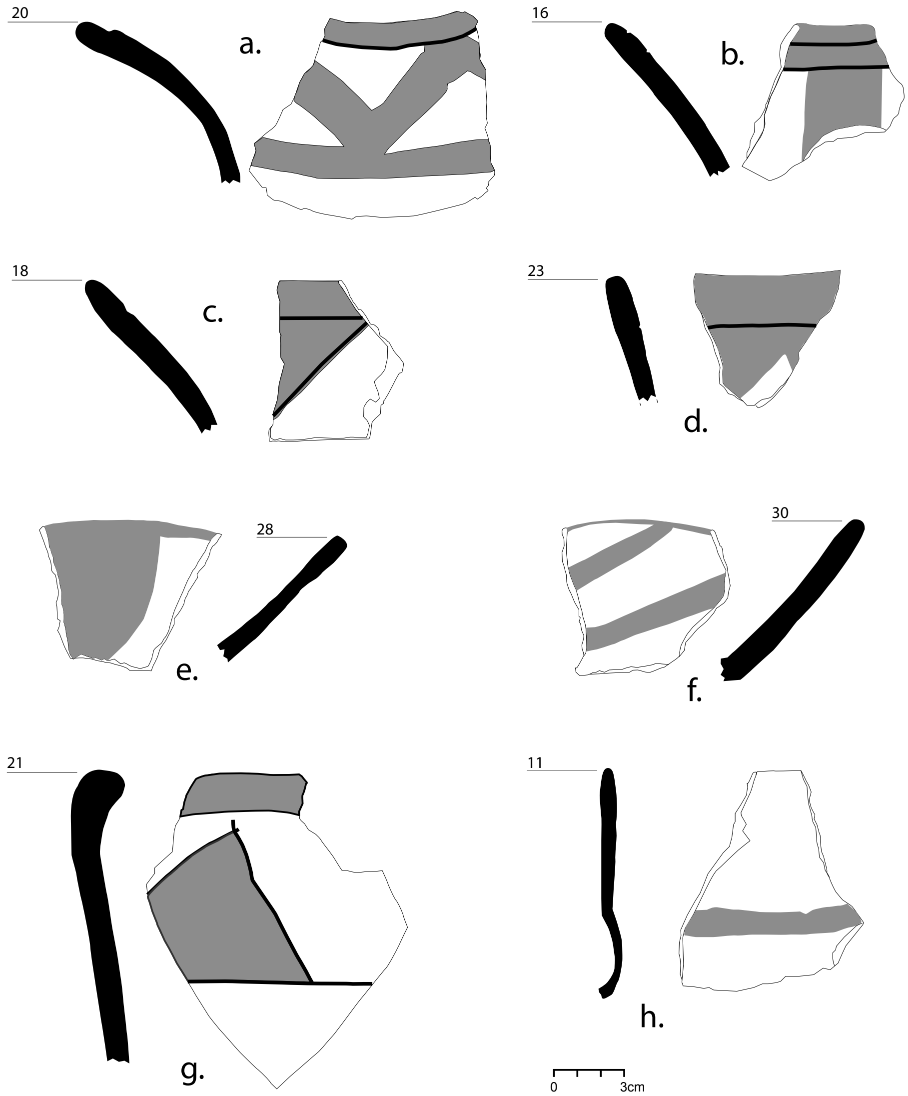


Figure 9.17. Tilapa Red-on-White rim profiles: (a through d) tecomates, (e and f) simple bowls, (g) tall-necked jar, and (h) rare form from bulldozer backdirt not included in the analyzed sample.

red designs over white. There were 60 rim sherds from the excavations. (Lesure and Pérez Suárez also searched diligently for this type in the bulldozer backdirt, and illustrations draw also on those materials—which are not included in the following counts.) Of the assemblage, dishes and bowls constitute 57 percent, tecomates 37 percent, tall-necked jars 3 percent, and unidentified 3 percent. Additional forms, including stool/pot rests, were found in the bulldozer backdirt. References: Coe and Flannery (1967:37–40, Figures 17 and 18, plate 13), Green and Lowe (1967:110, Figure 82), Ekholm (1969:43–45, Figure 34), and Clark and Cheetham (2005:323, 334, Figures 25d through f and i and 31a).

"Late Tilapa" Red-on-White

What we in the laboratory labeled Tilapa from the Terminal-period deposits of N95W0 has a different character from earlier Tilapa Red-on-White, and we have separated it here into what might be better considered a distinct type. However, we did not set out to describe it as such with the materials in hand. Bowls tend to be thicker than in Early through Late deposits, and simple bowls with a narrow slipped red band around the interior lip become very common in the collection. There were 81 rim sherds, of which 95 percent were dishes or bowls, 2.5 percent ollas, and about 1 percent each of slipped tecomates and unidentified.

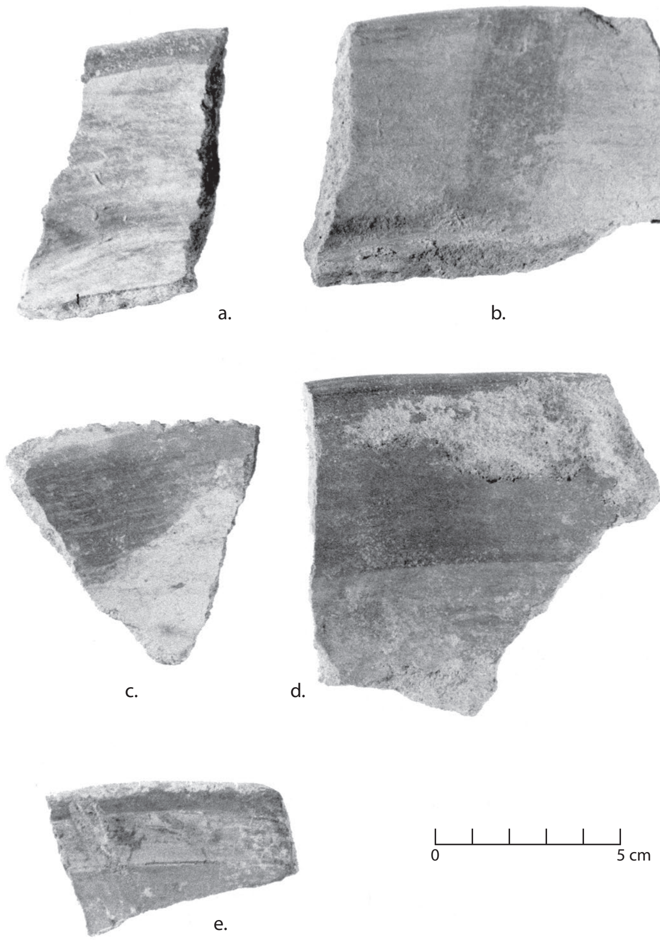


Figure. 9.18. Tilapa Red-on-White: a, b, d, and e) simple dishes and (c) dish with rounded sides and notched lip.

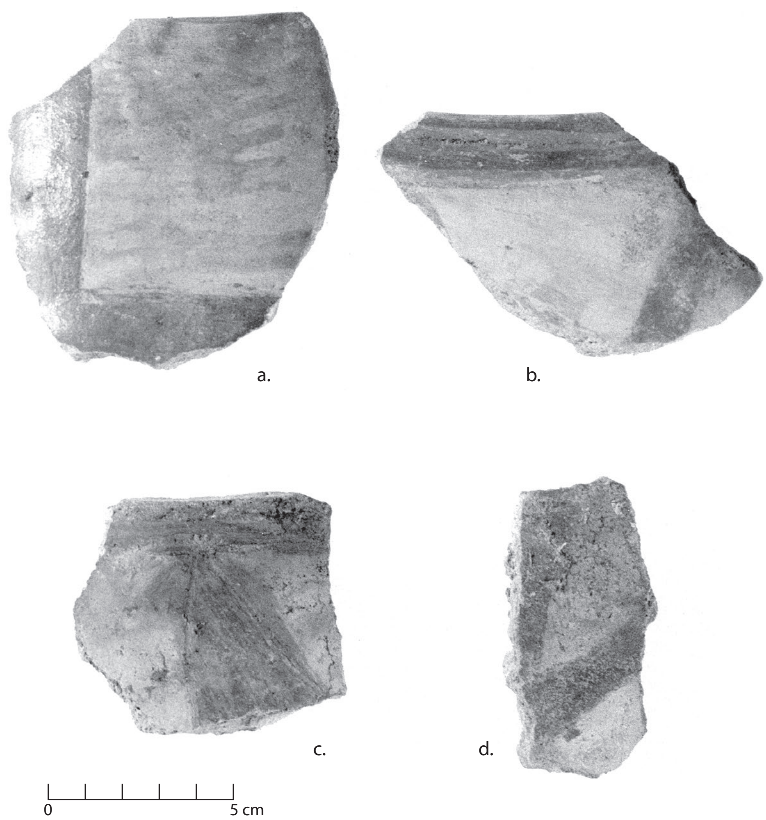


Figure 9.19. Tilapa Red-on-White: (a) jar with tall, insloping neck and (b through d) tecomates.

Coe and Flannery (1967:41) describe a Conchas Red-and-White in which red slip is laid down beside white. That pattern is not a characteristic of "Late Tilapa." Clark and Cheetham (2005:345) do include an unnamed red-*on*-white type in their description of Conchas-phase materials, with some characteristics (moderately thick walls, slipping only on the lip) that appear to match what we observed in the collection from N95W0.

Arenera Orange

Orange or reddish-orange slip over light brown paste. Smith was rather fond of this designation and identified most of the examples, whereas Lesure was skeptical that it could be reliably distinguished from Xquic Red. There were 34 rim sherds. Of those, 68 percent are dishes or bowls, 24 percent

are tecomates, 3 percent are tall-necked jars, 3 percent are basins, and 3 percent are vertical-walled bowls or jar necks. References: Green and Lowe (1967:114, Figure 87) and Clark and Cheetham (2005:334, Figures 31b through d).

Exotic Types

Three types have paste diverging from the Varal norm and distributions of vessel forms that differ distinctly from those of types grouped under the slipped-service and utilitarian ware tradition. They are in that sense "exotic" and probably include pots imported to El Varal from elsewhere in the Soconusco or even farther afield.

Tacaná White

A thick white slip over, most characteristically, a reddish brown paste (Figures 9.20 through 9.23). The slip on such characteristic pieces tends to be "flat" rather than glossy in appearance. Both of these characteristics are quite different from those of Siltepec White. However, other sherds classified as Tacaná range toward Siltepec norms. It may be that we have lumped imported pieces and locally manufactured copies together, but we were

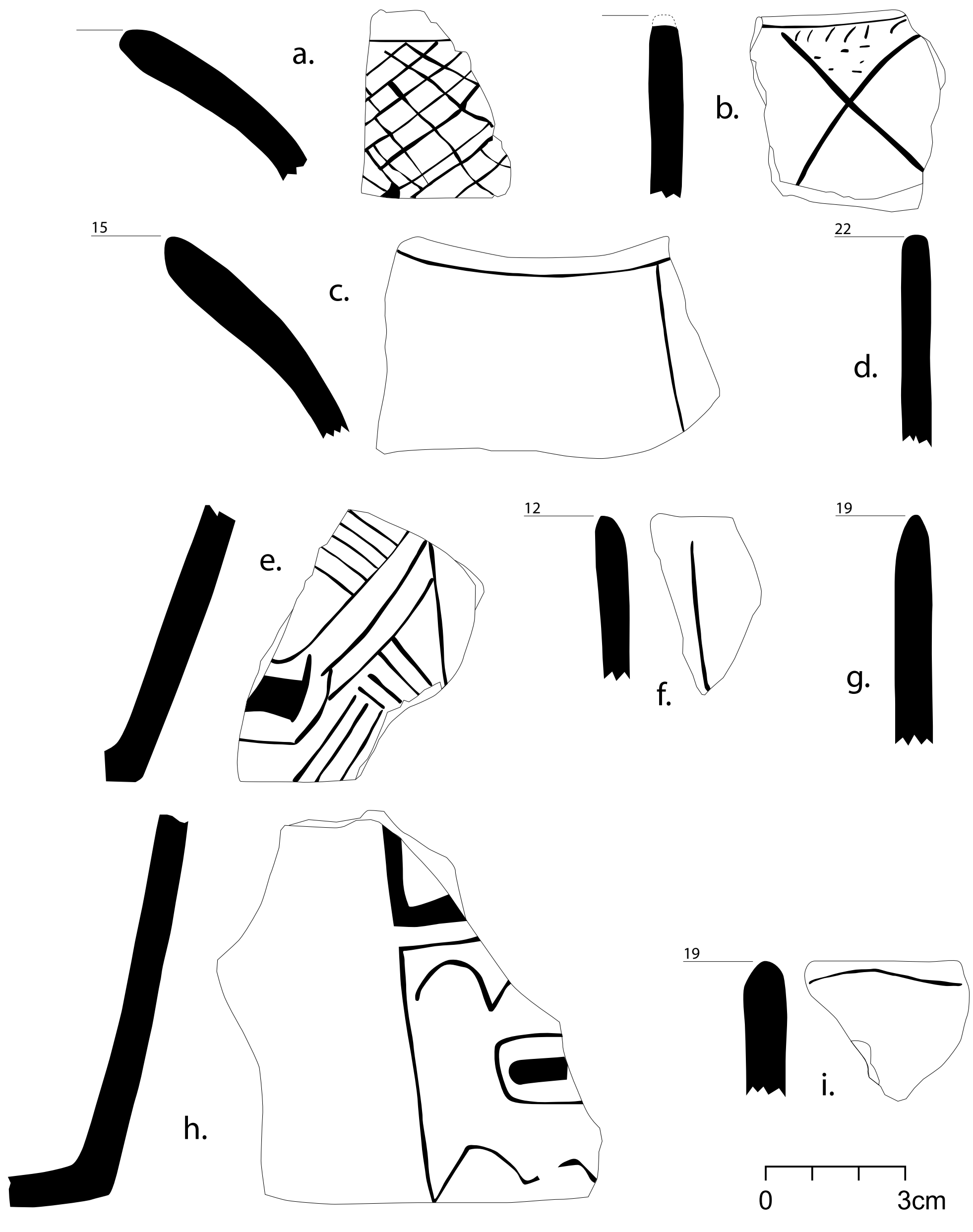


Figure 9.20. Tacaná White rim profiles and drawings: (a and c) tecomates. All others: bowls with vertical or outslanting walls and flat bases.

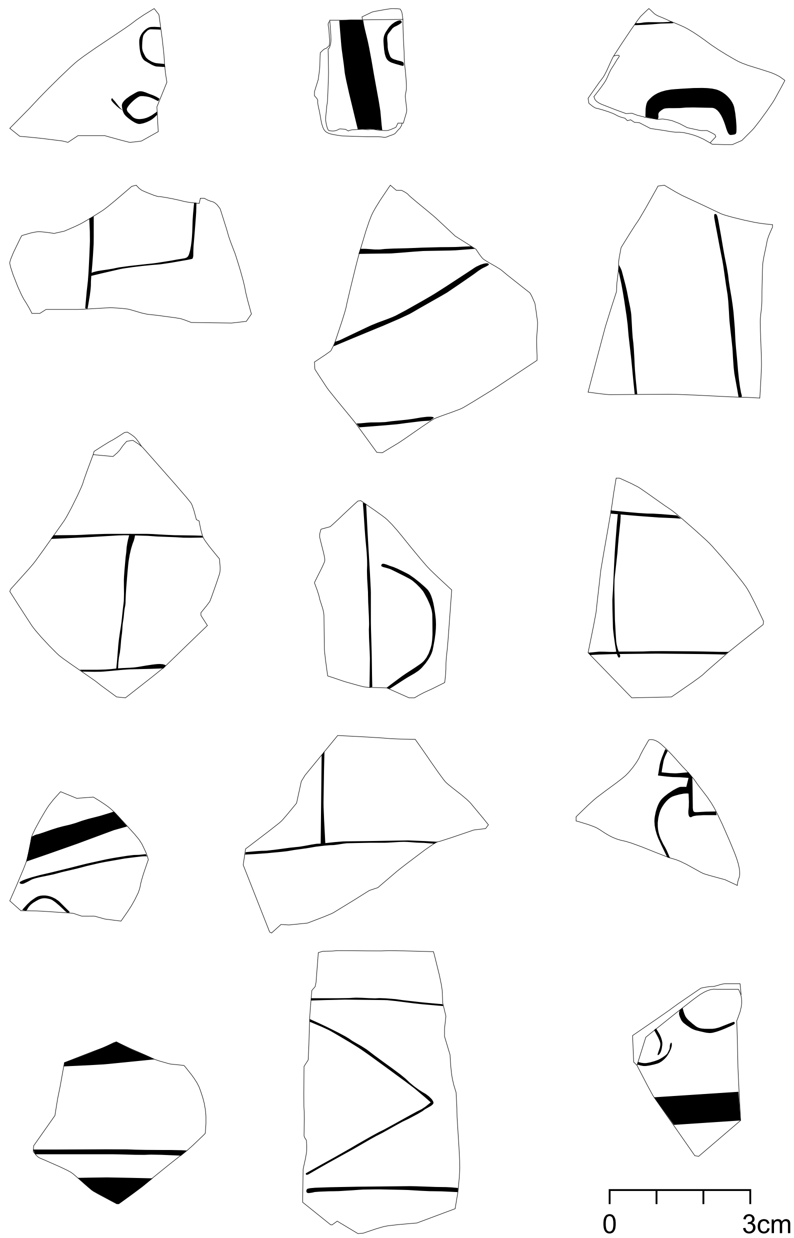


Figure 9.21. Tacaná White sherds from bowls with vertical or outslanting walls and decorated exteriors.

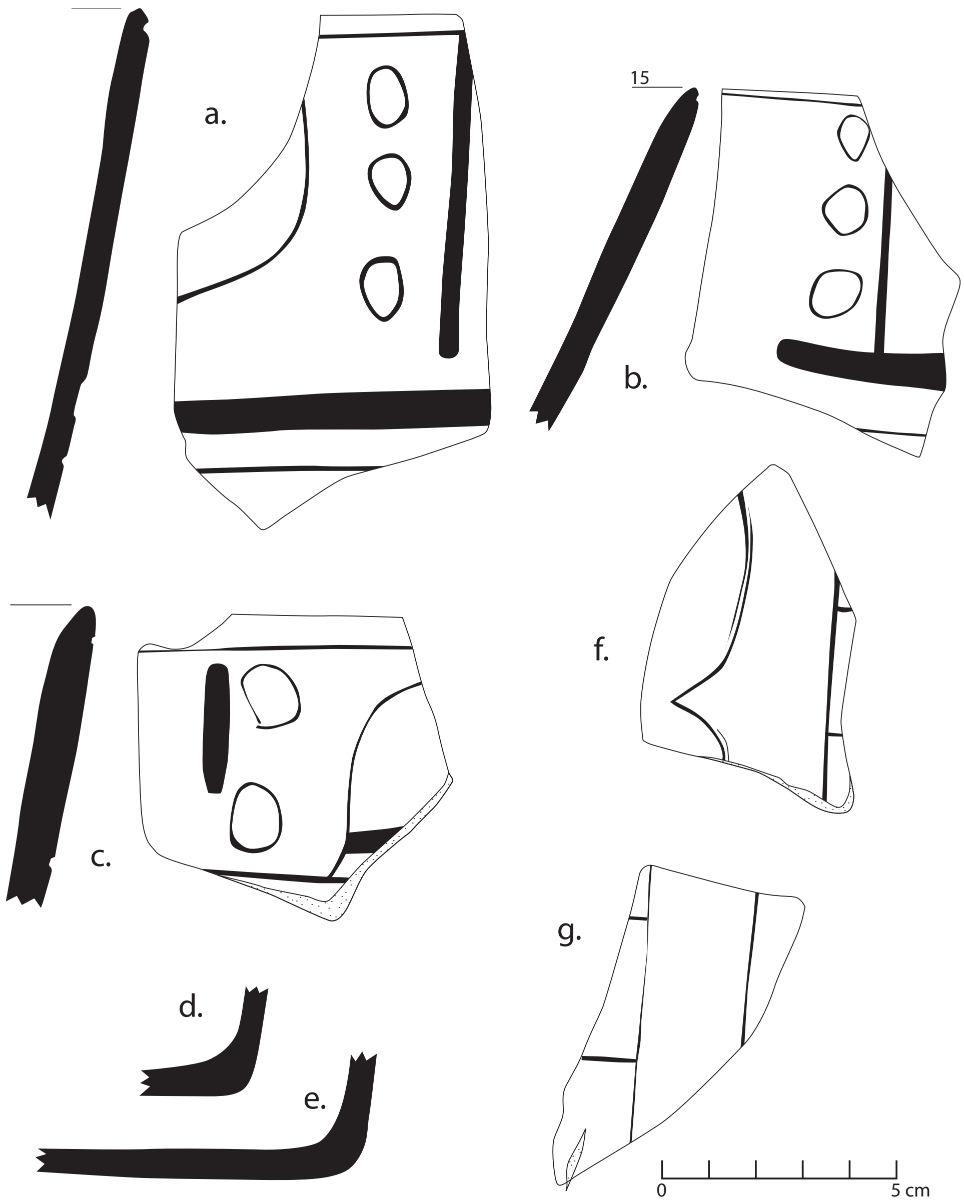


Figure 9.22. Tacaná White rim profiles and drawings: bowls with vertical or outslanting walls.

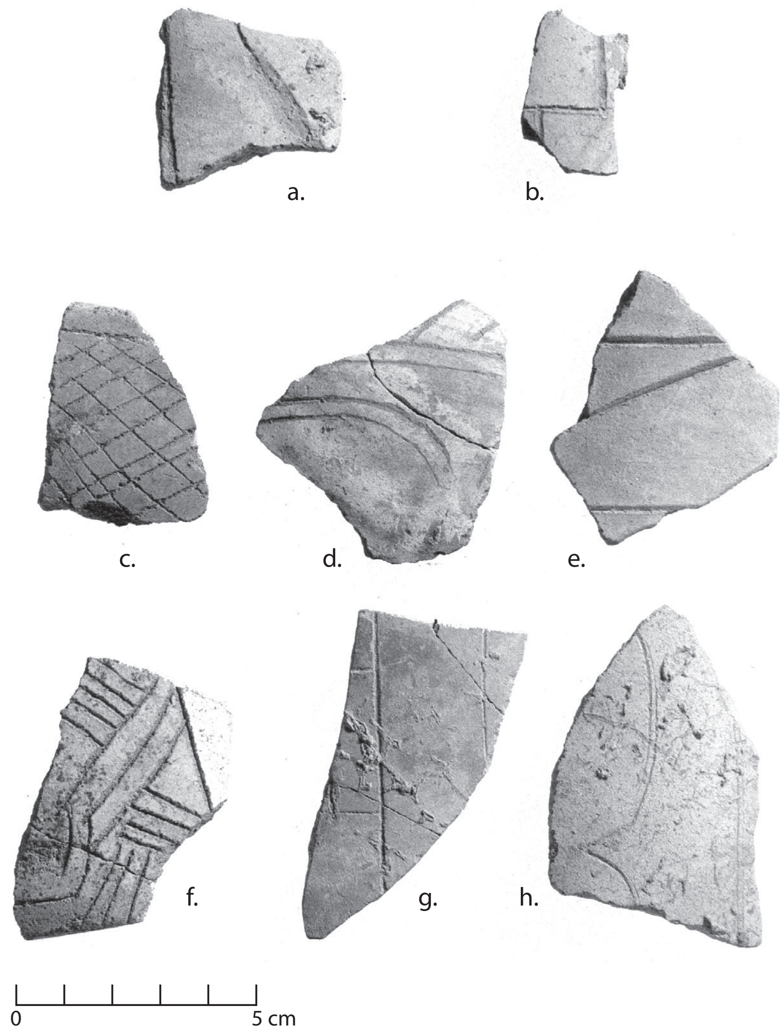


Figure 9.23. Tacaná White tecomates (c and d) and bowls with vertical or outslanting walls (all others). Note that c, f, g, and h are illustrated as drawings in Figures 9.20a, 9.20e, 9.22f, and 9.22g, respectively.

unable to convincingly divide these into two groups. Paste and slips approaching local norms are particularly common at the very end of the sequence, in N95W0.

The primary form, comprising most of the pieces illustrated here, is a bowl with vertical or somewhat outsloping sides (typically less than 20 degrees from vertical). Bases are flat, and rims direct. Rim diameters range from 11 to 26 cm, with most between 15 and 22 cm. Interiors are often scraped and unslipped (extremely unusual for what is still basically an open vessel form). There are typically post-slip incised and/or excised motifs, often elaborate, on the exterior walls.

On the most characteristic examples with a reddish paste and flat white slip, the contrast between white walls and excised designs is quite striking. As Clark and Pye (2000) note, the designs seem more similar to white wares from Tlapacoya than to such late Early Formative Gulf Coast sites as San Lorenzo. In addition to near-vertical-walled bowls, there were small tecomates (Figures 9.20a and c and 9.23c and d) and a few forms best characterized as dishes. References: Green and Lowe (1967:118, 120, Figure 91), Ekholm (1969:65, 66, Figure 57) and Clark and Cheetham (2005).

Vásquez Gray

Small serving vessels made of a hard, fine paste—fired to a uniform light gray clear through with no hint of a darker gray core (Figure 9.13, bottom row). When dropped against each other, such sherds have a metallic clink that contrasts with the duller noise produced when the same thing is tried with Culebra Black sherds. Surfaces are slipped black-gray and polished. Although

the distinguishing features of a small number of these sherds are very clear, Rodríguez López is skeptical that all examples can be reliably distinguished from Culebra Black. If she is right, we may have another case in which there are both imported pieces and local copies. Forms are more varied than for Tacaná, including near-vertical-walled bowls and dishes, small jars or ollas with short vertical necks or necks slanting outward, and a single probable tall-necked jar.

White Clear Through

A single small tecomate rim sherd from N95W0 is made of a fine white paste, uniform in color clear through. Coe and Flannery (1967:60) found a few such sherds at Salinas la Blanca. It was probably imported to El Varal.

Miscellaneous Types

In the Early to initial Middle stratigraphic period deposits of N35W0, N45W0, and N55W0, there were a few rim sherds from plain-walled red-rimmed tecomates in the well-known style of the Michis Red-on-Buff type [Green and Lowe (1967:104), Ceja (1985:106, Figure 78), and see Clark and Cheetham (2005) for shift in name]. These were probably carried up from an earlier occupation at El Varal (recall that the Martínez Mound, adjacent to Vásquez, had an occupation predating the Cuadros phase).

Chronological and Functional Analyses

Because the most striking aspect of inter-site assemblage variation in Early Formative Soconusco lies in the relative distributions of vessel forms, the uses of pots at El Varal is of considerable interest. Here we consider vessel function in generalized terms, postponing any attention to specific content (e.g., fish versus salt) to later chapters. Vessel function is complexly intermeshed with four processes: stylistic changes of the sort that provide the basis for phase divisions, long-term diachronic trends in the composition of vessel form assemblages in the Soconusco, synchronic differences in activities between sites, and the possibility of changes in site function raised by the Terminal-period reorganization of the Varal vessel assemblage. In the following sections, we review the impact of these processes on the Varal pottery assemblage and attempt to tease out a generalized functional understanding of the assemblage as a whole.

The materials considered are the 2,417 rim sherds classified previously. Our most basic method of analysis involved counting rim sherds in whatever categories were of interest. That procedure, however, tends to overestimate numbers of open dishes in comparison to tecomates—in that a broken dish will produce more rim sherds than a broken tecomate. To allow for an alternative analytical procedure, we calculated the proportion of a full vessel mouth represented by each rim sherd. These rim proportions can be summed to compare frequencies of different vessel classes. The results give a more accurate estimate of the relative numbers of open- versus restricted-mouthed vessels, but the procedure itself is not without problems.

Some rims (17 percent of the collection) were so small or damaged that it was impossible to estimate rim proportion. Any procedures relying on rim diameter charts also introduce more observer-to-observer differences than simply counting up rims (for lots analyzed by both Lesure and Smith, total summed rim proportions observed by Smith ranged from 95 to 105 percent of those observed by Lesure). We have made use of both rim counts and summed rim proportions in the analyses that follow, although space considerations have often led us to present just one version.

Phase Changes in the Varal Assemblage

To trace stylistic variation indicative of phase changes, it is necessary to look separately at the two traditions described previously. The skewed relation between tecomates and dishes otherwise swamps other patterns. Results indicate a variety of differently timed stylistic changes over the course of the occupation, with a concentration of loosely coordinated shifts at about the transition from the Middle to the Late stratigraphic period.

Two aspects of changing tecomate styles are traced in Table 9.2 (all analyses in this section are based on rim counts). The relative percentages of Guamuchal Plain and Mapache Red-on-Buff trace simply the use of red slip on the rim. In this case, there is stability from the Early to the Late period—with a sharp decrease in the Terminal period. The more dramatic decorative change in utilitarian tecomates is the loss of the convex rim band. That pattern was noted by Coe and Flannery (1967) as associated with the shift from Cuadros to Jocotal phases. It prompted their distinction between Guamuchal Brushed and Suchiate Brushed.

Table 9.2. Relative percentages of tecomate types and rim profiles by stratigraphic period

Type	Early	Middle	Late	Terminal
Utilitarian tecomate tradition:				
Guamuchal Plain	65.1	56.7	61.0	87.3
Mapache Red-on-Buff	34.9	43.3	39.0	12.7
Total rim sherds	*269*	*413*	*246*	*63*
Wall profile near rim:				
Profile break or convex band	53.1	58.2	5.3	6.1
Smooth profile	46.9	41.8	94.7	93.9
Total rim sherds	*213*	*239*	*152*	*49*

Clark and Cheetham (2005) relegate that distinction to the varietal level. In Table 9.2, we trace the relative percentages of tecomates with a convex band or a break in the upper rim profile (Guamuchal Brushed, Figure 9.5) to those with smooth upper profiles (Suchiate Brushed, Figure 9.6). In this case, we see a distinct shift from a 55/45-percent pattern among Early and Middle tecomates to a 5/95-percent pattern among Late and Terminal tecomates.

That stylistic shift at the transition from Middle to Late stratigraphic periods is considerably reinforced when we turn to the slipped wares (Table 9.3). It is scarcely remarkable that some shifts occur at different points in time. Arenera Orange persists at about 5 percent of the assemblage until it drops to virtually nothing in the Terminal period. (Observer bias could be a factor in this pattern. Lesure, who was skeptical concerning this type, analyzed much of the Terminal sample.) Culebra Black descends in frequency from the Middle through Terminal periods.

Table 9.3. Relative percentages of slipped wares by stratigraphic period

Type	Early	Middle	Late	Terminal
Slipped-ware tradition:				
Siltepec White	10.5	13.5	47.2	35.7
Culebra Black	25.2	32.4	20.7	10.0
Xquic Red	18.9	13.9	13.5	20.1
Pampas Black-on-White	17.5	20.9	6.2	0.0
Tilapa Red-on-White	21.7	10.2	2.1	0.0
“Late Tilapa”	0.0	0.0	0.0	30.1
Arenera Orange	4.2	6.6	5.7	0.4
Exotic types:				
Tacaná White	0.0	0.8	4.1	3.3
Vásquez Gray	2.1	1.6	0.5	0.0
White Clear Through	0.0	0.0	0.0	0.4
Total percentage	*100.0*	*100.0*	*100.0*	*100.0*
Total rim sherds	*143*	*244*	*193*	*269*

Xquic Red fluctuates between 13 and 20 percent of the assemblage. Tilapa Red-on-White would appear to fluctuate even more dramatically, from 22 to 2 percent and back to 30 percent. Since conducting the analysis, however, we have come to the conclusion that the “Tilapa” of N95W0 might be best represented as a distinct type (see type descriptions). The result would be a pattern of change that would make much more sense in terms of battleship curves. It would place a dramatic decline in the Tilapa frequency at the transition from Middle to Late period. That boundary is also a significant one for two other types of the slipped-service and utilitarian ware tradition: Pampas Black-and-White declines dramatically across that boundary, whereas Siltepec White increases sharply. There is also a shift in the favored exotic ware from Vásquez Gray to Tacaná White.

An inspection of frequencies by lot reinforces the idea that multiple stylistic shifts occurred about the same time. The change in tecomate profile was perhaps earliest. It was fully in place by ST-20 in the Step Excavation (our excavated and/or analyzed units from the P3 sequence miss the episode of transition). The shift in emphasis among the slipped wares occurred between ST-19 and ST-14. Transition from Middle to Late stratigraphic period (defined in Chapter 3 according to criteria entirely separate from those under consideration here) took place between ST-17 and ST-16.

Table 9.4 outlines the relative distributions of dish, bowl, jar, and other minor vessel forms across the stratigraphic periods. There is considerable stability,

Table 9.4. Relative percentages of slipped-ware vessel forms by stratigraphic period

Type	Early	Middle	Late	Terminal
Simple dish	53.2	61.2	57.1	74.3
Dish/bowls with near-vertical walls	6.4	10.3	7.8	6.4
Dishes with bolstered rims and flat bases	1.3			
Dishes with everted rims		2.3	1.4	
Dishes with rounded walls	5.1	1.5	2.3	2.3
Early composite silhouette dishes/bowls				2.3
Deep basins	0.6		1.4	1.3
Jars with tall necks	10.9	11.4	18.4	8.4
Jars or ollas with short necks	2.6	0.8	5.5	2.3
Slipped tecomates	19.9	12.2	5.5	1.6
Stools or pot rests			0.5	1.3
Total percentage	*100.0*	*100.0*	*100.0*	*100.0*
Total rim sherds	*156*	*263*	*217*	*311*

with simple open dishes a majority in each case—with an upward spike in the Terminal period. The most evident temporal trend is a steady decrease in slipped tecomates, a pattern we return to below. Another pattern is the appearance, in the Terminal period, of bowls and dishes with rounded bases and a distinct break in the exterior rim profile.

This again is probably related to shifts toward material-culture patterns characteristic of the Middle Formative [early complex silhouette bowls and dishes are 1.6 percent of the Terminal assemblage at Varal and 1.1 percent of the Middle Formative assemblage of La Blanca, Guatemala, reported by Love (2002)]. A final point is that dishes with bolstered rims and flat bases were identified only in Early deposits. That also makes sense in stylistic terms because the form is a Cuadros diagnostic (although as noted previously there were some problems with consistency in the identification of forms such as these among our investigators). Aside from these points, vessel form seems much more stable than surface treatment over the course of the occupation at El Varal.

In sum, a significant change of pottery style occurred partway through the occupation of the Vásquez Mound—somewhere past halfway through the sequence. The criteria involved were a shift from mixed upper-rim tecomate profiles to nearly all smooth profiles, sharp declines in Pampas Black-and-White and Tilapa Red-on-White, a sharp increase in Siltepec White, and a shift in low-frequency exotic wares from Vásquez Gray to Tacaná White.

Another stylistic shift occurred between the Late and Terminal periods. It was either more minor than the first or the termination of the Varal sequence at that point leaves the nature of the changes unclarified. Changes involved were a decline in the use of red slip around the rims of utilitarian tecomates, a drop in Culebra Black offset by what may be the appearance of a new red-and-white type replacing Tilapa, and the possible disappearance of Arenera Orange. A further criterion associated with the second shift is the appearance of bowls and dishes anticipating the complex silhouettes of the Middle Formative.

How do these two observed stylistic shifts at El Varal match known phase transitions in the Soconusco Formative? The second transition (Late to Terminal) probably reflects stylistic change underway at the very end of the Jocotal phase, at the time of transition to Conchas. The assemblage, however, is still "Jocotal." The earlier stylistic shift at El Varal is more of a puzzle. It would be possible to try to tie this to a shift from Cuadros to Jocotal phases. Such a move would not fit well with the radiocarbon dates (Chapter 12), which fall more clearly into Clark's reformulated dating for the Jocotal phase (that reformulation was not entirely independent of evidence from El Varal).

More telling, perhaps, is the virtual absence of the diagnostic Cuadros figurine group Eyah at El Varal (see Chapter 11). Finally, the changes observed at the Middle-Late boundary do not match well with those that Coe and Flannery (1967:23) cite as characterizing the transition to Jocotal: Tilapa Red-on-White, Pampas Black-and-White, and Morena Black (equivalent to our Culebra) are all supposed to *increase* at that time, not *decrease*—as are red-rimmed utilitarian tecomates, which at El Varal are stable across the transition before decreasing in the Terminal period. More consistent with these various lines of evidence would be a characterization of the Middle-Late shift as one between an "Early" and "Late" Jocotal. By implication, then, our earliest deposits in the Vásquez Mound would be either already Early Jocotal or from the end of the Cuadros phase.

Toward Function: An Overview of Form Categories

Lesure (1998) characterized the vessel form assemblage of Paso de la Amada for the Locona through Cherla phases. The assemblage was dominated by tecomates and open bowls or dishes with flat bases. The latter were generally slipped, and were often further elaborated—particularly with plastic modification of the rims. They appear to have been primarily for food service. Some tecomates were slipped or otherwise decorated, but most were unslipped below a band around the exterior rim. These "plain" tecomates appear to have been specialized or multipurpose vessels used for cooking, storage, transport, and preparation of foods and liquids.

Although it dates from more than a hundred years after the latest Paso material, the Varal assemblage is clearly related. Plain tecomates and slipped flat-bottom dishes still dominate the assemblage (Figure 9.24). Aside from the very high proportion of tecomates to dishes, the biggest difference is the expanded importance of jars (low-necked ollas appeared in the latest phase at Paso de la Amada, and tall-necked jars were still at that point unknown). Slipped tecomates are far less important. It seems possible that some of their functions were taken over by jars. Various rare forms

disappeared, and others appeared. Deep vertical-walled bowls with incised decorations on the exterior (Figures 9.20 through 9.23) are new. They were probably used for the consumption of beverages. At Paso, that role may have been filled by small slipped tecomates (Clark and Gosser 1995).

Overall, one is struck by basic formal continuity between the assemblages. Tecomate wall thicknesses are greater at El Varal than at Paso de la Amada, but that is true for other vessel forms. It may be more a phase characteristic than a functional criterion. Tecomate rim diameters are almost identical in range (4 to 27 cm for unslipped Cherla tecomates, and 6 to 28 cm for Early-period Varal unslipped tecomates), but the mouths of Varal tecomates tend to be larger [average rim diameter was 15.1 ± 3.1 ($n = 249$) at Paso de la Amada and 17.5 ± 4.1 ($n = 226$) at El Varal].

That difference is significant ($p < 0.001$). Note, however, that the Varal tecomates are more variable. Varal tecomates were generally larger than their Paso counterparts, potentially explaining the difference in rim diameters (Figure 9.2). From the perspective of the Early Formative assemblage of Paso de la Amada, it would seem reasonable to posit multiple functions for Varal tecomates—potentially including cooking, storage, transport, and preparation of foods and liquids. Further, the Varal assemblage looks *generalized* rather than specialized. It is the relative distribution of vessel forms rather than the forms themselves that raises the question of specialized activities at the site.

Further Consideration of Varal Tecomates

Although the basic set of vessel forms at El Varal is of no surprise, the relative frequency of tecomates is aberrant from the point of view of inland sites. It is thus appropriate to inquire more specifically into what uses tecomates recovered at the site might have had. In the utilitarian tecomate tradition, 94 percent of the rim diameters are between 11 and 25 cm and 72 percent between 14 and 21 cm. That size range is big enough to admit a hand (Figure 9.24), and content could have been easily stirred. At the upper part of the diameter range, it would also have been possible to scoop out content—as long as the scoop itself was small. We have no appropriate ceramic scoops, but an ark shell (*Anadara grandis*) would have worked.

Coe and Flannery (1967) pointed out that tecomates, with restricted mouths and rounded bases, seem well

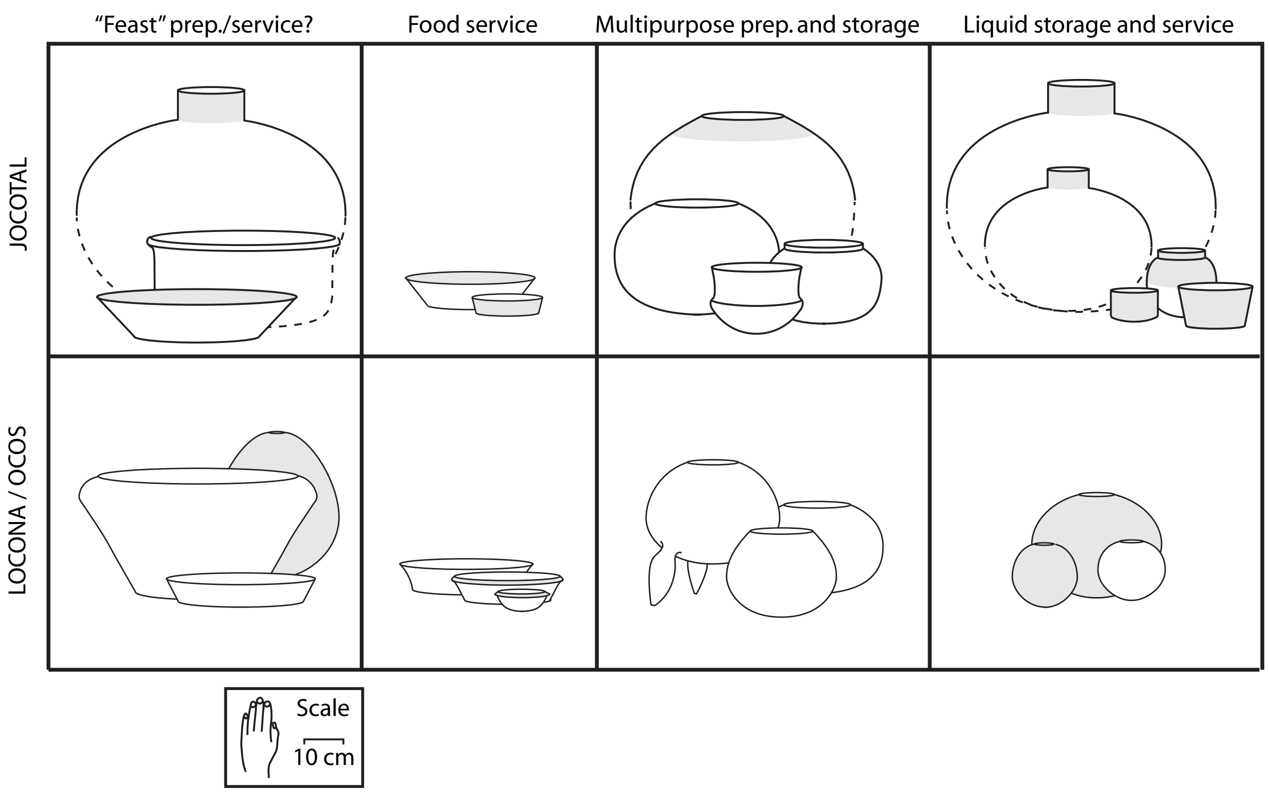


Figure 9.24. A comparison of vessel assemblages: Locona-Ocós phases from Paso de la Amada (bottom) and the Jocotal phase from El Varal (top). The same basic functional categories seem present in the two assemblages.

designed for prolonged boiling or steaming. As pointed out in Chapter 3, there was extensive evidence of the frequent use of fire at El Varal—and we have long suspected that something was cooked in tecomates. Some sherds have blackened surfaces, suggesting soot stains. The paste of many sherds is also orange, red, or pink—a trait not as regularly observed at inland sites such as Paso or San Carlos. Although we are not sure specifically what caused these bright colors, we postulate that it has something to do with the effects of fire on Varal sherds—during production or use or after breakage and discard.

Smith (1997:Appendix 3) collected systematic evidence of the effects of fire on rim sherds that she analyzed for her master's thesis. Patterns of surface blackening on tecomates, jars, and dishes are presented in Table 9.5. The differential distribution by vessel form is consistent with the idea that these patterns derive from the use of the vessels and indicates that at least some tecomates were indeed used for cooking or boiling. Smith also recorded paste colors near the exterior vessel surface, near the interior vessel surface, and in the middle of the sherd (based on a clean break). Observed colors and their Munsell equivalents are presented in Table 9.6. Smith considered orange, red, pink, and burgundy paste to be "fire altered." Table 9.7 presents patterns of such fire alteration among the three basic vessel forms. Patterns here are much less clear-cut than for sooting, and we suspect that much of this alteration occurred with the original firing of the vessels or subsequent to the breakage of the pots.

Table 9.5. Surface blackening/sooting on tecomate, jar, and dish rim sherds from El Varal[a]

Vessel Type	Total Sample	Number Sooted	% Sooted	Breakdown of Sooting (%) Interior	Exterior	Both
Utilitarian tecomate	915	146	16.0	1.4	9.4	5.1
Jar	101	4	4.0	3.0	1.0	0
Simple dish	381	11	2.9	0.3	1.0	1.6

a. Data from Smith (1997:Appendix 3).

Table 9.6. Paste colors of Varal sherds[a]

Paste Color	Munsell Equivalents
Not fire altered:	
Tan	10YR 6/8, 5/6, 5/8, 4/4, 4/6, 3/4, 3/6; 2.5Y 6/8, 5/6, 4/4
Cream	2.5Y 7/1, 7/2, 8/4; 5Y 8/3; Gley 1 7/1
White	7.5YR 8/2
Gray	Gley 1 6/ 5/ and 4/; Gley 2 5/1, 4/1
Black	Gley 1 2.5
Fire altered:	
Burgundy	10R 4/1, 3/1, 2.5/2
Red	10R 3/6; ranging to brighter red than anything in Munsell
Pink	10R 8/4, 7/4, 7/6
Orange	5YR 6/8, 5/8; 2.5YR 5/8, 4/6, 4/8; ranging to brighter orange than anything in Munsell

a. Data from Smith (1997:Appendix 3).

Table 9.7. Fire alteration of paste on tecomate, jar, and dish rim sherds from El Varal[a]

Vessel Type	Total Sample	% Fire Altered	Breakdown of Fire-altered Paste (%) Interior Only	Exterior Only	Throughout	Interior/Exterior, Not Center
Utilitarian tecomate	915	32.2	1.8	3.8	22.0	4.7
Jar	101	20.8	2.0	4.0	9.9	5.0
Simple dish	381	24.4	0.3	4.7	17.3	2.1

a. Data from Smith (1997:Appendix 3).

The Varal Assemblage and Soconusco Pottery over the Long Term

Some of the patterns that distinguish the Varal vessel-form assemblage in functional terms can only be teased out in relation to centuries-long processes of change in pottery assemblages of the Soconusco. In this section, we identify three such patterns by comparing the Varal materials to a series of seven assemblages from three inland, bowl-dominant sites—spanning the period from the initial Early Formative to the Middle Formative. The sites are Paso de la Amada [four samples: Locona, Early Ocós, Middle Ocós, and Cherla (Lesure 1998)], Cantón Corralito [two samples: a Cuadros collection from Clark's "Well" excavation (analyzed by Lesure in 1994 and still unpublished) and the Cuadros-to-Jocotal sample from near the San Carlos mound, described in Chapter 17], and La Blanca [a single pooled sample of the Middle Formative Conchas materials reported by Love (2002)].

For locations of the sites, see Figure 1.1. Although aligning these assemblages in chronological order yields the three striking directional trends shown in Figures 9.25 through 9.27, we recommend not setting too much store by these at this point. They are helpful here as a first approximation for sorting synchronic variation from diachronic change at El Varal. However, understandings of regional trends would ideally be based on syntheses of multiple contemporaneous sites.

The figures chart all tecomates, slipped tecomates only, and all jars as a percentage of each assemblage. The thick line in each case represents the "regional

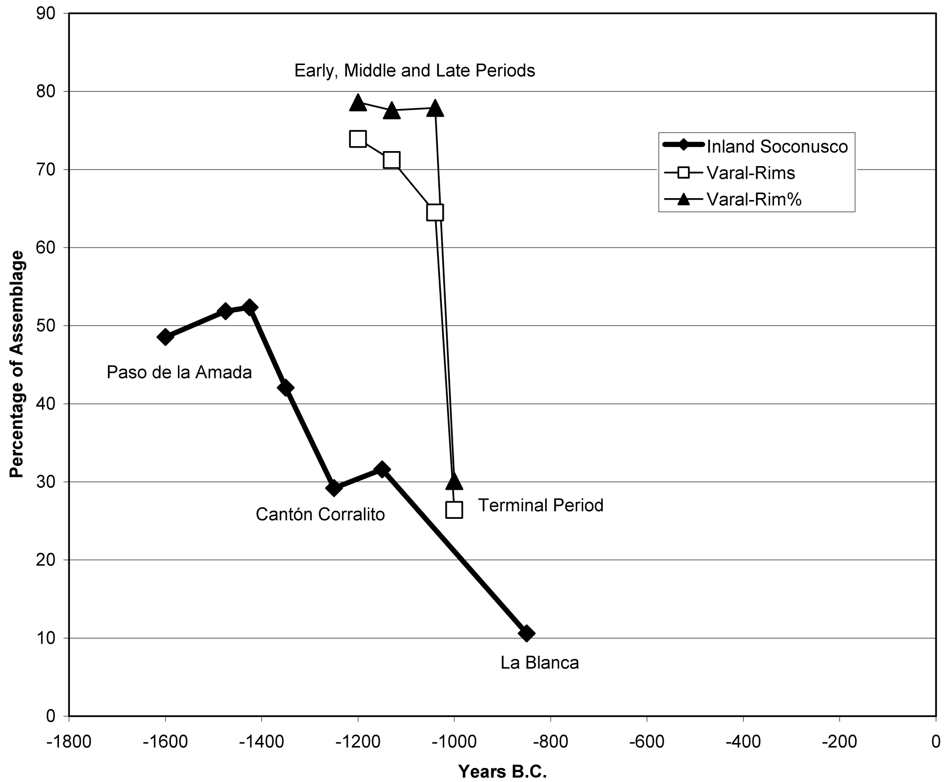


Figure. 9.25. Tecomates as a percentage of vessel assemblages from Early to Middle Formative in Soconusco. Dark line: long-term trend at inland sites. Two estimates are provided for El Varal. Open boxes represent percentages based on rim counts. Triangles represent percentages based on summed rim proportions.

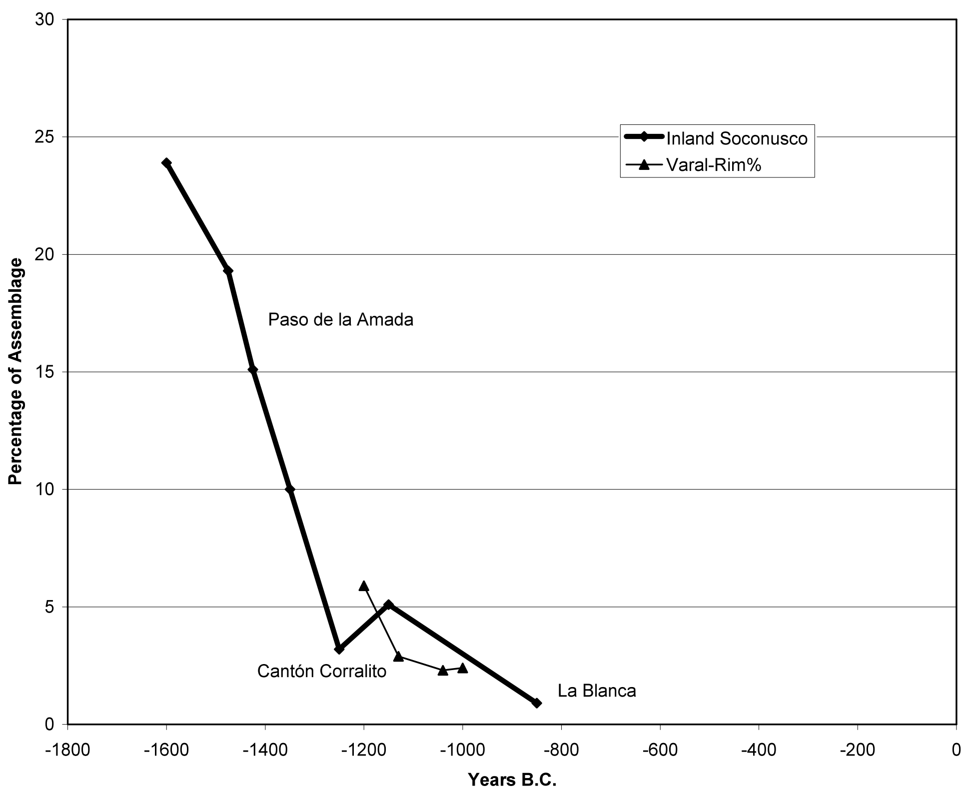


Figure 9.26. Slipped tecomates as a percentage of vessel assemblages from Early to Middle Formative in Soconusco. Dark line: long-term trend at inland sites. Triangles designate percentages at Early through Terminal periods at El Varal—calculated from summed rim proportions.

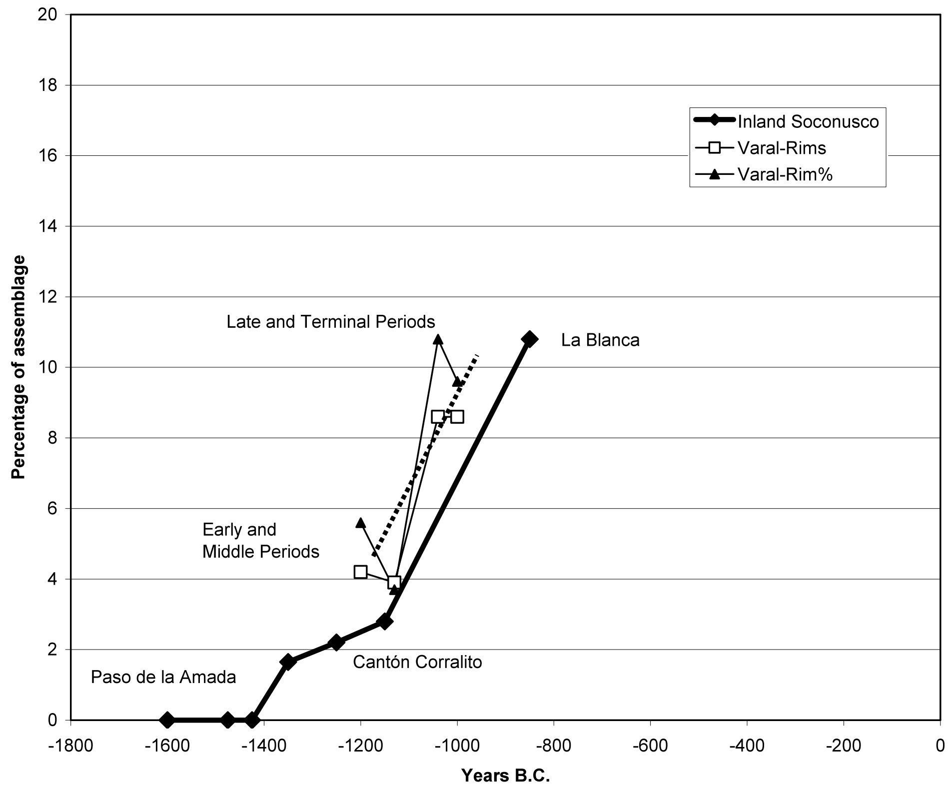


Figure 9.27. Jars as a percentage of vessel assemblages from Early to Middle Formative in Soconusco. Dark line: long-term trend at inland sites. Two estimates are provided for El Varal. Open boxes represent percentages based on rim counts. Triangles represent percentages based on summed rim proportions. Dotted line represents estimated trend at El Varal.

trend" as derived from, in chronological order, the four Paso de la Amada assemblages—followed by those of Cantón Corralito and then La Blanca. We have estimated a single date for each of those, even though they actually constitute materials from an entire phase or subphase (that from near the San Carlos at Cantón Corralito actually partly overlaps that from the Well excavation at the same site).

Varal materials are divided into four assemblages (Early through Terminal periods), with each period assigned an estimated date. For all tecomates and all jars, two versions are provided: one based on simply counting rims and the other based on summed rim proportions. As expected, the latter method yields higher estimates for restricted-mouth forms. For slipped tecomates, the analysis was complicated by the presence of numerous tecomates not identified as to slipped or plain (see introductory sections of this chapter). The values used in Figure 9.26 represent *estimates* of slipped tecomates present (see discussion associated with Tables 9.10 and 9.11, below).

There are three patterns to note in Figure 9.25. The prominence of tecomates at inland sites declined steadily during the Early and Middle Formative periods, from 50 to about 10 percent. The Early through Late assemblages at El Varal are clearly aberrant, but the Terminal assemblage seems to be in the ballpark of inland regional patterns for its epoch. Figure 9.25 thus encapsulates the argument made repeatedly throughout this book that any special activities characterizing the Early through Late periods had ceased by the Terminal period.

Figure 9.26 considers only slipped tecomates, a minor component of the Varal assemblage but one that (as noted in discussion of Table 9.4) exhibits clear directional change. The declining importance of slipped tecomates seems plausibly explicable with reference to a long-term regional decline in use of that vessel form. It should be remembered, however, that the overall composition of the Varal assemblage is different from those to which it is compared in the figure. If "extra" plain tecomates were removed, the first part of the Varal sequence would be raised in Figure 9.26 and would match inland trends less clearly—starting high and descending precipitously.

Trends among all jars are considered in Figure 9.27. The rising importance of this vessel form over the occupation of El Varal seems to reflect a more general shift toward this form, probably involving a functional replacement for certain categories of use originally fulfilled by tecomates. It is of interest, however, that the Varal values all fall above the regional line. Subtracting "extra" tecomates from the assemblage would raise the first three even higher. As suggested by the dotted line, a plausible interpretation is that although Varal tecomates grew in importance due to region-wide trends this vessel form consistently comprised a larger proportion of the vessel assemblage at the site than at inland sites. We suspect that this is because such jars were used to store potable water, a scarce resource in the estuary.

Other Trends at El Varal

Two other changes over the course of the occupation are worth noting briefly. We do not have a functional explanation for them, and suspect that they may relate to region-wide trends. A bimodal distribution of rim angles of utilitarian tecomates was noted in the type descriptions, constituting globular and subglobular categories. Rim diameters are identical between the two categories and are stable over the course of the occupation. However, subglobular tecomates disappear by the end of the Early stratigraphic period. The second trend is a steady increase in the average size of simple dishes from Early through Late periods (Table 9.8).

Basic Vessel-Form Data

The previous discussion provides the necessary background for an inspection of the changing frequencies of basic vessel-form categories over the course of the occupation. The raw data (both summed rim proportions and counts of rims, categorized by stratigraphic period) are provided in Table 9.9. Tables 9.10 and 9.11 present, respectively, the relative percentages of forms in each period (based on summed rim proportions) and the volumetric densities of rims of each form (categorized by period and based on rim counts). In these two last tables, the category that was either a tall-necked jar or vertical-walled bowl has been combined with unidentified jars.

More significantly, the rather large number of unidentified tecomates has been split between plain and slipped tecomates based on the relative proportions of those two actually observed for the period in question. In Table 9.11, the right-most column with densities of all rims should be noted: radical changes in overall density of pottery in the deposits complicate interpretation of the evidence.

The Terminal-period reorientation of the vessel assemblage is of course readily apparent in the tables. The question of more interest here is whether that change was an unanticipated shift from a situation of stasis or the culmination of a directional trend. The answer is not clear-cut. Changes in slipped tecomates and jars can be attributed to larger-scale trends in Soconusco pottery, instead of to any shift in the nature of the occupation at El Varal.

Still, in Table 9.10 there does appear to be some anticipation of the shift that was to come: plain tecomates fall by nearly 9 percentage points, and dishes rise again after having already increased during the Middle period. Even if we discount the expanded numbers of jars, there is the greater frequency of two rare forms: basins and stool/pot rests. That last pattern is evident in Table 9.11 as well, but in this second version of the analysis any subtleties as to the frequencies of dishes and plain tecomates get lost in the radical shifts in overall density of artifacts between periods.

Conclusions

Two points about assemblage variation in Early Formative Soconusco are documented in this chapter: a vessel-form distribution (of the Early to Late periods) skewed radically toward tecomates compared to contemporaneous sites a few kilometers inland, and a rapid shift to an "inland" pattern during the Terminal period. Although we have not directly addressed any of the general research topics identified in Chapter 1 (Chapters 14 and 16 through 18 do so more specifically, drawing on ceramic data), there is one point from our functional assessment of the Varal assemblage worth emphasizing.

The tecomate was an ancient vessel form in the Soconusco. In the Locona and Ocós phases, it constituted 50 percent of the vessel assemblage—even at an important inland center such as Paso de la Amada (Figure 9.25). Over the following centuries, its prominence in the pottery assemblage steadily decreased. It appears that pottery vessels were used for an expanded range of purposes or that functions originally filled by this simple "all-purpose" vessel form were increasingly relegated to other forms. From the standpoint of El Varal, it seems important that the site is characterized by an excess of a fundamentally *generalized* rather than specialized vessel form—a simple and ancient form that could plausibly have had a variety of functions.

Table 9.8. Average rim diameter of simple bowls by stratigraphic period

Stratigraphic Period	Mean	Standard Deviation	N
Early	24.7	5.3	61
Middle	27.9[a]	7.9	128
Late	32.4[b]	10.1	111
Terminal	32.3[c]	8.6	146

a. Significant change from Early period ($p < .005$).
b. Significant change from Middle period ($p < .001$).
c. No significant change from Late period.

Table 9.9. Raw data for different vessel forms by stratigraphic period[a]

Stratigraphic Period	Plain Tecomates	Slipped Tecomates	Unid. Tecomates	Dishes and Bowls	Bowl or Jar (Unid.)	Unid. Jar	Olla	Tall-neck Jar	Basin	Stool/Pot Rest	Unid.	Total
Early	21.05 (287)	1.72 (29)	2.35 (49)	5.07 (104)	0.00 (0)	0.00 (0)	.22 (3)	1.56 (18)	0.00 (1)	0.00 (0)	0.00 (3)	31.97 (494)
Middle	37.42 (494)	1.48 (29)	4.21 (92)	10.24 (204)	0.06 (1)	0.04 (1)	0.11 (1)	1.83 (31)	0.00 (1)	0.00 (0)	0.23 (10)	55.62 (864)
Late	24.31 (315)	0.84 (13)	4.46 (79)	8.58 (157)	0.06 (1)	0.10 (1)	1.03 (12)	3.56 (40)	0.56 (3)	0.10 (1)	0.12 (9)	43.71 (631)
Terminal	5.02 (69)	0.44 (5)	2.58 (39)	15.15 (267)	0.23 (3)	0.04 (1)	0.49 (7)	1.79 (26)	0.17 (4)	0.51 (4)	0.26 (3)	26.68 (428)

a. Summed rim proportions, followed by count of rims in parentheses.

Table 9.10. Percentages of vessel forms by stratigraphic period based on summed rim proportions

Stratigraphic Period	Plain Tecomates[a]	Slipped Tecomates[a]	Dishes and Bowls	Unid. Jar[b]	Olla	Tall- neck Jar	Basin	Stool/Pot Rest	Unid.	All Rims
Early	72.6	5.9	15.9	.0	.7	4.9	.0	.0	.0	100.0
Middle	74.6	2.9	18.4	.2	.2	3.3	.0	.0	.4	100.0
Late	65.5	2.3	19.6	.4	2.4	8.1	1.3	.2	.3	100.0
Terminal	27.7	2.4	56.8	1.0	1.8	6.7	.6	1.9	1.0	100.0

a. Based on estimated values involving inclusion of part of the unidentified tecomates.
b. Includes the few unidentified bowls and jar rim sherds.

Table 9.11. Volumetric densities of vessel forms by stratigraphic period based on counts of rims

Stratigraphic Period	Volume Excavated	Plain Tecomates[a]	Slipped Tecomates[a]	Dishes and Bowls	Unid. Jar[b]	Olla	Tall- neck Jar	Basin	Stool/Pot Rest	Unid.	All rims
Early	6.288	52.6	5.4	16.5	0.0	0.5	2.9	0.2	0.0	0.5	78.6
Middle	3.66	158.7	9.3	55.7	0.5	0.3	8.5	0.3	0.0	2.7	236.1
Late	3.43	114.0	4.7	45.8	0.6	3.5	11.7	0.9	0.3	2.6	184.0
Terminal	3.42	30.7	2.3	78.1	1.2	2.0	7.6	1.2	1.2	0.9	125.1

a. Based on estimated values involving inclusion of part of the unidentified tecomates.
b. Includes the few unidentified bowls and jar rim sherds.

CHAPTER 10

Artifacts of Stone and Shell

RICHARD G. LESURE

PROFILE SCRAPING AND EXCAVATION yielded a variety of artifacts of shell and stone. Those of stone I report only cursorily here. That collection, although small, deserves inspection by a specialist.

Description of the Finds

Obsidian

Small flakes of obsidian were pervasive in low numbers in the Vásquez Mound deposits (Figure 10.1). The industry is quite expedient, consisting of flakes removed from small bipolar cores. It has been documented elsewhere in Chiapas by Clark (1981, 1988). There appear to be no formal tools (uniface or biface) or prismatic blades. Counts and weights by lot are presented in Tables 10.1 and 10.2. No obsidian is recorded from N45W0, the same unit from which we have no shell. Worried that some bags might have been misplaced, we have not used this unit in stratigraphic analysis of obsidian.

Grinding Stones

Grinding stones at El Varal included *manos* and *metates*, as well as mortars and pestles (Figures 10.2 and 10.3). There was a wide range in the technology, from well-made trough *metates* and two-handed *manos* to quite expedient grinding stones—particularly evident in the thick and somewhat awkward cobbles apparently used directly as one-handed *manos*. A few complete mortars had been incorporated into kitchen activities in our workers' village. A complete trough *metate* was stashed in the bushes—also in anticipation of use. We did not attempt to recover those.

My analysis of grinding stones from El Varal has been somewhat haphazard, conducted in brief episodes while I was at the New World Archaeological Foundation laboratory in San Cristóbal for other reasons. In 1993, I reviewed all of N95W0 and various units of the Step Excavation—briefly recording all stone artifacts. Isabel Rodríguez López separated out all stone artifacts when she analyzed pottery from N35W0, N25W0, N15W0, and N55W0 in 2003. However, I am not certain if Natalie Henrich removed all stone artifacts from Step Excavation units she analyzed in 1996. It is thus possible that a few grinding stones recovered in the excavations are not recorded here. However, we have enough coverage from throughout the sequence to make overall patterns of frequency clear.

- *N95W0*, *profile:* Two *mano* fragments (one expedient and extremely thick and the other thin and well made with multiple grinding facets)
- *N95W0/4:* One fragment of *metate* grinding surface
- *N95W0/5:* Three fragments of *metate* and 1 mortar fragment
- *N95W0/7:* One fragment of *metate* grinding surface

Table 10.1. Distribution of obsidian chips by lot in the Step Excavation and N95W0

Provenience	Obsidian Count	Obsidian Weight (g)	Obsidian Density (g/m³)
N95W0/01	36	19.5	50
N95W0/02	9	11.1	61.7
N95W0/04+3	129	82.4	83.2
N95W0/05	45	28.8	62.6
N95W0/07	90	48.9	128.7
N95W0/09	5	3.7	16.1
N95W0/10	19	12.8	42.7
N95W0/11	9	7.3	10.7
N95W0/13	7	13.3	35.9
N95W0/14	12	6.5	17.1
N95W0/16	6	7	11.7
N95W0/17	19	14	45.2
N95W0/18	2	0.5	0.9
N95W0/19	5	10.8	36
N95W0/20	1	0.4	0.9
N85W0/00	1	2.5	25
N85W0/01	9	2.7	12.3
N85W0/02	7	1.2	6
N85W0/03	3	3	16.7
N80W0/03A	15	11.2	32
N80W0/03B	17	8.1	47.6
N80W0/03C	3	0.5	4.2
N80W0/05	5	6.7	67
N75W0/01C	3	4.6	23
N75W0/02A	1	0.6	2.2
N70W0/03A	3	3.3	13.8
N70W0/03B	4	0.4	3.3
N70W0/04	12	5.6	40
N70W0/05	19	8.1	67.5
N65W0/01A	25	8.4	140
N65W0/02	21	7.8	78
N65W0/03	3	0.7	11.7
N65W0/04	27	12.7	37.4
N65W0/05	31	12.3	111.8
N65W0/06	17	6.4	58.2
N65W0/07	12	2.6	65
N60W0/03	13	5.5	23.9
N60W0/04	5	0.8	5.7
N60W0/05	1	1.2	40
N60W0/06	1	0.1	5
N60W0/07	1	0.6	7.5
N60W0/08	2	0.1	1.4
N60W0/09	25	6.4	32
N55W0/01	4	0.7	5.8
N55W0/02	11	1.7	21.8
N55W0/03	6	4.3	33.1
N55W0/04	60	19.1	29.8
N55W0/05	16	5	26.3
N55W0/06	6	1.7	9.4
N55W0/07	23	9.5	31.7
N55W0/08	9	4	13.3

Table 10.2. Distribution of obsidian chips by lot in the Phase 3 South excavations

Provenience	Obsidian Count	Obsidian Weight (g)	Obsidian Density (g/m³)
N35W0/04	9	13.8	125.5
N35W0/06	4	2.6	20
N35W0/07	9	5.7	6.4
N35W0/08	2	.4	.7
N35W4/6	11	17.5	38
N35W4/7	1	7.1	22.9
N35W4/8	6	4.8	13.7
N25W4/01	1	.2	4
N25W4/02	32	10.7	97.3
N25W4/03	57	17.3	133.1
N25W4/04	16	6.9	36.3
N15W0/01	6	3.8	63.3
N15W0/02	6	3.2	21.3
N15W0/03	4	1.8	22.5

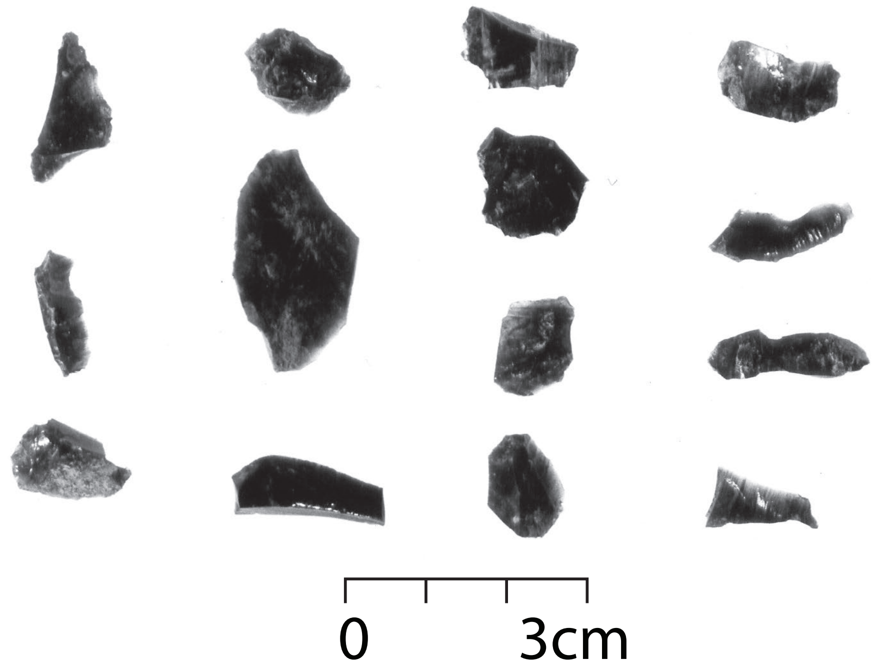


Figure 10.1. Obsidian fragments from El Varal, not in any particular orientation.

Figure 10.2. Complete mortar or circular *metate* (N60W4/profile).

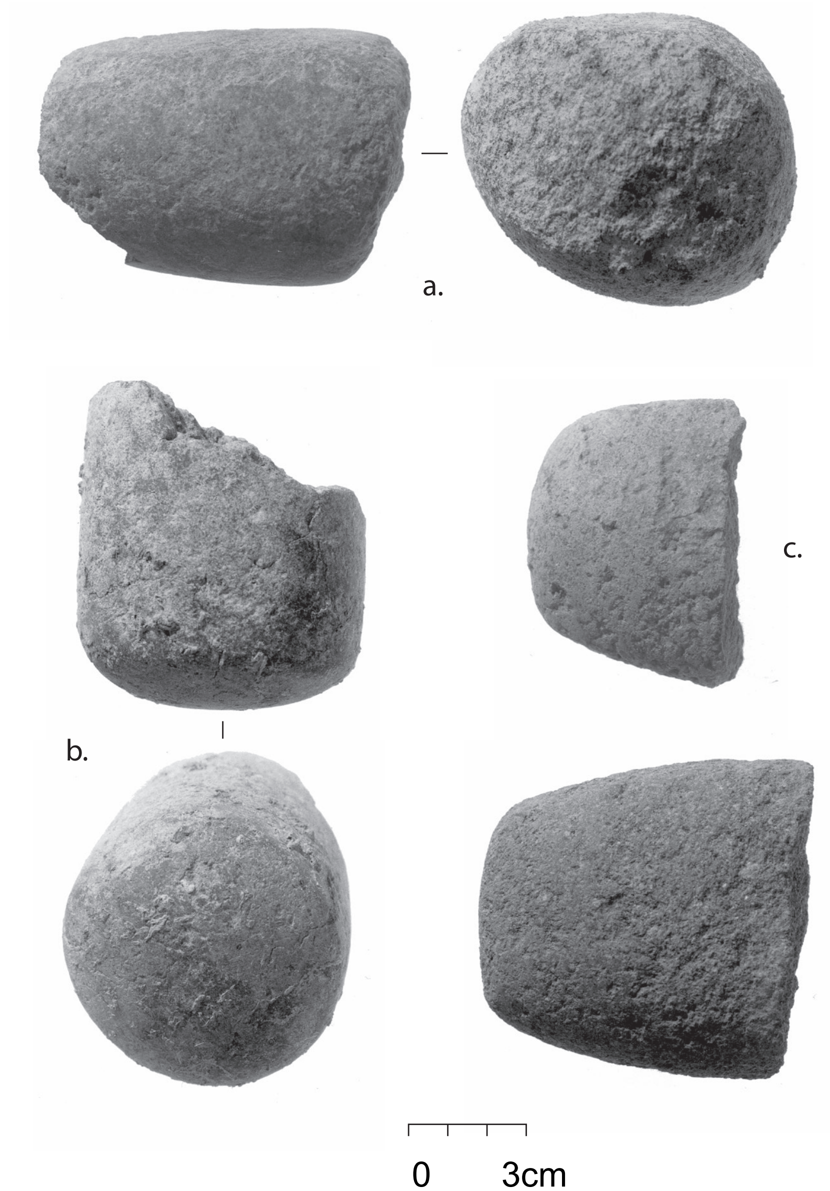


Figure 10.3. Grinding stones from El Varal: (a) thick, expedient *mano* (side and end views), (b) pestle fragment, and (c and d) *mano* fragments.

- *N95W0/10:* One *mano* fragment
- *N95W0/11:* One fragment *metate* grinding surface
- *N75-80W4-5*, *profile:* One *mano* fragment
- *N60W4*, *profile:* One complete mortar or circular *metate*, broken now in three pieces (exterior dimensions 37 by 34 cm, interior approximately 28 by 26 cm, height 11 cm)
- *N60W0/1:* One pestle fragment, very large and heavy
- *N35W0*, *profile:* One fragment of a thick *mano*
- *N35W0/6:* One *mano* fragment, with evidence of additional use of end for pounding

Miscellaneous Stone Artifacts

Other stone artifacts in low frequencies include three fragments of pumice: two from N95W0 and one from N35W0/11. The last had rounded edges, showing clear use as an abrader (Figure 10.4b). From profile scraping in N75-80 came the poll end of a celt made of dark metamorphic rock (Figures 10.4c and 10.5a). From N55W0/1 there is a thin pointed sandstone abrading tool with a triangular cross section (Figure 10.5b). Other stone artifacts include a possible hammer stone from N15W0/2 and a roughly shaped stone ball from N60W0/2 (Figure 10.4d).

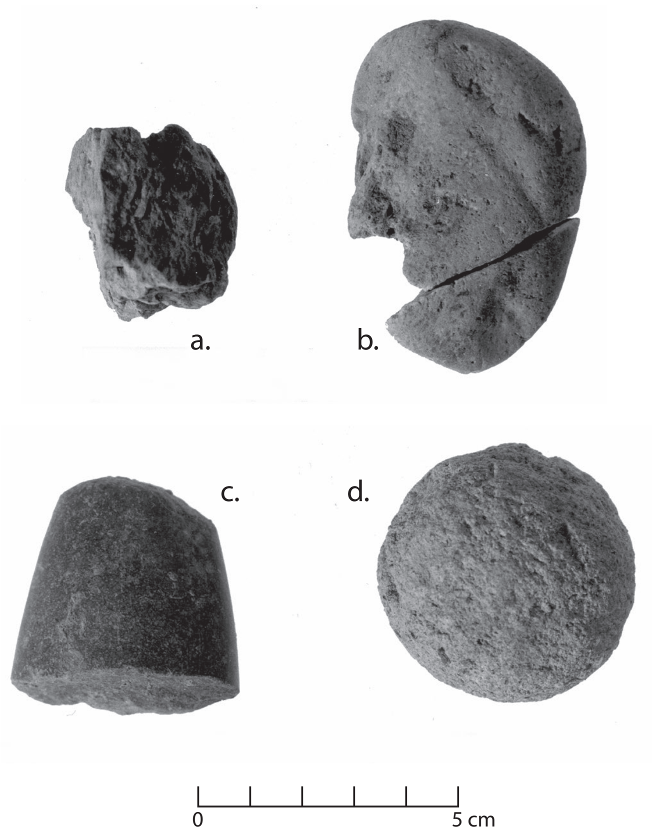


Figure 10.4. Miscellaneous stone artifacts from El Varal: (a and b) pumice fragments (N95W0/10 and N35W0/11, respectively), (c) poll end of celt (N75-80W4-5/profile), and (d) roughly worked stone sphere (N60W0/2).

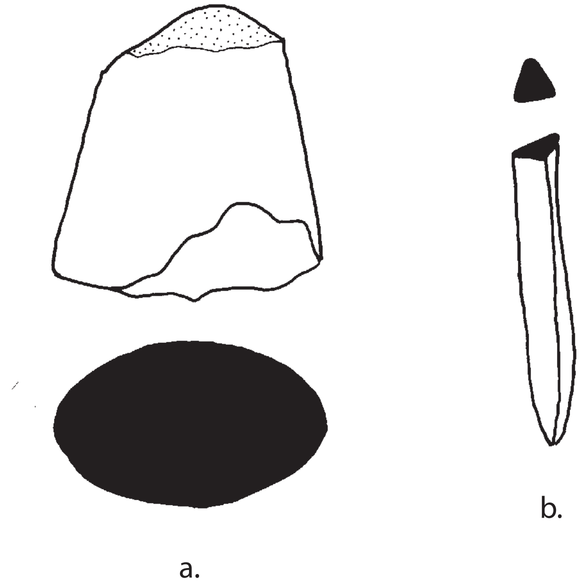


Figure 10.5. Miscellaneous stone artifacts from El Varal: (a) poll end of celt (N75-80W4-5/profile), the same piece pictured in Figure 10.4, and (b) sandstone abrading tool (N55W0/1).

Shell Artifacts

Throughout the sequence at the Vásquez Mound, the inhabitants of El Varal modified shells of *Anadara grandis* for a variety of tasks involving smoothing, scraping, and/or scooping. Some of them were likely also used as net weights. The large and heavy ark shells would have made durable tools. I suspect that three basic tool types are involved, although use wear suggests that the tools in each class were actually used in a variety of ways. Distributions by lot are provided in Table 10.3.

Most of the tools involved modification of the shell. Often the umbo (the swelling part of the shell surrounding the beak) was perforated or entirely removed (Figure 10.6). The size of the hole in the umbo varies quite a bit. Shells with large holes were clearly intentionally modified and usually had use wear along their edges. The origin of smaller holes is less clear. The holes were sometimes of irregular shapes, and signs of hole manufacture (battering around hole margins) were less often present. They sometimes bore evidence of use along the shell margin, but less often than shells with large holes.

Modified shells in general range in size. Two measurements were taken from the interior: width and height. Both measurements are bimodally distributed, with a lower mode at 3.3 to 3.5 cm and a larger mode at about 5.0 cm. Shell tools with small holes are 80-percent small in size, whereas those with larger holes are 50-percent large. Shells with use wear but no hole are mainly large (67 percent). It seems likely that the shells with small holes were net weights, whereas those with large holes were scrapers and scoops. Still, edge wear on some shells with small holes suggests that individual shells were used in multiple ways.

Table 10.3. Distribution of shell tools by lot

Provenience	Smoother	Scraper/ Scoop	Net Weight	Ark Shell with Small Hole, Broken	Ark Shell with Small Hole and Use Wear on Margin	Totals
N15W0/2			2	1		3
N15W0/3	1		1	1		3
N25W4/2	6			2		8
N35W0/5		1	2			3
N35W0/7	2		1			3
N35W0/8		1	1			2
N35W4/6	2					2
N55W0/1				1		1
N55W0/4		1	1	1		3
N55W0/5		2	1			3
N60W0/1		2		1	1	4
N60W0/2		4	3			7
N60W0/9			2			2
N65W0/1A	2	2				4
N65W0/1B				1		1
N65W0/2				1		1
N65W0/4	1	1	3	1	1	7
N70W0/1C			2	1		3
N70W0/2			1			1
N70W0/3A					1	1
N70W0/4	1		2		1	4
N70W0/5			4	1		5
N75W0/1B	1	1		3		5
N75W0/1C	3	1	3	2		9
N80W0/3A	1		2	4		7
N80W0/3B	1	2	1	1		5
N80W0/5	1	1		2		4
N85W0/1	1		1		1	3
N85W0/2	1	1			1	3
N85W0/3		1				1
N95W0/4	4	1				5
Totals	28	22	33	24	6	115

Heavy Scraper/Scoops with or Without Umbo Holes

The shell in this case was used largely intact (n = 22, Figures 10.6 and 10.7). The umbo, if perforated, had a large hole (typically 1.5 to 2.5 cm in width). Wear consists of battering or polishing on the sharp margin. It most typically appears along the serrated ventral edge opposite the beak, but wear can appear on the anterior or posterior margins. Multiple functions are possible. Large holes seem suitable for insertion of a finger to steady the tool, but that feature appears to have been an option rather than a necessity.

Similar tools made from perforated *A. grandis* are reported by Voorhies (2004:345–354) from the Archaic site of Cerro de las Conchas. She suggests several possible uses: as digging tools, net weights, or for cutting and smoothing of organic materials such as gourds. As digging tools, the shell scoops could have been used to scrape up salt-laden soils from the vicinity of the mound or perhaps to dig up shellfish. However, stratigraphic analysis provides no clear support for either of these ideas (see the sections following).

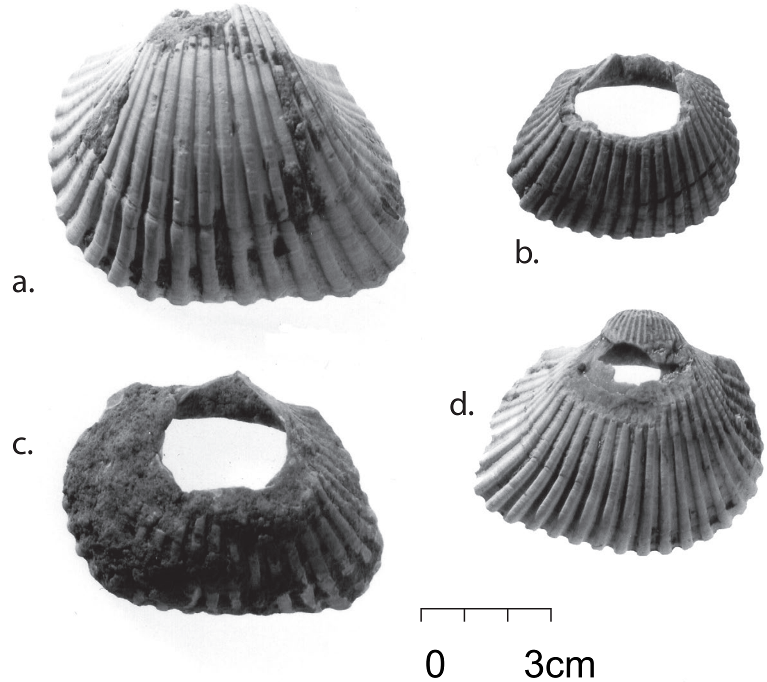


Figure 10.6. Ark shells with umbo removed: (a) large hole, with distal wear (N35W0/8), (b) large hole, with distal wear (N55W0/5), (c) large hole, with slight distal wear (N75W0/1C), and (d) large hole unfinished, no evidence of wear (N70W0/2).

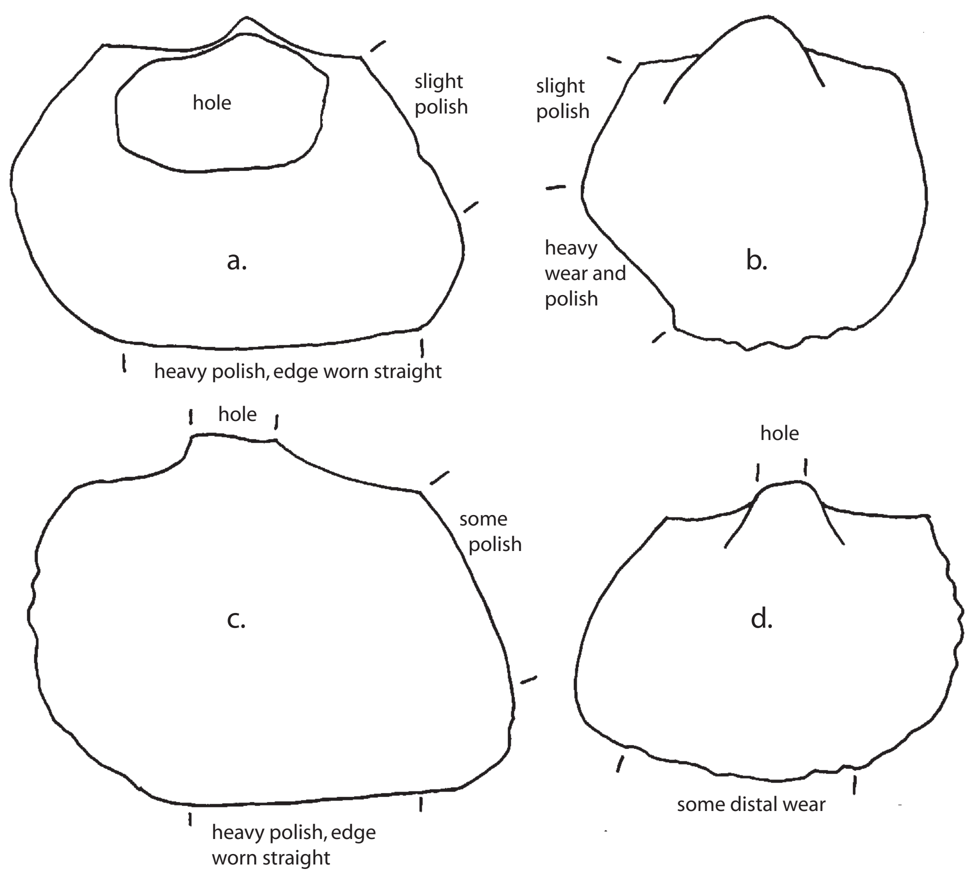


Figure 10.7. Wear patterns on heavy shell scrapers, schematic drawings viewed from the exterior: (a) N55W0/5, (b) N60W0/1, (c) N35W0/8, and (d) N65W0/4.

Possible Net Weights

Ark shells (n = 33) with small holes (0.3 to 0.7 cm in width) through the umbo and no evident edge wear (except modern breakage). When John Dietler was analyzing the crab remains from Varal (Chapter 6), he drew my attention to very similar pierced shells used as net weights by the Calusa of southwestern Florida. At Key Marco, pierced Arca shells (*Arca* sp.) and clam shells (*Venus* sp.) were used as net weights. Examples of the former were recovered tied in bunches to the remains of a net, which also had wooden floaters (Gilliland 1975:184, Plate 141). In the Key Marco case, holes are round and even. Small holes at El Varal tend to be more irregular in shape.

Small Scrapers or Smoothers

These were formed by breaking down shells of *A. grandis* to create a trapezoidal tool (n = 28; Figures 10.8 and 10.9). Toolmakers first broke a hole through the umbo, and then split the body of the shell along its veins. Scraper-smoothers exhibit two forms of edge wear. The loss of small flakes in an irregular pattern (resulting in a battered appearance) seems the result of heavy scraping. Polishing of the shell margin is the result of light scraping or smoothing. Wear was located on the ventral margin only (27 percent), on one or both of the new edges formed by removal of anterior and posterior margins (32 percent), or on both both ventral margin and new edges (32 percent). Shells exhibiting smoothing around the entire margin are probably ocean-worked fragments (9 percent).

The specific functions of scraper-smoothers are uncertain. They were probably used for a variety of tasks involving finer and more detailed work than the scraper-scoops. Somewhat surprisingly, and in contrast to the scraper-scoops, scraper-smoothers increased in frequency as the intensity of salt manufacture and shellfish harvesting increased (see the following section)—raising the question of whether they were part of the tool kits involved. Their size rules them out as digging tools. Conceivably, they could have been used to separate meat from shells—but I doubt that such a tool would have been necessary. In addition, the variety of wear patterns illustrated in Figure 10.9 suggests more than one function.

Stratigraphic Analysis

Except for the case of obsidian, stone and shell tools were too rare to allow an analysis of densities lot by lot. Instead, I lumped deposits by stratigraphic period and shell phase. In each case, I tried standardizing by volume of deposit and by weight of associated sherds. Finally, I broke the analysis down by sequence (Step Excavation and Phase 3 excavation) to check for consistency. Frequencies of obsidian were sufficient to support a lot-by-lot study, which I conducted using volumetric densities and shell phases only. Distributions were strongly skewed, and thus I used logarithms of density values to calculate means and standard deviations. In general, procedures used were similar to those applied to the shell distributions discussed in Chapter 5.

Frequencies of obsidian chips, whether standardized by volume or by sherd weight, varied greatly. Terminal-period deposits (N95W0) yield particularly high values, particularly for standardization against sherds (Table 10.4). That pattern comes out in the lot-by-lot study as well. Table 10.4, however, should be used with caution because it conceals considerable variability. Very low values characterized the Early shell phase in the Phase 3 sequence. They are offset by rather high values in the Step Excavation sequence, particularly in ST-32 through ST-27.

High values continue into the Middle shell phase in ST25 through ST-23, but are then offset by a series of lots with no obsidian. For the Late shell phase, very high densities characterized the Phase 3 sequence—particularly in N25W4. Much lower Late values characterized the Step Excavation sequence. Clearly, obsidian was generally available in low amounts throughout the occupation of the Vásquez Mound. It seems likely that the high variability observed reflects the "noise" of particular production events that led to the deposition of small concentrations of debitage. Still, there is enough consistency among analyses to raise the likelihood that the Terminal period was characterized by enhanced access to or use of obsidian.

Tools of stone other than obsidian were rare in the excavations (Table 10.5), but if we extend our consideration to pieces recovered in profile scraping it is clear that a full variety of stone tools were present in low numbers throughout the sequence. The only striking pattern is the sharp increase in grinding tools during the Terminal period (N95W0).

In the case of shell tools, results broken down by shell phases indicate stability or perhaps a decrease in frequencies of scraper-scoops over time and an increase in scraper-smoothers and net weights (Table 10.6). For net weights, I have included here all shells with small umbo holes—including six that appear also to

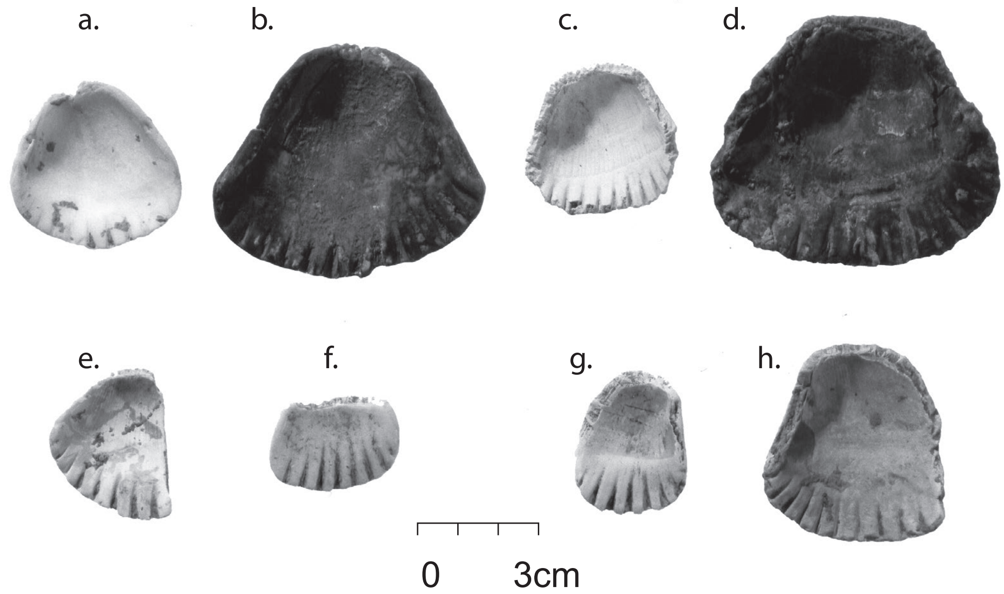


Figure 10.8. Shell scraper-smoothers: (a) N80W0/3A, (b) N25W4/2, (c) N35W0/7, (d) N85W0/1, (e) N15W0/3, (f) N25W4/2, (g) N85W0/2, and (h) N75W0/1C. Wear mainly on sides on a, b, e, and f. Mainly distal wear on c, d, g, and h.

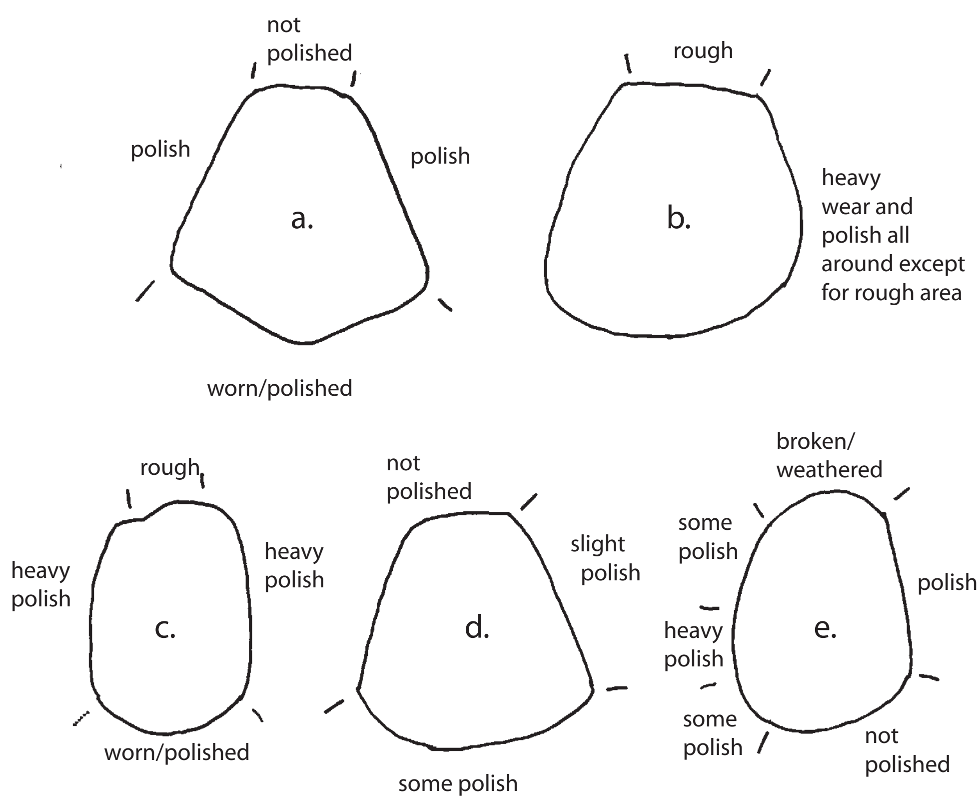


Figure 10.9. Shell scraper-smoothers, showing location of edge wear—viewed from the shell interior: (a) N75W0/1C (b) N70W0/4, (c) N80W0/3B, and (d and e) N25W4/2

have been used as scrapers. The Terminal deposit from N95W0/3-4 is also somewhat problematic because shells were weathered and it is possible that not all tools were identified.

Tools in Relation to Productive Activities

It is relevant to consider the frequencies of stone and shell tools in relation to three trends: the increasing intensity of shellfish harvesting (Chapter 5) and fishing (Chapters 7 and 14), a possible increase in the scale of production of salt (Chapters 3 and 14), and the shift from tecomate- to bowl-focused vessel-form assemblage toward the end of the occupation (Chapters 3 and 9).

Shellfish harvesting increased from low to moderate to high in the Early, Middle, and Late shell phases, respectively. Fishing probably also increased in intensity over the same time. Salt production seems to have been conducted at a greater scale during the Late stratigraphic period. Those shifts in productive activities were not associated with any robustly identifiable changes in the frequency of deposition of obsidian, grinding stones, or other stone artifacts. The increase in probable net weights from Early to Middle shell phases might relate to an increasing intensity of fish harvesting (as inferred from volumetric density of fish NISP), but net weight density stays stable into the Late phase while fish density goes up again. Shell scraper-smoothers increase steadily from Early to Late. It is unclear why this might be. As noted previously, it is conceivable that these tools were used in the harvesting of shellfish—but I remain skeptical of their utility for this purpose.

During the Terminal stratigraphic period, the vessel-form assemblage at El Varal shifted from overwhelmingly tecomate focused toward the type of bowl-focused assemblage familiar from inland sites (Chapter 9). Patterns of obsidian and grinding stone deposition appear to be correlated with that shift. Whether frequencies are standardized by volume of deposit or weight of associated sherds, usage of these tools appears to have risen during the Terminal period. Shell was poorly preserved in the clay of N95W0, and the patterns of shell tools are somewhat unclear.

Table 10.4. Stratigraphic analysis of obsidian

Shell Phase	Volume (m^3)	Volumetric Density (g/m^3)	Standardized by Sherds (g/kg Sherds)
Early	7.72	16.3	.27
Middle	5.35	12.5	.15
Late	2.28	32.1	.33
Terminal	3.60	54.2	1.53

Table 10.5. Grinding stone fragments and miscellaneous stone artifacts by shell phase[a]

Shell Phase	Volume (m^3)	Grinding Stones	Miscellaneous Stone Artifacts
Early	7.72	2	3
Middle	5.35	0	0
Late	2.28	0	1
Terminal	3.60	10	2

a. Raw counts, with associated volume for comparison.

Table 10.6. Volumetric densities of shell tools by shell phase

Shell Phase	Volume (m^3)	Scraper-scoops	Scraper-smoothers	All Possible Net Weights
Early	4.73	2.5	.6	4.4
Middle	2.65	1.9	3.8	9.0
Late	2.05	2.0	5.4	8.8
Terminal	1.37	.7	2.9	0

CHAPTER 11

Ceramic Artifacts

RICHARD G. LESURE

THE COLLECTION OF 155 ceramic artifacts from El Varal is small in absolute terms, but it represents the largest collection of such artifacts ever published from a Jocotal-phase site in the Soconusco. Most numerous are the 128 figurine fragments, but the mask fragments are perhaps more noteworthy. Still, it is important not to exaggerate the significance of the collection. El Varal is a minor site. When some larger Jocotal site is excavated, there is every reason to believe that a richer inventory of ceramic art will be revealed.

Figurines

In the late 1980s, John Clark devised an elaborate typology of Early Formative anthropomorphic figurines from the Mazatán region based on excavation and surface collections from Aquiles Serdán, Paso de la Amada, Cantón Corralito/San Carlos, and a few other sites. He never, however, wrote complete type descriptions. Based on Clark's type collection and a photo-based key he had devised, I was able to classify figurines from the 1990 to 1993 excavations at Paso de la Amada according to the typology. At that time, I drafted type descriptions—but that document also has not yet reached publication. Brief reference to the typology appears in Clark (1994a) and Lesure (1997b).

The scheme is hierarchical, with *groups* defined mainly on the basis of paste and surface treatment, *types* sensitive to variation in manufacture and subject matter within the groups, and *varieties* representing stylistic variation (primarily of facial features) within types. Groups relevant to El Varal are Eyah (characteristic of the Cuadros phase) and Yoca (characteristic of the Jocotal). Although neither has been formally described, the El Varal collection is not the sample on which to do that. I tentatively relate the Varal materials to the typology under the assumption that we will soon get around to producing formal type descriptions.

Yoca Group

The Yoca Group is extraordinarily diverse in surface finish, subject matter, and stylistic detail. However, because no large excavated collection is available replicable classification of that diversity is not yet possible. Yoca is by far the most common figurine group at El Varal (106 out of 128 total figurine fragments), and the diversity characteristic of the group is clearly evident. Varal Yoca figurines are tentatively classified into one type, Toya, and two unnamed sets: minimally hollow and fully hollow. The first (and perhaps the second) set may be subsumable into Toya once variation is better understood.

Yoca Group figurines are made of a coarse sandy paste that varies from tan to cream to gray in color. The paste appears identical to that used to produce pottery

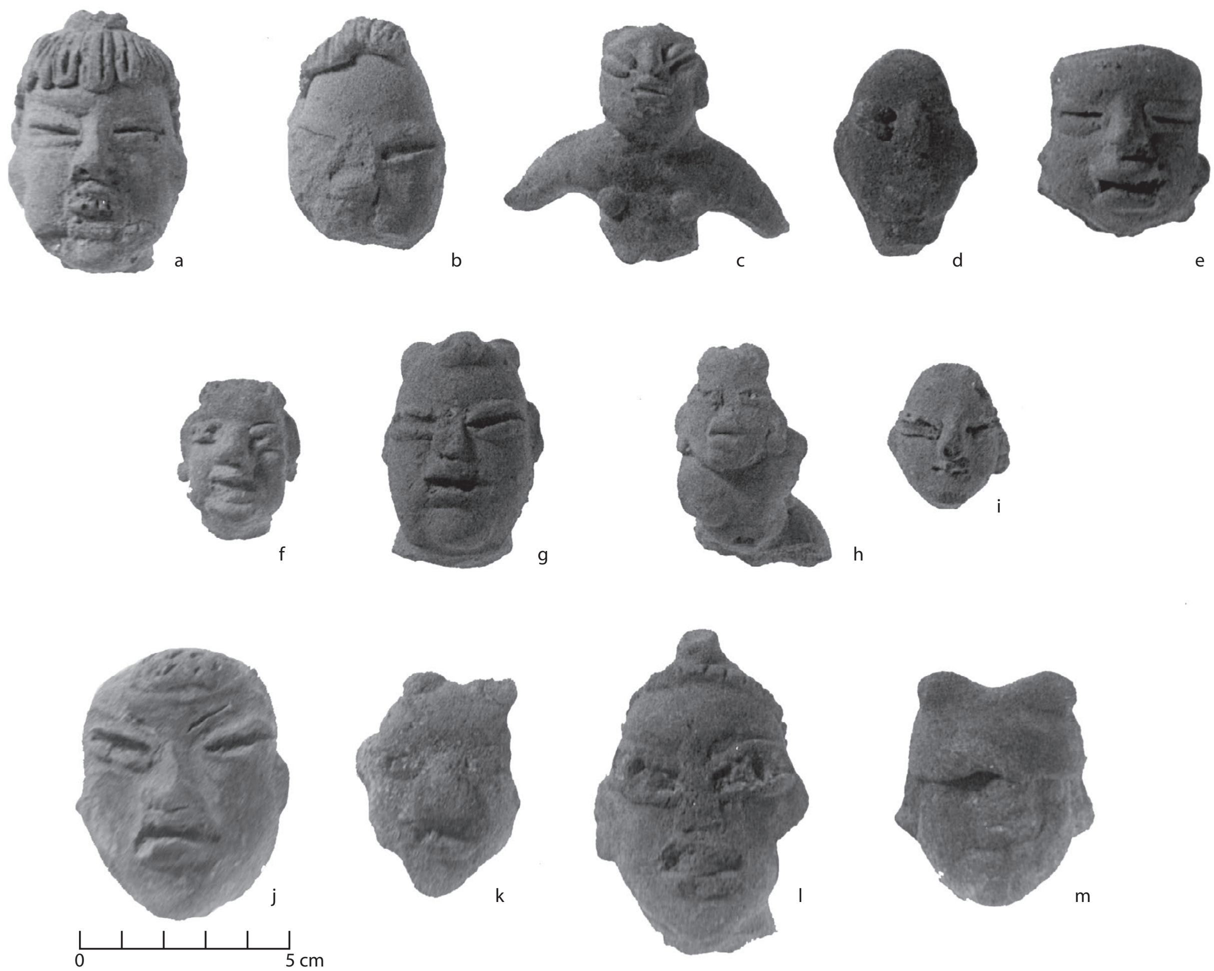


Figure 11.1. Solid figurine heads: (a) N60W0/profile, (b) surface , (c) N95W0/19, (d) N70W0/profile , (e) N75W4/profile, (f) surface, (g) N65W0/2, (h) N95W0/10, (i) N35W4/4, (j) N65W0/profile, (k) surface, (l) N95W0/4, and (m) N35W0/5.

at the site. Gray cores are common. Hardness varies considerably. The surface of many figurines is crumbling off, sometimes in plate-like flakes (a pattern of disintegration also observed on sherds). Surface finish varies. Most are roughly wiped or smoothed. A few are burnished. Traces of deep red, orange-red, and white paint are common.

Toya Type

Toya figurines are solid and range greatly in height, from approximately 8 to at least 25 cm. The norm was probably 10 to 15 cm. Surfaces are roughly finished or (rarely) burnished. The sample of 106 pieces includes 2 head-plus-torso fragments, 10 heads, 24 torso fragments, 40 legs, 11 arms, and 19 unidentified limbs (Figures 11.1a through e, 11.2b through d, 11.3, 11.4, and 11.5a and b).

Heads are typically long and oval, although one (radically different from the others) is thick with a flattened top (Figures 11.1 and 11.2). The flat-headed figure is bald (Figures 11.1e and 11.2b). Among the others, three have masses of striated hair in complex arrangements—with two of those depicting hair gathered into a topknot (Figures 11.1a and b and 11.2d). Four other heads have a very different hairstyle involving isolated appliqués covered with jabs or punctations (Figures 11.1f through h, and j). At least three figures have small round ear ornaments (Figures 11.1c, f, and h).

Eyes all involve appliqués with marked central impressions, yielding the effect of heavy upper and lower lids. Beyond that, however, the details differ. Five have “coffee-bean” eyes in which a single slot-like impression crosses the entire width of the appliqué (Figures 11.1a through d, and h). In two other cases, the impression does not reach the edge of the appliqué—resulting in a raised border around the entire eye (Figures 11.1e and j). In four cases, the appliqué has

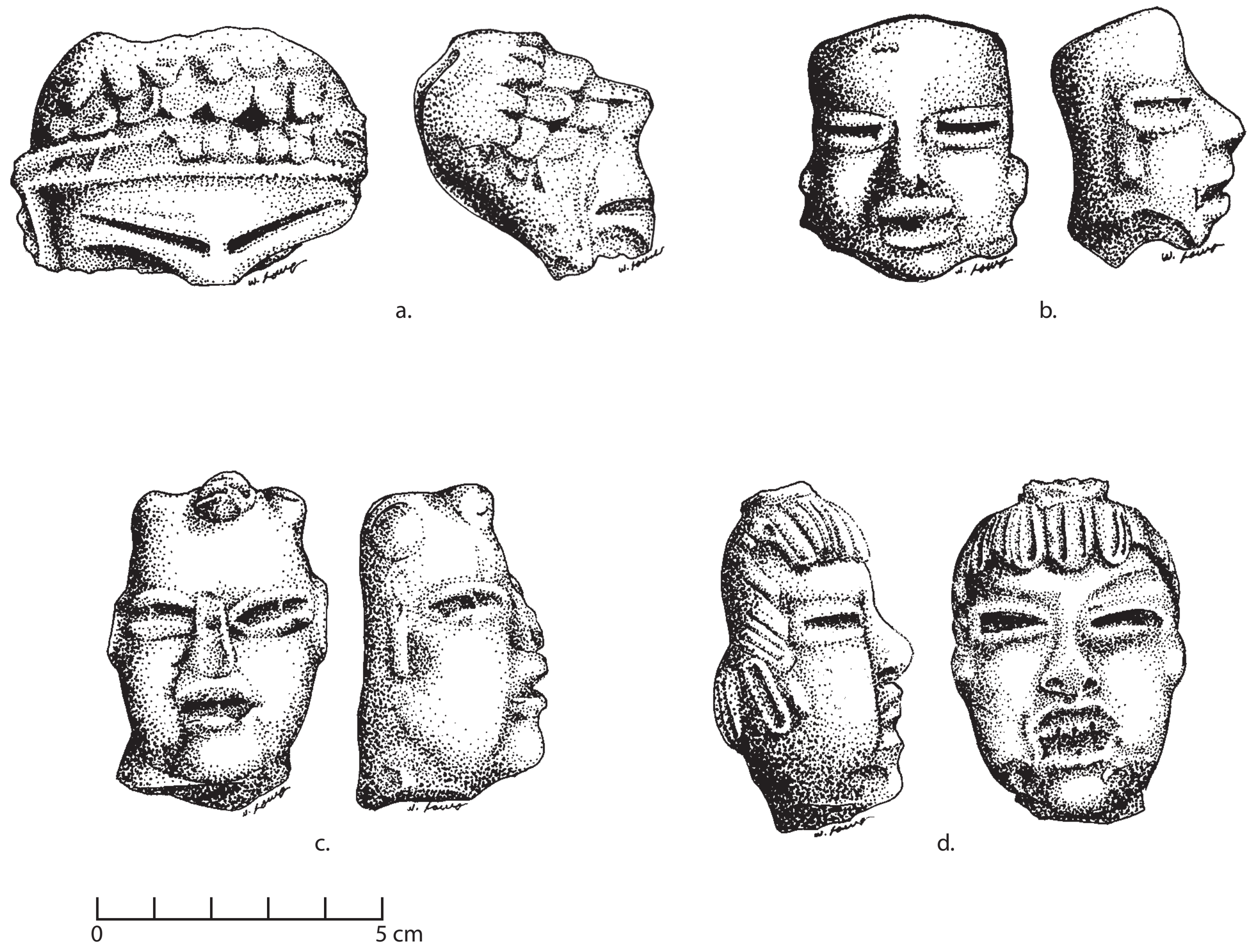


Figure 11.2. Figurine heads: (a) forehead and hair of hollow figurine, surface. All others are solid heads: (b) N75W4/profile, (c) N65W0/2, and (d) N60W0/profile.

been given two impressions—leaving a raised center that suggests a pupil (Figures 11.1f, g, i, and k). In one figure, wedge-shaped impressions indicate the whites of the eye and a vertically oriented slit forms the pupil (Figure 11.1e). Noses and mouths are in bad shape, the former tending toward a naturalistic shape and position and the latter formed in a manner similar to the eyes (with a deep central impression on a single appliqué).

Bodies tend to be flat and slab-like, although headdresses and neck ornaments were depicted in the round. The majority of figurines, somewhere between 57 and 70 percent, were seated. (The lower estimate is based on bodies only and is probably too low. The higher estimate is based on legs and bodies and is probably too high because it is easier to identify the original posture of loose legs that were seated.) One unique figure appears to have been crouching (Figure 11.1h). The most common seated position involved legs flat, straight out from the body, with the knees slightly flexed and hands resting on the thighs (Figures 11.5a and b). Other hand positions seem also to have been symmetrical. They included hands resting on the stomach (Figure 11.3e) and crude arms extending stiffly out from the body (Figures 11.3g and h).

Sexual features are depicted haphazardly and are difficult to interpret with confidence. Suggestion of primary sexual attributes is rare, although perhaps more common than is usual in collections of Formative Mesoamerican figurines. One figure had a triangle defined by grooves in the pubic area, perhaps depicting the female genital region (Figure 11.4a). Two other leg fragments bear traces of such grooves (Figures 11.4b and c). Depiction of secondary sexual attributes is confined to breasts. Three torsos bear no indication of breasts (Figures 11.4d, g, and i), three have nubbin breasts formed with small appliqués (Figures 11.3f, h, and i), nine have weakly protruding modeled breasts (Figures 11.3c and e), and three have

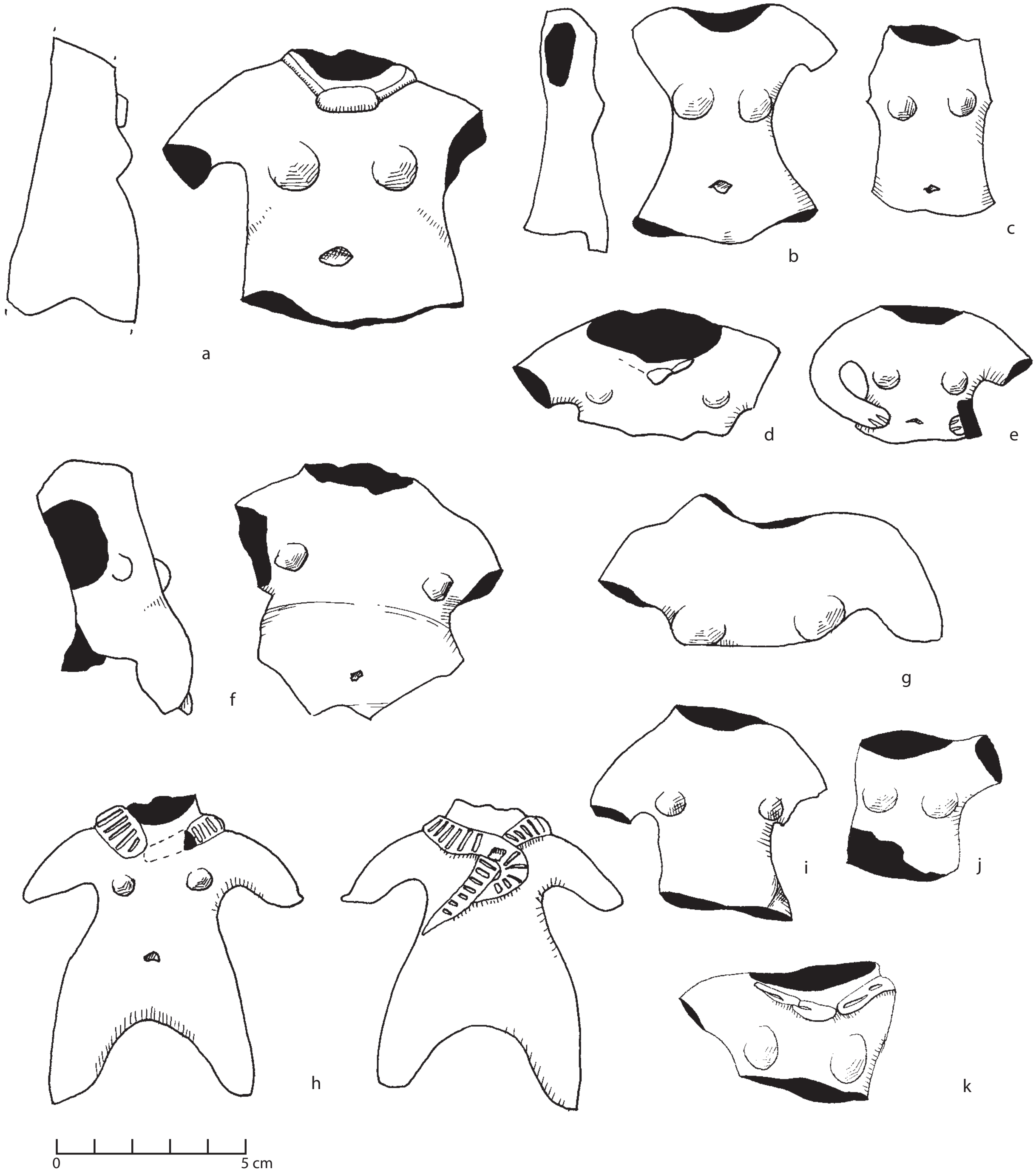


Figure 11.3. Toya-type torsos: (a) N5W0/profile, (b) surface, (c) N5W0/profile, (d) N95W0/11, (e) N95W0/16, (f) N95W0/8, (g) N95W0/18, (h) N95W0/4, (i) surface, (j) N80W0/3A, and (k) N95W0/10.

breasts that are modeled and moderately protruding (Figures 11.3a, b, and g).

Only the last seem definitely adult female in form. Two of the breastless torsos have masculine aspects: a muscular upper chest (Figure 11.4d) or a middle-aged paunch (Figure 11.4g). However, I may be reading too much subtlety into an essentially crude representational system. The single complete torso with a pubic triangle has weakly modeled breasts. One fat (pregnant?) torso has nubbin breasts (Figure 11.3f). Whether variable prominence of breasts might reflect efforts to depict females of different ages is anyone's guess. Again, the crudeness of the representations and the fragmentation of the collection are a challenge for any such

Figure 11.4. Toya-type torsos and legs: (a) N95W0/18, (b) surface, (c) surface, (d) N95W0/4, (e) N95W0/profile, (f) N10E4/profile, (g) N10E4/profile, (h) surface, and (i) N5W0/profile.

interpretation. The figurines were probably stereotyped representations of people—perhaps a few men (17 percent), but mainly women (83 percent, the latter potentially represented at various ages).

A third of the bodies have neck ornaments, all of which are different (Figures 11.3a, d, h, and k). Traces of red paint are common. Two torsos and several limbs are mostly covered with red paint (Figure 11.4h). One torso is distinctly fat (Figure 11.3f), and a few have moderately projecting bellies. The majority of bellies are flat or slightly rounded.

Minimally Hollow Figurines

Beginning in the Locona phase in the Mazatán area, there is a stylistic and iconographic divide between small solid figurines and large hollow figurines. In other words, "hollow" and "solid" seem to correspond to categories used by the original makers and users. That

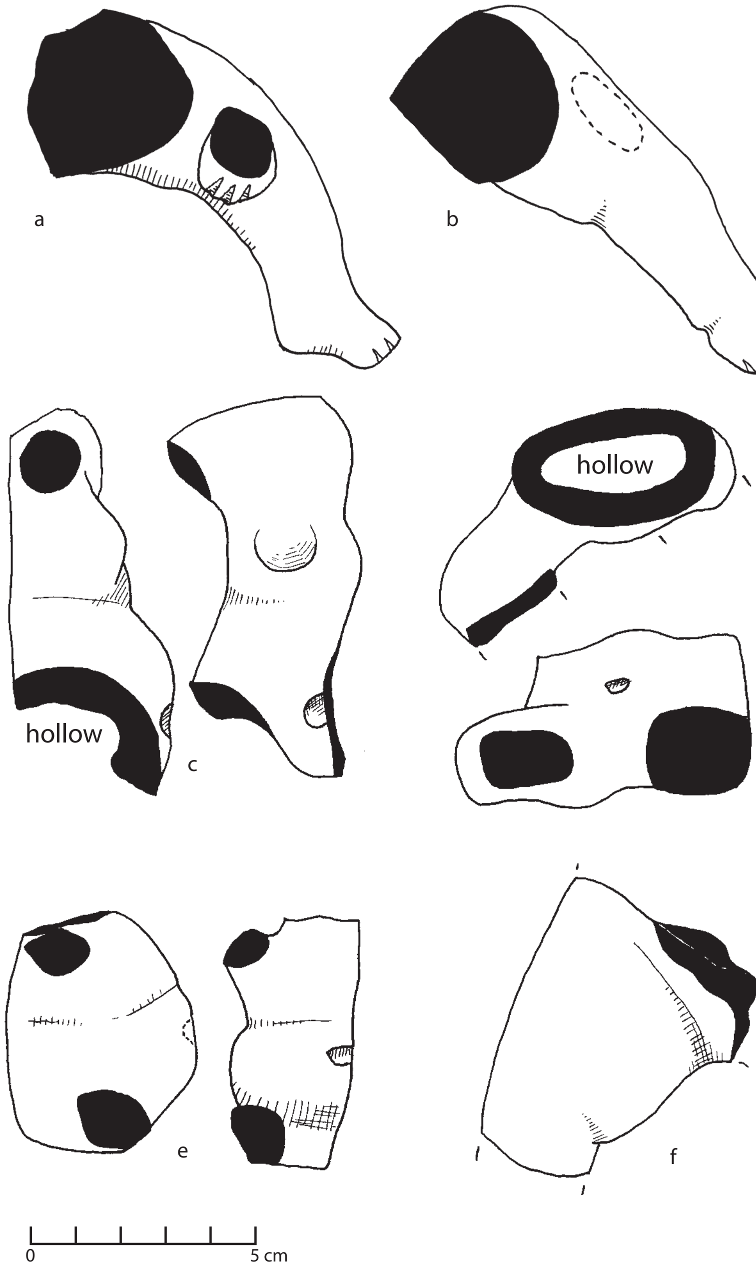


Figure 11.5. Toya-type legs and minimally hollow figurines: (a) surface, (b) N95W0/4, (c) N95W0/16, (d) N95W0/4, (e) N70E0/profile, and (f) N10W0/profile.

pattern persists through the Cherla phase (and possibly the Cuadros phase), but it is less clear-cut in the mainly Jocotal collection from El Varal. Four figurines in particular had hollow spaces in the torso but solid limbs (Figures 11.5c through f). They are of a size consistent with the Toya type and appear in all other respects part of the same type.

Fully Hollow Figurines

There are eight fragments of more fully hollow figurines, including one head, one head/arm, one belly, four legs, and one belly or head fragment (Figure 11.6).The collection is diverse, with a size range overlapping that of solid figurines. It is too fragmentary to characterize in detail. White and red paint are more common than

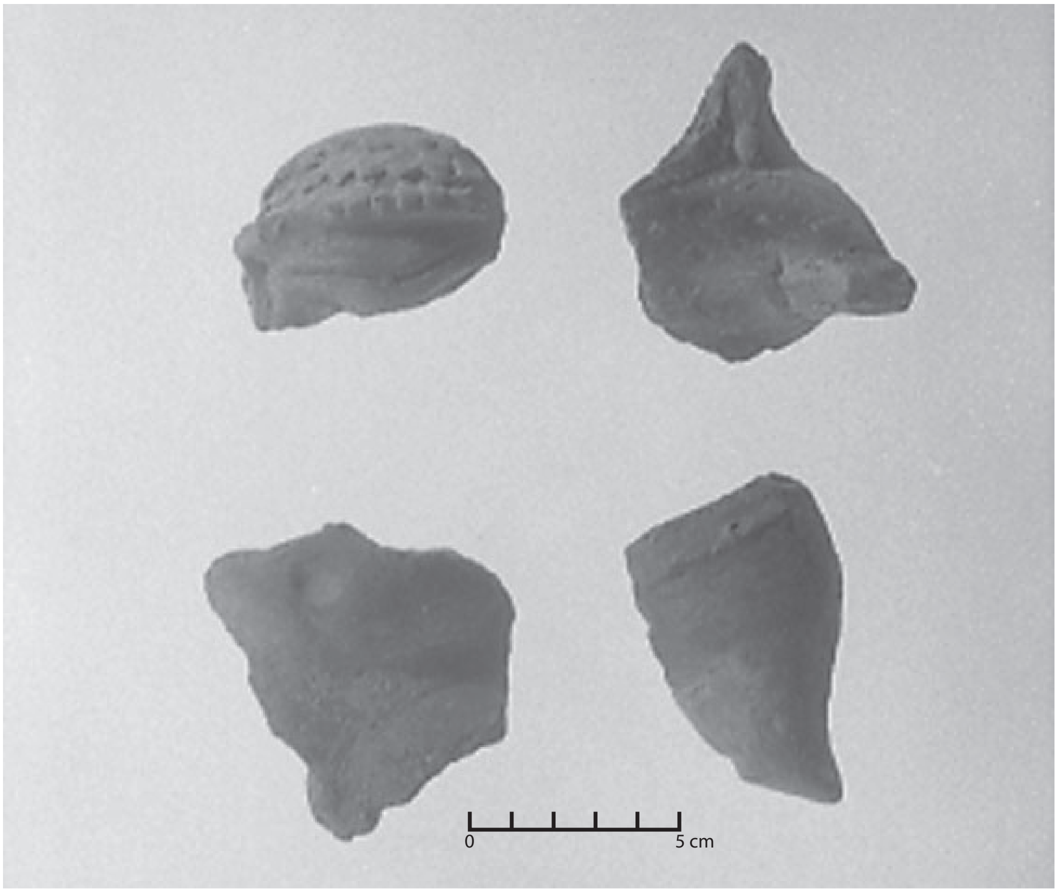


Figure 11.6. Hollow figurines: (a) head, surface, (b) head/shoulder fragment, N20W0/profile, (c) belly/thigh fragment, surface, and (d) leg, N45W0/profile.

among the solid figurines, and one head fragment appears to be from a quite elaborate piece (Figure 11.2a). That figure had a small opening at the top of the head and was thus strictly speaking a vessel rather than a figurine.

Eyah Group

All assignments to the Eyah Group are tentative. Because of the great diversity observed in the Toya type described previously, it is difficult to be sure that those labeled Eyah were not simply further variation within Yoca-Toya.

The Poposac type is white-to-gray slipped and medium-to-well burnished. Heads are "Olmec" in style, resembling figurine head styles from the Gulf Coast. No such heads were found at El Varal, although there are four white-slipped figurine limb fragments (two seated legs, one foot, and one arm). There is also a hand in a paste that is white clear through and thus resembles the kaolin figurines that appeared in various parts of Mesoamerica around the same time horizon as Poposac.

The Yacsas type is contemporary with Poposac, but more diverse in manufacture and style—with burnished surfaces tending toward darker gray and brown. Two possible Yacsas pieces in the El Varal collection have gray pastes with dark-gray/black surfaces and some indication of burnishing. (Again, they could be part of the ample variation of Yoca-Toya.) One is a leg from a seated figure with the hand resting on the lower leg. The other figure is an intriguing anthropomorphic head with a hint of flaring lips and downturned mouth—and eyes absent or covered by a wide headband depicted as tied across the forehead with the ends dangling in back (Figure 11.1m). Two projections at the top of the head suggest a headdress with horns or zoomorphic ears. The head is quite different from any of the Toya heads described previously.

Other Figurines

There are three unidentified figurine fragments: two limbs in a fine, soft, brown paste—and an eroded torso in a cream-colored paste that could be a representative of the Nicotaca type (characteristic of the Ocós and Cherla phases).

MASKS

The greatest surprise among the finds from El Varal were four pieces of anthropomorphic ceramic masks: three from the bulldozer backdirt and one from profile cleaning of Terminal-period deposits in N95W0 (Figures 11.7 and 11.8) The paste is in each case prepared as for contemporary pottery. Two sizes are represented: one with a diameter of 5 to 6 cm and the other with a diameter of 12 to 15 cm. The smallest is too small to use as a covering for a human face, but it does have three holes for suspension [one at the top of the head and one behind each ear (Figure 11.8, top)]. The surface has a thin white slip and light burnishing. Facial features are crude, formed as for contemporary figurines. There are no perforations in the eyes or the mouth. Presumably this piece was made as a costume or headdress element, or perhaps to mask the face of a large figurine.

The other three pieces are all from masks in the larger size range. These are also too small to have covered the human face completely, but masks of this size are well known from other regions of Mesoamerica in the Early and Middle Formative. A figurine from Tlatilco is depicted as wearing a mask covering only the lower part of the face (Niederberger 1987:286). Flannery (1976) suggests that covering the mouth—the source of breath—was the critical element of Mesoamerican masking. It seems reasonable to suppose that the larger El Varal masks were made to be worn by performers in rituals or ceremonies.

Figure 11.7. Ceramic masks, front and back: (top) surface; (bottom) N95W0/profile.

Figure 11.8. Ceramic masks, front views, from surface.

The mask from the N95W0 profile is a crude but colorful affair, painted white from the middle of the ear to the top of the head and an orange-red from mid-ear to chin (Figure 11.7, bottom). The eyes were formed from horizontal cane impressions with an off-center perforation for the pupil. The resulting eye holes were small but could conceivably have been functional if the mask was meant to cover the eyes. They could alternatively have served, along with a somewhat larger mouth hole, to facilitate breathing and speaking on the part of the performer. The nose and most of the mouth are broken away, but the latter involved a heavy upper lip and inset teeth. The mouth opening was just beneath the teeth. The suspension scheme was the same as for the smaller mask. Two suspension holes remain: one at the top of the head and the other in back of and beneath the remaining ear.

A half-mask and another small fragment of mask, both from the bulldozer backdirt, are more naturalistic. The small piece is simply a nose with bits of remaining eye and upper lip (Figure 11.8, bottom). The well-smoothed reverse is consistent with the other masks rather than with the unfinished interiors of hollow figurines, and thus even though it is small its identification as a mask fragment seems secure.

The final mask is of a gray paste and was originally lightly burnished (Figure 11.7, top). It is broken off at the eyes. Nose and mouth are also damaged. Eyes and mouth both again involve perforations, and as before the eye holes seem functional—for seeing or breathing/speaking, depending on how the mask was positioned on the face. Naturalistic features on this piece include rounded cheeks and a distinct chin. Nose and mouth are also naturalistic. The nose is open, with something of a flaring upper lip and down-curving ends. Those are plausibly attributes of Olmec style, but due to breakage the degree of overall match cannot be determined. One unusual feature is a projection below the upper lip into the space of the open mouth. It bears two gouges and appears to be a depiction of upper incisors.

Worked Sherds

Worked sherds were not recorded in their entirety. In 1993, I removed all such sherds from 15 lots of the Step Excavation and N95W0. That is the collection described here. Varal worked sherds are of two different types, with apparently very different uses. First are sherds ground into simple shapes (Figure 11.9, top two rows). The edges in this case are generally uniform and well smoothed. Triangles predominate (Figures 11.9a through d, f, and g). The specific uses of these are unknown, although it seems likely that they were *not* utilitarian. The second group seems instead to consist of tools used for scraping, smoothing, or light grinding. Certain edges are worn down, often at an angle to the surface plane of the sherd (Figures 11.9i through m). Other, nonfunctional, edges are left rough.

Other Ceramic Artifacts

Other ceramic artifacts include a miniature effigy vessel from profile cleaning in N35W4; a crude miniature ceramic cup from N80W0/3A; a tiny ceramic stool, perhaps an accoutrement for a figurine, from N65W0/3; and a fragment of a whistle from N65W0/4 (Figures 11.10a through d, respectively). From profile cleaning in N65W0, there is a perforated trianguloid ceramic plaque (manufactured as such, not made from

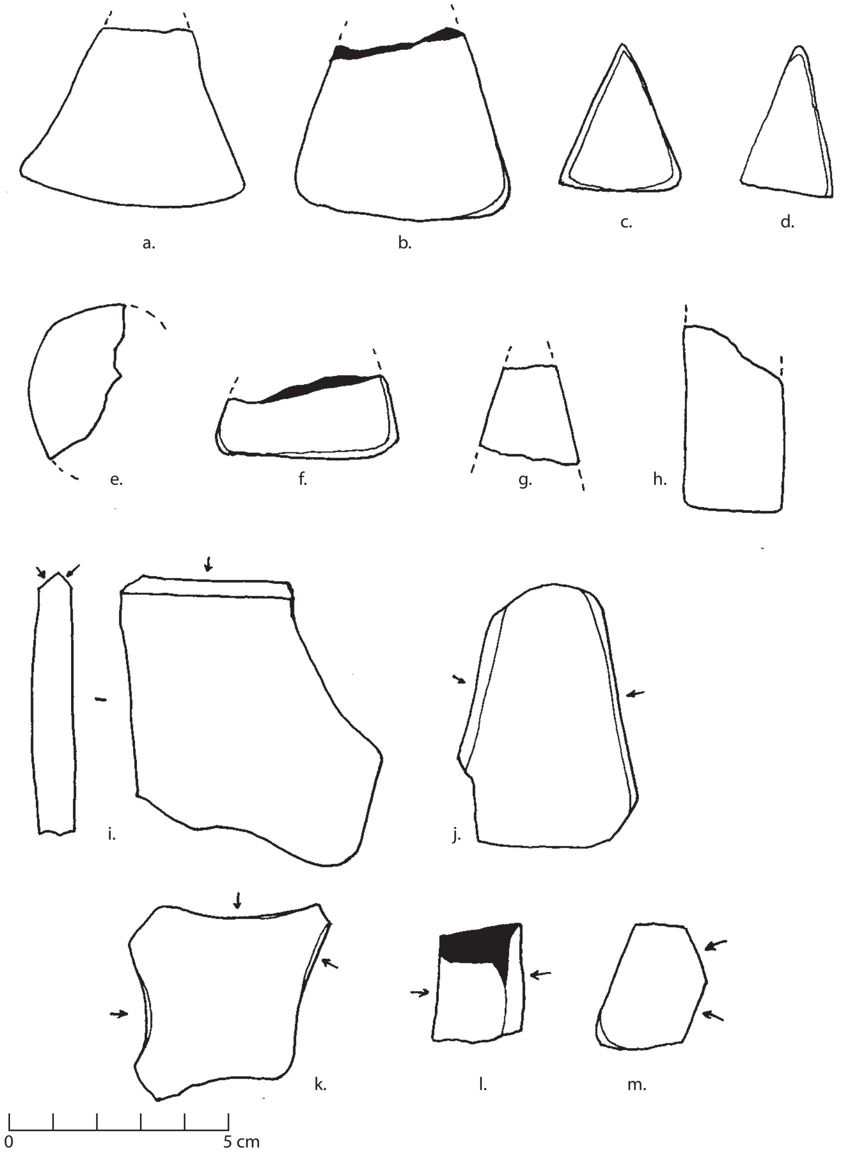


Figure 11.9. Worked sherds: (a) N95W0/11, (b) N95W0/7, (c) N95W0/7, (d) N95W0/5, (e) N95W0/5, (f) N95W0/4, (g) N65W0/4, (h) N65W0/4, (i) N95W0/17, (j) N95W0/7, (k) N65W0/4, (l) N95W0/5, (m) N95W0/7.

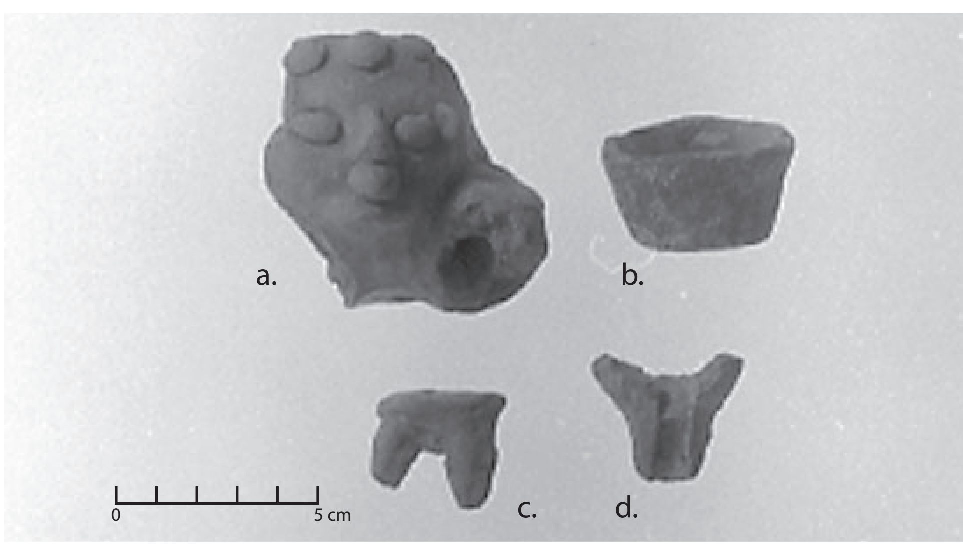


Figure 11.10. Miscellaneous artifacts: (a) N35W4/profile, (b) N80W0/3A, (c) N65W0/3, and (d) N65W0/4.

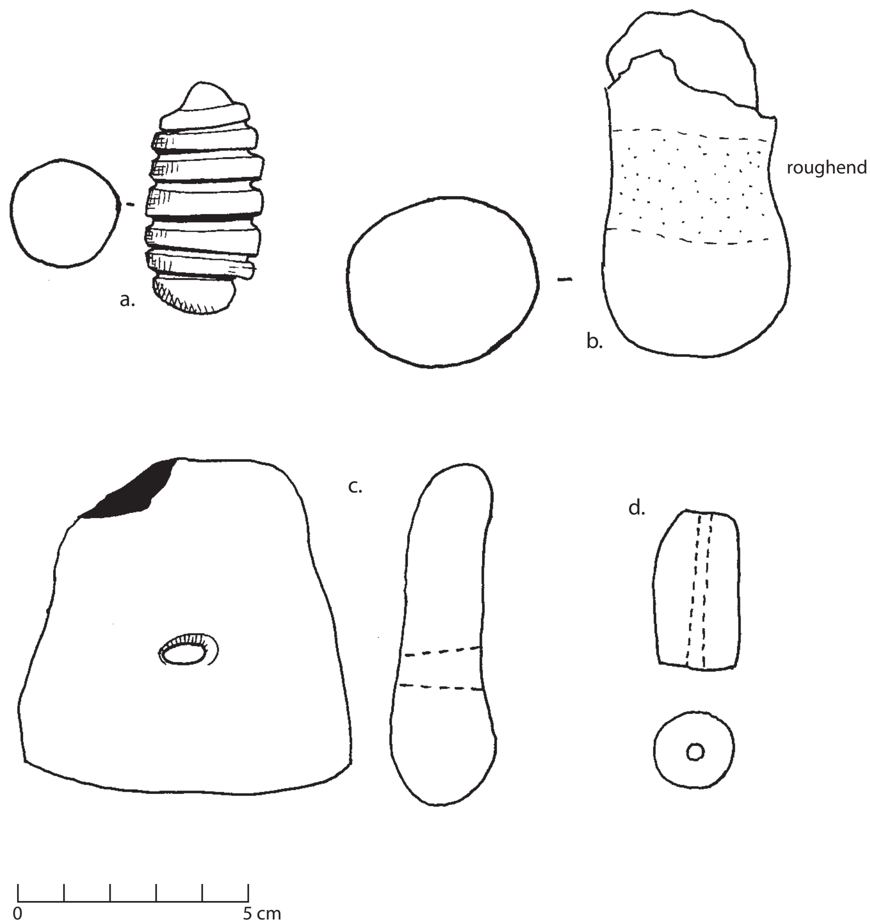


Figure 11.11. Miscellaneous artifacts: (a) surface, (b) surface, (c) N65W0/profile, and (d) N95W0/1.

a sherd). From N95W0/1, there is a ceramic cylinder perforated down its length—perhaps a net weight or bead (Figures 11.11c and d, respectively). Surface finds from the bulldozer backdirt include a crude cylinder seal (Figure 11.11a). There is also a cylindrical object with rounded ends and a slight central constriction (Figure 11.11b). The surface of the constricted area is worn, as if the object was hafted. The object resembles a mallet, but the one remaining end shows no evidence of damage from pounding. Either the heavily damaged end was used as the head of the mallet or the object had some other purpose.

Stratigraphic Analysis

Distribution of ceramic artifacts by provenience is provided in Table 11.1. The fact that a large number of figurines come from profile scraping rather than excavation should not be accorded any particular significance. We were particularly on the lookout for this class of artifact and every fragment found was collected.

One would expect Eyah Group figurines (Yacsas and Poposac types), considered characteristic of the Cuadros phase, to be earlier than Yoca (Toya type)—a Jocotal-phase diagnostic. Although there is a tendency in that direction, with Eyah concentrated in the Early (but more particularly the Middle) stratigraphic period, the pattern is far from perfect. There are two white-slipped figurine limbs ("Poposac") from quite late in the sequence (N90W0 and N95W0). It is certainly possible that there was a white-slipped Yoca variant. One other chronological pattern is that minimally hollow figurines tend to be very late in the sequence, particularly in the Terminal period.

In terms of the larger issues of the organization of behaviors at El Varal, there are two significant observations to be made concerning the figurines (by far the most numerous of the ceramic artifacts). First, activities involving figurines occurred throughout the occupation

Table 11.1. Distribution of ceramic artifacts by provenience

Provenience	Seq. No.	Toya-type Figurines			Other Ceramic Artifacts
		Heads	Torsos	Limbs	
N5W0, profile			3		
N10W0, profile				2	1 miniature hollow figurine leg
N20W0, profile					1 hollow figurine torso
N35W4/1	P3-10			1	
N35W4/4	P3-13	1			
N35W4/7	P3-16				1 Poposac arm
N35W4, profile					1 miniature effigy vessel
N35W0/5	P3-24				1 Yacsas head
N35W0/8	P3-27			1	
N35W0, profile				1	
N45W0/4	P3-35			2	
N45W0, profile				1	1 hollow figurine leg
N50W0, profile					1 Yacsas leg
N60W0/1	ST-39.1			1	
N60W0, profile		1			
N60W0/3	ST-33			1	
N65W0, profile				1	1 perforated ceramic plaque
N65W0/6	ST-31			1	
N65W0/4	ST-29		1	1	1 ceramic whistle fragment
N65W0/3	ST-28				1 miniature ceramic stool
N65W0/2	ST-27	1			
N70W0, profile		1		3	
N70W0/5	ST-24			1	
N70W0/3A	ST-21			1	
N75W0, profile				1	
N70W0/1C	ST-19			1	
N75W0/1C	ST-14			1	
N75W0/1B	ST-13				1 Poposac leg
N75W0/1A	ST-12			1	
N80W0, profile				1	
N80W0/3C	ST-07			3	
N80W0/3A	ST-05		1	2	1 crude miniature ceramic cup
N90W0, profile					1 Poposac leg
N95W0/1				1	1 longitudinally perforated ceramic cylinder (net weight? bead?)
N95W0/2				2	1 Poposac leg
N95W0/4		1	3	4	1 fully hollow and 1 miniature hollow figurine leg
N95W0/5				2	
N95W0/6					1 fully hollow figurine leg
N95W0/8			2	1	
N95W0/8A			1		
N95W0/10		1	1	2	
N95W0/11			1	1	
N95W0/15				2	
N95W0/16			1	2	1 miniature hollow figurine torso
N95W0/18			3		
N95W0/19		1		2	
N95W0, profile			2	5	1 mask fragment
general surface		5	5	18	1 Poposac arm, 4 fully hollow figurine fragments (1 head, 2 body, 1 limb), 1 miniature hollow figurine torso, 1 possible Nicotaca torso, 2 unidentified figurine legs, 3 mask fragments, 1 cylinder seal, 1 possible ceramic mallet

Table 11.2. Frequencies of figurines and other ceramic artifacts from excavations by stratigraphic period

	Early	Middle	Late	Terminal
Figurines:[a]				
Raw frequencies	4	12	9	38
Figurines per m^3	0.6	2.3	2.6	4.9
Figurines per 100 kg sherds	1.6	2.2	2.6	21.6
Other ceramic artifact[b]				
Raw frequencies	0	2	1	1
Volume excavated (m^3)	7.07	5.26	3.42	7.71
Total wt. sherds (kg)	244.0	553.3	340.7	176.4

a. Includes only figurines from lots for which excavated volume and total weight of sherds recovered are known.
b. All ceramic artifacts (except figurines and worked sherds) from lots for which excavated volume and total weight of sherds recovered are known.

Table 11.3. Frequencies of worked sherds in 15 lots analyzed by Lesure

Period and Lot	Weight Sherds (kg)	Shaped Sherd	Sherd Tool
Early: N60W0/9	37.2	0	0
Middle: N65W0/4	37.6	2	2
Late: N75W0/1A	15.4	0	0
N75W0/1B	51.8	0	0
N75W0/1C	41.5	0	0
N80W0/3A	55.4	0	0
N80W0/3B	31.2	0	0
N80W0/3C	18.0	0	0
N85W0/3	23.9	0	0
Terminal: N95W0/4	48.7	1	0
N95W0/5	17.5	2	1
N95W0/7	14.4	3	1
N95W0/8	3.7	0	0
N95W0/9	9.4	0	0
N95W0/10	12.7	0	0
N95W0/11	14.0	1	0

sequence at the Vásquez Mound. The second, contrasting, observation is that Terminal-period deposits yielded many more figurines than earlier periods. The pattern is particularly evident in the N95W0 profile scraping and excavations, but significantly it also holds for the southern side of the mound (where profile scraping yielded six figurine fragments in N5W0 and N10W0). These last finds raise confidence in the robustness of the pattern identified in N95W0.

Table 11.2 presents frequencies of figurines from the excavations, categorized by stratigraphic period and standardized first by volume of deposit and then by weight of sherds. (Division by shell phase would produce similar results.) The rise in figurine frequency at the end of the occupation is particularly clear when counts are standardized by weight of sherds. Figurines are an order of magnitude more common in Terminal deposits. The Terminal rise is less dramatic but noticeable in the case of standardization by volume. This is not surprising, in that the overall density of artifacts was less in N95W0 deposits than in the middens of the dump-and-fill zone.

If the measures of Table 11.2 are broken down by sequence (3P and ST), the dramatic change between Late and Terminal is preserved for standardization by sherd weight. In one of the sequences (ST), however, it is eroded for standardization by volume. Although no Late-period figurines were identified in Phase 3 excavations south of the mound core, several were found in Late deposits of the Step Excavation. I ascribe this pattern to the greater heterogeneity of deposits laid down at that time rather than to any change in the use of figurines.

Also indicated in Table 11.2 are the frequencies of ceramic artifacts other than figurines and worked sherds. This is an artificial category that includes objects with various purposes, but it seems worth pointing out that there is no documented rise in Terminal times among ceramic artifacts other than figurines.

The recording of worked sherds was unfortunately not comprehensive. The available distributional data come from analysis of 15 lots of the Step Excavation and N95W0 (Table 11.3). Worked sherds seem to have been almost entirely absent through much of the sequence, becoming common only in N95W0. Nevertheless, frequencies of worked sherds in individual lots in other parts of the sequence (such as N65W0/4) could occasionally rival those of N95W0.

It is disappointing that more is not known about the distribution of masks through the occupation. One of the masks was recovered during profile scraping of the same Terminal-period midden later excavated in N95W0 (indeed, it was discovery of the mask that prompted that excavation). I suspect that all masks were Terminal in date, but it is impossible to know for sure. The other three fragments were recovered from different locations in the bulldozer backdirt, but in each case toward an end of one of the lines of backdirt along each edge of the canal. In other words, these other masks come from dirt left by the bulldozer in the vicinity of Terminal-period deposits.

CHAPTER 12

Radiocarbon Dates

MICHAEL BLAKE AND RICHARD G. LESURE

SEVEN RADIOCARBON DATES [two conventional and five by accelerator mass spectrometry (AMS)] on charcoal span the stratigraphic sequence of the Step Excavation (Table 12.1). As a set, they are very consistent—ranging across 120 radiocarbon years from 2890 to 3010 B.P. The internal sequence is not as well behaved as one might hope. The conventional radiocarbon ages move forward without reversals in the sequence ST-45, ST-39, ST-29, ST-22, and ST-13. However, the penultimate date stratigraphically, from ST-12, has the same intercept as the earliest two (ST-45 and ST-39)—although it does have a larger standard deviation. The youngest deposit dated yielded the oldest date (ST-04).

Calibrations are presented in Table 12.1 as 2-sigma ranges with associated probabilities. Based solely on these dates, the occupation of the Vásquez Mound likely spanned no more than 400 years—from about 1410 through 1000 cal B.C. However, consideration of dates for ceramic phases before and after Cuadros/Jocotal leads us to suspect an occupation about half that length.

Blake et al. (1995) assembled a large set of dates from the Soconusco and adjacent coastal regions to the south. We have calibrated those relevant for comparison with El Varal dates using the same procedures noted in Table 12.1. A reevaluation of the chronology of the region is currently underway, incorporating the results of recent excavations and many new radiocarbon dates (J. Clark, 2007 personal communication).

The El Varal dates tend to be somewhat older than we would have expected based on comparable sets of Cuadros/Jocotal dates from Salinas la Blanca and El Mesak. In the Mazatán area, the Varal dates fit well with a Cuadros date from Aquiles Serdán but less well with one from the virtually adjacent site of Sandoval. A series of dates for the Conchas phase from the regional center of La Blanca (Naranjo River region) would not be consistent with a Jocotal phase extending after cal 1000 B.C.

Finally, Cherla/Ocós dates from the Mazatán sites of Aquiles Serdan, Paso de la Amada, Chilo, and Cosme set a boundary of approximately 1300 cal B.C. as the beginning date for the Cuadros phase. If, as we suspect, the Vásquez Mound occupation began only in the later Cuadros phase (see Chapter 9) and continued for the duration of the Jocotal phase, a span of 1250–1200 to 1050–1000 cal B.C. (c. 1050–950 bc) for the Vásquez Mound would seem a reasonable estimate.

Table 12.1. Radiocarbon dates from the Step Excavation at El Varal[a]

Lab Number	Sample Field Number	Provenience/ Layer	Phase	Context	Material	Dating Method	^{14}C Age B.P.	95.4%2σ Age Range (cal B.C.)[b]	Relative Area Under Distribution
Beta-84039	ST-04	N85W0/3	Jocotal	Dump midden	Charcoal	Conventional	3010 ± 70	**1410–1040** 1030–1020	0.994 0.006
Beta-84041	ST-12	N75W0/1A	Jocotal	Dump midden	Charcoal	Conventional	2980 ± 70	**1390–1005**	1.000
Beta-84040	ST-13	N75W0/1B	Jocotal	Dump midden	Charcoal	AMS	2890 ± 60	1260–1230 **1220–910**	0.049 0.951
Beta-84042	ST-22	N70W0/3B	Jocotal	Dump midden	Charcoal	AMS	2910 ± 60	1290–1280 **1260–920**	0.015 0.985
Beta-84043	ST-29	N65W0/4	Jocotal	Dump midden	Charcoal	AMS	2950 ± 50	1370–1360 **1320–1000**	0.007 0.993
Beta-84044	ST-39	N60W0/9	Jocotal	Dump midden	Charcoal	AMS	2980 ± 60	1390–1330 **1320–1020**	0.099 0.901
Beta-84045	ST-45	N55W0/6	Cuadros or Jocotal	Occupation surfaces	Charcoal	AMS	2980 ± 50	1380–1330 **1320–1040** 1030–1020	0.087 0.903 0.010

a. Arranged stratigraphically from late (top) to early (bottom). Calibrated with CALIB Version 4.4.2 (Stuiver and Reimer 1993).
b. Most likely interval in boldface.

CHAPTER 13

Shellfish Harvesting Strategies at El Varal

DOUGLAS J. KENNETT AND BRENDAN J. CULLETON

Early Formative-period sites are commonly found in peri-coastal and seasonally flooded wetland habitats in the Mazatán region (Lowe 1975; Blake 1991; Clark 1991, 1994). A similar distribution is evident in the Acapetahua and Pijijiapan regions to the northwest (Paillés 1980; Kennett et al. 2006), along the coast of Guatemala (Coe 1961; Coe and Flannery 1967; Love 1989, 1993; Arroyo 1994, 1995; Estrada Belli 1998), and into El Salvador (Arroyo 1995). Some of these sites were relatively sedentary fishing-farming communities (Kennett et al. 2002, 2006), whereas others (such as El Varal) appear to be more specialized locations for extracting resources from estuarine habitats.

Major economic and societal transformations occurred during the Early Formative period as people became more committed to maize-based food production (Kennett et al. 2006) and as institutionalized social hierarchies emerged (Clark and Blake 1994). Therefore, it is likely that the importance of estuarine resources varied regionally and temporally during this interval. This chapter assesses the seasonal periodicity of shellfish harvesting practices at El Varal using oxygen-isotope analysis of one mollusk species (*Polymesoda radiata*) collected at this location during the Early Formative period. The ultimate goal of this study was to assess the seasonality of occupation at the site.

Background

Oxygen-isotope analysis of *P. radiata* shell carbonate is a well-established method for reconstructing prehistoric seasonal shellfish harvesting strategies along the Pacific Coast of southern Mexico (Kennett and Voorhies 1996). Previous work has focused in on Late Archaic-period (5500 to 4000 cal B.P.) subsistence and settlement strategies in the Acapetahua region 80 km northwest of El Varal (Figure 13.1), where a series of five large shell mounds are composed almost entirely of this marsh clam species (Voorhies 2004; Kennett et al. 2006).

The distribution and extent of these shell mounds suggests that the favored habitat of this species was more extensive between 5500 and 4000 cal B.P. Limited populations of *P. radiata* are still found today in Los Cerritos, the most landward lagoon in the Acapetahua Estuary and the most influenced by seasonal pulses of freshwater associated with wet-season rains between July and January.

Our work with *P. radiata* was originally founded upon the empirical observation that the stable oxygen-isotope composition of mollusk shells records aspects of their aquatic environment during growth (Wefer and Berger 1991). Changes in water temperature and salinity contribute to the isotopic composition of shell carbonate, with warmer water or inputs of low-salinity

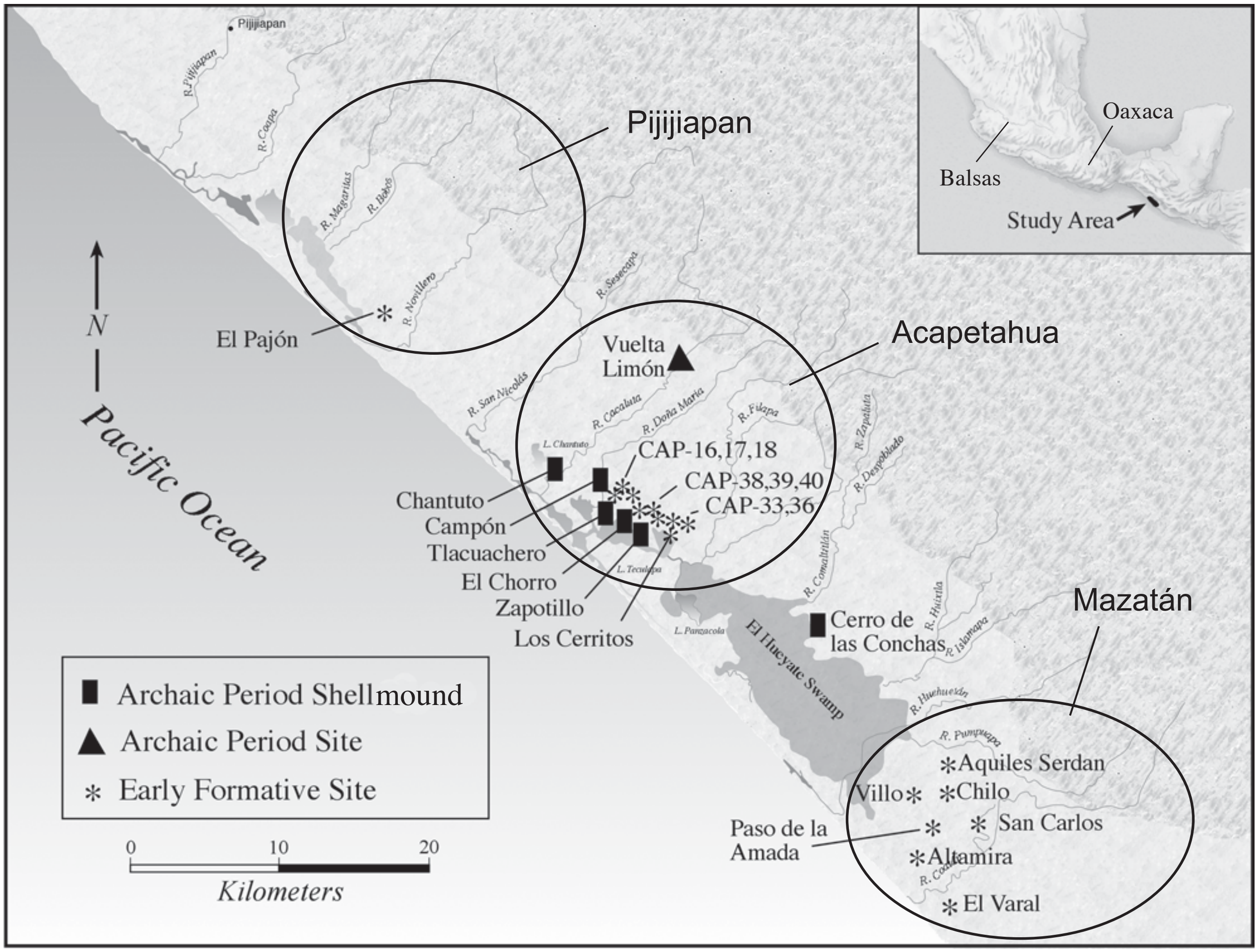


Figure 13.1. Map of the Pacific Coast of southern Mexico.

terrestrial runoff producing more-negative oxygen-isotope ($\delta^{18}O$) values (Epstein 1951, 1953; Shackleton 1973; Voorhies and Kennett 1995).

Kennett and Voorhies (1996) collected modern *P. radiata* specimens and water samples from the Los Cerritos Lagoon in the Acapetahua Estuary throughout one annual cycle to explore the environmental parameters influencing the stable oxygen and carbon isotopic records in their shells. They demonstrated that the final growth margin of these shells corresponded with the stable isotopic composition of the associated water sample (Figure 13.2), which in turn was linked to changes in water salinity and seasonal patterns of rainfall. More-negative oxygen-isotope values occurred during wet-season months, and more-positive values correlated with the dry season.

Water temperatures vary seasonally between 29.5 and 32.1° C (Voorhies 2004:13), but these contribute little to the overall oxygen-isotope composition of shell carbonate (Figure 13.2). Kennett and Voorhies (1996:697–698) also determined that seasonal fluctuations in water salinity were also recorded through the incremental growth of individual *P. radiata* shells. The interpretation of carbon isotopes ($\delta^{13}C$) was more complex—reflecting the composition of available dissolved inorganic carbon (DIC) in the habitat, salinity, and "vital effects" related to growth, reproduction, and other confounding factors (Keith et al. 1964; Killingley and Berger 1979; Krantz et al. 1987; Kennett and Voorhies 1995, 1996). Carbon-isotope data are presented in Table 13.1, but these data are not interpreted or discussed in this chapter due to this complexity.

Prehistoric seasonal shellfish harvesting strategies are based on the observation that *P. radiata* shells faithfully record the summer monsoon. In the Acapetahua region, we have documented significant changes in shellfish harvesting practices during the Middle and Late Archaic periods (Kennett and Voorhies 1996; Voorhies et al. 2000). Marsh clams are available throughout the

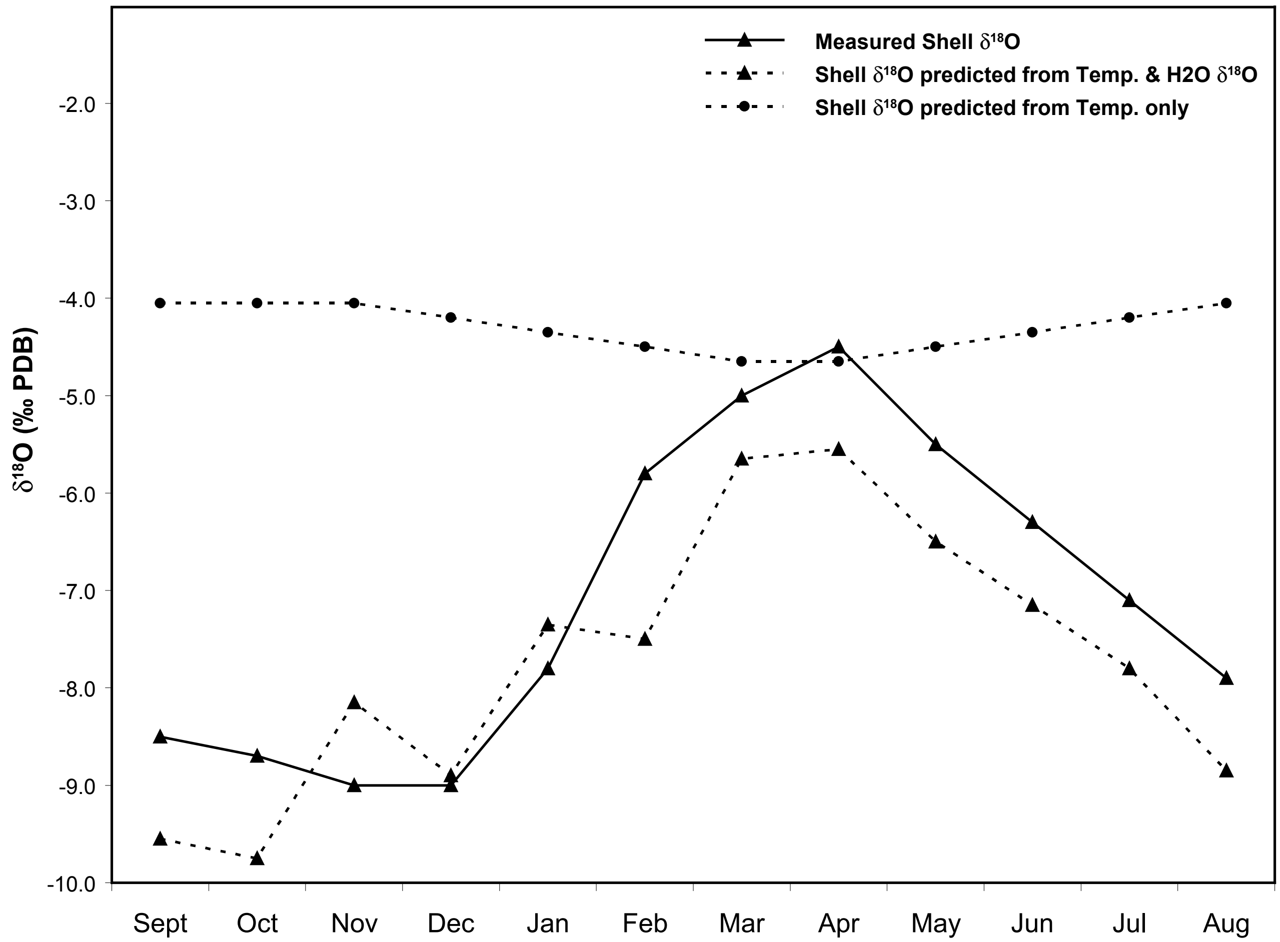


Figure 13.2. Measured and predicted shell $\delta^{18}O$ for Los Cerritos Lagoon (data from Kennett and Voorhies 1996; Voorhies 2004:13). Water temperature and water $\delta^{18}O$ values were used to model shell $\delta^{18}O$ according to the equation of Epstein et al. (1953), which agrees well with measured shell profile. Holding water $\delta^{18}O$ constant at –2‰ demonstrates the minor seasonal temperature effect, which makes most marine mollusks unsuitable for seasonality determination in the tropics.

year, but their collection may be sensitive to the use of estuarine settlements for other purposes. The overall abundance of resources increases in the Acapetahua Estuary during the dry season. Juvenile shrimp enter the estuary at this time, and a wider range of marine fishes preying upon them follows.

Marsh clams were collected throughout the year during the Middle and Late Archaic periods (7500 to 4500 cal B.P.), with a focus during the dry-season months. This is consistent with the idea that people were attracted to the fringe of this estuary primarily during the most productive time of the year. However, a major shift toward wet-season shellfish exploitation occurs at the end of the Late Archaic period that is synchronous with the first appearance of maize in these sequences (Kennett and Voorhies 1996; Kennett et al. 2006). This study provides a point of departure for interpreting the oxygen-isotope results from El Varal.

Table 13.1. Stable-isotope profile of *Polymesoda radiata*, N65W0/4, S29

Sample No.	Distance from Edge (mm)	$\delta^{13}C$ (PDB)	$\delta^{18}O$ (PDB)
EV2A	0	–7.20	–5.42
EV2B	2	–7.64	–7.50
EV2C	4	–6.85	–9.06
EV2D	6	–6.84	–9.32
EV2E	8	–7.64	–8.52
EV2F	10	–6.69	–8.68
EV2G	12	–6.42	–8.95
EV2H	14	–6.49	–10.50
EV2I	16	–6.78	–7.13
EV2J	18	–5.83	–3.52
EV2K	20	–5.43	–3.11

METHODS

In this study, intact valves of *P. radiata* shells were selected for analysis and scrubbed with a wire brush in distilled water to remove adhering sediment. Sample size was limited once the minimum number of individuals (MNI) was determined within the material available from each stratigraphic unit of interest (Early, Middle, and Late). The exterior surface of each shell was treated with 0.5 N HCl to remove contaminants and postdepositionally altered carbonate, rinsed in distilled water, and dried overnight. Samples were obtained from the outer layer of each shell using a dental drill (0.5-mm bit).

After inspecting the sample under the microscope to identify any foreign material, the powder was placed in a labeled glass vial. The drill bit was cleaned in a sonicated ethanol bath between samples to avoid cross-contamination. Thirty-nine edge samples for seasonality were drilled at intact sections of the growth margin. One of these shells was incrementally sampled (2.0-mm spacing) through its growth to establish the seasonal range of oxygen-isotope measures. This was done to confirm habitat similarity based on previous work in the Acapetahua region and to contextualize seasonality determination (Figure 5.6; see also Chapter 5).

The oxygen-isotope composition of shell carbonate samples was measured at the College of Oceanic and Atmospheric Sciences at Oregon State University using a Finnigan MAT 252 mass spectrometer and a Kiel-III online acid digestion system (Mix 2005). This system automatically reacts carbonate samples in individual sample vials with 100-percent H_3PO_4 *in vacuo* at 70° C, and cryogenically pumps the evolved CO_2 to the dual micro-inlet of the mass spectrometer. Average internal precision of carbonate analyses for oxygen-isotope and carbon-isotope measurements was (respectively) ±0.02 per mil and ±0.01 per mil.

External precision of replicate analyses of a local carbonate standard (known as Wiley marble) was run daily on this system in the same size range as the samples. Over the same time interval, this measurement was ±0.06 per mil for the oxygen-isotope measurement and ±0.02 per mil for the carbon-isotope measurement (±1 standard deviation, n = 722). Calibration of measured isotopic values to the Vienna Pee Dee Belemnite (VPDB) standard was done via certified carbonate standards provided by the U.S. National Institute of Standards and Technology (NIST). Primary calibration is based on the isotopic values and precision obtained for NIST-8544 (also known as NBS-19 limestone).

RESULTS AND INTERPRETATION

Oxygen-isotope data for *P. radiata* shells from El Varal are presented in Table 13.1 (profile data) and Table 13.2 (edge samples). The oxygen-isotope profile of one shell from the middle of the archaeological sequence ranges from –10.50 to –3.11 per mil, respectively, for wet and dry seasons. These data clearly show that this mollusk species lived in a brackish water environment that was heavily influenced by freshwater influx during wet-season months—an environmental setting analogous to that of the modern *P. radiata* populations analyzed by Kennett and Voorhies (1995, 1996) in the Acapetahua region. The existence of this species throughout the sequence suggests that a similar habitat existed in the vicinity of El Varal. The appearance of mollusk species from more distant marine habitats in the upper sections of the site suggests subsistence diversification in the context of resource depression, environmental change (e.g., loss of habitat due to lagoon in-filling), or both (see Chapter 5 for a more detailed analysis of habitats exploited).

Shell margin values from El Varal (n = 39) are plotted in Figure 13.3 against the entire range of oxygen-isotope variability exhibited by the archaeological specimens. These values extend across the full range of oxygen-isotope variability (–10.5 to –2 per mil) and indicate prehistoric collection throughout the year, with a clear emphasis during dry-season months (approximately –6 to –2 per mil).

Wet-season exploitation is only represented within the middle section of the sequence when these data are examined in greater stratigraphic detail. This could represent a temporary shift in seasonal harvesting strategies associated with more frequent visits to the site or perhaps with a resident population at this location collecting shellfish throughout the year. However, this interpretation should be viewed with caution due to the limited number of measurements available from each stratigraphic component. Dry-season exploitation of *P. radiata* is consistent with the idea that El Varal was used strategically during the year, when seasonal resource abundance was peaking in the estuarine zone.

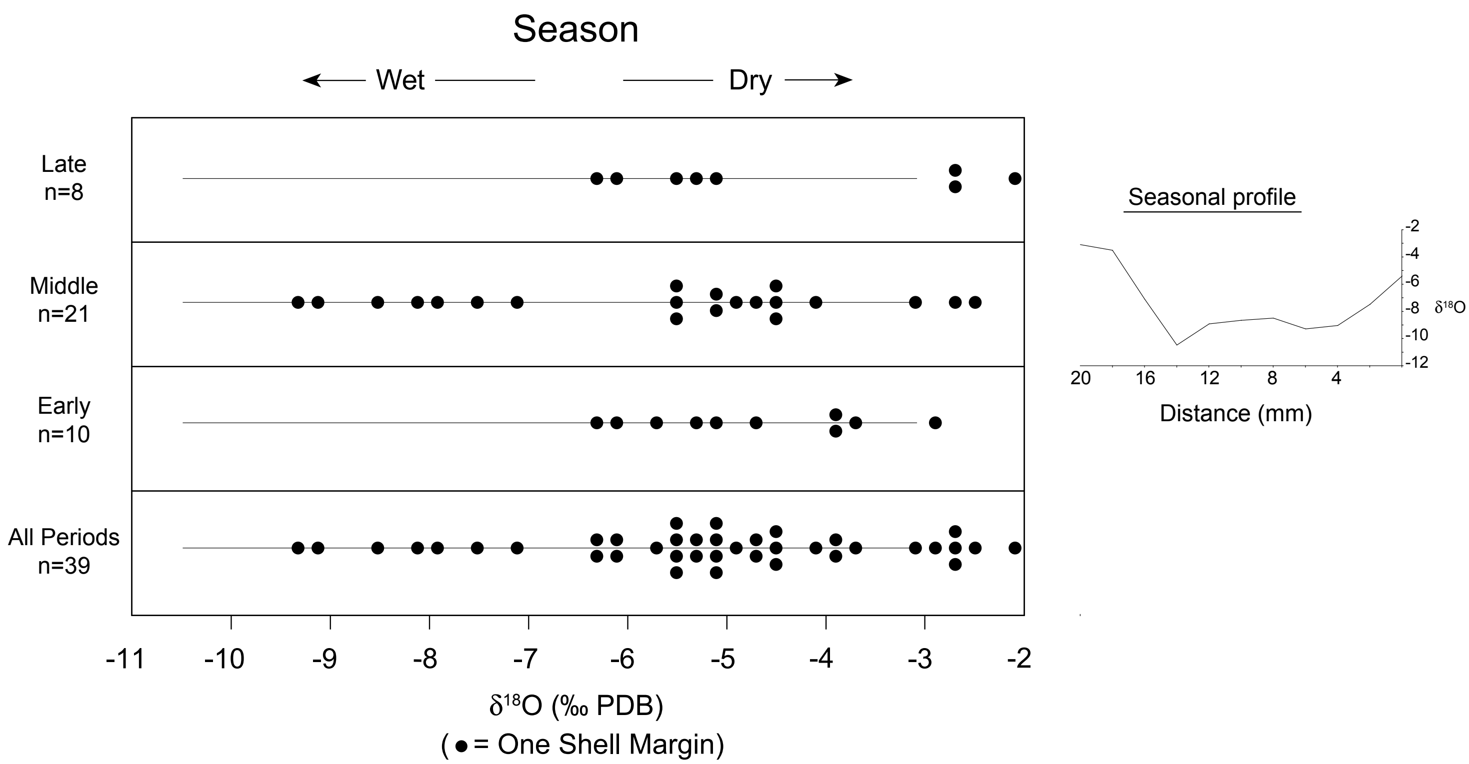


Figure 13.3. Summary of shell margin samples from each level analyzed at El Varal. The mid-sequence oxygen-isotope profile is included to show the full extent of seasonal variability.

Table 13.2. Stable-isotope values for shell margins of *Polymesoda radiata*

Sample No.	Unit/Level No.	Sequence No.	Stratigraphic Period	δ13C (PDB)	δ18O (PDB)
EVS13 Pr1 A	N75W0/1B	S13	Late	–6.33	–5.38
EVS13 Pr2 A	N75W0/1B	S13	Late	–2.12	–5.19
EVS13 Pr3 A	N75W0/1B	S13	Late	–8.33	–5.54
EVS14 Pr1 A	N75W0/1C	S14	Late	–6.32	–6.20
EVS14 Pr2 A	N75W0/1C	S14	Late	–7.08	–6.34
EVS14 Pr3 A	N75W0/1C	S14	Late	–3.04	–2.76
EVS2 Pr1 A	N85W0/1	S2	Late	–3.95	–2.18
EVS2 Pr2 A	N85W0/1	S2	Late	–3.20	–2.67
EV3S23 Pr1 A	N35W0/4	S23	Middle	–8.06	–4.01
EV3S24 Pr1 A	N35W0/5	S24	Middle	–8.48	–2.41
EVS29 Pr1 A	N65W0/4	S29	Middle	–9.01	–4.64
EVS29 Pr2 A	N65W0/4	S29	Middle	–6.41	–9.36
EVS29 Pr3 A	N65W0/4	S29	Middle	–9.72	–2.71
EVS29 Pr4 A	N65W0/4	S29	Middle	–8.07	–4.49
EVS29 Pr5 A	N65W0/4	S29	Middle	–4.86	–4.86
EVS29 Pr6 A	N65W0/4	S29	Middle	–8.39	–7.14
EVS29 Pr7 A	N65W0/4	S29	Middle	–9.08	–7.82
EVS29 Pr8 A	N65W0/4	S29	Middle	–7.61	–8.05
EVS29 Pr9 A	N65W0/4	S29	Middle	–7.43	–8.41
EVS29 Pr10 A	N65W0/4	S29	Middle	–7.46	–4.42
EV1A	N65W0/4	S29	Middle	–8.53	–3.13
EV2A	N65W0/4	S29	Middle	–7.20	–5.42

Table 13.2. *(continued)*

Sample No.	Unit/Level No.	Sequence No.	Stratigraphic Period	δ13C (PDB)	δ18O (PDB)
EV3A	N65W0/4	S29	Middle	–7.80	–5.53
EV4A	N65W0/4	S29	Middle	–6.14	–4.49
EV5A	N65W0/4	S29	Middle	–7.71	–5.03
EV6A	N65W0/4	S29	Middle	–7.39	–9.15
EV7A	N65W0/4	S29	Middle	–7.40	–7.58
EV8A	N65W0/4	S29	Middle	–8.37	–5.42
EV9A	N65W0/4	S29	Middle	–7.25	–5.18
EVS43 Pr1 A	N55W0/4	S43	Early	–8.31	–2.90
EVS43 Pr2 A	N55W0/4	S43	Early	–9.89	–5.79
EVS43 Pr3 A	N55W0/4	S43	Early	–7.44	–6.24
EVS43 Pr4 A	N55W0/4	S43	Early	–9.01	–6.16
EVS43 Pr5 A	N55W0/4	S43	Early	–8.84	–4.68
EVS43 Pr6 A	N55W0/4	S43	Early	–6.36	–3.70
EVS43 Pr7 A	N55W0/4	S43	Early	–8.98	–5.22
EVS43 Pr8 A	N55W0/4	S43	Early	–8.18	–3.98
EVS43 Pr9 A	N55W0/4	S43	Early	–8.67	–3.81
EVS43 Pr10 A	N55W0/4	S43	Early	–8.40	–5.05

CHAPTER 14

Artifact Synthesis and Intra-site Assemblage Variability

Richard G. Lesure

The overarching goal of this book is to understand the inter-site assemblage variation of Early Formative Soconusco in behavioral terms. How did human activities generate starkly different vessel assemblages—dish dominant and tecomate dominant—at contemporaneous sites a few kilometers from each other? As noted in Chapter 1, the investigations at El Varal followed more from the practicalities of the salvage situation than from any particular intellectual problem orientation. The theme of inter-site variability emerged as a central interest over the course of the fieldwork and subsequent study of the remains. Important categories of evidence are lacking, such as Jocotal-phase subsistence remains from dish-dominant sites. For these reasons, I have chosen to make the present volume an extended effort at hypothesis formulation in which pieces of the puzzle are synthesized as a whole only in the "concluding hypotheses" of Chapter 18.

Because the theme of central interest is *inter*-site variability, comparisons between sites are obviously crucial. To the extent practical, I have thus far kept such comparisons to a minimum. They become a prime focus in the chapters of Part III. However, the pattern that prompts the investigation of inter-site variability—the synchronic division between dish-dominant and tecomate-dominant assemblages—is replicated as a diachronic transformation at El Varal itself. The vessel assemblage was tecomate dominant throughout the occupation of the Vásquez Mound until just before abandonment at the end of the Jocotal phase. Then, in the Terminal stratigraphic period it became dish dominant.

Clearly, any viable explanation of the synchronic inter-site pattern should take cognizance of the potential for such a diachronic intra-site transformation. One goal of this chapter is to take a preliminary step toward explaining the Terminal-period reorientation of the vessel assemblage at El Varal. To do so, I draw together strands from the preceding chapters on features and artifacts—placing the vessel-form shift into the context of other dimensions of variability, particularly those in the artifact assemblage. A second goal is thus to examine and attempt to explain other dimensions of variability, particularly those occurring over the course of the Early to Late periods. The first effort in particular is preliminary in the sense that my attention here is restricted to evidence from the site itself. Chapter 18 returns to issues raised here with the added perspective provided by inter-site comparisons.

Productive Organization and Other Sources of Intra-site Variability

Although behavioral variability is the topic of central interest, it must be teased out in relation to other potential sources of variability in the artifact assemblage. Three such alternatives have been raised in preceding chapters: stylistic change in the material-culture tradition of site occupants (Chapter 9), the gradual silting-up of the lagoon originally surrounding the site (Chapters 3 and 5), and changes in formation processes of deposits in the mound (Chapter 3).

Further, behavioral variability itself may have multiple sources—and it can be conceptualized in different ways. Chapter 1 identified two approaches to the investigation of human activities at El Varal. One departs from the evident multidimensionality of economic organization even in relatively simple societies. It would frame a series of topics for investigation, with results in each domain allowed to vary independently of one another. This chapter is centrally concerned with three such topics: the nature of productive activities at El Varal, the permanence of the occupation there, and the distinctiveness of activities at tecomate-dominant (as opposed to dish-dominant) sites. That discussion produces a useful angle on a fourth topic: the number of people involved in occupations of the site. Finally, I will consider in passing also a fifth topic: the relations between producers and consumers. Discussion of all of these topics is continued in Chapter 18.

A second approach to behavioral variability is to work with idealized models that by synthesizing multiple parameters attempt to capture the fundamental organizational patterns behind dish-dominant and tecomate-dominant assemblages. Chapter 1 briefly identified two alternative sources of inspiration for such models. Treating the inhabitants of El Varal as hunter-gatherers, we could look to Binford's (1983) distinction between *foragers* and *collectors*. Turning instead to the literature on complexity in sedentary societies, we would find avenues to explore under the rubric of *specialization* (e.g., Costin 1991). It is now time to develop in greater detail a set of such models relevant to the case at hand, along with some associated archaeological correlates. Tables 14.1 and 14.2 summarize points raised in the following discussion and subsequent sections.

Inter-site assemblage variability was a basic interpretive issue underlying Binford's (1983) distinction between foragers and collectors. The strategy of generalized *foraging* is to move people to products through frequent residential moves of an entire community (the unit of consumption). From each residence, foragers would move out daily in search of whatever resources they might encounter. A resultant archaeological record would include *residential bases* with a high diversity of artifacts and features (in that these were the main locations for processing, manufacturing, and maintenance activities) and *locations*, where extractive tasks were conducted during brief visits. The archaeological manifestation of locations would vary depending on the nature, distribution, and seasonality of resources. Conditions might favor repeated visits to one location, but the artifact inventory left behind after short visits is typically scant and a buildup of remains in palimpsest fashion is likely to generate sites lacking in internal structure (Binford 1983:344).

On the face of it, the foraging model seems of little relevance to the question of inter-site variability in Mázatan because this model alone cannot satisfactorily account for observed vessel-form differences. Still, it will prove useful for explaining some aspects of the Varal assemblage (Chapters 15 and 18).

Of more obvious interest is Binford's *collecting* model, characterized by a logistical strategy in which resources are moved to people. Collectors establish more stable residential bases than do foragers. Specially organized task groups leave the residential base, sometimes for significant periods of time, to obtain specific resources. These task groups are "small and composed of skilled and knowledgeable individuals. They are not groups out 'searching' for any resource encountered" (Binford 1983:344).

Collectors generate residential base sites and locations, but Binford identifies several other site types expected of a collecting system. Of most interest here is the *field camp*, a temporary center of operations for a task group. The group (a small subset of the entire community) sleeps and eats there while it is engaged in collecting and processing some specific resource. Such small task groups, producing for a consumption unit larger than themselves, may deploy elaborate special-purpose technology and can generate considerable quantities of debris (Binford 1983:346). As noted, collectors generate more distinct types of sites than do foragers. Further, field camps and locations are each likely to be used for the extraction of a different resource. Consequently, inter-site assemblage variability increases as a subsistence system becomes

Table 14.1. Proposed interpretations of assemblage variability in Mazatán from the perspective of each model

Model	Sites with Dish-dominant Assemblages	Sites with Tecomate-dominant Assemblages
Generalized foraging	Residential bases for entire groups	Locations to which entire groups shifted for consumption of estuary resources (leaves vessel-form difference unaccounted for)
Logistical collecting	Residential bases for entire groups	Field camps for temporary residence of task groups during collection and processing of estuary resources
Specialization with residence part of the year	Permanent residences of both producers and consumers	Production camps and locations of residence for producers during part of the year
Specialization with permanent full-year residence	Permanent residences of consumers	Permanent residences of producers

Table 14.2. Generalized expectations of each model concerning archaeological patterns at tecomate-dominant sites

Expected Archaeological Patterns	Foraging	Collecting	Specialization Part-year	Specialization Full-year
Interpretation of tecomate-dominant sites	*Location*	*Field camp*	*Production locale occupied part of the year*	*Production locale occupied permanently*
1. Seasonality	Site use may be seasonal	Site use may be seasonal	Site use may be seasonal	Site occupied year-round
2. Site structure	Little stratigraphic differentiation	Marked stratigraphic differentiation	Marked stratigraphic differentiation	Marked stratigraphic differentiation
3. Overall artifact content	Few artifacts	Artifacts potentially numerous	Numerous artifacts	Numerous artifacts
4. Artifacts involved in production	Generalized rather than specialized tools	Tool kit may be special-purpose	Tool kit likely to be special-purpose; standardization and efficiency possible concerns	Tool kit likely to be special-purpose; standardization and efficiency possible concerns
5. Domestic features and artifacts	Few	Fewer than at dish-dominant sites, with frequencies dependent on group size and length of stay	Fewer than at dish-dominant sites, with frequencies dependent on group size and length of stay	Similar to dish-dominant sites (but need separation from residues of production)
6. Overall differences between domestic assemblages	Homogeneous, few differences	Homogeneous, few differences	Potentially heterogeneous, due to occupational differentiation	Potentially heterogeneous, due to occupational differentiation
7. Wild resources represented	Spectrum of locally available resources	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)

more elaborately logistical in organization (Binford 1983:347).

The literature on economic specialization and social complexity is vast, and it is not my intention here to get bogged down in it. Two essential themes are that *specialization* involves a division of occupations and that producers and consumers are reciprocally dependent on each other. The occupational aspect further raises the likelihood of special-purpose technology or signs of standardization and efficiency in the productive process beyond those to be expected of logistical collecting. Still, these generalized types of expectations often vary considerably in the real world—depending on the particularities of individual products, the types of processing required, and numerous social parameters (Costin 1991:33–39).

Specialists produce for consumers beyond their households, and receive in exchange necessary goods they themselves do not produce (Costin 1991:4). Muller (1984) took Mississippianists to task for their loose use of the concept of specialization. He distinguished "site specialization" (in which a limited range of activities is conducted at one place) from "producer specialization" (involving relations of mutual dependence between specialists and consumers). The latter is of greater interest for the study of social complexity because the former can correspond to a variety of arrangements, not all of which properly qualify as specialization in the organizational sense. Muller's commentary resonates with previous interpretations of Early Formative inter-site assemblage variation in the Soconusco, in which "specialization" has indeed been used loosely to call up the specter of societal complexity.

Any specialization of production at El Varal would have been low on the various scales and dimensions surveyed by Costin (1991). In terms of intensity, Varal specialists would have been "part-time" participants. Surrounded by an abundance of fauna in the estuary, they would surely have fished and hunted for their own food.

Still, it is possible to identify two distinct models of residence (year-round and seasonal) with differing archaeological expectations. If tecomate-dominant assemblages were produced by part-time specialists in residence year round, we would imagine the site as housing a permanent settled community. Households would have produced beyond their own needs, and goods would have been transferred to consumers by some institutionalized mechanism—whether exchange relations or a tribute system. Consumers at dish-dominant sites would have otherwise lacked the particular resource involved. The specialists at tecomate-dominant sites would likewise have needed to acquire resources they did not themselves produce (maize?, though see below).

Under this scenario, we would expect to find evidence of year-round activities at tecomate-dominant sites. A typical range of domestic tasks would be represented, and the archaeological assemblage generated would be both qualitatively and quantitatively equivalent to sites of nonspecialists. In other words, we would expect domestic debris with the same categories of artifacts in similar relative percentages. We could also, however, expect potentially large amounts of debris—perhaps including the remains of special-purpose, standardized, or "efficient" technology—to be generated by the specialized productive activity. Separation of these two types of refuse might prove challenging.

A second possibility is that the occupants of El Varal were specialists but resided at the site only part of the year. In this scheme, we would expect similar technological elaboration and the same types of relations of producers to consumers—but a different record of habitation. Seasonal residence would imply that the occupants of tecomate-dominant sites maintained other dwellings, elsewhere. At the location of production, we would expect a domestic assemblage with reduced representation of artifacts not involved in the productive activity. Reductions might involve fewer categories of artifacts or simply depressed frequencies of certain classes of item. Again, however, such debris (from domestic activities) could be inextricably mixed with whatever detritus the specialized productive activities generated.

Where the resource subject to specialization is some wild food item, the organization of production in this second scheme seems similar in many respects to a field camp in Binford's collector model. In both cases, production sites would have been occupied for part of the year by people who were producing for others and whose main residential location was elsewhere. There are differences, of course. The technology of specialized production seems likely to be more narrowly functional in design, distinguishable from tools used for other tasks and potentially incorporating attributes of standardization, streamlining, or efficiency. Still, all of this depends on the product involved and hardly represents a categorical divide with logistical collecting.

The term *specialization* properly applies only when there is an occupational division such that specialists provide consumers with goods the consumers themselves do not produce. In the case of collectors, that distinction is momentary rather than occupational: next month or next year this episode's consumers may join the production task force. This observation points to a fundamental division between the two models: the relations they posit between producers and consumers.

In the collector model, the unit of consumption is the entire population of the residential base (or some substantial portion of it). Binford (1983) did not inquire into intra-group relations in such units. Even given the potential for considerable complexity in relations of food sharing in hunter-gatherer groups, it seems not outrageous to suggest that producers owe food to others by virtue of their shared group membership. Further, the identity of "producer" is fluid: task groups are continually constituted and reconstituted.

The identity of any particular individual as a producer of X is more stable in the specialization model. Further, producer/consumer relations are conceived as economic transactions between production-consumption units (such as households) rather than relations of obligation of producers to a larger consumption unit.

Although these points reflect important differences in social relations posited in the two models, producer/consumer relations are a challenge to identify archaeologically. In this and subsequent chapters, inferences relevant to this and other aspects of the four organizational models are built up gradually. I make use of the four models—and their sometimes diverging, sometimes overlapping, expectations for tecomate-dominant sites (Table 14.2)—as tools of thought for exploring social and economic organization in late Early Formative Mazatán. Thus, I will not focus on trying to categorize the inhabitants of El Varal as foragers, collectors, or specialists. Instead, the idea is to investigate the foraging, collecting, or specialized qualities to estuary resource acquisition, processing, and consumption. Concluding proposals in Chapter 18 are not a perfect match for any of the four models. That chapter

rejects full-year-resident specialization and weighs the possibility that more than one of the others might apply, because each is applicable to a different mode of activity or even to a particular resource.

Chronological Division of Deposits

Two chronological schemes for dividing the sequence of excavated deposits have been proposed, each sensitive to different potential sources of assemblage variability. Chapter 3 introduced the concepts of "mound core," "sandy edges," "dump zone," and "surface zone" for classifying mound deposits. Those seem to correspond to significant differences in formation process corresponding to different periods in the occupation. Division of deposits into stratigraphic periods (Chapter 3) was inspired by that assessment of site stratigraphy. Early deposits correspond to the mound core and much of the exposed sandy edges, the Middle period begins at the initiation of the dump zone, the Late period constitutes the second half of the dump zone (when the volume of salt tailings increases), and the Terminal-period deposits appear in the surface zone at the edge of the mound.

The distinction between Middle and Late stratigraphic periods has proven to correspond to a change in pottery styles (Chapter 9). Clear stylistic changes in material culture have been observed only in ceramics. They involve changes in types as well as form. Some are gradual through the sequence (e.g., the reduction of slipped tecomates). Others occur at the transition to the Terminal period (e.g., the surge in red-on-white ware). There are, however, several changes in the frequencies of types occurring at about the Middle-Late transition (the shift from rim band to smooth upper profile of utilitarian tecomates, the rise in Siltepec White, declines in Pampas Black-and-White and Tilapa Red-on-White, and the shift in favored exotic from Vásquez Gray to Tacaná White). In Chapter 9 we identified this as a point of transition from Early to Late Jocotal.

The shell phases identified in Chapter 5 constitute an alternative periodization for the deposits. They emerged from observations concerning the harvesting of mollusks by the site inhabitants. The basic pattern of low-level harvesting (Early shell phase), moderate harvesting (Middle), and intensive harvesting (Late) was mirrored on the north and south sides of the western profile of the Vásquez Mound and therefore seemed robust enough to form the basis of a second chronological scheme. The idea was that the changes in shellfish harvesting might have been associated with other behavioral changes.

A key point is that these two chronological schemes break up the deposits in different ways, basing their correlations of strata to the north and south of the mound core on different observations. The division between Middle and Late is a particularly important one, which is shifted to the north in the shell phase scheme compared to that of the stratigraphic periods. The latter scheme as a result ends up being a more even division of excavated deposits of the Step Excavation. We have used both chronological schemes, as well as occasional reference to the lot-by-lot sequences (P3 and ST, described in Chapter 4).

A significant topic for the investigation of intra-site variability is the distinction between the tecomate-dominant assemblage (Early to Late stratigraphic periods) and dish-dominant assemblage (Terminal period). Two other dimensions of variability *within* the tecomate-dominant occupation are highlighted in Figure 14.1, which shows the distribution of salt tailings and middens of mollusk shells in the west profile—with period boundaries of the two chronological schemes superimposed. Based on the volume of deposits identified as salt tailings, it would appear that the production of salt intensified late in the occupation of the mound—with a significant shift in scale captured by the transition from Middle to Late stratigraphic period. Somewhat after that transition, large-scale harvesting of shellfish began—with this second shift captured most precisely by the shell phase divisions.

Productive Activities at El Varal

The data presented in Chapters 3 through 12 provide a basis for an initial consideration of productive activities at the site. I first consider salt, and then general aspects of subsistence. In both cases, a full understanding of organizational aspects of production requires assessment of the comparative evidence from dish-dominant sites (Chapters 15 through 17).

Salt Production and the Distinctive Character of Tecomate-dominant Sites

I argued in Chapter 3 that the production of salt by a *sal cocida* method similar to that documented

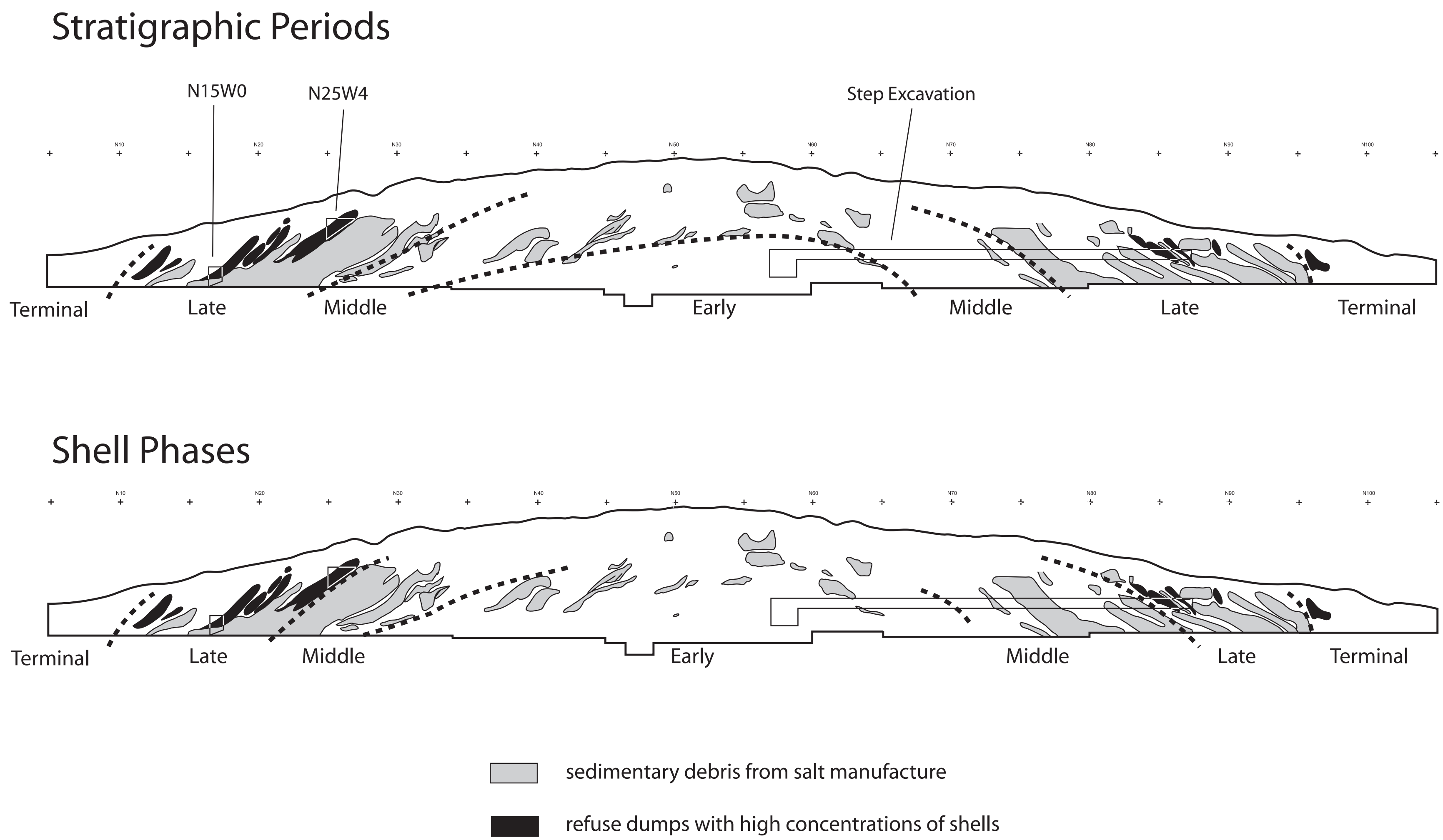


Figure 14.1. The west profile of the Vásquez Mound showing deposits of salt tailings (gray) and mollusk shell middens (black). Chronological divisions are superimposed: top, stratigraphic periods; bottom, shell phases. Vertical dimension exaggerated by a factor of 2.

ethnohistorically in the Soconusco (Coe and Flannery 1967:92) was likely a significant focus of activity at El Varal. Salt production would help account for the abundant evidence of burning, the vast quantities of utilitarian cooking ware, and the alternation between middens and layers of sediment in the dump zone. Salt production is particularly attractive on that last point because there seem to be no other satisfying reasons for why site occupants would have transported large amounts of sediment (consistently homogeneous in texture and color) to the surface of the mound and dumped it over the sides. In the interpretation proposed here, those sediments were the detritus from which salt-laden brine had been leached. The brine would have been reduced to salt by boiling in tecomates.

Salt production may have been the single biggest factor creating the distinctive archaeological character of tecomate-dominant sites. The features that dominated the Váquez Mound profiles (large quantities of broken cooking pots, evidence of frequent burning, and layers of sediment) are all expected outputs of salt production. Further, all three may be absent in Terminal deposits at the site. We have only a limited view of variability in Terminal refuse and face a particularly acute problem with mineral discoloration of the pottery in N95W0. However, it seems possible that extensive burning largely ceased in the Terminal period with the reorientation of the vessel-form assemblage. Thus, tecomate-dominant assemblages may be the result of salt production. Although I believe that to be the case, I will also be suggesting that the productive activities of site occupants were not confined to salt.

What organizational model best makes sense of salt production at El Varal? The evidence on this question is somewhat frustrating and I defer a final decision on it until Chapter 17. The quantities of artifacts generated and the complex resultant stratigraphy, combined with attention to the resource itself and the proposed manner of production, indicate that the foraging model will be of little use. Collecting and specialization (the latter with either form of residence) would at this point appear to be possibilities.

One significant drawback to a specialization argument is the technological choices of the occupants of El Varal. For a long time I dismissed salt as a possible product at El Varal because the restricted-mouth tecomate seemed an inappropriate vessel form when the goal was evaporation rather than prolonged simmering. The vessel assemblages apparently associated with salt manufacture at Guzmán (Nance 1992) and El Salado (Santley 2004) have helped convince me to revise that position. Although open vessels are preferable for evaporating brine, variability among convincing cases of prehispanic *sal cocida* production (Nance 1992; Pye 1995; McKillop 2002; Santley 2004) suggest lack of strong "selection" (in the evolutionary sense) for any particular vessel form.

Still, I do not intend to suggest that the tecomate was a well-designed vessel form for the reduction of brine. Indeed, it was *not* an ideal choice. What I am suggesting here is that although not ideal it served the purpose adequately. Figure 14.2 illustrates vessel forms apparently used for the reduction of brine by boiling at El Varal alongside those of four other convincing archaeological cases and a modern one. The vessel forms are charted in time and according to their technological efficiency if the primary goal is boiling off liquid.

The technological choice of the occupants of El Varal was not unprecedented, but it must be considered not particularly efficient. Further, it is impossible to argue that efficiency increased over time in Mesoamerica—in that perfectly reasonable technology was in use at El Mesak, some 70 km from El Varal at the southeastern extreme of the Soconusco (Pye 1995). These points pose a challenge to the idea that salt production at El Varal was specialized in the organizational sense. If the Varal salt producers were specialists, we would have expected more of a concern for technological efficiency (Table 14.2, row 4). I return to the tecomate as a vessel form in Chapters 17 and 18.

In this chapter, I am more concerned with another aspect of salt production: variation over the course of the occupation. Judging by the distribution of characteristic yellow-brown sediment layers in the profile of the Vásquez Mound (Figure 14.1), salt production intensified from the Early to Late periods—with the most extensive dumps (and thus largest-scale production) in the Late stratigraphic period.

Subsistence

The problem of subsistence at El Varal has two basic dimensions, as suggested in row 7 of Table 14.2. There is the question of what people at the site actually ate, but there is also the possibility that those people produced food for others. Especially in light of the lack of efficiency of the tecomate as a tool of salt production, we need to seriously consider the second possibility. Here, I emphasize the first issue—reviewing information from Chapters 3 through 8 concerning habitats exploited by site occupants, direct evidence of subsistence (primarily

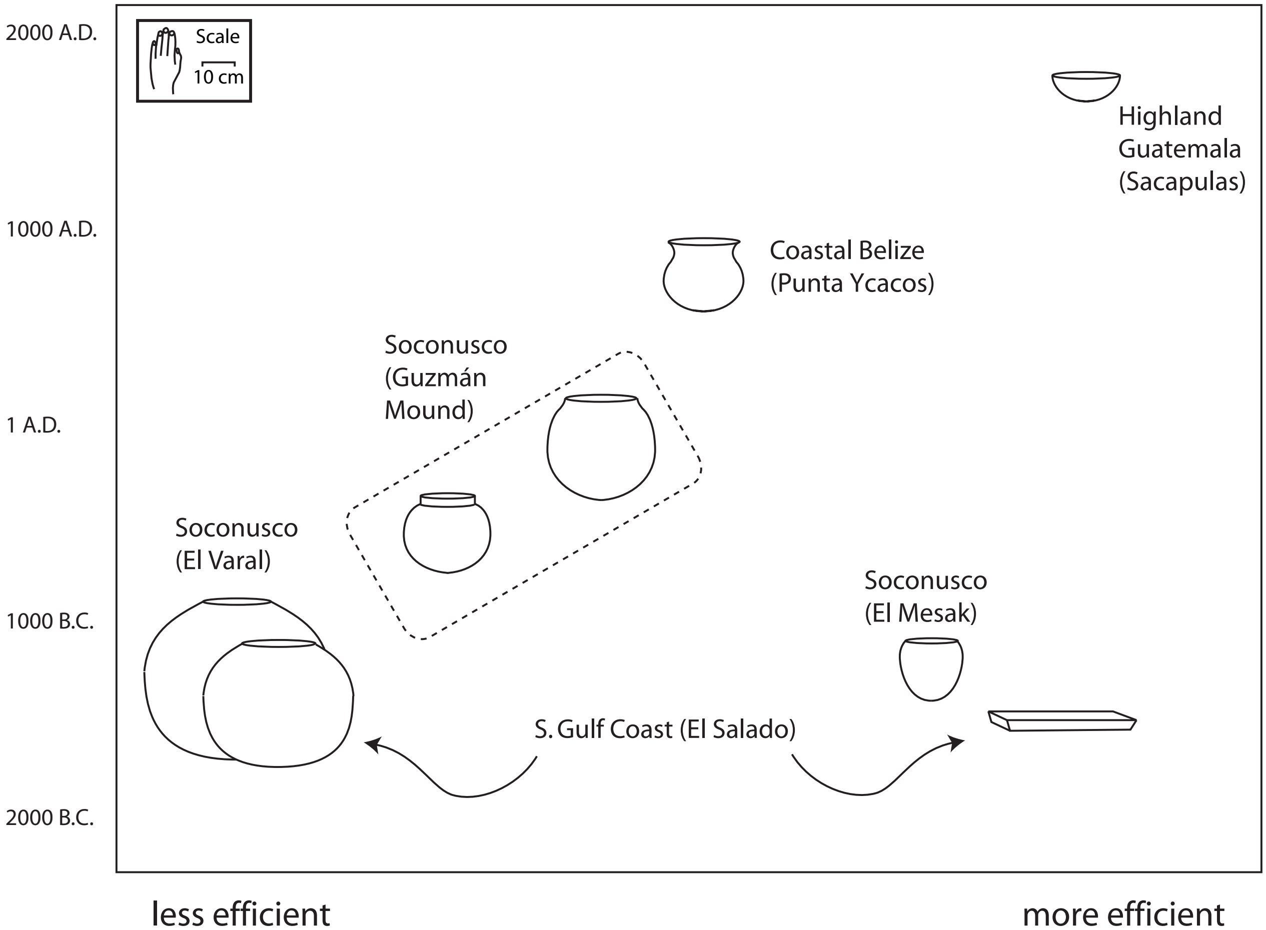


Figure 14.2. Vessel forms used in the boiling of brine to produce salt in six cases across Mesoamerica from about 1300 B.C. to the present, with the horizontal scale rating efficiency (assuming the primary goal was to boil away liquid). Sources: El Salado (Santley 2004), El Mesak (Pye 1995), Guzmán Mound (Nance 1992), Punta Ycacos (McKillop 2002), Sacapulas (Reina and Monaghan 1981).

faunal remains), and patterns of change over the course of the occupation. The issue of production for others is considered in Chapter 15.

Clark's (1994a:Figure 9) reconstruction of the local habitat places El Varal just inland from a thin strip of mangroves, in a seasonally inundated area known locally as the Pampa Cabildo. The site is near a modern salt flat, a formation identified by Coe and Flannery (1967:14) as indicative of a silted-in lagoon still too salty to support vegetation. Evidence from the excavations (Chapters 3 through 5) indicates that the lagoon existed during the Early Formative and that at least during the early part of the occupation the site was, during the rainy season, an island (Figure 14.3). During the dry season, waters withdrew from the immediate vicinity of the mound.

In the imaginative reconstruction shown in Figure 14.3, lagoon waters withdrew sufficiently in the dry season such that the mound was joined with the mainland. However, because we did not dig beyond the boundaries of the mound we have no evidence one way or another on that point. Habitats within 3 km of the site would have shifted seasonally, but would generally have included the lagoon, seasonally inundated pampa areas, stands of mangroves, the beach, the ocean, and (inland) poorly drained savannas or tropical forest. With a canoe, the marine-oriented estuary areas near the mouth of the Coatán and the river itself would also have been easily accessible.

There is no longer a lagoon system associated with the lower Coatán. Deposition of waterborne sediments has converted much of what was formerly lagoon into seasonally inundated pampa. That shift may have been underway during the course of the Early Formative occupation (Chapters 3 and 4). Early in the occupation of the Vásquez Mound, the site was surrounded by a

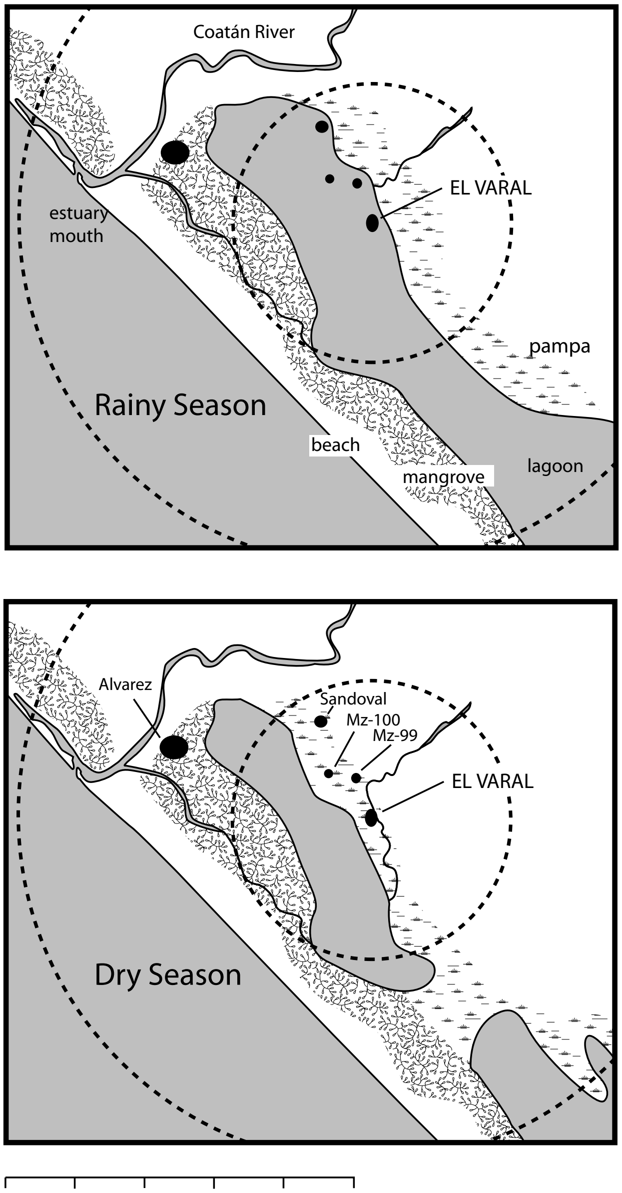
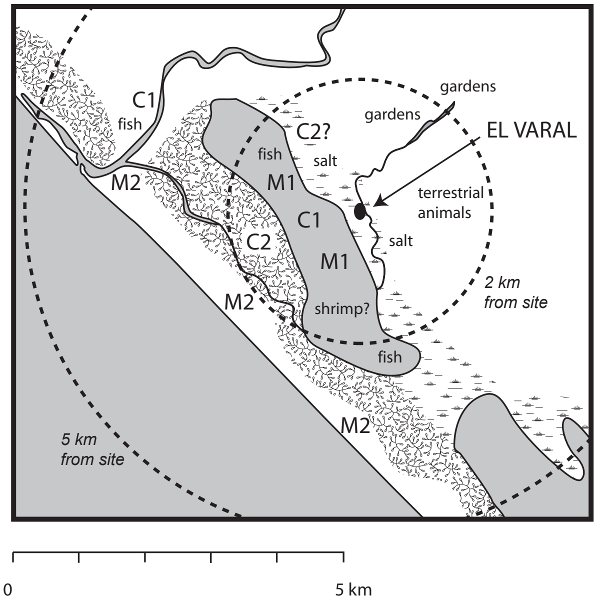


Figure 14.3. Map of habitats in the vicinity of El Varal. The location of El Varal is indicated, along with those of several other nearby Early Formative sites. Habitats in rainy season and dry season are hypothetical, based on the 1:50,000 modern topographic map, the excavations of El Varal, and (more generally) discussion of Soconusco habitats by Voorhies (1976, 2004) and Clark (1994a). Note that the site was occupied primarily in the dry season.



M1 marsh clams (*Polymesoda*)
M2 marine clams (*Chione, Protothaca, Anadara*)
C1 aquatic crab (*Callinectes*)
C2 mangrove crabs (*Ucides, Uca*)

Figure 14.4. Schematic illustration of the locations in which important resources were collected from El Varal.

sandy beach with sediments sorted by wave action. By the end of the occupation (and ever since), deposition at the mound edges was occurring in a low-energy environment. The organic-rich clays seem to indicate the type of vegetated and seasonally inundated pampa found in the area today.

Throughout the occupation of the Vásquez Mound, mollusks (Chapter 5) were collected from at least two habitats: the lagoon and the ocean beach or estuary mouth (Figure 14.4). Still, the relative importance of those habitats shifted over time in one of the clearest directional changes among the subsistence remains from the site. The shift in emphasis from a lagoon species (*P. radiata*) to marine species obtained at a greater distance could have been a response to a decreased availability of marsh clams in the immediate vicinity of the site, due to shrinkage of the lagoon or to overexploitation by the numerous Jocotal-phase inhabitants of the region.

A related shift is found in the crab remains (Chapter 6). Aquatic crabs (*Callinectes* sp.)—probably from the lagoon—dominate the assemblage, but decreased from 92 to 73 percent by the Late shell phase as mangrove crabs (*Ucides* sp. and *Uca* sp.) rose from 8 to 26 percent. Still, the volumetric densities of these different taxa show no decrease in aquatic varieties—suggesting less a shift in focus from one habitat to another (as observed for the mollusks) than the addition of a second habitat (the mangroves) along with continued exploitation of the lagoon.

The occupants of El Varal harvested vertebrates mainly in the lagoon, among the mangroves, and in the vegetated pampa (Chapter 7). Wake found only

limited evidence for the ocean beach as a source of vertebrate fauna: the green sea turtle could have been collected there during its laying season (Voorhies 1976:24). Seasonally inundated pampa areas could have been fished in the rainy season and beginning of the dry season. As they dried out, however, a variety of terrestrial species identified in low numbers in the El Varal faunal assemblage (deer, cottontail rabbit, peccary, armadillo, iguana, and a few rodents) would have moved in.

Fish identified are generally characteristic of lagoon-estuary systems rather than specifically lagoonal in focus. Based on the screened sample, the Pacific fat sleeper (*Dormitator latifrons*)—a major component of the fauna recovered from Acapetahua Archaic sites, and according to Cooke et al. [2004:292, 260, citing Yañez-Arancibia (1980)] a bioindicator of low-salinity lagoons—seemed unimportant at El Varal. Identifications of bone from the modest set of flotation samples available suggest that our 5-mm-mesh screens may have been too coarse to recover smaller members of this species (Chapter 7). Still, the range of fish species harvested appears to have been generally stable even as patterns of exploitation of crab and shellfish changed.

The birds of El Varal, identified by Steadman et al. (2003), are primarily aquatic species (83 percent of NISP) that would have been found in lower estuary or lagoon settings. The identified terrestrial birds (17 percent) would have been available in pampa and savanna areas also within an easy foraging radius of the site. [The assemblage of bird remains published by Steadman et al. (2003) as from Paso de la Amada is actually a combination of bird remains from Paso de la Amada and El Varal. See Chapter 15 for discussion, and Table 15.1 for an updated version of Steadman et al. (2003:Table 1) by site.]

Alternative attempts to assess the importance of the various fauna are provided in Tables 14.3 and 14.4. I have not attempted to calculate meat weights. Relatively simple calculations based on weights of recovered bone and shell are ruled out because of concretions on the remains, particularly on shell but also on bone. Calculations based on MNIs would require data on average biomass of each of the identified taxa. Relevant evidence presented by Cooke et al. (2004:Table 5.1) indicates sufficient variability within taxa to create skepticism about any claims based on averages. I consider instead MNI (and, in Table 14.4, NISP) as a basis for comparison. MNI calculations for all classes were calculated lot by lot. Table 14.3 provides relative percentages of shellfish, crab, fish, reptiles/amphibians, birds, and mammals—whereas volumetric densities are presented in Table 14.4.

The emphasis is clearly on aquatic fauna. Shellfish are numerically predominant, and in the deposits of the Late shell phase they overwhelm all others. Fish and crab were more important in the diet than the relative percentages might indicate, particularly in the Late shell phase. Volumetric densities increased from Early to Middle to Late among these three (mollusks, crabs, and fish), with reptiles, amphibians, birds, and mammals showing little change. Densities of fish and crab remains thus amplify the pattern observed among the mollusks, the original basis for identifying shell phases.

These volumetric densities suggest that the pattern at El Varal from 1250/1200 through 1050/1000 B.C. is for intensified production of aquatic estuary resources without significant change in the exploitation of terrestrial fauna. Particularly in the Late phase, the occupants of El Varal were also collecting a greater *variety* of fauna from a greater variety of estuary habitats. In some cases, the greater diversity may have involved recourse to lower-ranked resources—most clearly in the case of the two deposits of the miniature bivalve *Amphichaena kindermanni* encountered in Late deposits (Chapter 5).

Just because our botanical evidence is slender does not mean that plants were not important. We presume that a variety of wild plants of the estuary were utilized by the occupants of Varal, but we have no evidence of them. We do have some likely evidence of

Table 14.3. Relative percentages of faunal remains at El Varal based on MNIs

Site	Mollusk	Crab	Fish	Reptile/ Amphibian	Bird	Mammal
Early shell phase	60.3	26.9	9.5	1.1	0.9	1.4
Middle shell phase	74.4	16.1	6.7	0.4	1.2	1.3
Late shell phase	96.9	1.8	1.0	0.1	0.1	0.1

Table 14.4. Volumetric density of faunal remains at El Varal based on MNIs[a]

Site	Mollusk	Crab	Fish	Reptile/ Amphibian	Bird	Mammal
Early shell phase	104 (207)	45 (182)	15 (63)	1.8 (2.0)	1.4 (1.4)	2.1 (2.9)
Middle shell phase	326 (652)	59 (233)	22 (239)	1.4 (2.8)	2.7 (3.1)	4.2 (8.4)
Late shell phase	2,822 (5778)	69 (281)	36 (352)	2.4 (3.0)	1.2 (1.2)	1.8 (3.0)

a. Calculations based on NISP (in parentheses).

Figure 14.5. Photo of maize growing beside the full canal, late February to early March (middle of the picture). Note the water in the canal.

maize (Chapter 8). In contemplating the specialization models, we have tried to identify resources that hypothetical full-time inhabitants of the estuary would have lacked. Maize has occurred as a possibility.

I would be skeptical, however, of any claim that maize production was impossible in the vicinity of the site. In 1992, I recorded two successive crops in the area—each in the form of small *chahuites* [see Chapter 1, and Clark (1994a)]. One patch beside the newly excavated canal was well advanced in later February or early March (Figure 14.5). Once there was no longer any standing water in the canal, the owner of the site planted the canal bed itself with maize—which can be seen just coming up in a shot from mid-April (Figure 14.6). In Figure 14.4, I suggest the possibility of small dry-season plots on the inland side of Varal's catchment along a freshwater drainage. It is possible that small-scale dry-season farming became more feasible later in the occupation as parts of the lagoon shifted to pampa lands.

A final topic is whether the recovered subsistence remains bear on the organizational models under consideration. Unfortunately, based only on materials from El Varal we can compare tecomate-dominant to dish-dominant subsistence only in the vaguest of terms. The heavy clay content and lack of rapid subsequent deposition on top of Terminal deposits seems to have led to deterioration of subsistence evidence. With only a single sample of shells, we lack a sense of variability. Worse, a small bag of heavily encrusted faunal remains from N95W0 (including vertebrate remains and at least some crab claws) was left behind in San Cristóbal and has not been analyzed by Wake, Dietler, and Sims. We can say that there does not seem to have been any radical change of subsistence at this time—certainly nothing to compare with the scope of the contemporary change in vessel forms.

The subsistence data from the tecomate-dominant era of occupation of the Vásquez Mound are of more uniform quality, and (as indicated in Tables 14.3 and 14.4) there is internal variability—probably reflecting intensified exploitation of mollusks, crabs, and fish. How do the four hypothetical models of organizational patterns fare in confrontation with this evidence? The

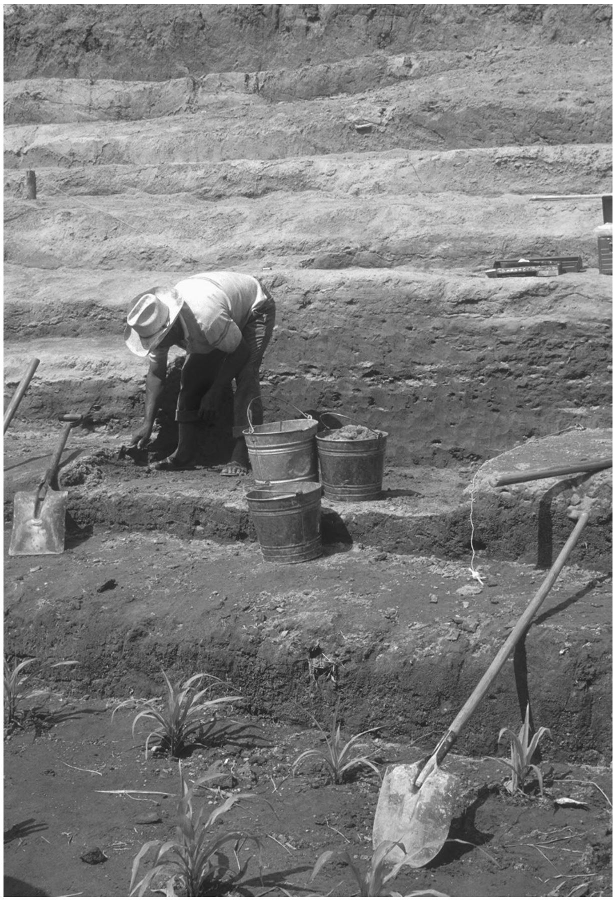


Figure 14.6. Photo of maize just coming up in the canal bottom, mid-April (foreground). At this point the canal was dry.

most obvious point is that the occupants of El Varal collected a broad array of subsistence resources throughout the occupation. That is arguably a strike against specialization, although we could have here simply the meals occupants ate while engaged in some other economic activity (Table 14.2, row 7).

The range of resources exploited certainly raises the issue of foraging. To what extent were the subsistence remains of site inhabitants collected on an encounter basis as opposed to through a logistical strategy? Terrestrial species may well have been taken on a purely opportunistic basis. I have seen workmen take time off from clearing brush to stalk and capture iguanas encountered by chance. Crabs were likely taken by trapping, as suggested by Coe and Flannery (1967:77) and by Wake (Chapter 7). Wake has considered a variety of potential fishing methods (Chapter 7), with emphases ranging from foraging (hooks, nets) to collecting (weirs, traps).

In 1997, Wake and I accompanied some of our workmen from the *ejido* of Buenos Aires on a fishing expedition to the freshwater Hueyate Swamp. The practice employed was to encircle a stand of floating vegetation with a long net and then pull out the vegetation, constrict the net, and harvest the fish that had been clustered beneath the vegetation (Figure 14.7). In one day of fishing, we repeated the strategy in three locations. Species harvested in that case were freshwater ones (mainly cichlids), rare at El Varal (Chapter 15). In February of 1992, during excavation of El Varal local residents were using small cast nets in the newly created drainage canal through the site (Figure 14.8). Their harvest consisted of tiny shrimp (Figure 14.9). Most of the animal foods eaten by site inhabitants were probably harvested in daily logistical sallies by small task groups to locations favorable for specific resources, up to 5 to 6 km from the site. In Chapter 15, Wake and I return to the topic of Early Formative subsistence as we compare the Varal fauna to those of two inland dish-dominant sites.

Domestic Assemblages and Permanence of Occupation

The organization of activities posited for Early Formative Mazatán from the perspective of each model involves differing expectations concerning the appearance of domestic artifacts at tecomate-dominant sites (Table 14.2, row 5). I experiment with two approaches to examining the behavioral causes of intra-site variation in artifacts and features. The first concerns categorical presence or absence of activities. If activities involved in the creation of one assemblage were absent in another, we might expect certain categories of *artifact* to be missing. Generally, the more brief and narrowly focused the activities at a special-purpose site the more we should see the absence of classes of artifact typically present at habitation sites.

A second possibility is that there were quantitative rather than qualitative differences in activities: certain activities may have occurred less frequently at special-purpose sites, yielding depressed frequencies of associated artifacts in the archaeological record in relation to a normal habitation site. In the case of special-purpose sites, we might well expect depressed frequencies rather than the absence of entire categories of artifact when occupation is long-term but not permanent. As people's stays lengthen, they are more likely to engage in an expanding range of extraneous activities—although a variety of other factors, such as group

Figure 14.7. Fishing in the Cantileña Swamp, winter of 1997.

Figure 14.8. Cast-net fishing for shrimp in the canal, El Varal, February of 1992.

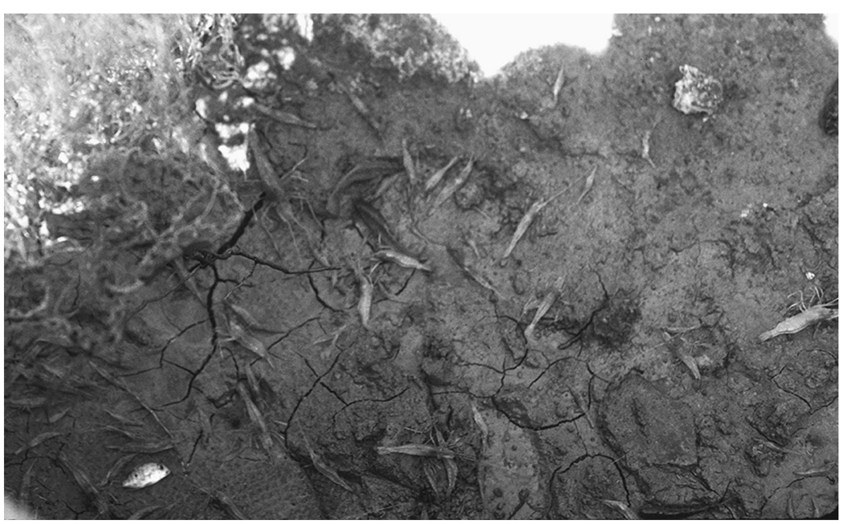


Figure 14.9. Shrimp harvested in a single throw of the net, February of 1992.

size, might be involved. The following analyses provide a basis for ruling out the full-year resident specialist model for the Early to Late occupation of El Varal.

Qualitative Variation

A first consideration is whether the tecomate-dominant (Early through Late) and dish-dominant (Terminal) portions of the occupation are associated with the presence or absence of particular *categories* of artifacts/features. In terms of the hypothesized organizational models, pure foraging (with its division between residential base and location) is unable to account satisfactorily for the vessel-form divergence. The tecomate-dominant portion of the assemblage seems too rich, and the associated stratigraphy too complexly structured, for a location.

Of the other three models, if tecomate-dominant assemblages were produced by full-time resident specialists and dish-dominant assemblages by nonspecialist consumers we would expect the full range of domestic artifacts in both cases—with a possible addition of specialized features or tools in the former case. If tecomate-dominant assemblages were generated by part-year resident specialists or collectors who in either case resided the rest of the year at a dish-dominant site, we might expect tecomate-dominant assemblages to lack certain categories of artifact/feature present in the residential bases. The scope of such absences could vary considerably, depending on the size of the task group, the narrowness of their focus on one productive activity, and (probably most importantly) the length of their stay.

To sum up the results described in detail in Chapters 3 through 11, numerous categories of artifact are present in Early to Late deposits. The range involved compares favorably to those found in the Terminal period. In the pottery assemblage, the only vessel form completely absent prior to Terminal times is the early composite silhouette bowl—the appearance of which is related to regional stylistic changes. Obsidian flakes and grinding stones (including *manos* and *metates* as well as pestles and mortars) are all present throughout the sequence. Rare stone artifacts—including pumice fragments, a sandstone abrader, a hammer stone, a roughly shaped stone sphere, and the poll end of a celt—are haphazardly distributed. Most occur in the tecomate-dominant deposits of the Early to Late periods, where our exposure (and thus the probability of making a find) was greater. Shell tools (both smoothers and scoops were net weights) appear throughout the occupation. Figurines also appear throughout, whereas rare ceramic artifacts have the same haphazard distribution observed in the case of rare stone objects. Worked sherds were not evenly distributed, but they did occur in Terminal deposits as well as in deposits of earlier times. I suggested in Chapter 11 on the basis of slender evidence that masks were associated only with Terminal deposits, but for our purposes here that claim must be considered unproven.

The distribution of features is significant (see conclusion of Chapter 3). As previously noted, no burned features (probably often related to salt manufacture) were identified in Terminal deposits. The burials at the site, on the other hand, may all be Terminal in date, though some could instead be Late. Evidence of two small platforms was in addition noted [around N30-35 in the east profile (Chapter 3) and in the N95W0 excavations (Chapter 4)]. Finally, pit features suggesting storage seem to be small and rare in the 200 m of exposed deposits at Varal (Chapter 3) compared to their size and frequency in excavations at the (earlier) inland sites of Paso de la Amada (Lesure 1995). All of this evidence may signal a shift to more permanent occupation in the Terminal period.

In sum, categories of *artifacts* in the tecomate-dominant assemblage compare favorably with those in the dish-dominant assemblage—a finding consistent with full-time resident specialists or with part-year but long-term residence (weeks or months?) by specialists or collectors. A comparison of categories of *features* in the two cases, however, nudges us toward the second option: the idea that dish-dominant assemblages were associated with permanent occupation and tecomate-dominant assemblages with some type of part-year stay. Relatively long-term visits but not permanent residence would be consistent with the shell isotope evidence for primarily dry-season harvesting (Chapter 13). A consideration of quantitative variation among artifacts will reinforce these preliminary conclusions.

Quantitative Variation

A second line of inquiry is into fluctuations in the frequencies of artifacts. (The sample of features is too small to consider here.) If tecomate-dominant assemblages were produced by full-time resident specialists and dish-dominant assemblages by nonspecialist consumers, domestic artifacts should have been discarded in comparable frequencies in the two cases. If, on the other hand, tecomate-dominant assemblages were generated by people who maintained primary

residences elsewhere those assemblages should have depressed frequencies of artifacts typical of domestic assemblages but peripheral to the primary activities at special-purpose sites.

Comparison of artifact frequencies is more subject to variation in formation process than was the review of categories of artifact in the last section. There are two major potential confounding factors. The first has been mentioned: if domestic debris is mixed with debris deriving from "specialized" production, the two might be difficult to separate. I postpone that issue for the moment and begin instead with a second hurdle: variation from one layer to another in the densities of artifacts.

The challenge is finding systematic criteria for selecting deposits to be compared and standardizing comparisons between them so that the results are not simply a reflection of the size or overall artifact density of the deposits chosen. I had initially anticipated focusing only on what I took to be "midden" deposits [an idea in place during the Phase 3 excavations (Chapter 2)]. After working with the various materials recovered, I have shifted toward a radical ecumenicalism concerning inclusion of deposits—that is, as far as the missing data for various materials allows (on this last point, see relevant discussion in Chapters 5 through 11).

Basically, formation processes appear to have been so complex that focus on any selected set of "best" lots would introduce arbitrary criteria into the analysis. Further, lots originally considered "fill" I now understand to derive from the debris of salt manufacture. As noted in Chapter 3, their artifact content bears no more evidence of trampling than does that of the "middens." I have thus chosen to run analyses several times on *all* available lots, breaking down the deposits and standardizing comparisons in multiple ways.

A standard approach to the analysis of artifact frequencies when deposits are of different sizes is calculation of volumetric densities, but this approach cannot be considered a panacea. The experience of excavating at El Varal left me with a strong sense that formation processes extraneous to the behavioral factors of interest were likely involved in determining the overall packing of artifacts in deposits. For instance, the densest deposit was an outwash area in N35W0 that had probably been washed of fine sediments by waves in the lagoon. Of particular concern was that the deposits of N95W0 seemed to be less dense overall than those earlier in the occupation.

To assess the problem, sherd size can be compared with sherd density. Sherd "size" was calculated as average sherd weight (g sherds/number of sherds) by lot. The distribution was normal. Density was calculated as kg sherds/m^3 excavated. The distribution of the raw densities was highly skewed. Logarithms of these values produced a distribution that was more nearly normal. Average sherd weight and log of sherd density were uncorrelated ($r = 0.11$).

If high artifact density was the direct result of rapid deposition of materials, one would expect high densities of sherds to be correlated with larger sherd sizes because rapid deposition would leave less opportunity for trampling. Density and sherd size, however, turn out to be uncorrelated. That finding reinforces the idea that the overall density of artifacts in a given deposit might be the product of a variety of factors, some potentially extraneous to the behavioral factors of central interest. Further, there seem to be systematic changes through the sequence in overall artifact density. There is admittedly no easy way to measure such a parameter.

Table 14.5 outlines volumetric density of sherds by weight as a rough gauge of overall density. Densities were calculated by lot. The distribution within each stratigraphic period was highly skewed. Logarithms of the densities produced distributions more nearly approximating normal. Averages and standard deviations of the transformed values are shown in the table. Density rises from Early to Middle with the transition to the dump-and-fill zone. It plunges again with the transition from Late to Terminal. It seems desirable, in light of these considerations, to use some other method of standardization conjointly with volumetric density.

One approach is standardization by sherd weight (Chapters 10 and 11). For instance, Table 11.2 calculates figurine fragments per 100 kg of sherds. Such a measure is independent of density fluctuations, but it brings problems of its own. If the sherd assemblage

Table 14.5. Changing artifact density by stratigraphic period[a]

Period	Average of the Transformed Density Values [Log(WtSherds/m^3)][a]	Standard Deviation
Early	1.43	0.43
Middle	2.00	0.31
Late	1.90	0.36
Terminal	1.12	0.47

a. Values for the weight of sherds per m^3 were first calculated for each lot. The resulting distributions within each period were highly skewed. Logarithmic transformation of those values produced distributions approaching normal. Those transformed values were used to calculate average "density."

includes specialized production tools from the Early through Late periods, but not in the Terminal period, a pattern such as the spectacular Terminal increase in figurines per 100 kg of sherds might exaggerate the actual rate of input of figurines to the archaeological record. Finally, of course, standardization by weight of sherds is of dubious utility for studying the pottery itself.

In consideration of all of the foregoing, we have tried in the preceding chapters to divide deposits by *both* stratigraphic period and shell phase. We have also tried standardization by *both* volume and (where appropriate) sherd weight. For the pottery, we considered relative percentages of the various vessel forms as a complement to volumetric density. Finally, consideration was also given to the symmetry of patterning between the Phase 3 and Step Excavation sequences. The basic idea behind this experimentation has been that robust patterns are those that emerge recurrently in analyses.

A central question here is: To what extent are there significant shifts in the frequencies of artifacts other than tecomates and dishes at the time of the shift from tecomate-dominant to dish-dominant assemblage? Among the vessel forms, the tecomate-to-dish shift emerges clearly from all analyses but is associated mainly with vessel-form shifts attributable to general stylistic changes. Robust patterns do emerge among stone and ceramic artifacts, however. Frequencies of figurines and obsidian flakes soar in Terminal deposits. Although the data are less complete, the same pattern appears to hold for worked sherds and grinding stones (*manos*, *metates*, pestles, mortars). All of these fit a criterion of interest: they are common finds in typical Formative residential sites but seemingly would not have been involved in "specialized" production involving boiling estuary resource in tecomates.

There are diachronic patterns that do not fall out neatly on the Late/Terminal divide. The most interesting in behavioral terms are several that hint at directional change—over the course of the occupation or particularly in the Late period—toward greater richness of material culture inventory and thus plausibly greater permanence (although I eventually ascribe this to larger numbers of people and/or longer stays). Tecomates as a percentage of the assemblage declined in the Late period, and rare forms such as stool/pot rests and deep basins became more common. Dishes increased steadily in average size between Early and Late and were then stable into the Terminal period, although in Chapter 9 we wondered whether that might be a general stylistic shift. Frequencies of obsidian and figurines rose in the Late period as well, perhaps anticipating the further jump of the Terminal period.

The analyses just summarized again direct us away from a model of full-time residence in the Early to Late periods. The Terminal-period rise in frequencies of domestic objects (arguably unrelated to whatever productive activity had characterized the site until that point) supports the idea that the site became the location of a full-time community only at that late date. But is there still room for concern here? At the outset of this section, I mentioned a second potential confounding factor: the mixture of domestic and "specialized" debris.

Ideally, standardization by volume should transcend such problems because each artifact is considered independently. However, because of the doubts raised concerning the multiple formation processes affecting volumetric density it would be desirable to separate domestic debris from the detritus generated by any specialized production. The two cannot be separated in any definitive way. I offer the following arguments as a final attempt to resuscitate a model involving permanent residence.

Utilitarian tecomates were likely used for a variety of tasks. Because they do occur in dish-dominant assemblages they were likely part of any typical domestic inventory (probably involved in food preparation/storage). Yet at tecomate-dominant sites they may have been used for specialized activity. Attention thus needs to focus on the utilitarian tecomates.

Assuming that the ratio of utilitarian tecomates to dishes in N95W0 constitutes that expected of "normal" domestic output, we can use that assumption to cull the "extra" tecomates from Early to Late deposits (here I use stratigraphic periods only). In Chapter 9 we pointed out the distinct diachronic patterns of slipped and utilitarian tecomates and proposed a heuristic division of the unidentified tecomates between those. I use those resulting estimates for total utilitarian tecomates here.

Assuming that the ratio of utilitarian tecomates to dishes in N95W0 (the equivalent respectively of 7.4 to 15.1 complete vessel rims, or 0.4879) was stable in domestic debris throughout the sequence, we can compute domestic and extra tecomates by period (Table 14.6). (Recall that the 0 in Terminal is an assumption of the analysis.) Note that the resulting percentage of the vessel assemblage (by period) comprised by extra tecomates declined slightly in Late times, reinforcing the pattern noted in the straight percentages of tecomates at that time (Table 9.10).

Table 14.6. Hypothetical separation of "domestic" and "extra" tecomates based on summed rim proportions

Period	Total Σ Rim Prop.	Total Dishes (*D*)	Estimated Total Utilitarian Tecomates[a] (*T*)	Hypothesized Total "Domestic" Tecomates[b]	Hypothesized Total "Extra" Tecomates[c]	Percentage of "Extra" Tecomates[d]
Early	32.0	5.1	23.2	2.5	20.7	64.9
Middle	55.6	10.2	41.5	5.0	36.5	65.6
Late	43.7	8.6	28.6	4.2	24.3	55.9
Terminal	26.7	15.1	7.4	7.4	0	0

a. See Chapter 9.
b. Calculated as 0.4879*D* for each row.
c. Calculated as *T* – (0.4879*D*) for each row.
d. Hypothesized extra tecomates divided by total of summed rim proportions.

Assume also for the moment that we have indeed separated normal domestic from specialized production debris in the Early through Late periods. Further suppose that we remain skeptical of the patterns observed previously among figurines and obsidian flakes when those are standardized by volume or by weight of sherds. Does separating the extra tecomates reveal a fully normal domestic assemblage? No. The relevant analysis is presented in Table 14.7.

Values were calculated as frequencies of figurines and obsidian flakes divided by the total summed rim proportions of the hypothesized domestic assemblage (i.e., with all extra tecomates removed). Although there is in each case plausibly a directional trend—with Late values, especially of obsidian flakes, approaching those of the Terminal period—frequencies in the Early and Middle stratigraphic periods are still depressed in comparison with those of the Terminal period.

To sum up all of the analyses reviewed in this section, the analytical move from artifact categories to an assessment of frequencies has cast further doubt on a model that would see tecomate-dominant assemblages as the product of full-time resident specialists. When these results are added to those of the shell isotope study indicating mainly dry-season harvesting of shellfish, the case for part-year rather than full-year occupancy seems strong.

Table 14.7. Frequencies of figurines and obsidian flakes standardized against summed rim proportions of the hypothesized domestic assemblage

Period	Hypothesized "Domestic" Vessel Assemblage[a]	Obsidian (g per Pot)[b]	Figurines (Fragments per Pot)[c]
Early	11.2	4.7	0.27
Middle	19.1	4.3	0.47
Late	19.3	6.4	0.47
Terminal	26.7	7.1	0.79

a. Equivalent number of vessels, calculated as total of summed rim proportions, minus the rim proportions of "extra" tecomates.
b. Calculated as weight of obsidian (g) divided by the equivalent number of vessels from the associated domestic assemblage.
c. Calculated as number of figurine fragments divided by the equivalent number of vessels from the associated domestic assemblage.

Hypothetical Population Sizes for El Varal

The analyses just described provide a basis for some hypothetical estimates of population at the site. The fastidious reader may wish to simply skip this section. The population estimates here are definitively heuristic, based as they are on an assumption of full-year residence (which I have rejected). They are provided in the spirit of thinking through as many dimensions of the problem at hand as possible. They prove helpful in any attempt to assess the scale of the phenomenon we are attempting to explain.

The basic idea is that because so much of the mound consists of dump deposits full of broken pottery if we could estimate the total amount of pottery present and establish a relation between numbers of people and the quantity of debris they generate we might be able to estimate population size for the site. Early work by Schiffer (e.g., 1975) along these lines has led to a diverse field of "accumulations research" (Varien and Mills 1997).

The rather strange aspects of the occupation of El Varal (rapid production of broken pottery at a site occupied only part of the year and potentially involving specialized production of salt or other resources) are not easily amenable to this type of analysis. I will instead draw on my hypothesized domestic assemblage (Table 14.6) and assume for the sake of argument that it was produced by year-round residents. I then ask: How many people would have produced that quantity of domestic debris over the 200 to 250 years the site was occupied? Table 14.8 provides necessary parameters for calculating population figures: total summed rim proportions of dishes, domestic tecomates, and extra

Table 14.8. Calculation of total vessel frequencies based on summed rim proportions

Excavated Materials (Early to Late Only)	
Sum of dish rim proportions	24.38
Sum of "domestic" tecomates	11.65
Sum of "extra" tecomates	81.64
Total volume excavated	13.47
Estimated Totals for Vásquez Mound	
Total dishes in mound	30,360
Total "domestic" tecomates	14,510
Total "extra" tecomates	101,660
Total volume of Early to Late mound (m^3)[a]	16,770

a. Based on approximation as truncated cone: upper radius, 18.5 m; lower radius, 45 m; 5 m high.

tecomates (used to produce salt or other goods) in the Early to Late excavations along with the volume excavated—followed by estimated totals for the entire Vásquez Mound. Schiffer (1975:840) hypothesized the relation between total artifacts discarded (T_D), the total systemic number of those artifacts in use at any given time (S_T), the period of occupancy (t), and the artifact use-life (L) as:

$$T_D = S_T t/L \quad (14.1)$$

The parameter most dependent on population is the total systemic number, expressed as:

$$S_T = T_D L/t \quad (14.2)$$

We can draw on comparative ethnographic information compiled by Varien and Mills (1997) to relate S_T to numbers of people, but that information is presented by household. Unfortunately, that adds the variable "the systemic number of the artifact in question per household" (S_h). If h is the number of households:

$$S_T = hS_h \quad (14.3)$$

Assuming four (4) people per household yields an estimated total population (P) of

$$P = 4T_D L/tS_h, \quad (14.4)$$

where T_D is provided by Table 14.8, t = 200 or 250 years (Chapter 12) and L and S_h need to be estimated from ethnographic compilations.

Results are outlined in Table 14.9. The calculations based on dishes and domestic *tecomates* are gratifyingly similar, suggesting that the amount of domestic pottery produced over the 200 to 250 years of occupation at the site was equivalent to that 200 to 400 people *in residence for a full year* might have produced. However, with S_h right on the ethnographic median I suspect these values of being too low for El Varal.

With only part-year residence, we might want to think in terms of even more people—although we could also fiddle with vessel use-life and/or systemic numbers. I propose that we need to think in terms of *at least* 200 people occupying the site on a seasonal basis. It should be borne in mind that these figures are based only on a minor part of the assemblage (the hypothesized "domestic" assemblage) and that actual numbers of people could have been higher, *perhaps much higher*.

Review of Intra-site Variability

The central goal here has been to take a step toward understanding inter-site assemblage variation in Early Formative Soconusco by scrutinizing intra-site variability at El Varal, where the tecomate-dominant and dish-dominant distinction appears as a diachronic transition. I have placed the shift from tecomates toward dishes into the context of other shifts in material culture. That involved consideration of factors other than behavioral change that might have produced assemblage variation. Stylistic change in material culture was identified only in the pottery, and even in that case only a few vessel forms are affected.

A shift from lagoon to pampa in the immediate vicinity of the site is suggested by site stratigraphy and might in part explain a change in species of shellfish harvested. However, that change does not have much explanatory power when applied to other artifacts. Mangrove crabs became more common toward the end of the occupation, but volumetric densities indicate that they were not replacing the more common crabs likely caught in the lagoon (more of both crabs were being harvested). Variation in formation processes between deposits of differing types is the biggest worry as a factor that might confound the effort to trace stability or change in the organization of activities. Any conclusions that ride on artifact frequencies are affected, but results of multiple standardizations and divisions of the deposits end up pointing in a similar direction.

In this volume, we are using two strategies to look into behavioral variability. The first poses general topics for investigation and pursues each where it leads. Here, I have considered several of the topics introduced in Chapter 1—including resources harvested at El Varal (food and salt), the permanence of the occupation, the

Table 14.9. Hypothetical population estimates for El Varal based on the discard equationa

Vessel Form	Duration of Occupation (*t*)	Population Estimates[b] Lower	Median	Higher
Estimates for People at Site:				
Based on dishes	200	152	364	607
	250	121	291	486
Based on "domestic" tecomates	200	181	308	453
	250	145	247	363
Estimates for Population Supported				
Based on "Extra" Tecomates	200	1,017	1,728	2,542
	250	813	1,383	2,033

a. Includes people at site and larger population supported.
b. Variation in population values comes from different estimates of vessel use-lives (*L*), based on ethnoarchaeological compilations provided by Varien and Mills (1997: Table II and Figure 2). They provide the medians. Lower and higher estimates in the table are approximations of interquartile ranges read off the box plots in their Figure 2. Use-life values used for dishes (considered serving vessels): .5, 1.2, and 2.0 years; for tecomates (considered cooking pots): 1.0, 1.7, and 2.5 years. S_h in equation 14.4 (see chapter) likewise can vary widely (see Varien and Mills 1997:Figure 4). This table uses the average of 2.0 for serving vessels per household (based on 13 cases) and 1.6 for cooking vessels per household (based on 39 cases) reported by Varien and Mills (1997:Table II).

distinctiveness of activities that generated tecomate-dominant assemblages, and (very hypothetically) the number of people at the site.

There is direct evidence for a range of foods consumed by the occupants of El Varal. Their focus was on wild resources of the estuary-lagoon system, among which fish were probably the most consistently important to the diet. Although subsistence data are fragmentary for the Terminal period, there does not appear to have been any significant change of diet at the time of the shift from tecomates toward dishes.

Much of the volume of archaeological deposits at the site was generated by salt production, and this product will need serious scrutiny under the rubric of "specialization" (Chapter 17). It seems likely that salt production ceased in the Terminal period, probably accounting for much of the changed character of the deposits. Still, there was more going on. Frequencies of several artifacts other than dishes—particularly figurines, obsidian flakes, grinding stones, and worked sherds—seem to have soared in the Terminal period. The various changes can be accounted for by positing part-year, special-purpose occupation from the Early through the Late periods and a shift to full-year occupation only with the Terminal period.

I have begun consideration in this chapter of the second approach to behavioral variability, in which idealized organizational models are identified along with their associated archaeological expectations. An attempt is then made to match those expectations with the patterns actually identified in the archaeological record. Of the four such models considered, this chapter has cast doubt on two. The distinction made in the foraging model between a residential base and a location does not hold much promise for shedding light on dish- versus tecomate-dominant assemblages. Further, the deposits are complexly structured (Table 14.2, row 2)—and artifacts abundant (row 3). The diversity of subsistence remains, however, prompts me to keep this model in the running. It will prove a useful conceptual resource for understanding Early Formative adaptations (Chapters 15 and 18).

On the other hand, the model positing full-time resident specialists can at this point be set aside. Features to be expected of permanent communities (e.g., architectural platforms and probably burials) are confined to the Terminal period (Table 14.2, row 5). Several different analyses of artifact frequencies point to impoverishment of the domestic assemblage in the Early to Late periods in comparison to the Terminal period. Finally, the shell isotope data indicate primarily dry-season harvesting (Table 14.2, row 1). Thus, throughout most of the occupation of the Vásquez Mound El Varal was a special-purpose site occupied only part of the year. In the Terminal period, occupation shifted from part-time to permanent. In effect, El Varal became an "inland site."

What, though, of changes over the course of the occupation before the Late-Terminal shift? Relevant evidence is plotted in Figure 14.10 as volumetric densities. Note that the scale on the Y axis is logarithmic. The seven lines can be more easily understood by thinking of them in terms of three sets: ceramics (tecomates and dishes), subsistence remains (mollusk, crab, and fish), and small domestic artifacts (obsidian and figurines). I have not found a satisfactory way of quantifying the volume of salt tailings deposited in each phase. The volume of tailings discarded seems to have

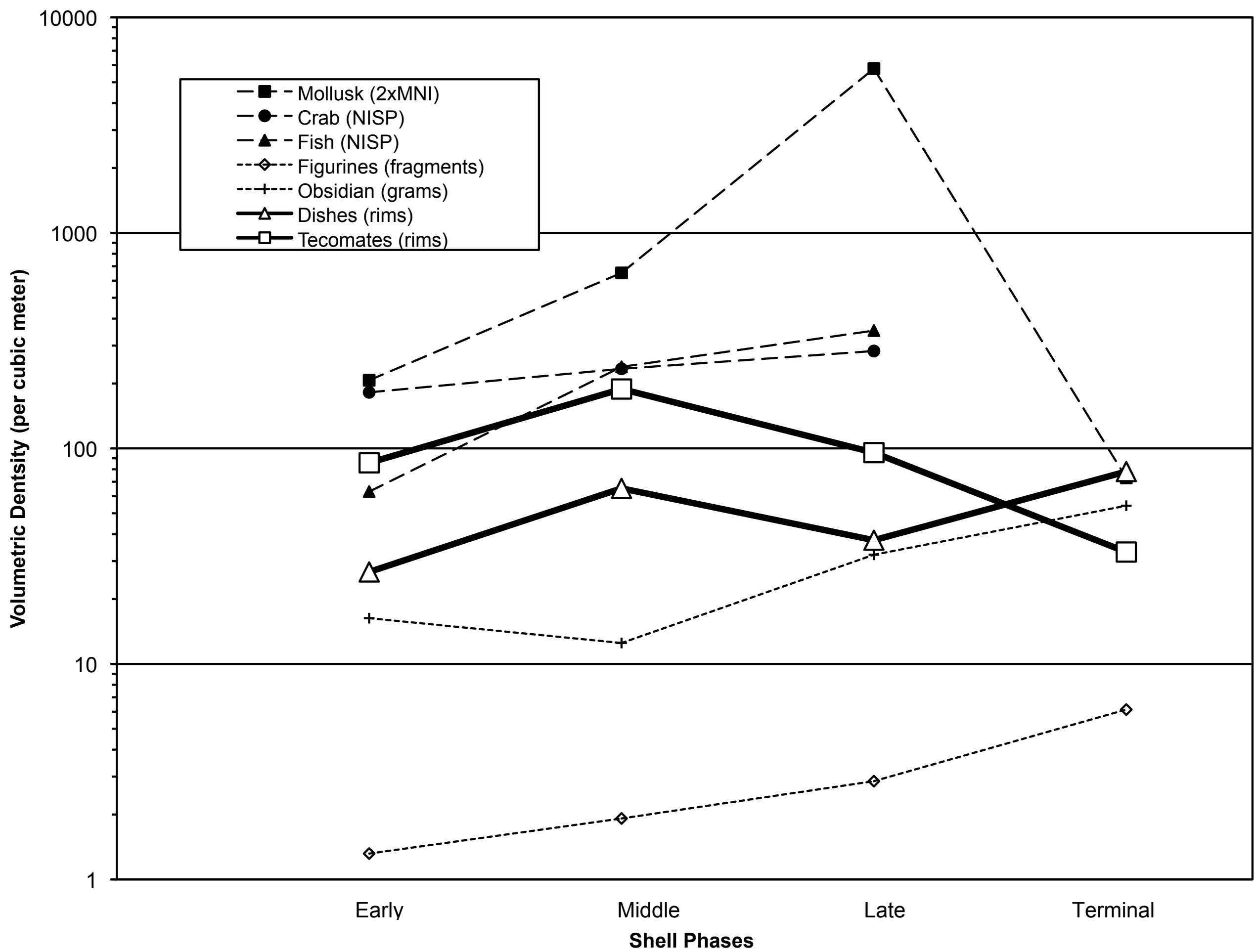


Figure 14.10. Volumetric densities of subsistence remains (mollusks, crabs, and fish), pots (dishes and tecomates), and miscellaneous domestic artifacts (figurines and obsidian) over the course of the occupation—split by shell phase.

increased in the Early to Middle to Late periods and plunged to zero in the Terminal period.

Note the stable relationship between dishes and tecomates from Early through Late phases, suggesting substantial behavioral and (I would argue) organizational continuity throughout that time. The fall in volumetric densities of pots in the Late phase even as salt production and the harvesting of wild foods intensifies is probably an artifact of the heightened rate of deposition of dirt (from salt production) and of mollusk shells at that time. The three classes of aquatic fauna each register increases from Early through Late—the result, I have argued, of intensified production.

We do not have evidence of Terminal crab or fish remains. The density of mollusks plunges, but preservation is a concern. The rises in density of figurines and obsidian even before the Terminal-period reorganization are of considerable interest. It is not immediately apparent why frequencies of these extraneous domestic artifacts should rise at the time of most intensive

harvesting of salt and wild animal resources. Wouldn't we have expected people to be more single-mindedly focused on production at that time?

The reason for the observed patterning, I suspect, is that during the Late period people were present at the site in larger numbers and/or for longer periods of time. Those are the circumstances that should produce greater quantities of domestic artifacts (Table 14.2, row 5). Still, the character of use of the site had not changed. That would only occur with the Terminal period.

Conclusions Thus Far

To summarize conclusions based on the artifacts and features of El Varal itself, I propose the following. Occupation through the Late period involved part-year residence by a sizable group, perhaps a few hundred people. The occupants were not single-mindedly devoted to whatever productive tasks brought them to the site, probably because the occupation lasted for weeks and the group itself was large and diverse.

In the terminology of Binford's collecting model, the site might be conceived of as a "field camp"—albeit a particularly large and ambitious one in hunting-and-gathering terms. People slept and ate there while they worked at salt production and any other tasks that occupied them during their stay. They fed themselves in part by harvesting wild resources. Those efforts focused on the estuary-lagoon system and involved a mix of foraging and collecting strategies appropriate to the nature and distribution of fauna there. The occupants also ate maize, whether grown in the vicinity or brought in from elsewhere. In the Terminal period, the character of the occupation changed. Salt production ceased, and El Varal became a village occupied year-round. This village, though, did not last long (a generation or perhaps two?). It was abandoned by 1000 B.C. and never reoccupied.

This is as far as materials of El Varal itself allow us to move toward resolving the puzzle of inter-site assemblage variation in Early Formative Soconusco. The topics considered here (the nature of productive activities, the distinctiveness of those activities, and the permanence and size of the occupation) remain not fully explored. Consideration of a fifth topic, the relations between producers and consumers, has barely begun. There is also more work to be done in weighing applicability of the organizational models by product. The chapters of Part III bring inter-site comparisons to bear on all of these issues.

Part III

Inter-site Differences: Settlement, Subsistence, and Community

CHAPTER 15

Subsistence in the Estuary:

Surplus Production, Expedient Meals, or Something Between?

RICHARD G. LESURE, THOMAS A. WAKE, AND DAVID W. STEADMAN

The chapters of Part III delve further into the resource(s) that brought people to El Varal for lengthy dry-season stays and explore in greater detail the organization of production and consumption of those resources. Each draws on comparative evidence from other Formative sites in the Mazatán region or the Soconusco more generally to place El Varal into a larger context. This chapter examines subsistence. Vertebrate fauna is the only subsistence category for which we have relatively good evidence from dish-dominant and tecomate-dominant sites in the Mazatán area and receives most of our attention.

A recurring suggestion in the interpretive literature on tecomate-dominant sites in the Soconusco (reviewed in Chapter 1) is that such sites might have served as locations for the harvesting of estuary food resources, perhaps even the specialized production of such resources for transfer to consumers at inland sites. Estuary fauna in particular have been seen as an intensifiable resource capable of fueling population concentration and social complexity, even in the absence of any heavy reliance on maize (Blake et al. 1992a, 1992b). Thus, one idea to be considered is that the seasonal occupants of El Varal might have been in the estuary for resources other than salt. Of particular interest is the possibility that site occupants produced surplus food for transfer to inland sites, although we will be suggesting that another possibility is dry-season movements of people seeking to eat estuary foods at the point of origin. A third option is that the occupants of El Varal were really only at the site for the salt and that subsistence remains recovered are simply the remains of meals of those directly involved in production.

The forager/collector framework (Binford 1983) provides a useful set of contrasts for exploring the possibilities. Although it was noted repeatedly in Chapter 14 that the forager model cannot itself explain inter-site assemblage variability in Early Formative Mazatán, two particular features of the model are of interest here: the basic forager strategy is to move people to resources and foraging involves generalized harvesting of a range of locally available wild foods. The collecting strategy is instead to move resources to people. That is accomplished by sending out task groups that target specific resources for collection, processing, and transfer to residential bases. We will not try to distinguish collecting from specialization in this chapter. In this case, the two should leave rather similar archaeological signatures.

The basic question we pose here is: Does the subsistence evidence conform to expectations of a collector model in which tecomate-dominant sites were dry-season field camps for the processing of wild foods, which were then removed to and consumed at

dish-dominant sites? In terms of expectations of the organizational models, this chapter elaborates the issues highlighted in Table 14.2, row 7. We find modest, but hardly definitive, support for collecting as an organizational strategy and conclude that the harvesting of wild estuary foods at El Varal had in the organizational sense a substantial foraging component—although we hasten to remind readers that we are using such models as tools for thought (Chapter 14) and are *not* suggesting that the semi-mobile village dwellers who visited El Varal in the dry season be labeled "foragers."

We conclude by proposing two ways to account for the evidence presented in this chapter. It could be that salt makers foraged to feed themselves while in residence at the site. In that view, food (other than salt) did not play a significant economic role at El Varal. We refer to this variant of the foraging model as *task-group provisioning*. The other possibility is that people other than salt makers shifted to estuary sites in the dry season to take advantage of that habitat's seasonal peak in resource availability. In this case, subsistence would indeed had have been part of the economic significance of the site. We refer to this variant of the foraging model as *subsistence-oriented seasonal mobility*. These possibilities are further explored in Chapter 18.

After describing the collections of faunal remains to be considered, we begin our consideration of collecting versus foraging of wild foods by placing the Early Formative cases into a long-term perspective on adaptive transformations in Soconusco extending back to the preceding Archaic—known from the Hueyate Swamp and Acapetahua regions. This is useful because Archaic adaptations have been interpreted within a forager/collector framework by Voorhies and colleagues (Voorhies et al. 2002; Voorhies 2004; Kennett et al. 2006). Comparison with Archaic patterns also helps to highlight significant *similarities* as well as differences between our Formative cases and helps lay groundwork for the synthetic efforts of Chapter 18.

NATURE OF THE EVIDENCE

We select three Formative sites for comparison—one tecomate dominant and two dish dominant. The assemblages compared are Early Formative but not strictly coeval. The tecomate-dominant sample is of course that of El Varal (Chapters 5 through 7), late Cuadros to Jocotal in date (1250/1200 to 1050/1000 B.C.). No faunal assemblage from a contemporaneous dish-dominant site of the Mazatán region has been analyzed. The best available comparative samples are from Cherla-phase deposits (1400 to 1300 B.C.) at Paso de la Amada and Aquiles Serdán. It is possible that resource collection strategies changed in the interval between the assemblages, but that will have to remain a topic for future investigation. The fact that the dish-dominant/tecomate-dominant distinction dates to the Locona phase (1700 to 1500 B.C.) in the Mazatán region helps justify the relevance of our comparison (Ceja 1974; Lowe 1977; Clark 1994a). We assume here that the persistence of the vessel-form distribution pattern throughout the Early Formative indicates a general stability of adaptive patterns at least from 1400 through 1000 B.C.

Excavations of the Mazatán Early Formative Project (Blake 1991; Clark 1991; Clark and Blake 1989, 1994) yielded a very large sample of subsistence remains, particularly vertebrate fauna (Blake et al. 1992a). Unfortunately, only part of that material has been analyzed to date. Flannery and Mudar [1991; cited in Blake et al. (1992a)] identified vertebrate remains recovered from a Cherla-phase trash pit at Aquiles Serdán. We use the data from that study as reported by Blake et al. (1992a). Unfortunately, the report provides only the minimum number of individuals (MNI) statistic—limiting our ability to compare it with the other samples. In addition, actual MNIs are not provided for all of the identified taxa. We have assumed an MNI of 2 for "several" and 1 for "rare." Archaeological vertebrate specimens from Cherla-phase deposits at Paso de la Amada are reported by Wake (2004) and Steadman et al. (2003). The main sample derives from the lower fill of Mound 1 (Lesure 1995). This was a Cherla-phase midden that had been quarried and redeposited as mound fill. It was extremely rich in artifacts. The lower fill (lots 9 through 11) was predominantly Cherla, but with some Locona and Ocós admixture. Our third sample is the El Varal material reported in Chapter 7. Table 15.1 brings together data on all three samples for direct comparison.

The faunal collection from Paso de la Amada is large, and it is still only partially analyzed. Bird remains were generally rare. Early in the analysis, Wake combed through all material from the site—including multiple deposits from the Locona, Ocós, and Cherla phases—pulling out bird bone. Birds from Paso and Varal were sent to the Florida Museum of Natural History (University of Florida) for analysis, and the results were published by Steadman et al. (2003). Through a misunderstanding between the investigators, that paper lists

Table 15.1. Identified vertebrate fauna from Paso de la Amada, El Varal, and Aquiles Serdán

Common Name	Scientific Name	Paso de la Amada Lot 11[a]		Paso de la Amada Unsystematic[b]		El Varal[c]		Aquiles Serdán[d]
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	**MNI**
Sharks	Carcharhinidae					2	**1**	
Cartilaginous fish	Elasmobranchii	2		2				
Tropical gar	*Atractosteus tropicus*	47	**1**	47	**1**	1	**1**	**15**
Machete	*Elops affinis*	2	**1**	2	**1**			
Chihuil sea catfish	cf. *Bagre panamensis*					1	**1**	
Sea catfish	*Cathorops* sp.	1	**1**	1	**1**			
Blue sea catfish	*Sciades guatemalensis*					3	**2**	
Blue sea catfish	cf. *S. guatemalensis*					6	**4**	
Comminate sea catfish	*Sciades platypogon*	8	**4**	8	**4**			
Chili sea catfish	*Sciades troscheli*	3	**2**	3	**2**	4	**1**	
Chili sea catfish	cf. *Sciades troscheli*					2	**2**	
Sea catfish	*Sciades* sp.	974	**40**	974	**40**	29	**16**	**97**
Sea catfish	cf. *Sciades* sp.					8	**5**	
Sea catfishes	Ariidae	8		8		394	**71**	
Walter's toadfish	*Batrachoides waltersi*					14	**10**	
Toadfish	*Batrachoides* sp.					3	**3**	
Toadfishes	Batrachoididae					1		
Needlefish	*Strongylura* sp.					1	**1**	
Jack	*Caranx* sp.					3	**3**	
Jack	cf. *Caranx* sp.					1	**1**	
Pacific bumper	*Chloroscombrus orqueta*					1	**1**	
Leatherjack	*Oligoplites* sp.					2	**1**	
Pompano	*Trachinotus* sp.					4	**2**	
Jacks	Carangidae	6		6				
Snook	*Centropomus nigrescens*					1	**1**	
Snook	*Centropomus pectinatus*					2	**1**	
Snook	*Centropomus* sp.	32	**4**	32	**4**	54	**31**	
Three-spotted mojarrra	*Cichlasoma trimaculatum*	1	**1**	1	**1**			**171**
Freshwater mojarra	*Cichlasoma* sp.	43	**6**	43	**6**	1	**1**	
	Cichlidae					2	**1**	
Pacific fat sleeper	*Dormitator latifrons*	57	**19**	57	**19**	2	**2**	
Spotted sleeper	*Eleotris picta*					14	**6**	
Sleeper	*Eleotris* sp.					3	**3**	
Sleepers	Eleotridae	350		350		2		
Marine mojarra	*Diapterus* sp.					6	**5**	
Marine mojarra	*Eugerres* sp.	4	**2**	4	**2**			
Yellow-fin mojarra	*Gerres cinereus*	1	**1**	1	**1**	3	**2**	
Marine mojarra	*Gerres* sp.					1	**1**	
Marine mojarras	Gerreidae	2		2		1	**1**	
Grunt	*Haemulopsis* sp.					1	**1**	
Big-spine grunt	*Pomadasys macracanthus*	2	**1**	2	**1**	7	**5**	
Grunt	*Pomadasys* sp.	2	**1**	2	**1**	2	**2**	
Grunts	Haemulidae	5		5		8	**2**	
Yellow snapper	*Lutjanus argentiventris*	2	**1**	2	**1**			

Table 15.1. *(continued)*

Common Name	Scientific Name	Paso de la Amada Lot 11[a]		Paso de la Amada Unsystematic[b]		El Varal[c]		Aquiles Serdán[d]
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	**MNI**
Jordan's snapper	*Lutjanus jordani*					1	**1**	
Snapper	*Lutjanus* sp.	33	**3**	33	**3**	50	**16**	**3**
Parrotfish	Scaridae							**1**
	Mugil cf. *cephalus*					2	**1**	
Mullet	*Mugil* sp.	4	**1**	4	**1**	6	**3**	
Sea chub	*Kyphosus* cf. *K. elegans*					2	**1**	
Weakfish	*Cynoscion* sp.					6	**2**	
Corvina	*Micropogonias* sp.	2	**1**	2	**1**			
Croakers	Sciaenidae	1		1		2	**2**	
Mackerels	Scombridae					1	**1**	
	Perciformes					6		
Pufferfish	*Sphoeroides* sp.	1	**1**	1	**1**			
Bony fish	Teleostei	312		312		1,098		
Marine toad	*Bufo marinus*					2	**1**	
Toad	*Bufo* sp.	7	**3**	20	**3**	1	**1**	
True frog	*Rana* sp.			1	**1**			
Frogs and toads	Anura			4				
Mexican caecilian	*Dermophis mexicanus*	1	**1**	1	**1**			
American crocodile	*Crocodylus acutus*	2	**1**	4	**1**			**1**
Crocodilians	Crocodilia	11		15				**Several**
Green iguana	*Iguana iguana*	2	**1**	2	**1**	3	**3**	**Several**
Black iguana	*Ctenosaura similis*	2	**2**	8	**2**	1	**1**	**Several**
Green/black iguana	*Iguana/Ctenosaura*	24	**3**	57	**3**	4	**4**	
Helmeted lizard	*Coritophanes* sp.			1	**1**			
Lizard	Lacertilia	5		13				
Green sea turtle	*Chelonia agassizi*			1	**1**	2	**2**	
Sea turtles	Cheloniidae					7	**5**	
Mud turtle	*Kinosternon scorpioides*	49	**2**	116	**4**	1	**1**	**Several**
	Dermatemys sp.							**Rare**
Pond slider	*Trachemys scripta*			1	**1**			**Several**
Sliders	Emydidae	1		7				
Turtles	Testudines	6		15		3		
Boa	*Boa constrictor*							**Several**
Boas	Boidae			1				
Indigo snake	*Drymarchon corais*	2	**1**	3	**1**			
Nonvenomous snakes	Colubridae	52		109				
Pit vipers	Viperidae			1				
Snakes	Serpentes	2		2				**Several**
Reptiles	Reptilia	2		1		1		
Least grebe	*Tachybaptus dominicus*	1	**1**	1	**1**			
Pied-billed grebe	*Podilymbus podiceps*			1	**1**	1	**1**	
	Podilymbus nigricollis							**1**

Table 15.1. *(continued)*

Common Name	Scientific Name	Paso de la Amada Lot 11[a]		Paso de la Amada Unsystematic[b]		El Varal[c]		Aquiles Serdán[d]
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	**MNI**
Darter	*Anhinga anhinga*							**1**
Brown pelican	*Pelecanus occidentalis*			2	**1**	1	**1**	
Neotropic cormorant	*Phalacrocorax brasilianus*			2	**1**	1	**1**	
Yellow-crowned night heron	*Nyctanassa violacea*					3	**3**	
Green heron	*Butorides virescens*	1	**1**	3	**2**			**1**
Great egret	*Ardea alba*			1	**1**			
	Egretta sp.			1	**1**	6	**5**	
Bare-throated tiger heron	*Tigrisoma mexicanum*			1	**1**			**1**
Black-bellied whistling duck	*Dendrocygna autumnalis*			2	**1**			
Muscovy duck	*Cairina moschata*			2	**1**			**1**
	Anas sp.			3	**1**			**Several**
Goose	*Anser* cf. *albifrons*							**1**
Lesser scaup	*Aythya affinis*			1	**1**			
Osprey	*Pandion haliaetus*	1	**1**	12	**2**			
Common moorhen	*Gallinula chloropus*			1	**1**			
American coot	*Fulica americana*					2	**2**	**2**
Semipalmated plover	*Charadrius semipalmatus*					1	**1**	
Black-necked stilt	*Himantopus mexicanus*					1	**1**	
Marbled godwit	*Limosa fedoa*					1	**1**	
Whimbrel	*Numenius phaeopus*					1	**1**	
Willet	*Catoptrophorus semipalmatus*					4	**4**	
Least sandpiper	*Calidris minutilla*			1	**1**			
Sandwich tern	*Sterna sandvicensis*					2	**2**	
	Sterna sp.			1	**1**			
Turkey vulture	*Cathartes aura*	1	**1**	1	**1**			
Black vulture	*Coragyps atratus*			1	**1**			
Sharp-shinned hawk	*Accipiter striatus*			4	**1**			
Roadside hawk	*Buteo magnirostris*	1	**1**	4	**1**			
Short-tailed hawk	*Buteo* cf. *brachyurus*							**1**
Harpy eagle	*Harpia harpyja*			1	**1**			
Small hawk	*Accipiter* sp.							**1**
	Accipitridae sp. 1			1	**1**			
	Accipitridae sp. 2			1	**1**			
Crested caracara	*Polyborus plancus*	1	**1**	16	**1**	3	**2**	
Plain chachalaca	*Ortalis vetula*			3	**2**			
White-bellied chachalaca	*Ortalis leucogastra*	2	**1**	8	**2**	1	**1**	
	Ortalis sp.	2		2				
Northern bobwhite	*Colinus virginianus*	4	**2**	17	**2**			
Spotted wood quail	*Odontophorus guttatus*			1	**1**			
Ocellated quail	*Cyrtonyx ocellatus*			3	**1**			
Mourning dove	*Zenaida macroura*	1	**1**	3	**1**	1	**1**	
Blue ground dove	*Claravis pretiosa*			1	**1**			
Inca dove	*Scardafella inca*			21	**3**			
White-tipped dove	*Leptotilas verreauxi*			1	**1**			
Ruddy quail dove	*Geotrygon montana*			1	**1**			
	Columbidae sp.			4				
Military macaw	*Ara militaris*			1	**1**			
Orange-fronted parakeet	*Aratinga canicularis*			1	**1**			
White-fronted parrot	*Amazona albifrons*			1	**1**			
	Amazona sp.			9	**1**			
Goove-billed ani	*Crotophaga sulcirostris*			1	**1**			
Lesser ground cuckoo	*Dromococcyx erythropygus*			1	**1**			
Barn owl	*Tyto alba*	1	**1**	2	**1**			
Blue-crowned motmot	*Momotus momota*			2	**1**			
	Momotidae sp.	1	**1**	1	**1**			
Ringed kingfisher	*Ceryle torquata*			1	**1**			

Table 15.1. *(continued)*

Common Name	Scientific Name	Paso de la Amada Lot 11[a]		Paso de la Amada Unsystematic[b]		El Varal[c]		Aquiles Serdán[d]
		NISP	**MNI**	NISP	**MNI**	NISP	**MNI**	**MNI**
Emerald toucanet	*Aulacorhynchus prasinus*	1	**1**	1	**1**			
Sulphur-bellied flycatcher	*Myiodynastes luteiventris*			2	**1**			
	Tyrannus sp.			1	**1**			
Parrot	Unidentified							**1**
Jay	Unidentified							**1**
Wild turkey	*Meleagris gallopavo*							**1**
Rose-throated becard	*Pachyramphus aglaiae*			1	**1**			
	Emberizidae							
	Nine-primaried oscine 1			1	**1**			
	Nine-primaried oscine 2			1	**1**			
	Nine-primaried oscine 3			1	**1**			
Great-tailed grackle	*Quiscalus mexicanus*	1	**1**	5	**1**			
Mesoamerican opossum	*Didelphis marsupialis*	3	**1**	8	**2**			
Virginia opossum	*Didelphis virginianus*							**2**
Opossum	*Didelphis* sp.	1	**1**	1	**1**			
Nine-banded armadillo	*Dasypus novemcinctus*	38	**2**	105	**3**	2	**2**	**1**
Dolphin	Delphinidae					2	**2**	
Human	*Homo Sapiens*					2	**2**	
Domestic dog	*Canis familiaris*	7	**1**	9	**1**			
Dog	*Canis* sp.	1	**1**	13	**2**			**4**
Gray fox	*Urocyon cinereoargenteus*	2	**1**	2	**1**			
Coati	*Nasua narica*			3	**1**			
Raccoon	*Procyon lotor*							**1**
Weasel	*Mustela frenata*			1	**1**			
Cats	Felidae			1	**1**			
Carnivores	Carnivora			4				
Brocket deer	*Mazama americana*	1	**1**	1	**1**			
White-tailed deer	*Odocoileus virginianus*	12	**1**	26	**2**	11	**5**	**5**
Collared peccary	*Tayassu tajacu*	4	**2**	7	**2**	1	**1**	**1**
Even-toed ungulates	Artiodactyla	1		9				
Jackrabbit	*Lepus* sp.			1	**1**			
Cottontail rabbit	*Sylvilagus* sp.	15	**2**	68	**4**	8	**7**	**2**
Gray squirrel	*Sciurus aureogaster*							**1**
Deer mouse	*Peromyscus* sp.			3	**2**			
Mice	Cricetidae	4		4		3	3	
Giant pocket gopher	*Orthogeomys grandis*	15	**3**	46	**3**	5	**5**	**9**
Cotton rat	*Sigmodon hispidus*					3	**2**	
Paca	*Agouti paca*			1	**1**			
Rodents	Rodentia	18		69				
Large mammal	Large Mammalia	203		775		8		
	Medium Mammalia	41		103				
Small mammal	Small Mammalia	9		20		3		
Mammal	Mammalia	20		110		2		
Total		2,487		3,840		1,868		

a. Includes all fish, herp, bird, and mammal remains from mound 1 units F9 (lot 11), H8 (lot 11), and H9 (lot 11). Bird identifications from Steadman et al. (2003).
b. Includes all mammal, amphibian, and reptile remains from mound 1, lot 11 (all screened units). Bird remains are from all materials collected in mounds 1, 6, 12, and 32. Bird identifications from Steadman et al. (2003).
c. From Chapter 7.
d. From Blake et al. (1992:Tables 1 and 2).

the entire combined sample of birds as from Paso. The Paso and Varal birds are separated here in Table 15.1, which should be understood as superseding Table 1 of Steadman et al. (2003).

Wake also extracted mammals, reptiles, and amphibians from the lot 11 collections of multiple excavation units in Mound 1 and identified those. Fish remains, however, were overwhelmingly the most common in the collection. Only a small fraction of the total has been studied to date. Wake (2004) included fish remains from a single lot (11) in two units (H8 and F9). Since then, he has added another unit (H9/11). The full assemblage of fish, amphibians, reptiles, birds, and mammals of those three units is reported in Table 15.1 as *Paso de la Amada Lot 11* (the corresponding crab remains are reported as the Cherla sample in Chapter 6, and there are notes on the mollusks below, in Tables 15.2 and 15.3). A separate column in Table 15.1 provides a larger but unsystematic sample that includes all identified mammals, reptiles, amphibians, and birds—as well as the fish identified to date. That sample (*Paso de la Amada Unsystematic*) should be used with care. Fish tallies are based on a few lots of Mound 1 only; reptiles, amphibians, and mammals are from a larger Mound 1 sample; and birds are from an even larger sample that includes multiple mounds.

Our information on Archaic fauna is drawn from various chapters in Voorhies (2004). Comparison of these various data sets presents a variety of challenges. In the case of Aquiles Serdán, we suspect that rare fish went unidentified. Although the different analysts quantify collections in various ways, MNIs are generally available. One of the biggest problems is the confusing and fluctuating taxonomy of marine catfishes (Ariidae; Cook et al. 2004:266–268). The most common Ariidae genus in our collection (*Sciades*) has changed names several times during preparation of this manuscript and now includes at least two species identified at El Varal previously classified as separate genera [*S. guatemalensis* (formerly *Hexanematichthys guatemalensis*) and *S. troscheli* (formerly *Notarius troscheli*)]. In several of the analyses reported in the following, we have decided to treat all identified Ariidae as a single taxon. Note that because we have calculated MNI by lot at El Varal we have assigned a considerable number of the total MNI to that family (Chapter 7).

Early Formative and Archaic Systems Compared

Voorhies (2004:397–417) identifies the Archaic shell mounds of the Acapetahua and Hueyate areas as the most archaeologically visible component of an adaptive system actually centered inland on the coastal plain. Bulk processing of marsh clams in locations with little dry land favored repeated visits to the same locales and led to the creation of these impressive artificial mounds. However, the sites were temporary processing stations in a logistical system. Task groups visited these field camps to process estuary subsistence resources (clams, certainly, although possibly shrimp and fish) for transfer to larger consumption units at residential bases located along rivers in the coastal plain.

One way of posing our question here is to ask whether tecomate-dominant sites such as El Varal were the Early Formative analog of the Archaic shell mounds—field camps in a logistical system of wild resource acquisition. The prominence of the mounds at El Varal, formed as islands in an estuary setting, strikes a note of similarity. However, their composition diverges markedly from that of their Archaic counterparts. Except for a few layers late in the occupation of the Vásquez Mound, pottery rather than mollusk shells constitutes the bulk of the deposits. It may be possible to account for that pottery with salt production, but what about the harvesting of other foods? In the scheme under consideration, dish-dominant sites would be the Early Formative equivalent of coastal-plain residential bases of the Archaic.

Our expectations for the distribution of faunal remains generated by such a system are that residential bases should have a richer and more diverse array of fauna than field camps. The remains at a field camp would represent fauna harvested from habitats in the immediate vicinity of the site, whereas those at the residential bases should reflect the results of pooling resources from multiple habitats. Unless processing involves selective removal of the archaeologically visible part of a particular resource, we would generally expect the fauna represented at a field camp to be a subset of that identified at the residential base.

A good example of selective removal would be the marsh clam shells that appear in such numbers at the Acapetahua estuary sites: because one of the main goals of processing would have been to leave the shells behind, we do not expect to find them at the residential bases. One further complication to the idea that field

camp faunas should be a subset of those at residential bases is that occupants of field camps might have worked at one thing (e.g., processing clams for transfer to inland sites) while eating something else (such as fish or crab). Still, if the faunal remains of the proposed field camp diverge significantly from that of the putative residential base it becomes necessary to consider a foraging rather than collecting model—one in which people are moved to resources rather than resources to people.

Comparison of the Early Formative assemblages under consideration with their Archaic counterparts is hindered by the lack of faunal remains at the single residential base known from the Archaic (Vuelta Limón). Thus, although data from multiple Archaic sites are available (Tlacuachero, Campón, Zapotillo, Cerro de las Conchas) it is hypothesized that these comprise only one component of the Archaic system. Other obstacles are those inherent in trying to compare very different types of faunal evidence (shells to vertebrate remains), discordant analyses by different investigators, differential preservation (particularly affecting shellfish remains at Paso de la Amada), and sample size effects [especially significant for assessments of diversity; see Grayson (1978) and Thomas (1989)].

Persevering through all these obstacles, we have assembled two types of comparative data (readers are advised to review the various caveats in the notes associated with the tables). Table 15.2 provides relative percentages of basic classes of fauna at a Late Archaic site (Tlacuachero) and three Early Formative sites (El Varal, Paso de la Amada, and Aquiles Serdán), whereas Table 15.3 presents the number of taxa identified at the genus level (or higher levels if those were assigned MNI values by the original investigators) for each of those classes.

El Varal shares with the Archaic sites the high relative proportion of mollusks, although absolute numbers are orders of magnitude less. In the Archaic case, the extreme predominance of shells helps support the idea that the occupants were engaged in bulk processing for transport to inland sites. [There is other evidence. See Voorhies (2004:Chapter 3).] In the Late shell phase at El Varal, the episodes of intensive collecting may derive from a similar production strategy, but for the Early and Middle shell phases we suspect that mollusks were primarily consumed on-site. Shellfish may have been consumed at the site even in the Late phase. The high numbers of the tiny bivalve *Amphichaena kindermanni* recovered in huge numbers in several lots is one basis for this suggestion. We have trouble imagining *A. kindermanni* of interest for processing and drying as proposed for marsh clams. In response to Lesure's skepticism concerning any use at all of this shellfish as food, inhabitants of the area in 1992 assured him that those were perfectly edible—but only for making soup. Note in Table 15.2 that the Tlacuachero/Campón values are based on estimates of meat weight. Those for Varal, instead, are based on MNIs. Converted into meat weight, the mollusk percentages for Varal would be lower and the fish and mammals (the latter including a few deer) would be higher.

Despite points of similarity, the Varal assemblage is hardly a close match with those of the Archaic sites and in key respects falls in much more comfortably with its Early Formative counterparts. Previous observers—including Blake et al. (1992a), Kennett et al. (2006), and Neff et al. (2006)—note an expanded diet breadth in Early Formative Soconusco relative to the local Archaic. That pattern can be noted in both tables here, at both dish-dominant and tecomate-dominant sites. Among the shellfish, the number of taxa identified at El Varal is much higher than at the Late Archaic Acapetahua sites (Tlacuachero in Table 15.3)—and higher as well than at Middle Archaic Cerro de las Conchas. The shells of Paso de la Amada were in terrible condition due to soil conditions that nevertheless allowed good preservation of bone. Still, a range of taxa is present despite the small sample (158 g of shell). Crabs, all but absent in the Archaic, were significant in both numbers and variety at Varal and present even at Paso—where they were more significant than mollusks. In the Early Formative, generally there seems to be a greater representation of reptiles, amphibians, birds, and mammals than in the Archaic cases.

Volumetric densities of vertebrate remains at El Varal overlap with those registered at Cerro de las Conchas, but at the lower end of the range for the Archaic site despite the preponderance of shell in the latter case. In strata I, II, and III at Cerro de las Conchas (the first ceramic, the last two Archaic), total NISP densities were 371, 1306, and 189 specimens/m^3, respectively. Total vertebrate NISP densities at Varal are 114, 244, and 299 specimens/m^3 for Early, Middle, and Late shell phases, respectively. The density in our single analyzed sample from Paso de la Amada was approximately 1,000 specimens/m^3 (recovered in the same 5-mm screens used at Varal). Still, this density is clearly at the high end of the inland sites's range, and there was variation lot to lot in the Varal case—with a

Table 15.2. Best available estimates for relative percentages of fauna at Late Archaic Acapetahua shell mounds (Tlacuachero/Campón) and three Early Formative sites[a]

Site	Mollusks	Crabs	Fish	Reptiles/ Amphibians	Birds	Mammals
Tlacuachero/Campón[b]	99.4	0	0.44	0.06	<.01	0.10
El Varal:[c]						
Early shell phase	60.3	26.9	9.5	1.1	0.9	1.4
Middle shell phase	74.4	16.1	6.7	0.4	1.2	1.3
Late shell phase	96.9	1.8	1.0	0.1	0.1	0.1
Paso de la Amada[d]						
Lot 11	4.5	8.4	58.7	9.0	9.0	10.3
Aquiles Serdán[e]	Small?	Small?	83.4	4.6	4.4	7.6

a. Percentages are based on summed MNIs where available, except for values from Tlacuachero/Campón—which are based on estimates of meat biomass.
b. From Voorhies (2004:125, 147, and Figure 3.1).
c. From Table 14.3. Only the four most consistently important mollusks are included in the counts. Note that this means excluding vast numbers of *Amphichaena kindermanni* shells from two Late lots.
d. From Tables 6.7 and 15.1. Mollusk remains from the site were in terrible shape, apparently because of soil conditions. In the lot 11 sample, the most common shells represented are the same four most consistently found across the sequence at Varal (in the following order, from most to least common): *Chione subrugosa*, *Anadara grandis*, *Protothaca metodon*, and *Polymesoda radiata*.
e. From Blake et al. (1992:Tables 1 and 2). See also Table 15.1. Mollusk shells and crab claws are not reported there. We believe that they were not common or absent. See the methods section in this chapter for how we dealt with MNIs listed as "Several" and "Rare."

Table 15.3. The number of distinct taxa (at the genus level or above) of mollusks, crabs, fish, reptiles, amphibians, birds, and mammals at Archaic and Early Formative sites[a]

Site	Mollusks	Crabs	Fish	Reptiles/ Amphibians	Birds	Mammals	Vert. N[b]
Cerro de las Conchas[c]	~10	~1	21	3	1	3	*199*
Tlacuachero[c]	1 + ~4[d]	0	12	2	0	2	*123*
El Varal:[e]							
Early shell phase	15	4	17	3	7	7	*104*
Middle shell phase	14	5	16	4	9	5	*114*
Late shell phase	27	4	16	2	5	1	*73*
Paso de la Amada:[f]							
Lot 11	~10	3	16	7	13	9	*135*
Unsystematic			16	12	21	15	*199*
Aquiles Serdán[g]	Unknown	Unknown	5	8	13	9	*327+*

a. Focus on the genus level helps to even out some of the differences of reporting among investigators. Taxa above the genus level were included where the bone(s) in question had to be from a genus other than those identified and original investigators had assigned an MNI value.
b. Sample size (MNI) of vertebrate remains only.
c. From Voorhies (2004:147, and Tables 3.2 and 3.3) and Wake et al. (2004:Tables 4.1 and 4.8). This last table has formatting errors in Lesure's copy of Voorhies 2004. He has inferred actual MNIs based on column totals.
d. The better value for comparison here is 1. Virtually all of a vast number of shells were from a single taxon (*Polymesoda radiata*). A few other taxa were identified in minuscule numbers (Voorhies 2004:Table 2.2).
e. From Tables 5.5, 6.3, and 7.3.
f. From Tables 6.7 and 15.1. The nature of the two samples is described there. For notes on mollusks and crabs, see Table 15.2. For birds, see the methods section of this chapter.
g. From Blake et al. (1992:Tables 1 and 2). See also Table 15.1. For notes on mollusks and crabs, see Table 15.2.

high of 1,080 specimens/m^3. Vertebrate faunal remains are neither overabundant nor scarce at El Varal in comparison with Archaic estuary sites or inland Early Formative sites.

The spectrum of resources in modest densities would seem to raise the possibility that the subsistence remains recovered from El Varal include no debris from bulk harvesting but instead represent remains of meals eaten by occupants. Plausibly, then, the occupants provisioned themselves with animal foods through what were essentially foraging strategies—potentially while occupying the site for some other purpose (such as producing salt). Such an argument could be extended to the non-mollusk remains from the Archaic shell mounds, although it should first be borne in mind that crabs were clearly more important at El Varal than at the earlier shell mounds (even when all mollusks are removed from the picture) and second that Voorhies (2004:408–409)

thinks fish might have been harvested at the Archaic sites for transfer to inland residential bases.

It is important, though, not to hastily dismiss the Varal fauna. If the vertebrate remains of both Varal and the Archaic shell mounds derive from low-level foraging by temporary occupants primarily engaged in some *other* economic activity, we might expect those assemblages to have the same character—one that in addition should diverge from the character of fauna from residential bases. Further consideration of diversity among the vertebrate remains suggests that the Varal assemblage instead diverges in significant ways from the Archaic assemblages and aligns itself with the other Early Formative sites.

The relevant analysis is presented in Figure 15.1. We have calculated Simpson's diversity measure (D)[1] for the top-10-ranked taxa (based on MNI at the genus level, except with Ariidae and Eleotridae—considered single taxa to allow use of the data from Campón, Tlacuachero, and Zapotillo (Wake, Anikouchine, and Voorhies 2004:Table 4.8). By looking at evenness of spread among the top 10 taxa rather than overall diversity, we were hoping to focus on the most significant taxa as well as avoid the sample size effects that plague diversity measures. To assess the possible effects of sample size, we follow Thomas (1989) in plotting diversity against the logarithm of sample size and inspecting the results for lines of points radiating from the origin.

The results, which seem unaffected by sample size, reveal distinctly higher evenness among the 10 highest-ranked taxa at the Archaic sites. Varal falls with the other (dish-dominant) Early Formative cases. We would propose that the Early Formative villagers were using different strategies to procure vertebrate fauna than their Archaic predecessors (we might speak more specifically of strategies for procuring *fish*, because that class dominates the top 10 taxa in each case). The Early Formative strategies involved focus on a few taxa, resulting in more clumping of specimens.

Given Figure 15.1, it would appear unwise to dismiss the Varal vertebrate fauna as simply the result of low-level provisioning by task-group members. For one thing, if we were to do so we would raise the issue of whether the inland vertebrate remains should be similarly categorized. In that Figure 15.1 establishes a general similarity of the Early Formative assemblages in contrast with those of the known Archaic sites, it seems appropriate at this point to delve further into a comparison of the three Formative cases—considering them further in relation to a foraging/collecting continuum.

Hunting and Fishing in the Early Formative: Foraging Versus Collecting

Tables 15.2 and 15.3 arguably provide some evidence for the idea that the faunal assemblages of Paso de la Amada and Aquiles Serdán result from the pooling of animals caught in a variety of habitats and brought to the residential base for consumption. Terrestrial animals are more important and more diverse at the dish-dominant sites. Greater diversity is the type of pattern we might expect of a residential base, but we must use caution here. In a foraging model, we expect the range of animals consumed at any site to reflect those habitats most immediately available from that site. That could actually be a more straightforward interpretation of the greater frequency and diversity of reptiles, amphibians, birds, and mammals at the inland sites of Paso de la Amada and Aquiles Serdán in comparison to El Varal.

This simpler alternative is reinforced by Table 15.4, which breaks down the birds of El Varal and Paso de la Amada into aquatic and terrestrial taxa (Steadman et al. 2003:Table 1). Birds from the estuary site are mainly aquatic, whereas those from Paso are mainly

Table 15.4. Aquatic versus terrestrial birds at an estuary site (El Varal) and an inland site (Paso de la Amada)

	El Varal		Paso de la Amada Lot 11		Paso de la Amada Unsystematic	
Habitat	NISP	%	NISP	%	NISP	%
Terrestrial	5	17.2	16	84.2	127	69.5
Aquatic	29	82.8	3	15.8	35	30.5

1. Simpson's diversity measure [described by Pielou (1969:223–224)] is calculated as follows. Suppose we have N individuals (or observed specimens), classified into C different taxa. The number of specimens in the *j*th taxon is designated N_j (j = 1, 2,..., C; $\sum_j N_j = N$). If we pick two specimens at random without replacement from N, the probability that they will be of the same taxon is $\sum_j [N_j(N_j - 1)]/[N(N - 1)]$. When that probability is high, the diversity of the collection is low—and thus we can define the diversity measure, D, as:

$$D = 1 - \sum_j \frac{N_j(N_j - 1)}{N(N - 1)}.$$

D can vary from 0 to 1. The minimum possible diversity of 0 corresponds to the case in which all specimens are assigned to the same taxon, whereas the maximum diversity of 1 would be the case in which each specimen is from a different taxon.

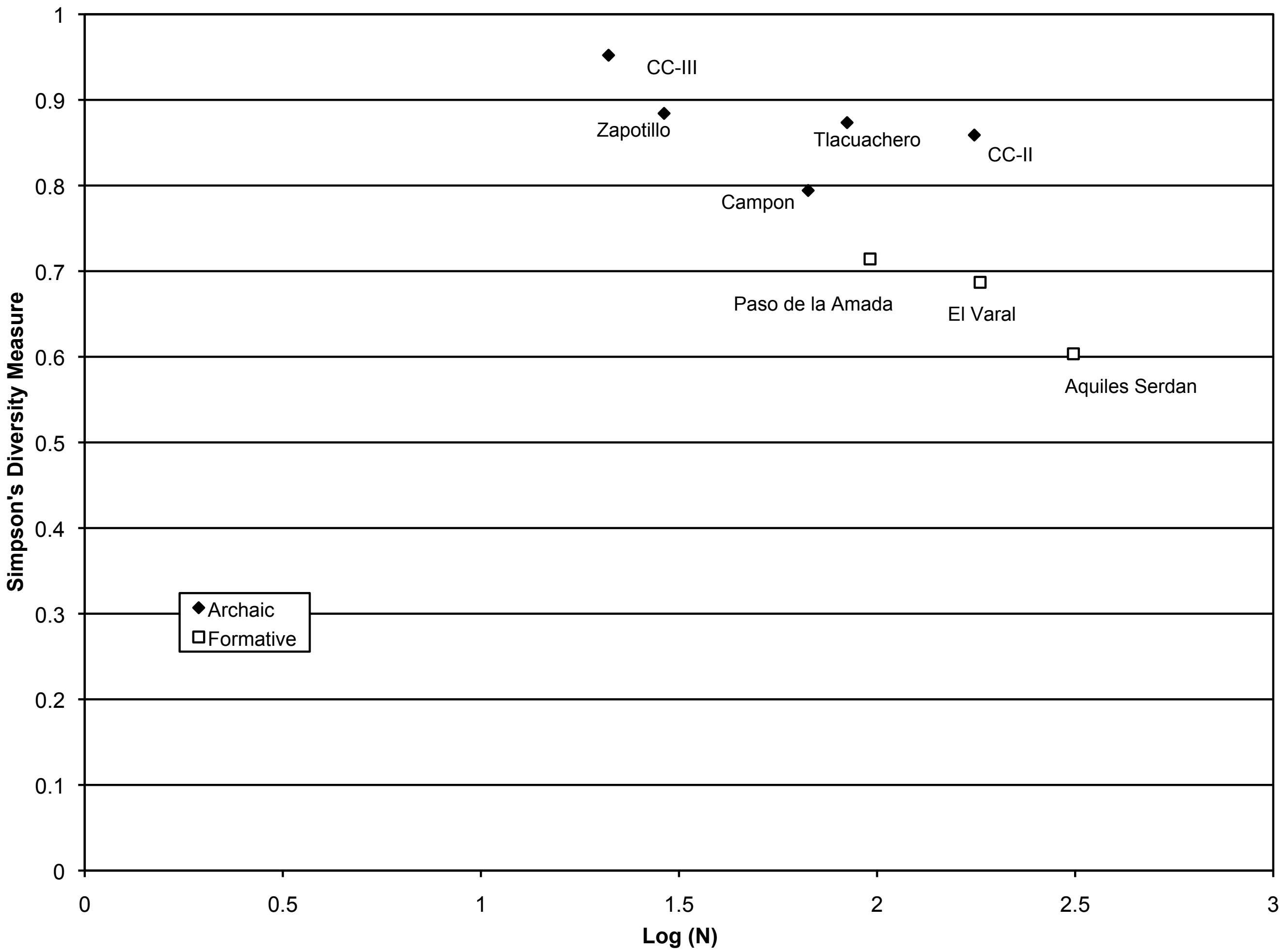


Figure 15.1. Simpson's diversity measure for the top-10-ranked taxa plotted against the logarithm of sample size. Diversity calculations based on MNI at the genus level—except for Ariidae and Eleotridae, each considered a single taxon to allow use of the data from Campón, Tlacuachero, and Zapotillo (Wake, Anikouchine, and Voorhies 2004:Table 4.8).

terrestrial. Still, hunting of birds seems to have been very much a sideline for inhabitants of both sites. There is considerable diversity but relatively few specimens in any category.

Fish predominate at all three sites, and Figure 15.1 suggests that the occupants may have shared fishing strategies that in turn contrasted with those of Archaic visitors to the estuaries. The patterns of distribution of fish among the three sites warrant a closer look. Again, we are drawing here on Binford's (1983) distinction between foraging and collecting strategies—although we have pointed out that a foraging outcome could point either to task-group provisioning or to subsistence-oriented seasonal mobility. Either way, foraging would have involved collection of food in the vicinity of the site and immediate consumption without much movement of food items between sites. In the contrasting collecting model, task groups from dish-dominant sites would use tecomate-dominant sites as field camps for the collection of estuary resources—which would then be transported back to the home base.

Archaeological expectations of foraging are that the faunal remains of each site would derive from habitats in the vicinity of the site. Fauna found at the different sites would overlap only to the extent that there was redundancy of habitats in their respective catchments. We refer to a pattern of this type as a "foraging signature." In the collecting model, dish-dominant sites would be permanent residential bases—and tecomate-dominant sites temporary bases for task-specific extraction activities. The former sites should include remains of fauna from a range of microhabitats, whereas the latter should include only habitats within the immediate site catchment. A characteristic "collecting signature" would be the presence at dish-dominant

(but not tecomate-dominant) sites of species from disparate habitats beyond those in the immediate vicinity of the sites. The fauna should also be more diverse at dish-dominant sites. Finally, as suggested above the assemblages at tecomate-dominant field camps should generally be a subset of those at dish-dominant sites. Deviations from that pattern might constitute a foraging signature, although as noted previously processing at a field station could leave behind remains (such as mollusk shells) that would then not appear in the assemblage of the residential base.

Hypothetical catchments for the three sites are mapped in Figure 15.2 as circles with a 5-km radius and are classified in Table 15.5 according to 10 simplified habitats focused on aquatic resources. The 5-km radius probably underestimates the potential range for the occupants of each site. This is intentional.

Table 15.5. Habitats within 2-km catchment (2) and 5-km catchment (5) of the three sites[a]

Habitat	Code	El Varal	Paso de la Amada	Aquiles Serdán
Ocean beach	B	5		
Marine/estuary mouth	M	5		
Lower estuary (close to mouth)	LE	2		
Coatán River	R	5	5	
Upper estuary (far from mouth)[b]	UE	5	2	
Lagoon	L	2		
Hueyate Swamp	SW			5
Pampa[c]	P	2	5	2
Savannas, cleared fields	SV	5	2	2
Forest	F		5	2

a. Codes are used in Tables 15.8 and 15.10.
b. Defined as including, in the rainy season, inundated abandoned river courses fingering into savanna and forest.
c. Dry season only. Rainy-season pampa areas included with swamp or upper estuary, as appropriate.

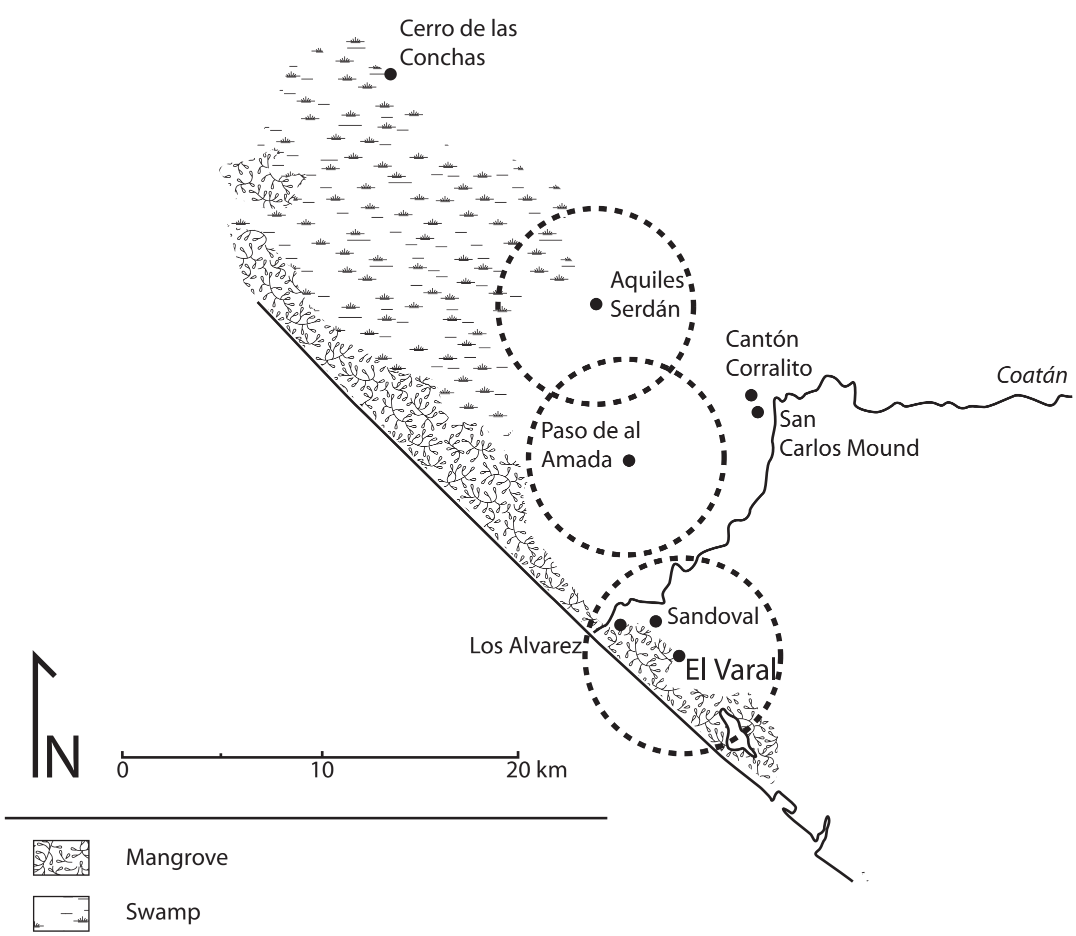


Figure 15.2. Location of El Varal, Paso de la Amada, and Aquiles Serdán—with catchment circles of 5 km in radius.

Table 15.6. Most important fish at the three sites, ranked by MNI (with data on habitat)[a]

Rank	Taxon	M	Br	FW	Environment Comments	MNI	NISP
	El Varal:						
1	Ariidae	x	x	x	Mainly marine-brackish	102	447
2	*Centropomus* sp.	x	x	x	Estuaries, lagoons	33	57
3	*Lutjanus* sp.	x	x		Marine, tolerates brackish	17	51
4	*Batrachoides waltersi*	x	x	x	Common in bays, tolerates freshwater	13	17
5	*Eleotris* sp.		x	x	Mainly freshwater	9	17
	Paso de la Amada:						
1	Ariidae	x	x	x	Mainly marine-brackish	47	994
2	*Dormitator latifrons*	x	x	x	Mainly freshwater, tolerates marine	19	57
3	*Cichlasoma* sp.			x	Freshwater	7	44
4	*Lutjanus* sp.	x	x		Marine, tolerates brackish	4	32
5	*Centropomus* sp.	x	x	x	Estuaries, lagoons	4	35
	Aquiles Serdán:						
1	*Cichlasoma* sp.			x	Freshwater	171	
2	Ariidae (*Sciades* sp.)	x	x	x	Mainly marine-brackish	97	
3	*Atractosteus tropicus*			x	Freshwater, rivers and lakes	15	
4	*Lutjanus* sp.	x	x		Marine, tolerates brackish	3	

a. M = marine habitats; Br = brackish water habitats; FW = freshwater habitats. Habitat information (including comments on environment) from *fishbase.com* (Froese and Pauly 2000, consulted May of 2008).

Although we cannot prove that animals deriving from distances of greater than 5 km were harvested with a collecting (as opposed to foraging) strategy, the claim at least starts to sound plausible at such distances. The catchment of El Varal was lower estuary and lagoon in focus, with the beach, the marine estuary mouth, and the lower Coatán River included in a 5-km radius. Also accessible were seasonally inundated pampa and savanna lands that would have supported a variety of terrestrial species (and potentially cultivated fields) in the dry season. We would expect an emphasis on fish species of the lower estuary—generally those oriented toward more saline habitats.

Aquiles Serdán, by contrast, is located inland some 8 km from the estuary but within 3 km of Hueyate Swamp. Its tell-like structure contrasts with the more extensive settlement at Paso de la Amada and may indicate that it was more closely surrounded by wetlands in the past. The aquatic fauna in its immediate catchment would have included freshwater species of the swamp. Even in rainy-season conditions, the upper estuary was probably beyond its 5-km catchment.

Paso de la Amada lies in the Coatán delta, some 7 km from the ocean. It is 7+ km from the swamp and 5+ km from the modern estuary. Still, the site is located beside an abandoned river course that even today fills with water in the rainy season. Residents report that prior to concerted drainage operations in the mid to late twentieth century it was possible to fish in the area during the rainy season. It is likely that the Early Formative residents of Paso de la Amada had direct access to the upper estuary system within the immediate vicinity of the site, at least during the rainy season. We would thus expect an aquatic fauna, with salinity preferences intermediate between the lower-estuary focus of El Varal and the freshwater-swamp focus of Aquiles Serdán.

The results of a closer scrutiny of the fish are complex, with both foraging and collecting signatures detectable. An introduction is provided by Table 15.6, which presents the rank order (by MNI) of the most important identified fish genera at the three sites. We provide also NISP for Paso de la Amada and El Varal. The pictures provided by the two measures, NISP and MNI, are very consistent as long as the chaos of sea catfish is pooled as simply Ariidae.

Table 15.6 also includes assessments of the appearance of the different taxa in marine, brackish, and freshwater habitats as well as further notes on environmental preferences of the different fish. That information was obtained online at *fishbase.com* [Froese and Pauly (2000), consulted May of 2008]. Given that many of our identifications are to genus rather than species, we have tried to summarize habitat information generally characteristic of the probable range of species that may have been present at El Varal. There are differences within genera ignored in our table.

In the collecting model, we would expect the fish fauna of the dish-dominant sites to derive from multiple locations—potentially river, lagoon, upper estuary, lower estuary, and ocean. If inhabitants were instead

Table 15.7. Most important fish recovered on Wake and Lesure's 1997 fishing trip to the Hueyate Swamp (with data on habitat)[a]

Rank	Taxon	M	Br	FW	Environment Comments	N
1	*Amphilophus macracanthus*			x	Freshwater	63
2	*Cichlasoma trimaculatum*			x	Freshwater	56
3	*Dormitator latifrons*	x	x	x	Mainly freshwater, tolerates marine	30
4/5	*Atractosteus tropicus*			x	Freshwater, rivers and lakes	1
4/5	*Cichlasoma* sp.			x	Freshwater	1

a. M = marine habitats; Br = brackish water habitats; FW = freshwater habitats. Habitat information (including comments on environment) from *fishbase.com* (Froese and Pauly 2000, consulted May of 2008).

Table 15.8. Fish taxa at Paso de la Amada and Aquiles Serdán, probably from beyond the sites' 5-km catchments (with habitat information)

Common Name	Scientific Name	NISP	MNI	M	B	LE	L	R	UE	SW	P	SV	F
Paso de la Amada:													
Comminate sea catfish	*Sciades platypogon*	8	4	x		x	x						
Corvina	*Micropogonias* sp.	2	1	x		x	x						
Croakers	Sciaenidae	1		x		x	x						
Pufferfish	*Sphoeroides* sp.	1	1	x		x	?		?				
Aquiles Serdán:													
Sea catfish	*Sciades* sp.		97	x		x	x	?	?	?			
Parrotfish	Scaridae		1	x									

simply foraging in the immediate vicinity of their places of residence, we would expect a gradation of preferred salinity among the fishes represented from most saline (El Varal) to least saline (Aquiles Serdán)—with Paso de la Amada expected to fall between the two. Limited empirical support for this claim is provided by Table 15.7, which reports the results of a fishing expedition to Hueyate Swamp we undertook with some of our workmen from the area in 1997.

Freshwater species, particularly cichlids, predominated. The single species of marine origin (*D. latifrons*) is one regularly encountered in freshwater (Cooke et al. 2004:266). There is no simple means of associating a given habitat or even a general level of salinity with a particular fish species because many shift among habitats on a regular basis or over the course of their lives. Still, Table 15.7 provides some basis for expecting a certain coherence to the habitat preferences of species deriving from any given location. More specifically, it provides baseline expectations for the ancient fauna of Aquiles Serdán given localized foraging only. For foraging, we would expect Paso de la Amada to include more brackish-friendly species, and El Varal mostly brackish- and marine-oriented taxa.

There would appear to be some support for both models. The top four fish at El Varal are marine and brackish in orientation, whereas the first- and third-ranked fish at Aquiles Serdán are freshwater species (Table 15.6). Overall, there is something of a gradient of decreasing salinity preferences among the top fish as one moves from Varal, to Paso, to Aquiles Serdán. Thus, the mix of top-ranked species at each site is different—and those differences seem broadly explicable with reference to the immediate catchment of each site, as expected if site inhabitants were essentially foraging for fish.

If we designate as a possible collecting signature any fish obtained farther than 5 km from a site, there are some hints of such a signature here. The observation of most interest is the high rank of sea catfish at all sites. We believe those catfish would have been unavailable in Hueyate Swamp, and thus anywhere in the vicinity of Aquiles Serdán. The full list of archaeologically recovered fish that were probably from beyond a 5-km catchment of Paso de la Amada and Aquiles Serdán is recorded in Table 15.8.

It is important to remember that other fish, particularly from Paso, could have been collected in the lower estuary or in a lagoon setting more than 5 km from the site. Still, the list in Table 15.8 seems a modest one—with marine catfish the most important taxon regularly caught at a distance and transported back to each site. In other words, although we do see a collecting signature among the fish remains it seems limited. The fish recovered from each site are dominated by species that would have been available in their immediate

Table 15.9. Two measures of diversity of fish genera at the three Early Formative sites[a]

	Diversity by MNI			Diversity by NISP		
	No. Taxa	Simpson's *D*	Total MNI	No. Taxa	Simpson's *D*	Total NISP
Tecomate-dominant:						
El Varal	23	0.75	185	23	0.49	629
Dish-dominant:						
Paso de la Amada	13	0.69	91	16	0.34	1,227
Aquiles Serdán	4	0.53	286			

a. The first measure is a simple count of the number of taxa present at the genus level (higher levels included only if Wake assigned an MNI value to the taxon in question). The second is Simpson's diversity measure, described by Pielou (1969:223–224). *D* can vary from 0 to 1. The minimum possible diversity of 0 corresponds to the case in which all specimens are assigned to the same taxon, whereas the maximum diversity of 1 would be the case in which each specimen is from a different taxon.

catchments. A foraging signature seems strong. Two further analyses help to emphasize this point

In the collecting model, we would expect a more diverse fauna at dish-dominant than at tecomate-dominant sites (although it is important to bear in mind caveats concerning the possibility of archaeologically visible portions of animals left behind at processing stations). When the assemblages are compared as wholes (Table 15.3), the greater diversity of nonaquatic fauna at dish-dominant sites is evident. When we focus in on just the fish, however, our supposed field camp (El Varal) is more diverse than the residential bases (Paso and Aquiles Serdán). The relevant analysis is provided in Table 15.9. We consider two measures of diversity at the genus level: a simple count of the number of taxa represented and Simpson's diversity measure (D). We also try MNI and NISP as a basis for measuring diversity. El Varal is most diverse in both cases.

In the collecting model, the fauna at residential bases are expected to be diverse because foods are transported there from a variety of locations. The taxa identified at any particular field camp should thus be a subset of those recovered from the residential base. Table 15.9 raises doubts about whether that will be the case for our tecomate-dominant and dish-dominant sites. The issue is explored further in Table 15.10, where the Varal fauna are divided according to whether they were identified at both Varal and Paso or only at Varal.

Our best effort at characterizing the habitat ranges of each taxon [based in large part on Cooke et al. (2004:Table 5.6)] is provided in the 10 columns at right using the letter designations from Table 15.5. The column labeled ">5 km" records taxa identified at El Varal that were probably not available in the immediate catchment (within 5 km) of Paso de la Amada. Of the Varal MNIs, 75 percent fall into taxa shared with the inland site and 25 percent are from taxa identified only at El Varal. Among the shared taxa, only 4 percent would have been out of the catchment of Paso de la Amada. In contrast, of the total MNI of 53 for taxa identified only at Varal 61 percent would have been out of the catchment of the inland site. The latter include one of the top five fish genera from El Varal (*Batrachoides waltersi*) and three other reasonably important taxa (*Eleotris picta*, *Diapterus* sp., and *Caranx* sp.). The shared taxa that were out of range for Paso (Sciaenidae and Cheloniidae) seem to have been of minor importance to the diet at El Varal and at Paso.

These patterns are all suggestive of what we are referring to as a foraging rather than collecting signature. If the inhabitants of Paso maintained a station such as El Varal for the logistical harvesting of estuary resources, we would expect to have identified taxa such as *B. waltersi*, *E. picta*, *Diapterus* sp., and *Caranx* sp. at the inland site.

Caution is certainly in order here. The marine catfish *Sciades platypogon* was reasonably important at Paso, but it seems on the basis of information in Cooke et al. (2004:Table 5.6 and online "Fishbase") to be a species that prefers high salinity, is not well adapted to variations in salinity, and is only an occasional visitor to lagoons and estuaries. Its absence at El Varal is perhaps surprising and reminds us that our sample sizes are not huge. It is perhaps wise to be cautious in how much we make of the lack of *B. waltersi*, *E. picta*, *Diapterus* sp., and *Caranx* sp. at Paso de la Amada. We propose nevertheless to take seriously the evidence as it stands and let future investigators prove us wrong.

We have provided two possible explanations for a foraging signature in the distribution of fauna. The first posits that entire consumption units from dish-dominant sites moved temporarily to tecomate-dominant sites during some part of the dry season, fished in the vicinity, and ate what they caught there (subsistence-oriented seasonal mobility). The second posits that our evidence from El Varal derives from

Table 15.10. El Varal fauna, divided into taxa also identified at Paso de la Amada ("shared") and those only identified at Varal (with habitat information)

Common Name	Scientific Name	>5 km[a]	% NISP	% MNI	M	B	LE	L	R	UE	SW	P	SV	F
Shared Taxa:[b]														
Tropical gar	*Atractosteus tropicus*		0.05	0.34					x	x	x			
Chili sea catfish	*Sciades troscheli*		0.32	1.02	x		x	x		x				
Sea catfish	*Sciades* sp.		1.93	7.19	x		x	x	?	?	?			
Sea catfishes	Ariidae		21.09	24.32										
Snook	*Centropomus* sp.		3.05	11.30	x		x	x	x	x	x			
Freshwater mojarra	*Cichlasoma* sp.		0.05	0.34				x	x	x	x			
Pacific fat sleeper	*Dormitator latifrons*		0.11	0.68	?		?	x	x	x	x			
Yellow-fin mojarra	*Gerres cinereus*		0.21	1.02	x		x	x	x	x				
Marine mojarras	Gerreidae		0.05	0.34										
Big-spine grunt	*Pomadasys macracanthus*		0.37	1.71	x		x	x	x	x				
Grunt	*Pomadasys* sp.		0.11	0.68	x		?	?	?	?				
Grunts	Haemulidae		0.43	0.68										
Snapper	*Lutjanus* sp.		2.73	5.82	x		x	?	?	x				
Mullet	*Mugil* sp.		0.43	1.37	x		x	x	?	?				
Croakers	Sciaenidae	*	0.11	0.68	x		x	x						
Toad	*Bufo* sp.		0.05	0.34										
Green iguana	*Iguana iguana*		0.16	1.03			x			x		x		
Black iguana	*Ctenosaura similis*		0.05	0.34			x			x		x		
Iguana	*Iguana/Ctenosaura*		0.21	1.37			x			x		x		
Green sea turtle	*Chelonia agassizi*	*	0.11	0.68		x								
Sea turtles	Cheloniidae	*	0.37	1.71		x								
Mud turtle	*Kinosternon scorpioides*		0.05	0.34							x			
Pied-billed grebe	*Podilymbus podiceps*		0.05	0.34			x	x	x	x	x			
Brown pelican	*Pelecanus occidentalis*		0.05	0.34	x	x	x	x						
Neotrop. cormorant	*Phalacrocorax brasilianus*		0.05	0.34		x	x	x	x	?	x			
	Egretta sp.		0.32	1.71			x	x		x	x			
Crested caracara	*Polyborus plancus*		0.16	0.68		?	x			x		x	x	x
White-bellied chachalaca	*Ortalis leucogastra*		0.05	0.34								x	x	x
Mourning dove	*Zenaida macroura*		0.05	0.34								x	x	x
Nine-banded armadillo	*Dasypus novemcinctus*		0.11	0.68								x	x	
White-tailed deer	*Odocoileus virginianus*		0.59	1.71								x	x	x
Collared peccary	*Tayassu tajacu*		0.05	0.34								x	x	x
Cottontail rabbit	*Sylvilagus floridanus*		0.43	2.40										
Mice	Cricetidae		0.16	1.03								x	x	
Giant pocket gopher	*Orthogeomys grandis*		0.27	1.71								x	x	
Taxa only at El Varal:														
Sharks	Carcharhinidae	*	0.11	0.34	x		?							
Chihuil sea catfish	cf. *Bagre panamensis*		0.05	0.34	x		x	x	x	x				
Blue sea catfish	*Sciades guatemalensis*		0.16	0.68	x		x	x	x	x	x			
Blue sea catfish	cf. *S. guatemalensis*		0.32	1.37	x		x	x	x	x	x			
Walter's toadfish	*Batrachoides waltersi*	*	0.75	3.42	x		x	x						
Toadfish	*Batrachoides* sp.	*	0.16	1.03	x		x	x						

Table 15.10. *(continued)*

Common Name	Scientific Name	>5 km[a]	% NISP	% MNI	M	B	LE	L	R	UE	SW	P	SV	F
Needlefish	*Strongylura* sp.	*	0.05	0.34	x		x	x						
Jack	*Caranx* sp.	*	0.21	1.37	x		x	?		?				
Pacific bumper	*Chloroscombrus orqueta*		0.05	0.34	x		x	x	x	x				
Leatherjack	*Oligoplites* sp.		0.11	0.34	x		x	x	x	x				
Pompano	*Trachinotus* sp.		0.21	0.68	x		x	x	x	?				
Spotted sleeper	*Eleotris picta*		0.75	2.05	?		?	x	x	x	x			
Sleeper	*Eleotris* sp.		0.16	1.03	?		?	x	x	x	x			
Marine mojarra	*Diapterus* sp.	*	0.32	1.71	x		x	x	?	?				
Grunt	*Haemulopsis* sp.	*	0.05	0.34	x		?	?		?				
Sea chub	*Kyphosus* cf. *K. elegans*	*	0.11	0.34	x		?	?						
Weakfish	*Cynoscion* sp.	*	0.32	0.68	x		?	?						
Mackerels	Scombridae	*	0.05	0.34	x		?	?						
Marine toad	*Bufo marinus*		0.11	0.34										
Yellow-crowned night heron	*Nyctanassa violacea*	*	0.16	1.03			x	x			?			
American coot	*Fulica americana*		0.11	0.68			x	x	x	x	x	x		
Semipalmated plover	*Charadrius semipalmatus*		0.05	0.34		x	x	x	x	?	?			
Black-necked stilt	*Himantopus mexicanus*	*	0.05	0.34			x	x						
Marbled godwit	*Limosa fedoa*		0.05	0.34			x	x		?	?			
Whimbrel	*Numenius phaeopus*	*	0.05	0.34		x	x	x						
Willet	*Catoptrophorus semipalmatus*	*	0.21	1.37		x	x	x						
Sandwich tern	*Sterna sandvicensis*	*	0.11	0.68		x	x	x						
Dolphin	Delphinidae	*	0.11	0.68	x		?							
Cotton rat	*Sigmodon hispidus*		0.16	0.68								x	x	

a. Taxa probably from outside a 5-km catchment of Paso de la Amada.
b. Taxa identified at El Varal and Paso de la Amada, at Aquiles Serdán, or both.

the meals of site occupants—the produce of localized foraging that harvested species not targeted for consumption by the larger group (task-group provisioning). To these we might add the possibility that fish was processed in some way that removed certain categories of evidence from the archaeological record of the inland sites. We will review available evidence bearing on this last possibility and consider briefly the seasonal mobility model before summing up the implications for intersite variability among the faunal remains.

Fish as Product

The marine catfish identified at Aquiles Serdán and Paso de la Amada could have been caught in the vicinity of El Varal. However, it would have spoiled quickly in the tropical climate. Processing at a field camp such as El Varal would have been unnecessary. The most reasonable thing to do would have been to transport the fish back directly to the permanent habitation site.

Smith's (1997) "gefilte fish" hypothesis (Chapter 1) has the advantage of accounting for the tecomates at El Varal and for the removal of bones from the archaeological record. Still, the purpose such processing would have served is unclear. We have found little ethnographic reference to the processing of fish in such a way. Beyond gefilte fish, there is the Roman fish sauce garum. Plausibly, then, the seasonal occupants of El Varal manufactured a boiled fish product that would have survived short-term storage. We are skeptical, however.

Drying of fish appears to have been more prevalent worldwide, and it was conducted in the Pacific estuaries of Mexico during the twentieth century—where the practice was to split the fish open and lightly salt and sun dry it. Lindner (1944) specifically mentions

drying for mullet (*Mugil* sp.; total catch of 3,000,000 lb. recorded for 1941), milkfish (*Chanos Chanos*; 1,000,000 lb.), snook (*Centropomus* sp.; 1,000,000 lb.), mojarras (Gerridae; 75,000 lb.), and marine catfish (Ariidae; 55,000 lb.). The inhabitants of tecomate-dominant sites could have dried fish, and such a practice could well have required salt.

Both wet and dry methods of converting fish into some type of storable product might leave little trace in the archaeologically recoverable faunal assemblage. A bone-incorporating product such as gefilte fish would be particularly difficult to identify. Voorhies (2004:408–409) notes that drying practices conducted today in coastal Oaxaca would leave little trace at the processing site because bones are left in. Kennett et al. (2006), however, raise the possibility that heads might have been removed prior to drying and recommend investigation of that possibility.

It is useless to belabor a lack of evidence. One thing we can do is inspect the El Varal and Paso assemblages in greater detail, looking for any hint of differential preparation and processing. At this level of detail, there is significant "noise" from the different taphonomies of the analyzed assemblages. The Paso de la Amada lot 11 assemblage comes from a rich midden quarried for platform fill in Mound 1. The bones are significantly more fragmentary than those of El Varal, where accumulation of deposits rapidly sealed secondary refuse. Still, our assessment is that the fish assemblages seem to have been generated by essentially similar processing practices.

Although drying may be conducted without removal of bones, in other cases heads may be cut off or other parts removed. In Table 15.11, we compare the frequencies of identified elements of marine catfish (Ariidae) at the two sites according to skeletal regions defined by Wheeler and Jones (1989). Because we are looking for differences in element frequencies, it is certainly of interest that 29 percent of the Varal assemblage consists of *identified* cranial elements—whereas the figure for Paso is 7 percent. In addition, 10 percent of the Varal assemblage is vertebrae—whereas for Paso the figure is 14 percent. Still, our preliminary assessment is that the assemblages are probably similar—with differences largely the result of differential fragmentation and its consequences for identification. Note particularly in the Paso collection the large number of miscellaneous cranial bones and elements identified simply as bone. The former were mainly fragments of the distinctive head plate of the marine catfish.

Table 15.11. Comparison of skeletal elments among identified Ariidae remains at El Varal and Paso de la Amada

Skeletal Region/Element	El Varal	Paso de la Amada
Cranial bones:		
Neurocranium		
Basioccipital	1	5
Dermethmoid	1	
Frontal	5	3
Headplate	3	
Parasphenoid	4	
Posttemporal	24	
Prevomer		4
Supraoccipital		3
Vomer	2	1
Oromandibular		
Articular	7	21
Dentary	17	6
Premaxilla	1	
Quadrate	5	6
Hyoid		
Ceratohyal	35	
Epihyal	2	1
Hyomandibular	9	
Hypohyal	1	
Interopercular	7	
Opercular		3
Urohyal	2	
Miscellaneous cranial		
Cranial bone	7	293[a]
Near-cranial bones:[b]		
Appendicular skeleton		
Cleithrum	110	81
Coracoid		12
Pectoral spine	106	98
Supracleithrum		1
Postcranial bones:		
Vertebral column		
Vertebra	34	137
Weberian apparatus	9	
Median fins		
Dorsal pterygiophore	12	7
Dorsal spine	20	42
Pterygiophore	4	20
Miscellaneous:		
Bone	1	249
Otolith	2	1

a. Mainly fragments of neurocranial elements with granual upper surface distinctive of Ariidae.
b. Would probably have been removed with cranial bones if head was separated from body in processing.

Cranial bones (including miscellaneous) constitute 29 percent of the Varal assemblage, but 46 percent at Paso. If we include near-cranial bones that Wake feels would be removed with the head in butchery of the sea catfish (see Table 15.11), those percentages become 81 percent at Varal and 72 percent at Paso. Thus, one can find more cranial bones at Varal, more at Paso, or similar numbers at the two sites—depending on how one chooses to break down the data. The evidence as it stands does not indicate processing of fish for storage at tecomate-dominant sites.

Foraging at El Varal?

What about the possibility of entire consumption units descending on El Varal for collective fish boils? In other words, could there have been subsistence-oriented seasonal mobility in the El Varal case? Voorhies (2004:406) considered such a possibility for the Archaic shell mounds. Although she could not rule it out, she thought it was probably only an occasional practice. Products were more likely to have been moved to people than people to products. As we will see in Chapter 18, distances between residential base and field camp are less during the Early Formative than in the system postulated for the Archaic. It seems plausible that certain people could have been installed at tecomate-dominant field camps for several weeks during the dry season at the same time others commuted back and forth between that site and the permanent residential bases.

Still, the overall density of subsistence remains seems equivocal here with reference to a proposed transfer of people to product as the primary practice at El Varal. We have already noted that the volumetric densities of NISP at Varal, compared to an Archaic site (Cerro de las Conchas) and a dish-dominant Early Formative site (Paso), indicate that densities of vertebrate remains are neither superabundant nor particularly scarce at the tecomate-dominant site. Collective dry-season picnics may have been involved in the use of El Varal, but they were not the only practice associated with the site. It also seems impossible, based solely on the faunal remains, to distinguish between such subsistence-oriented seasonal mobility and an alternative of task-group provisioning. The analyses to be presented in Chapters 16 and 17 are helpful in this regard, and Lesure argues the "seasonal mobility" scenario in Chapter 18.

Conclusions

Inter-site comparisons among three Early Formative faunal assemblages and consideration of those in relation to Archaic samples suggest that dish-dominant Formative sites probably had some of the functions of residential bases in the collecting model. Foods from a variety of habitats were transported there for consumption. Thus, terrestrial animals are more diverse and abundant at dish-dominant inland sites than at their estuary counterparts. Even though it seems possible that tecomate-dominant estuary sites were field camps where task groups processed estuary foods in bulk for transfer to inland sites, we have not been able to produce much specific evidence of such activities.

Although El Varal is similar to the Archaic sites in the importance of mollusk shells, differences seem to outweigh similarities. The Early Formative site exhibits an expanded diet, and fishing practices seem to have been distinct as well—much more in line with those of its contemporaneous inland neighbors. This is important because had the Varal patterns diverged from those of the dish-dominant sites and fallen in with the Archaic field camps we might have had a clear basis for arguing that the remains constituted low-level foraging by site occupants engaged in some *other* economic activity.

Instead, the overall assemblage at Varal falls in well with the dish-dominant Early Formative sites in terms of recovery and processing. Further, a foraging signature is identifiable at all Early Formative sites: the faunal assemblages seem to a significant degree explicable with reference to the habitats immediately available to site inhabitants. In other words, a significant proportion of the animal foods consumed at dish-dominant residential bases was not brought in from outposts in the lower estuary but caught in the immediate vicinity of the inland sites.

Further, although we have argued that some foods (particularly marine catfish) were indeed harvested in the estuary and transported to inland sites the fish bone from El Varal was more diverse than the sample from Paso de la Amada—whether measured by MNI (Varal sample larger) or by NISP (Paso sample larger). That diversity primarily involved species favoring lagoons or lower estuaries, which would have been immediately available to the inhabitants of El Varal but outside a 5-km foraging radius from Paso. That finding reinforces claims for a foraging signature at the Early Formative sites and prompts us to leave open the

possibility of considerable mobility of people (rather than simply products) between estuary and inland sites. The issue of mobility is further elaborated in Chapter 18.

Acknowledgments

The research documented in this chapter was supported in part by a grant from the National Science Foundation (SBR-9730918) to Wake, a grant from the Wenner-Gren Foundation for Anthropological Research to Lesure, and Arthur and Fran Sherwood. The Paso de la Amada and El Varal vertebrate archaeofaunas were identified by Wake using the comparative osteological collections housed in the UCLA Zooarchaeology laboratory, the UCLA Department of Biology's Dickey Natural History Collection, the Los Angeles County Museum of Natural History, the U.C. Berkeley Museum of Vertebrate Zoology, and the California Academy of Sciences.

CHAPTER 16

The Manufacture and Content of Pottery Vessels in Early Formative Mazatán

DAVID M. CARBALLO, RICHARD G. LESURE, JELMER W. EERKENS, DOUGLAS J. KENNETT, STUART TYSON SMITH, HECTOR NEFF, AND MICHAEL D. GLASCOCK

The issue that unites this volume is inquiry into the social dynamics that generated tecomate-dominant and dish-dominant assemblages at contemporaneous sites a few kilometers from each other in Early Formative Mazatán. Existing interpretations of the pattern touch on many of the social transformations thought to have characterized early complex societies more generally: the adoption of sedentary lifeways, status competition and social inequality, the formation of multi-village polities, and the expansion of economic networks at the inter- and intra-community levels. Each of the chapters in this final section considers some specific dimension of the larger problem.

In this chapter, we explore two aspects of the possibility of specialized production at El Varal. Our evidence derives from chemical analyses of potsherds. Analyses included *compositional studies*—based on instrumental neutron activation analysis (INAA) and microwave digestion inductively coupled plasma mass spectrometry (MD-ICP-MS)—and *residue analysis* using gas chromatography mass spectrometry (GC-MS). These studies provide novel sources of evidence on the production, exchange, and use of ceramic vessels in late Early Formative Mazatán.

As noted in Chapter 1, when Carballo began the research reported here as his master's thesis work at UCLA (Carballo 2001) he and Lesure had great hopes that the data produced (particularly the residue analysis) would resolve the puzzle of Early Formative inter-site variability in the Mazatán region. Although those original high hopes have not been borne out, the work contributes crucial pieces of the picture built over the course of this volume that are synthesized into "concluding hypotheses" in Chapter 18.

Specifically, this chapter provides the best available evidence concerning two plausible explanations for inter-site variability in vessel forms. First, maybe tecomates dominate the assemblage at El Varal perhaps because that was where tecomates were manufactured—in a specialized productive system involving the transfer of *tecomates as products* to other sites. Second, perhaps the tecomates of El Varal were primarily used in the processing of a single primary estuary resource (Table 14.2, row 7). Alternatively, both of these hypotheses may not find supporting evidence in our study—leading us to explore other possibilities more seriously.

Sherds from several sites in the Mazatán region were included in the study, but our interpretations are primarily derived from just two: tecomate-dominant El Varal and dish-dominant Cantón Corralito (see Figure 1.1 or 15.2 for locations). Sherds from El Varal span the Early through Late periods. Cantón Corralito sherds

were from test unit 10 in the San Carlos Mound area (see Chapter 17 for further discussion of that unit).

Our sample is small, and the residue analysis was affected by degradation of fatty acids. Still, neither study yields concrete evidence for specialized production in the organizational sense. Compositional analysis produced no clear evidence for specialized production of pottery. We suggest that the bulk of the pottery assemblage (including tecomates) at dish-dominant and tecomate-dominant sites was produced at the sites themsevles. Still, pottery vessels do seem to have occasionally been transferred to the inland site from some location in the estuary near El Varal (perhaps from El Varal itself).

Residue analysis, in turn, reveals no significant differences between vessel content at tecomate-dominant and dish-dominant sites or between dishes and tecomates. Further, the content of Varal tecomates seems to have been more varied than one might have expected from a pattern of specialized production of a single estuary resource. Finally, in the methodological domain our study demonstrates how different chemical analyses can be effectively used in conjunction to address more complex topics in material-culture studies.

Early Sedentism, Social Complexity, and Economic Specialization

The primary anthropological issues of interest in this study concern the evolution and maintenance of social complexity within the context of early sedentary communities. For the purposes of this chapter, we follow an evolutionary archaeological definition of complexity: a nonprogressive multilinear quantitative measure that describes a system based on continuous degrees of differentiation and integration in its constituent parts (e.g., Kantner 2002). Our use of the term *social complexity* is intentionally broad, intended to refer to an entire spectrum of potential social dynamics rather than to isolate particular arenas of human interaction—such as political, economic, religious, or kinship relations among individuals.

The earliest deposits in the Vásquez Mound at El Varal date from some 700 years after the appearance of ceramics in the region. As is clear from Clark's efforts at unraveling Early Formative sociopolitical transformations in the area, we can expect considerable "complexity" during the Cuadros and Jocotal phases—regardless of our position on the precise nature of that complexity (Clark 1994a, 1997; Blake and Clark 1999; Clark and Pye 2000; Lesure 2000; Cheetham 2006). Could inter-site assemblage variability at El Varal be ascribed to economic specialization? Such a claim would fit comfortably with the degree of late Early Formative political centralization hypothesized by Clark.

When we began the studies reported here, previous explanations for inter-site variability—including those emerging from Lesure's (1993) and Smith's (1997) work on El Varal materials—tended to assume that Early Formative communities with tecomate-dominant assemblages were occupied year-round and were under the political sway of some larger inland community. Inhabitants of tecomate-dominant sites might plausibly have been part-time specialists, producing some estuary product or products for exchange with inland communities.

The relationship between economic specialization and social complexity has long been of interest to archaeologists (Childe 1958; Costin 1991, 2004). Sorting out the causal relationships involved can be difficult (Clark and Parry 1990). Authors are not always explicit regarding whether they are presenting evidence for economic specialization as an *indicator* or as a *cause* of increased social complexity (Chapman 1996:74), and such ambiguity leaves important questions unresolved.

Foremost among such questions are the following. Did increased economic specialization stimulate incipient social divisions based on status and occupation, necessitating increasingly complex social arrangements between individuals? Alternatively, did preexisting social divisions provide the infrastructure that permitted specialized economic activities to evolve and comprise increasingly greater proportions of an economic system? Any particular case may have involved a confluence of both factors, developing a coevolutionary trajectory with "snowball" effects that drove accelerated social change. Archaeologists investigating particular sequences may, nevertheless, be able to identify which factors were of greater relative importance for particular portions of the sequence—and that was our goal in this study.

In developing a set of hypotheses for explaining the Early Formative inter-site assemblage variation in the Mazatán area, we searched for evidence of possible specialized economic activities against null hypotheses postulating lack of economic specialization. Carballo added hypothetical scenarios not involving specialization by considering the possibilities that the following

two behaviors, or a combination of them, resulted in the pattern: residential mobility of inland populations who resided in the estuary seasonally [especially influenced by Arnold (1999)] and/or differential emphases in the material elaboration of food service [especially influenced by Clark and Blake (1994); see also Rosenswig (2007)].

Compositional Analyses

Chemical-composition studies of ceramics have been popular and productive methods for augmenting archaeological materials analyses (e.g., Neff 1992 and Tite 1999). The overwhelming majority have focused on reconstructing ancient exchange networks and interregional contacts. In this study, we applied compositional analyses to a more spatially restricted issue. Two separate analyses were conducted on the 51 sherds. First, Carballo and Kennett analyzed the samples at California State University, Long Beach (CSULB), using MD-ICP-MS following the procedures detailed by Kennett et al. (2001, 2002).

The analyses were undertaken when the CSULB laboratory methods were being developed and refined. To confirm the results of our analyses, pieces from the same samples were sent to the Missouri University Research Reactor (MURR) and analyzed by Neff and Glasscock using INAA and following MURR's well-documented procedures (Glascock 1992; Neff 2000). The pairing of these two analytical techniques allowed us to verify Carballo's (2001) interpretations derived from MD-ICP-MS alone.

Hypotheses

Lesure has discussed the puzzles of inter-site assemblage variability in Early Formative Mazatán with numerous archaeologists over the years. Many of those consulted suggested that the abundance of tecomates at El Varal might indicate that the site was used for the manufacture of that particular vessel form. Although we were always skeptical of the idea, it seemed desirable to assess it empirically rather than dismiss it out of hand. Compositional analysis of sherds from El Varal and Cantón Corralito presented an opportunity to generate relevant evidence, even if the small sample of sherds available was unlikely to allow us to derive a definitive conclusion.

Clay is reasonably abundant in the deltaic deposits of the Mazatán region. It would seem most likely that people in each community manufactured their own pots from local clays. That idea became our null hypothesis. Pots at each site should generally be more similar to each other, irrespective of vessel form, than to those of another site. They should also be similar in composition to clay samples from the vicinity of the site.

Plausibly, however, the occupants of El Varal manufactured tecomates—which they exchanged with people living inland for products (maize?) not available in the estuary. They would, in that sense, have been specialists—presumably part-time, because they also fished and foraged in the vicinity of the site. If this pattern was a general one in the area, we might expect the tecomates of dish-dominant sites to be "imports" from tecomate-dominant sites. Conceivably, the tecomates of Cantón Corralito might actually be imports from El Varal itself. However, because there were numerous sites (both dish dominant and tecomate dominant) in the region it would have been possible for the inhabitants of El Varal to have been specialized tecomate producers even if none of their products ended up at Cantón Corralito. The pattern we are looking for would thus be a divergence between the clay composition of dishes and tecomates at Cantón Corralito, with dishes similar in composition to local clay samples and tecomates diverging from such samples.

There is, of course, a third possibility. Perhaps tecomates had a secondary use (other than cooking; see Chapter 9), such as in the transport of resources harvested at El Varal. The vessels do not seem well designed for such a use. When full, they would have been quite heavy. The lack of neck would in addition have made them impossible to close. Spillage during transport would seem a problem. Still, partly filled tecomates could have been readily transported by canoe. In this scenario, some tecomates might have moved between sites without any specialized production of this vessel form. Inhabitants of both dish-dominant and tecomate-dominant sites would have manufactured a full range of vessels, but some transport vessels might have ended up inland.

Sample and Methods

The samples used in this study were acquired through excavations conducted under the aegis of the Mazatán Early Formative Project (directed by John Clark and Michael Blake) and exported to UCLA by Lesure in 1996. Fifty-one sherds were selected for compositional analyses. Although these samples originated from five sites in the Soconusco, three of the sites are poorly

represented (Paso de la Amada, *n* = 9; Aquiles Serdán, *n* = 2; and Los Alvarez, *n* = 2)—and our interpretations are based on samples from El Varal (*n* = 18) and Cantón Corralito (*n* = 20).

The samples from El Varal originated from the Step Excavation. Those from Cantón Corralito originated from unit 10 near the San Carlos Mound, excavated by Mary Pye and John Clark in 1990. The San Carlos Mound area is just across the modern highway from the main area of Cuadros-phase settlement at Cantón Corralito (Pérez Suárez 2002; Cheetham 2006). The comparison of El Varal to Cantón Corralito is one between social extremes. El Varal was a minor settlement, occupied only part of the year through most of its occupation. Cantón Corralito was a large permanent settlement near the heart of social, political, and economic power in the region.

Results

The sherd samples from El Varal and Cantón Corralito are characterized by very low chemical variability. Only a few elements—including Barium (Ba), Cesium (Cs), and Sodium (Na)—show substantial divisions between groups, and these elements fail to define completely discreet clusters (Figure 16.1). This relative ceramic homogeneity is likely due to the proximity of the two sites. Three clay samples taken by John Clark from the vicinity of El Varal, and a fourth taken from the Cantón Corralito site, do not clarify the situation because they all cluster along with the majority of the sherds from Cantón Corralito. In cases such as these, when individual element concentrations provide little information for how compositional groups are differentiated multivariate statistical methods such as principal component analysis (PCA) provide the most appropriate means of assessing the multiple axes of variability that exist in the data.

The concentrations registered through MD-ICP-MS (for 39 elements) and INAA (for 33 elements) were transformed from parts per million (ppm) into log-10 values. This step served to flatten the variability between elemental concentrations and to enable comparisons between samples on a more uniform scale. Individual elements that did not have registered concentrations for all sherd samples were discarded, leaving an overlap of 26 elements between the two methods. PCA was used to define the major compositional groupings and to evaluate which particular elements

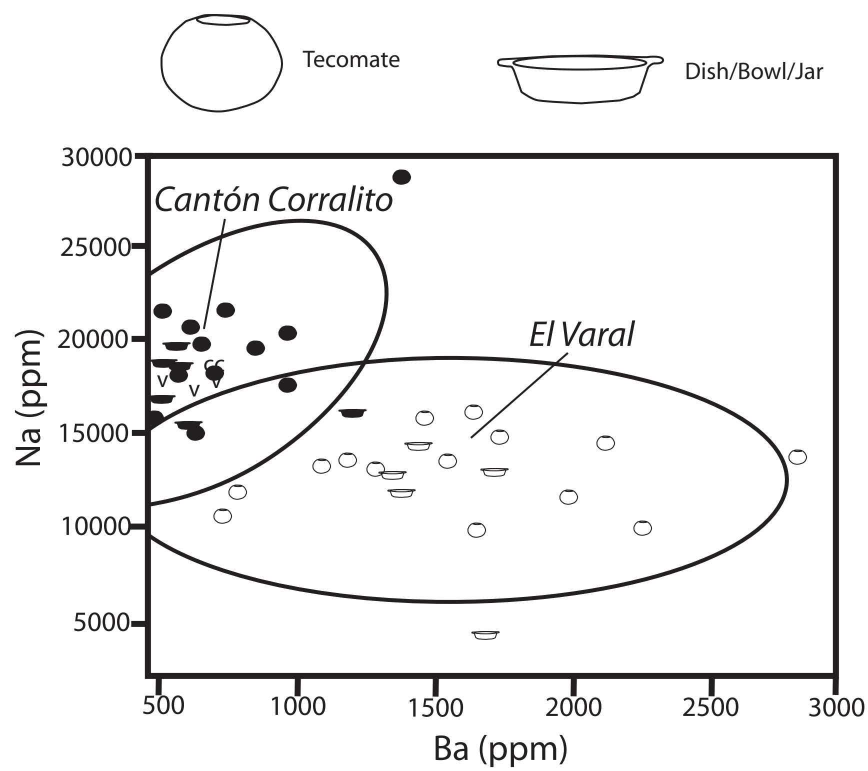


Figure 16.1. Bivariate projection of sodium and barium using INAA values in parts per million (ppm), and showing site pottery clusters within 95-percent probability ellipses for group membership. Open symbols represent samples excavated from El Varal. Those from Cantón Corralito are solid. Raw clay samples cluster with sherds from Cantón Corralito (V = Varal, CC = Cantón Corralito).

contributed the most to structuring the groups by condensing the multivariate data set into a few axes that explain most of the variability.

In both cases, outliers were identified by examining whether they lay outside a 95-percent group membership ellipse for bivariate projections of the first three principal components (PCs)—and whether their Mahalanobis distances from the group centroid were considerably higher than the next highest sample. A tecomate (20 percent higher) and a dish (100 percent higher) fit these criteria for the ICP and NAA analyses, respectively. If not due to a lab inconsistency, outliers can be interesting in compositional studies because they may represent secondary or tertiary loci of production and vessels that were exchanged to the sites being studied.

In cases where outliers are so aberrant as to be classified as their own compositional group, they should be removed to better understand the composition of the majority of the group. In comparing our two analyses we noted that the sherd identified as an outlier by NAA was identified by ICP as having potentially been produced at El Varal and transported to Cantón Corralito. Its aberrant status in both analyses could be evidence of it having come from a third site or having been moved between sites. However, the ICP outlier clusters securely within the Cantón Corralito cluster in NAA—suggesting that the sample may represent a single discrepancy between labs.

Compositional groups were assigned based on the assumption that they corresponded with the number of statistically significant PCs, or factors (Bishop and Neff 1989; Glascock 1992; Neff 1994). The number of significant PC-based compositional groupings can be determined with the Kaiser criterion (which uses all factors with eigenvalues greater than 1) or with a scree test, which charts when the number of factors reaches the point of diminishing returns in explanatory value. Whereas the Kaiser criterion may result in the selection of too many factors because a factor only has to explain its proportional share of the variability, scree tests can select too few because compositional groups exhibit significant differences that are not part of the major axes of variability in multidimensional space (Madsen 1988).

By coupling the Kaiser criterion and the scree test, one obtains an upper and lower limit for group possibilities. If adding or subtracting groups would result in differing interpretations of the data, the analyst should comment on all possibilities. Otherwise, it is more desirable to retain fewer factors that explain proportionally more of the variability. Such was the case in our analyses where three groups (explaining 70 percent of the variability) were defined for the ICP data and six groups (explaining 77 percent of the variability) were defined for the NAA data. Group membership for individual sherd samples was assigned by creating hierarchical clustering dendrograms of the significant PCs using Ward's method (Figure 16.2).

Although variability existed between the two methods in the number of groups assigned by PCA, the methods were highly consistent with each other in their assignments of sherds to the two sites. The exception to this was due to a lab inconsistency in the ICP analysis in which the first group of sherds, run on a different day than the rest, recorded lower concentrations in certain elements—causing them to cluster apart from the rest in the second PC. The lower values were clearly the result of a lab discrepancy, and because dates were recorded for the processing of the samples we were able to catch this error.

A bivariate projection of the first and third PCs for the ICP samples shows strong variability between the samples from El Varal and Cantón Corralito, as does one of the first and second PCs for the samples run by NAA (Figure 16.3). Three-dimensional projections of the first three PCs also show strong divisions, and illustrate how the ICP lab-error group clusters apart based on PCs 1 and 2. Most important, a bivariate projection of the particular elements with the greatest contribution to the division of samples by site for NAA separates the ICP lab-error group out by site as well (Figure 16.4).

By coupling the results from these two compositional methods, we are confident that the division of the ceramic samples into two groups largely corresponds to their site of origin—suggesting that occupants of both sites produced their pottery on-site, with occasional movement of pots between sites. A sherd-by-sherd summary is provided in Table 16.1.

In examining group membership, we observe that of the 19 sherds run from El Varal all have signatures consistent with on-site manufacturing of ceramics. Of an equal number of samples from Cantón Corralito, however, between three and four samples (representing 16 to 21 percent) have signatures consistent with manufacture elsewhere. It is possible that all aberrant samples from Cantón Corralito originated from El Varal (or some other nearby special-purpose site) and were transported to Cantón Corralito—or that as many as three originated from a third site.

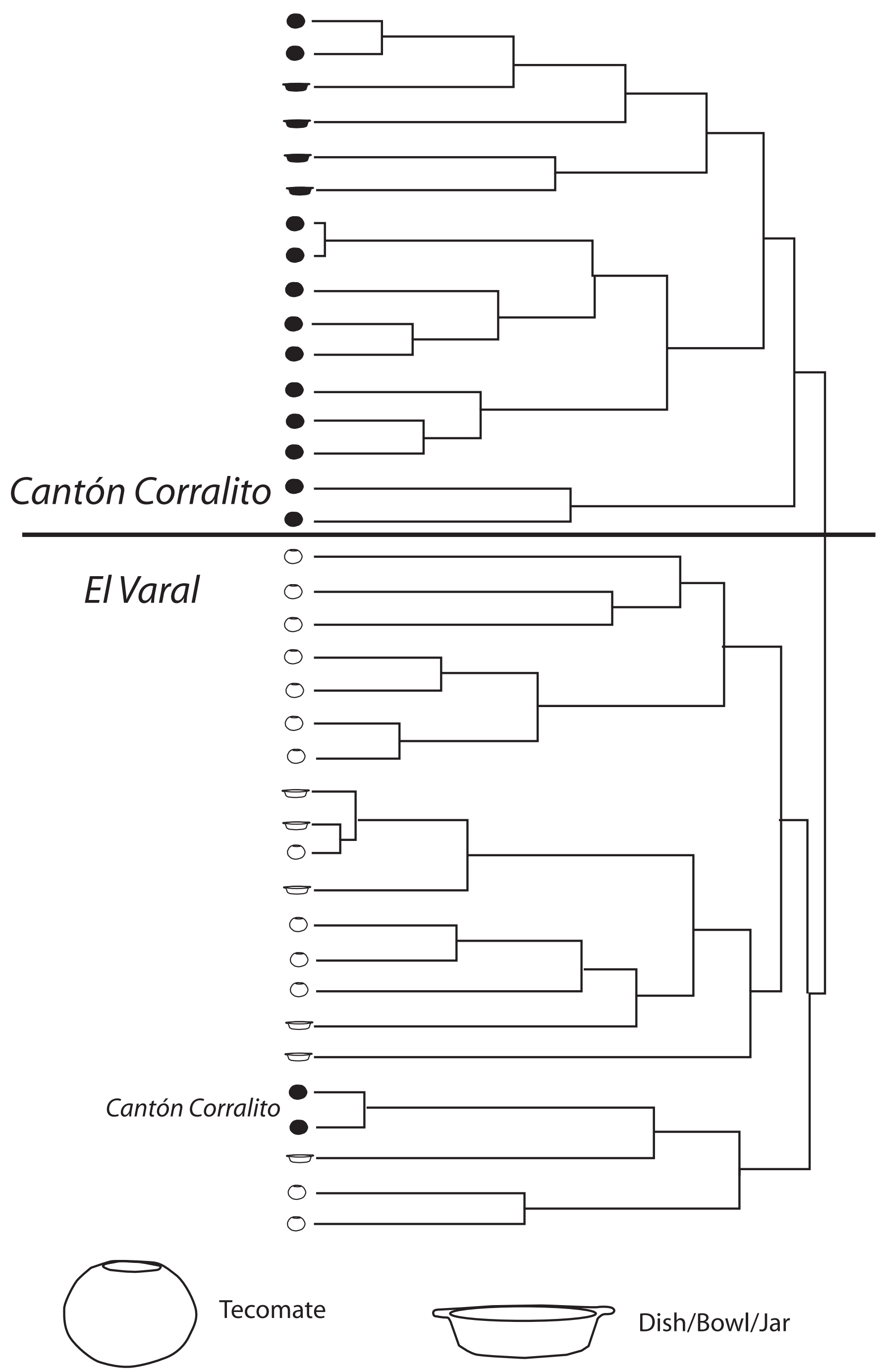


Figure 16.2. Cluster dendrograms for samples run by INAA. Open symbols represent samples excavated from El Varal. Solid symbols represent samples from Cantón Corralito.

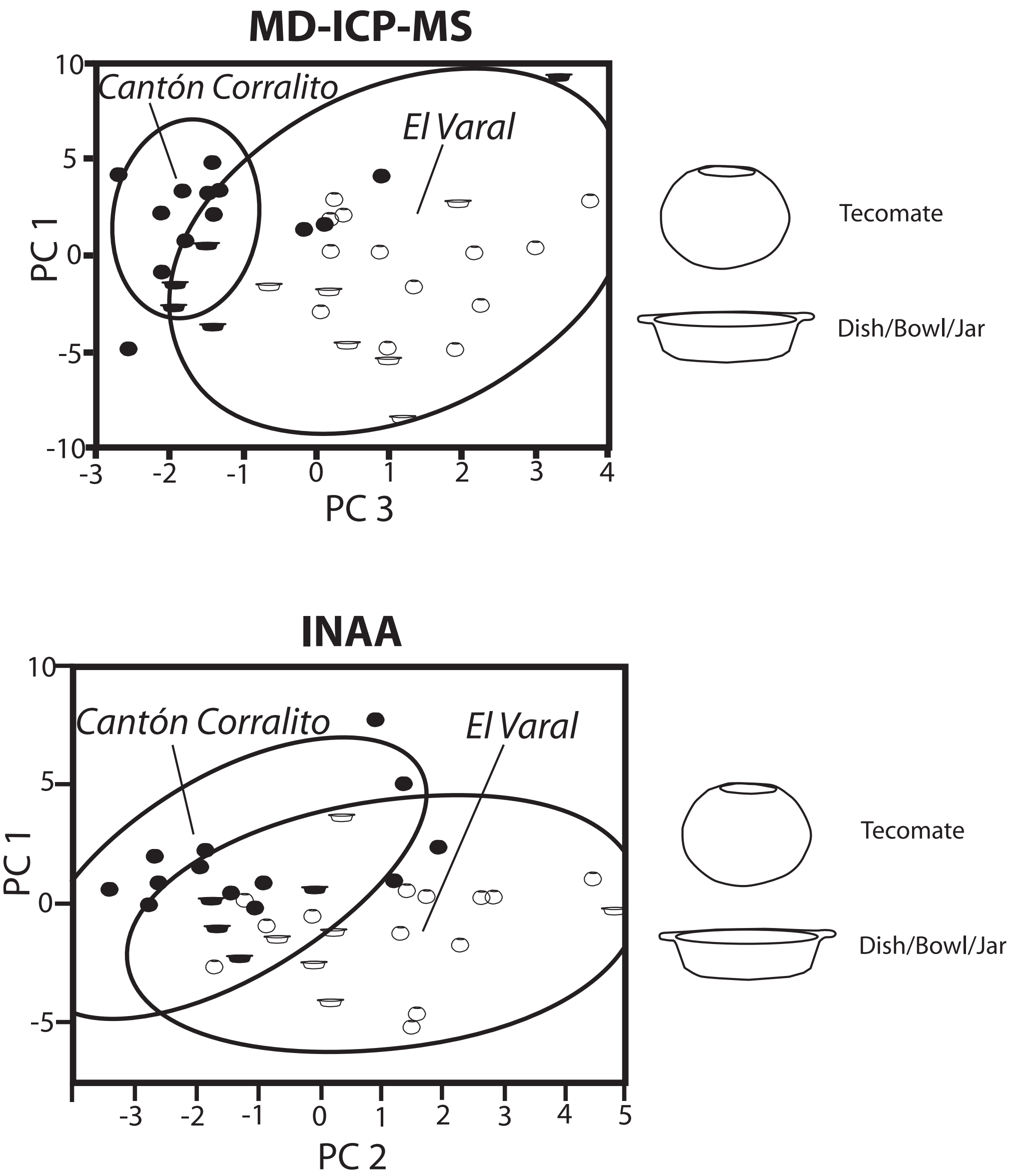


Figure 16.3. Bivariate projection of principal components for MD-ICP-MS (above) and INAA (below) showing site pottery clusters within 95-percent probability ellipses for group membership. Open symbols represent samples excavated from El Varal. Those from Cantón Corralito are indicated with solid symbols.

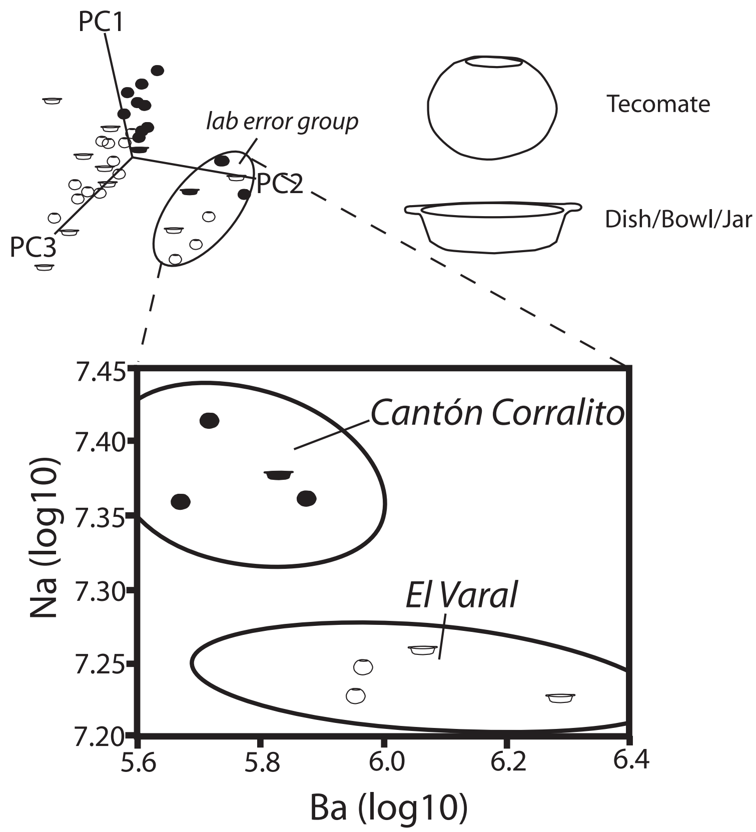


Figure 16.4. MD-ICP-MS lab-error group depicted in a spinning ("three-dimensional") plot with three principal components as axes X-Y-Z (top) and in a sodium-barium bivariate projection with 95-percent probability ellipses dividing the group by site (bottom). Open symbols represent samples excavated from El Varal. Those from Cantón Corralito are indicated with solid symbols.

The two forms of analyses can consistently support a scenario in which a thick tecomate was transported from El Varal to Cantón Corralito and a Tacaná White bowl was produced at a third site and transported to Cantón Corralito. However, they differ in the case of two Suchiate Brushed tecomates that were potentially manufactured at El Varal (and a third site) and transported to Cantón Corralito (following ICP)—an alternative being that one was manufactured at Cantón Corralito and the other made at El Varal and transported to Cantón Corralito (following NAA).

In either case, the two analyses yielded largely comparable results, with a disagreement on only one sample (designated as aberrant through ICP but not NAA) out of 38—a concordance of greater than 97 percent. They indicate that the inhabitants of El Varal produced their pottery on-site, including tecomates and serving vessels, and that vessels were neither transported to the site through exchange nor moved with residentially mobile populations who came to the estuary on a seasonal basis. Finally, the two analyses indicate that some movement of pots from the estuary to inland locations occurred during the Jocotal phase (all three of the most likely candidates for an El Varal origin were deposited in the upper stratum at San Carlos, unit 10, level 2).

Residue Analysis

The analysis of vessel residues offers archaeologists the exciting prospect of determining what foods were associated with specific pots. The technique functions on the logic that different plants and animals vary in their organic composition, and that differing organic compounds or relative concentrations of compounds can leave their traces in archaeological ceramics by being absorbed into the pores of vessel walls during cooking, storage, or consumption activities.

Such compounds are more likely to be absorbed during cooking or storage, but may also be absorbed as served food provided that contact between food and vessel is long and/or repeated enough. At the time of our study, archaeological applications of residue analysis were considerably less developed than was the case for

Table 16.1. Provenience summary for all El Varal and Cantón Corralito samples[a]

No.	Site	Lab No.	Vessel Form	Vessel Type	ICP Interpretation	NAA Interpretation
1	El Varal	B26	Pedestaled censer	Censer	Site cluster	Site cluster
2	El Varal	B22	Jar	Eroded	Site cluster	Site cluster
3	El Varal	B23	Jar	Pacaya Red	Site cluster	Site cluster
4	El Varal	B24	Jar	Pacaya Red	Site cluster	Site cluster
5	El Varal	B25	Jar	Aquiles Mottled Orange & Brown	Site cluster	Site cluster
6	El Varal	B20	Bowl	Tacaná White	Site cluster	Site cluster
7	El Varal	T38	Tecomate	Suchiate Brushed	Site cluster	Site cluster
8	El Varal	T39	Tecomate	Suchiate Brushed	Site cluster	Site cluster
9	El Varal	T40	Tecomate	Suchiate Brushed	Site cluster	Site cluster
10	El Varal	T42	Tecomate	Suchiate Brushed	Site cluster	Site cluster
11	El Varal	T41	Tecomate	Suchiate Brushed	Site cluster	Site cluster
12	El Varal	T37	Tecomate	Suchiate Brushed	Site cluster	Site cluster
13	El Varal	T34	Tecomate	Suchiate Brushed	Site cluster	Site cluster
14	El Varal	T57	Tecomate	Guamuchal Brushed	Site cluster	Site cluster
15	El Varal	T58	Tecomate	Guamuchal Brushed	Site cluster	Site cluster
16	El Varal	T59	Tecomate	Guamuchal Brushed	Site cluster	Site cluster
17	El Varal	T16	Tecomate	Mendez Red Rim	Site cluster	Site cluster
18	El Varal	T74	Tecomate	Tilapa Red-on-White	Site cluster	Site cluster
19	El Varal	T14	Tecomate	Michis Red	Site cluster	Site cluster
20	Corralito	B13	Bowl	Siltepec White	Site cluster	Site cluster
21	Corralito	B12	Bowl	Pampas Black-and-White	Site cluster	Site cluster
22	Corralito	B11	Bowl	Pampas Black-and-White	Site cluster	Site cluster
23	Corralito	B4	Bowl	Pacaya Red	Site cluster	Site cluster
24	**Corralito**	**B19**	**Bowl**	**Tacaná White**	**Produced at Varal or at a third site**	**Produced at a third site**
25	Corralito	T11	Tecomate	Michis Red	Site cluster	Site cluster
26	Corralito	T10	Tecomate	Michis Red	Site cluster	Site cluster
27	**Corralito**	**T70**	**Tecomate (thick)**	**Thick Tecomate**	**Produced at Varal or at a third site**	**Produced at Varal**
28	Corralito	T73	Tecomate	Tilapa Red-on-White	Site cluster	Site cluster
29	Corralito	T31	Tecomate	Suchiate Brushed	Site cluster	Site cluster
30	Corralito	T33	Tecomate	Suchiate Brushed	Site cluster	Site cluster
31	**Corralito**	**T26**	**Tecomate**	**Suchiate Brushed**	**Produced at Varal**	Site cluster
32	Corralito	T28	Tecomate	Suchiate Brushed	Site cluster	Site cluster
33	Corralito	T32	Tecomate	Suchiate Brushed	Site cluster	Site cluster
34	Corralito	T29	Tecomate	Suchiate Brushed	Site cluster	Site cluster
35	Corralito	T30	Tecomate	Suchiate Brushed	Site cluster	Site cluster
36	**Corralito**	**T27**	**Tecomate**	**Suchiate Brushed**	**Produced at a third site**	**Produced at Varal**
37	Corralito	T55	Tecomate	Guamuchal Brushed	Site cluster	Site cluster
38	Corralito	T56	Tecomate	Guamuchal Brushed	Site cluster	Site cluster

a. Sherds that do not cluster by site are indicated in bold.

geochemical compositional studies. Archaeologists are only recently developing measures that will standardize procedures (Bernard et al. 2007).

Under the supervision of Smith, Carballo processed the samples from El Varal and Cantón Corralito at the University of California, Santa Barbara, for lipid analysis using GC-MS. Lipids are organic compounds that are relatively insoluble in water. Lipid analyses employing GC-MS have been productive endeavors for archaeologists because of the detectability and relative stability of lipids. However, past cooking activities and postdepositional processes clearly expedite their degradation (e.g., Malainey et al. 1999b and Eerkens 2005). If relative rates of degradation are accounted for, fatty acids such as carboxylic (carbon-based) acids may be registered in the lipids of vessel residues. Our methods for detecting and comparing carboxylic acid concentrations largely mirror those of Eerkens (2005) and Malainey and associates (1999a, 1999b, 1999c).

Hypotheses

Remains of a variety of fauna were recovered from archaeological deposits at El Varal (Chapters 5 through 7). Estuary fish were apparently particularly important as a food source, along with mollusks and crabs. More rare but present were reptiles, amphibians, and terrestrial mammals. Our recovery of botanical remains was much more limited, but maize was present and we suspect that it was consumed on a regular basis (Chapter 8).

Finally, a substantial portion of the tecomates was probably used to reduce brine to salt. Because our goal was to look for the possibility of specialization in some particular resource, we chose as our null hypothesis the proposition that pots at El Varal were generalized rather than special purpose in function. In this scheme, the pottery of El Varal was used to prepare, cook, and consume all types of foods. Further, because the range of food remains at inland dish-dominant sites does not differ in any dramatic way from that of El Varal (Chapter 15) we might expect uses of pottery at Cantón Corralito that are quite similar to those at El Varal. If pots at El Varal were generalized in function, we would expect a variety of fatty acid signatures among the sherds and general overlap between Cantón Corralito and El Varal—irrespective of vessel form.

An alternative possibility (Chapter 15) is that the faunal and botanical remains recovered at El Varal are simply the extraneous food remains of site occupants whose primary purpose was specialized production of one particular food item or some other resource. There are options other than salt. Shrimp, for instance, are known to swarm during the dry season in the lagoons of the Acapetahua Estuary—and large-scale shrimp harvesting has been suggested as an activity of Archaic inhabitants of that area (Voorhies 2004:147–157). During the Varal excavations, our workmen caught shrimp in the canal flowing through the site (Figures 14.8 and 14.9).

The hypothesis to be examined through residue analysis is the idea that the occupants of El Varal were conducting large-scale harvesting and exchange of a single resource available in the lower estuary but not at sites further inland. Our emphasis is not on shrimp per se but on whether there was some *specific* resource—potentially one that left little obvious evidence in the archaeological deposits, given that the actual remains of fauna (at least) are diverse (Chapter 15).

If tecomates were an important tool in the production of such a resource, we would expect a distinct *redundancy* of fatty acid signatures among Varal tecomates. In other words, Varal tecomates should all have essentially the same signature. The specific acid ratios might also allow us to identify the resource involved. Under this hypothesis, we would expect greater variety among fatty acids identified in other vessel forms at El Varal and in all vessel forms (including tecomates) at Cantón Corralito.

Sample and Methods

All of the sherd samples from El Varal and Cantón Corralito that were part of the compositional analysis were also processed for the residue analysis. Unfortunately, fatty acid concentrations were so low in an initial set of samples run through the GC-MS that additional grinding and processing were needed. Storage of ground sherd powder for several months seems to have resulted in additional lipid degradation to practically undetectable levels.

Of the samples that were ground and immediately processed for analysis, 16 had intensities comparable to an internal standard included in each sample—allowing for evaluation free of the background noise that interferes with weak signals. Fourteen of these were from sherds that were also part of the compositional analysis, all of which clustered with their site of origin. Two dish sherds from Varal were added to the analysis.

Our procedure largely mirrored the one presented by Eerkens (2005:88). It included pulverizing the interiors of sherds and mixing the sherd powder in a 2:1

mixture composed of (respectively) chloroform and methanol so that lipids absorbed into vessel walls would be detectable. Inorganic sherd residues were removed by siphoning out the solvent and lipids before placing the samples in a vacuum centrifuge to dry. Lipids were then transformed into fatty acid methyl esters by adding methanolic HCl (100:1), heating to 60° C for one hour, and allowing them to dry again. These were revived with a solvent (hexane) and internal standard mixture prior to introducing them via syringe into the gas chromatograph, which separated acid compounds based on differential rates of burn-off. The mass spectrometer measured the relative concentrations of carboxylic acids in each sample.

Carballo also processed a few experimental food samples, eight of which registered useful signal intensities on possible Soconusco foodstuffs obtained from markets in Southern California—including Pacific Coast shrimp and fish, maize, pinto beans, cacao, chia, and combinations of these foods. Unfortunately, no signals were registered on experimental vessels that were ground and processed following the same procedure as the artifact samples. Half were registered on scrapings from the scum lines of experimental pots, and half were introduced into the solvent directly as powdered substances.

The latter were not included in the analysis, as they did not undergo the expected fatty acid degradation associated with cooking (Malainey et al. 1999b; Eerkens 2005). In hindsight, it would have been desirable to have many more reference samples applicable to our particular case—especially for shrimp, crabs, and mollusks. As it is, the data set is too limited to allow us to confidently identify any particular food signature. Common carboxylic acid ratios were compared primarily with data from California (acquired by Eerkens) and published data from western Canada (Malainey et al. 1999b). The few cooked experimental samples run by Carballo (maize, beans, fish, and shrimp) allow single points of comparison, but only the maize and fish samples can be joined with Malainey's data to create 95-percent confidence ellipses for food identifications.

The use of ratios (as opposed to absolute values) of fatty acids facilitates inter-sherd comparison. This is largely a result of not being able to control the amount of residue extracted from a sherd and of variations in the density of fatty acids in archaeological sherds. Moreover, because fatty acids tend to degrade over time due to hydrolysis and oxidation (Christie 1989; Frankel 1998) it is important to use the ratios of fatty acids that decompose at approximately the same rate—as we did in this study.

The extent of degradation in a sherd depends on the depositional context, how well lipids are sealed, and the length of time since the pot was used. In previous studies by Eerkens (2005), the following fatty acid ratios were found to be of use in discriminating between residues extracted from pots used to cook different types of foods: C15:0 + C17:0 to C18:0, C16:0 to C18:0, C16:1 to C18:1, and C12:0 to C14:0. This classification system is followed here, although we have added maize as a distinct residue category. Note, however, that the "maize" ellipse was defined based on only four reference samples: one processed by Carballo and three published in Malainey et al. (1999b). Other categories were based on larger sample sizes.

Results

Overall, the recovery of fatty acids from the El Varal and Cantón Corralito sherds was low—suggesting that significant degradation has taken place. When we conducted the residue study, we were still strongly skeptical of the possibility of salt production at El Varal based on the inefficiency of the tecomate if the goal is simply evaporation of liquid (see Chapters 1 and 14, including Figure 14.2). The use of tecomates for salt production would leave no lipids in the pots. Could salt production by itself explain our results? We cannot rule out the possibility, although we are skeptical because low signatures were found for all vessel forms and for both the dish-dominant and tecomate-dominant sites.

We proceed, then, with an analysis based on the idea that some or all of the pots were used for food. C12:0 was unfortunately not recovered in any of the sherds, making it difficult to evaluate the relative influence of meats versus plant products among the recovered fatty acids. However, it was also not recovered from the experimental samples Carballo processed for maize, beans, fish, and shrimp. C12:0 was absent or only recorded in trace quantities by Malainey et al. (1999b) for the Canadian foodstuffs with reasonable analogs in the prehispanic Soconusco (i.e., maize, beans, squash, fish, and terrestrial mammals).

C12:0 is more common in greens and plant root foods. The remaining fatty acids were recovered in greater frequencies from the sherds, especially C16:0, C18:0, and C18:1. The relatively high concentrations registered of the latter (C18:1, oleic acid) suggest that our attempt to draw some interpretations from the data is not an exercise in futility. Malainey et al. (1999a)

report large decreases of C18:1 in their replicated decomposition experiment, with the concentration decreasing by as much as half in its relative percentage in some cases.

In contrast, the sherd samples on which we base our interpretation registered high C18:1 concentrations (range, 9 to 76 percent; mean, 45 percent; standard deviation, 20 percent). Therefore, based on these samples and their ratios of acids that decompose at similar rates we first examine their degree of overlap with certain types of foods. However, these identifications bring very little new to the discussion—and we only present them as potential avenues for future investigations. We can comment with somewhat greater conviction on the general patterning of vessel usage at the two sites, and the lack of evidence for specialized production in the tecomates at El Varal.

Following the ratios and food reference data used by Eerkens (2005), the current suite of fatty acid ratios suggests that we can rule out the presence of greens having been prepared or stored in these vessels—and only two of the sherds have ratios that overlap with the ranges reported for root products. Instead, the majority of the sherds have fatty acid ratios consistent with that observed among maize, fish, terrestrial mammals, seeds, and berries.

Common Soconusco foods such as shrimp, crabs, and mollusks are missing from this comparative database—as is the specificity of knowing, for instance, whether certain North American root products have signatures similar to that of manioc. Figure 16.5 depicts two of these ratios for the seven sherds that had enough data to be plotted. The figure suggests that outside a dish from Varal that closely matches ratios for fish the majority of sherds overlap with the ranges associated with maize, seeds, berries, roots, and terrestrial mammals. It further appears that most of the tecomates are close to the ratios derived from maize samples, although

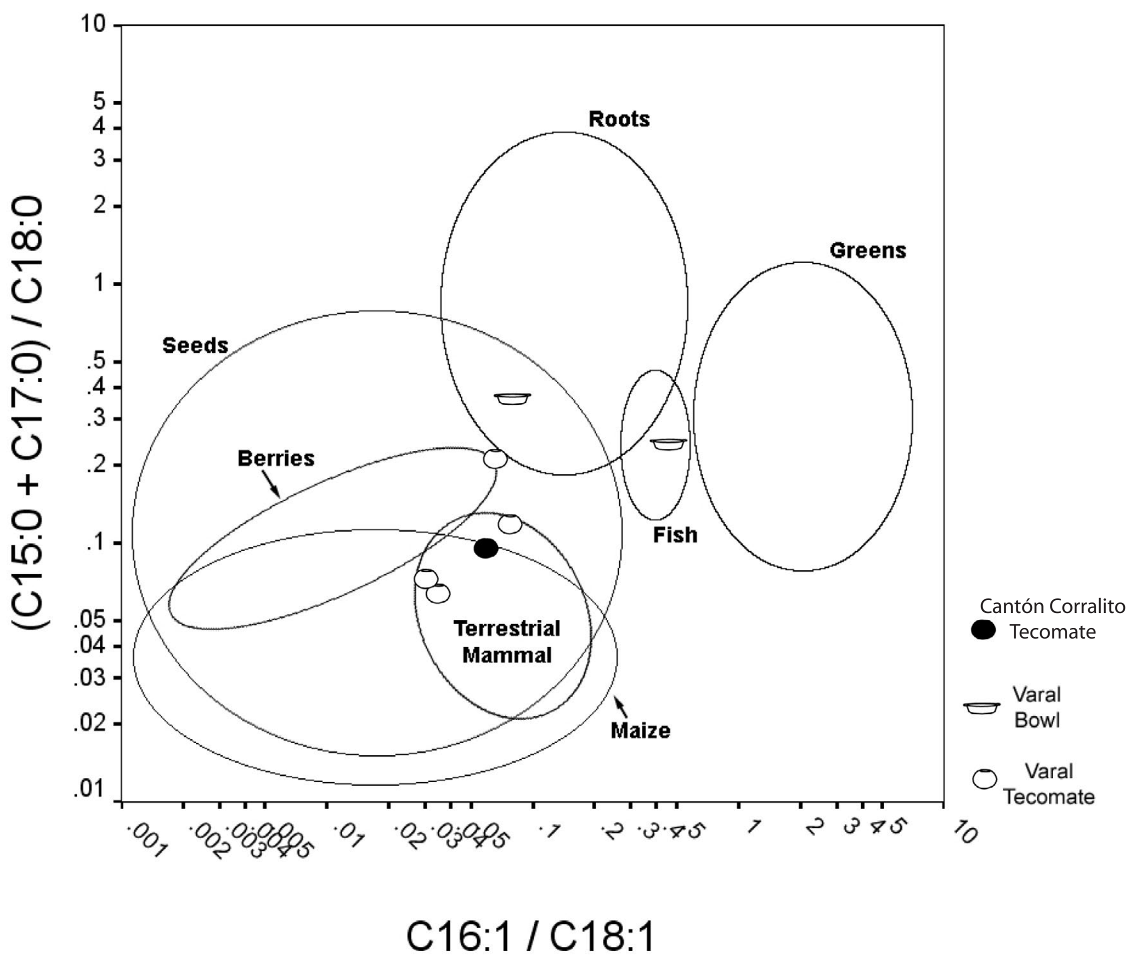


Figure 16.5. Bivariate projection of fatty acid ratios, including sherd samples for which data is available and showing 95-percent confidence ellipses for food types.

the maize ellipse would likely grow larger were additional food reference samples included—and thus might grow to encompass the other archaeological samples.

The fact that the maize and terrestrial mammal ellipses largely overlap in the comparison of these particular residues is particularly frustrating because it prevents us from teasing apart two Soconusco food categories that speak to wildly divergent usages, as could be accomplished if we were able to compare C12:0 to C14:0. Malainey et al. (1999c) based most of their interpretations on the relative percentages of C18:1, C18:0, and medium-chain acids (C12:0, C14:0, and C15:0).

Following this methodology, the Mazatán samples look more similar to the signature these authors report for mixtures of maize and fish (with decreasing relative quantities of the acids cited previously) than to the signatures of plants or large terrestrial mammals. However, the Mazatán samples registered higher 18:1 concentrations across the board—with a range of 9 to 76 percent (mean of 45 percent), compared to the 15- to 27.5-percent range they report. The maize issue is of interest because tamale steaming was the usage for coastal tecomates, suggested by Coe and Flannery (1967:102). An *atole*-like maize beverage and a fermented maize beer could also be possibilities.

The processing of maize products in tecomates also offers a possible explanation for the overabundance of broken tecomates in relation to the remains of the frequently proposed animals, in that botanical preservation is limited. The inhabitants of El Varal might have been able to grow small dry-season plots of maize, or they could have brought it from inland gardens. Still, maize as a primary subsistence item at the site would be something of a surprise.

The ratios of the two solitary cooked and scraped residue reference samples run for pinto beans and shrimp are as follows: beans (C15:0 + C17:0/C18:0 = 0.028, C16:1/C18:1 = 0.641); shrimp (C15:0 + C17:0/C18:0 = 0.551, C16:1/C18:1 = 1.114). These ratios fall well outside the range of values in the archaeological sherds presented in Figure 16.5, with beans joining the confidence ellipse for greens and shrimp positioned apart from any of the sherds or food ellipses. However, given that these are only single reference samples any conclusions should be drawn with extreme caution.

We hold out more hope for our general inter-site comparisons. Figure 16.6 plots three fatty acid ratios, comparing the sites of Varal and Cantón Corralito and comparing dishes with tecomates. The figures show that the fatty acid ratios from the two sites, divided by vessel type, largely overlap. This suggests one of two possibilities. Either pots were generally used for the same types of foods or degradation has been so extensive that evidence of such differences is no longer obtainable. As mentioned previously, the C18:1 concentrations recorded in the samples are not consistent with the experimentally degraded samples in Malainey et al. (1999a). Moreover, differences are observable between

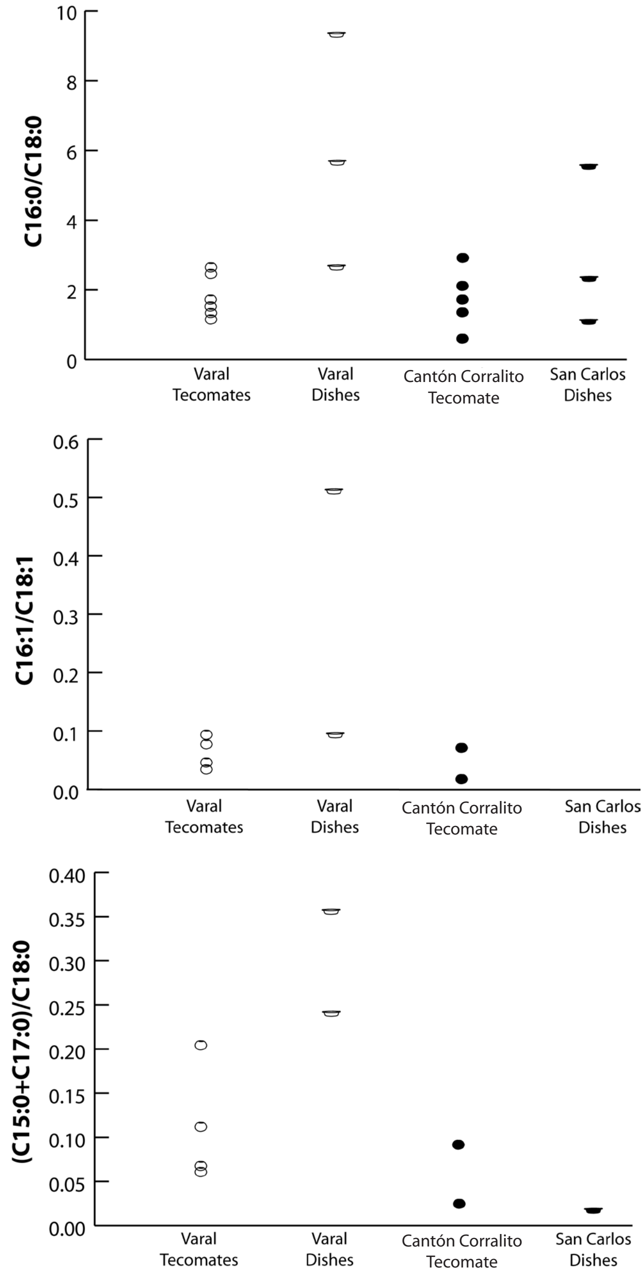


Figure 16.6. Plots of individual fatty acid ratios and sherd samples, divided by site and vessel type.

vessel types—which we would expect to have become equally obscured through degradation. Nevertheless, the generally weak signals of the samples are troubling.

With these provisos in mind, the ratios from the two sites seem to be equally variable. More specifically, there appears to be slightly greater variation among the Varal samples as a whole (their coefficients of variation are greater for two of the three ratios). However, as can be observed from the charts the variability of all samples together obscures a more restricted variability among tecomates.

Looking exclusively at tecomates, those from Varal are slightly less variable than those from Cantón Corralito. For instance, in the ratio of C16:0/C18:0 the coefficient of variability of Varal tecomates is 34 percent—whereas that of the Cantón Corralito tecomates is 49 percent. Although there are too few samples from Cantón Corralito to calculate meaningful coefficients for the other two ratios, visual inspection suggests that Varal tecomates are less variable in one ratio and more variable in the other. This general equality in the level of variability of fatty acid ratios runs contrary to the hypothesis positing the processing of a single specific estuarine food.

An interesting point of contrast is that tecomates at both sites have a more restricted range of fatty acid ratios than do dishes, suggesting that the latter might have been associated with a greater variety of source products and that the former may have been more standardized in their function. Although this finding is consistent with the expectations for specialization in food processing activities involving tecomates, the tecomates from Varal and Cantón Corralito appear to be equally standardized against the expectation of inter-site variability.

A possible alternative lies in vessel function. It seems likely that tecomates were used for cooking a range of available resources. Little work in residue analysis has been done to gauge the effects of long vessel use-lives involving the cooking or processing of diverse foodstuffs. Thus far they have been more successful with specialized vessels such as oil or wine amphorae, or vessels for storing milk. This alternative possibility fits nicely with Arnold's (1999) characterization of tecomates as a versatile vessel form for populations who still retained significant mobility in their subsistence activities.

Furthermore, there is no reason to think that Formative cuisine in the Soconusco could not have been as intricate as many modern Mexican dishes. Given the environment, mixtures of fish or shrimp tamales, seafood stews/chowders, and a range of combinations involving terrestrial resources are all imaginable. Perhaps the generalized utility of tecomates has resulted in the admixture of numerous intricate combinations of food signatures acting to reduce the variability among specimens.

Discussion

The results of the analyses provide new insights into the social dynamics underlying the tecomate-dominant versus dish-dominant assemblage pattern. The two compositional studies allow us to discard and/or refine scenarios related to the predominance of tecomates at estuary sites. First, the compositional analyses indicate that pottery was produced in the estuary at El Varal throughout the Cuadros and Jocotal phases. Although it is not necessarily indicative of permanent occupation in the estuary, the evidence is suggestive of at least extended stays.

Second, the tecomates produced at El Varal were not regularly produced for export to inland sites such as Cantón Corralito—although some vessels moved in that direction. Nor were serving wares produced inland for export to the estuary. None in the sample appears to have been exchanged in the opposite direction.

Although lipid preservation was unfortunately poor in the samples, several general trends in the data can be inferred. Because the fatty acid ratios recorded from vessels originating at El Varal and Cantón Corralito largely overlap, they do not support the interpretation of intensive specialization of some specific estuarine resource at El Varal. The lipid analyses are more consistent with processing and/or the consumption of a range of similar resources at both sites.

Due to the small sample size and comparative collection, however, subtle differences in the usage of the vessels from Cantón Corralito and El Varal cannot be discerned. Our food identifications can be read as consistent with the faunal and botanical analyses in support of the consumption of maize and fish. A root crop such as manioc might also have been important. Our single experimental shrimp sample did not register ratios similar to those of the archaeological samples, but this finding is relatively meaningless and more studies are needed as a foundation for more sound interpretations.

More interesting for the initial goals of the study, the analyses are more supportive of two scenarios that

would adequately explain the higher proportion of tecomates at the estuary site of El Varal: some degree of residential mobility and/or a greater emphasis on food service assemblages at inland sites relative to estuary sites. These possibilities are not mutually exclusive.

A combination of the two could involve certain segments of inland communities alternating between a first household and a second (seasonal) household in the estuary. Due to the status of this segment of the population or to differential norms regarding food consumption practices, there was less of a need for elaborated serving wares in the estuary. Communal pots or perishable individual plates may have been more common.

Indeed, the evidence presented here is largely consistent with a social interpretation of residential mobility combined with variability in consumption practices. Seasonal mobility would suggest that some resource was culturally desirable in the estuary. If inland and estuary populations were largely one and the same, or were at least significantly integrated through kin or exchange relations, we might expect to see evidence of the consumption of similar foods with slightly greater redundancy in food processing in estuary tecomates (as suggested by residue analyses). We may also expect that vessels made in the estuary were occasionally transported inland as containers, as suggested by compositional analyses.

Once again, we are less confident with our interpretations based on the residue data. However, the interpretations we present fit comfortably with multiple lines of evidence presented in this volume. If our interpretations are correct, specialization should be rethought as an explanation for the inter-site pattern. We would not have evidence for specialization defined as one community producing beyond its own needs (e.g., Arnold 1987), but we would have evidence for intra-community specialization if we accept a broader definition of community.

Returning to our discussion of complexity, a more fluid definition of later Formative communities in the Mazatán region—involving movement between larger inland sites and smaller estuary sites by people who consider themselves members of the same community—provides greater support for complex economic and kinship ties linking affiliated groups of people (rather than the political subordination of one community to another).

CHAPTER 17

The Organization of Salt Production

Specialization or Collection?

RICHARD G. LESURE

Terminal-period changes in the artifact assemblage provided the basis, in Chapter 14, for an initial assessment of the role of El Varal in the settlement/subsistence system of late Early Formative Mazatán. Before the Terminal period, the site was occupied for weeks or months during the dry season by a sizable group of people dedicated to some productive activity involving cooking with tecomates. Those people were seasonal visitors to the estuary, maintaining primary residences elsewhere. Site occupants also seem to have produced beyond their own immediate subsistence needs, leaving an archaeological record dominated by broken tecomates. Chapters 14 through 16 have considered various products and possible products: salt, pottery, shellfish, shrimp, crabs, and fish.

Beyond simply the products themselves, the organization of production and consumption is of interest. In Chapter 14, I proposed four organizational models that might help make sense of El Varal. Analyses in that chapter prompted rejection of the model positing full-year residence by specialists. I suggested that the remaining models might be used as tools of thought to explore the specific organizational arrangements of Early Formative Mazatán (rather than simply as classificatory devices).

It thus becomes necessary to consider each product separately. In the discussion so far, salt has remained the only resource plausibly subject to specialized production. The inhabitants of El Varal made their own pottery on-site, but we have no particular evidence that pots were transferred inland except occasionally—probably as containers (Chapter 16). Although we suspect that shrimp were available in considerable quantities during the dry season (Figures 14.8 and 14.9), we have no archaeological evidence of them (Chapter 7) and our residue study indicates that a variety of foods were cooked in tecomates (Chapter 16).

We have some modest evidence for transfer of wild animal foods to inland sites from the estuary and beach, but we were not able to produce convincing evidence of the processing of mollusks, crabs, or fish at Varal in quantities that would suggest collecting—let alone specialization (Chapter 15). Subsistence remains seem to be mainly from foods consumed on-site. Although it is not the only option, one possibility is that subsistence remains derive from the meals of salt-producing personnel. What, though, of salt itself? Was it the subject of specialized production by the inhabitants of El Varal?

The goal of this chapter is to weigh that question. Again, it proves useful to draw upon two of the idealized organizational models discussed in Chapter 14. One possibility is that the Early to Late occupants

of the site were part-time specialists in the manufacture of salt. Production units constituted a subset of households from inland communities. Those people moved to an estuary camp for some part of the year, extracted salt from the saline soils left by receding waters of the lagoon, and transferred their product to nonspecialist consumers.

That scenario would contrast with a collecting model in which producers and consumers were part of the same consumption unit. There were no permanent occupational distinctions between them, and the relations through which salt moved from producer to consumer were "social" in nature—primarily those of kinship and alliance. In the specialization model, by contrast, producers and consumers were members of distinct units of consumption—and occupational distinctions would have been more permanent. Products moved between people through what might be termed *economic relations* (e.g., exchange between households or some type of patron/client interaction).

Although the two models (framed in that way) differ significantly in the organizational arrangements they posit, distinguishing them archaeologically can be a challenge. The case of salt production at El Varal is no exception, and I have not managed to come up with any definitive way of deciding between the two models. My approach instead is to consider various types of evidence (and perspectives on that evidence), which in combination point more in one direction than the other.

In terms of Table 14.2, I continue to work on row 7 but introduce here issues raised in row 6 and return to those associated with row 4. My conclusion is that the organization of salt production at El Varal was closer to collecting than it was to specialization. I begin with an effort to find generalized evidence of social heterogeneity in Jocotal-phase Mazatán through a detailed comparison of domestic assemblages from two sites. Although the effort is hardly definitive (I am essentially examining two complex data points) and the results somewhat mixed, the overall picture is one of social *homogeneity* rather than the heterogeneity that would be expected under the specialization model. I then turn to salt, first reviewing reasons salt production should be considered an important focus of activity at El Varal before concluding with a series of arguments for why the organization of that activity should be considered closer to collecting than specialization.

A Search for Social Heterogeneity

The specialization model posits a division of occupations and thus what we might term *social heterogeneity*. We would expect "economic" differentiation between households, such as different productive activities, different acquisition networks, or differences in wealth. The collector model instead posits a situation of relative social *homogeneity*, with no long-lasting occupational distinctions between producer and consumer and transfer of product in the context of "social" obligations such as kinship or alliance. Thus, one indirect approach to assessing the likely applicability of the collecting model versus the specialization model would be to look for evidence of social homogeneity versus heterogeneity within the Mazatán region.

I compare a sample of domestic refuse from the inland site of Cantón Corralito (the San Carlos Mound area) to refuse from El Varal, concentrating in the latter case on the Terminal-period dish-dominant assemblage from N95W0. The plan is thus not to directly compare "producer" and "consumer" refuse but to gauge the nature and magnitude of inter-site variation in *domestic* refuse unmixed with the debris of any specialized production. We will then assess the degree to which any observed differences might be explicable as "economic" differentiation of the type implied in the specialization model. If economic differentiation can be identified, it might make a claim of specialized production more *plausible*. However, it would not provide any direct evidence of whether there was in fact specialization. To anticipate briefly, my analysis actually reveals no strong evidence of economic differentiation.

Cantón Corralito Assemblage

Ideally, a large excavated sample of refuse from a sizable inland site of the Jocotal phase (with a dish-dominant vessel-form assemblage) would be available for systematic comparison with El Varal. However, no large assemblage meeting those characteristics is available from the Mazatán region. Significant Cuadros-phase assemblages from Cantón Corralito deriving from the earlier excavations of Pérez Suárez (Lesure and Pérez Suárez 1998; Pérez Suárez 2002) and the more recent work of Cheetham (2006) are still under analysis.

Clark and Blake also excavated Cuadros-Jocotal materials at Aquiles Serdán in 1985, but those also have not been published in detail. I make use of four samples of a stratified Cuadros-Jocotal midden from the San

Carlos Mound area, across the modern highway from the area of Cuadros settlement that forms the focus of work by Pérez Suárez and Cheetham. Most of the materials considered were excavated in 1990 by Mary Pye under the direction of John Clark [San Carlos test unit 10, strata 2 through 5 (referred to here as 10:2 through 10:5)].

Also included is a small sample from an adjacent unit excavated by Barbara Voorhies in 1994 (San Carlos unit 10/4, 130–150 cm). In the following, I consider these as a single pooled sample or as four separate samples: unit 10/4 (130–150 cm), stratum 10:5, strata 10:3 and 10:4, and stratum 10:2. Excavated earth was screened through a 5-mm mesh—the same size used at El Varal.

I analyzed the unit 10 materials in 1992 (Lesure 1993) and the unit 10/4 sample in 1994. The pooled sample included approximately 135 kg of sherds, with 839 at least minimally identified rims. I also examined associated ceramic artifacts and obsidian flakes. Unfortunately, I do not have data on volumes excavated. In addition, the ceramic analysis was somewhat abbreviated. It focused on vessel forms without making a serious effort to type the collection (which was indeed eroded, particularly in stratum 10:2).

As can happen when analyzing collections one did not personally excavate, years after the actual excavation there is some concern that a few "special" artifacts might have been removed from the general collections of the unit precisely because they were so special. John Clark (personal communication, 2008) recalls a fragment of sculpture from unit 10, and in our *informe* from that season a cylinder seal—apparently from level 6 (a layer not included in my sample)—is pictured (Clark et al. 1990:Figure 18). The latter item is of more interest here. The former I take to be evidence of those dramatic "political" differences between inland town and estuary hamlet that make the comparison itself of so much interest.

Admixture of earlier Locona, Ocós, and Cherla sherds is more of a problem than at El Varal. Of particular concern is that about half of the plain tecomates are Michis Red-Rim and thus probable carry-ups. Because many of the sherds were eroded and my attention to typology cursory, I have decided to use the analyzed sample as it is rather than to attempt to separate earlier materials from the Cuadros-Jocotal sherds. Attention is focused on the rims as well as the ceramic artifacts and obsidian.

General Comparisons to El Varal

Chronological assignments for the Cantón Corralito sample are based on dish forms, tecomate rim profiles, figurines, and a very general assessment of type frequencies. Unit 10/4 (130–150 cm) and stratum 10:5 are Cuadros, and are probably earlier than the Vásquez Mound sequence from El Varal. Strata 10:3 and 10:4 may overlap with the Early period at El Varal, and stratum 10:2 is "early" Jocotal (see Chapter 9)—correlated with the Early to Middle periods at Varal.

The pooled Cantón Corralito (San Carlos Mound area) rim assemblage (n = 839) consists of 73 percent dishes and bowls, 24 percent tecomates, 2 percent jars, and <1 percent "other" forms (based on rim counts). The breakdown for El Varal is 64 percent dishes and bowls, 27 percent tecomates, 8 percent jars, and 1 percent "other" for the Terminal period (n = 428). The breakdown for the Early to Late periods at El Varal is 24 percent dishes and bowls, 70 percent tecomates, 5 percent jars, and <1 percent "other" (n = 1,989). The Terminal period and the Cantón Corralito assemblages are obviously close, the most striking difference being the relative importance of jars. Table 17.1 provides a more detailed comparison of slipped-ware vessel forms.

Variability in bolstered-rim dishes, a Cuadros-phase diagnostic, is probably chronological in origin. The scarce representation of dishes and bowls with vertical

Table 17.1. Relative percentages of slipped-ware vessel forms in four samples from Cantón Corralito (San Carlos Mound area), compared to the Terminal period at El Varal

Type	10/4:130–150 cm	10:5	10:3–4	10:2	Varal Terminal
Simple dish	75.0	68.3	77.8	85.2	*74.3*
Dishes/bowls with near-vertical walls	3.8	1.7	3.4	2.6	*6.4*
Dishes with bolstered rims and flat bases	7.5	11.7	3.1	1.6	
Dishes with modified rims (everted, etc.)	2.5	2.5	5.4		
Dishes with rounded walls	3.8	6.7	5.8	3.7	*2.3*
Early composite silhouette dishes/bowls				0.5	*2.3*
Deep basins			0.8	0.5	*1.3*
Jars with tall necks			1.2		*8.4*
Jars or ollas with short necks		2.5	0.8	4.8	*2.3*
Slipped tecomates	7.5	6.7	1.5		*1.6*
Stools or pot rests			0.2	1.1	*1.3*
Total Percentage	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*
Total N	*80*	*120*	*261*	*189*	*311*

sides at Cantón Corralito is surprising. The difference in representation of jars proves to result from the scarcity of one particular form, tall-necked jars. I suspect that the difference is functional but not related to any specialized activity. These appear to be good candidates for water-storage containers at El Varal, where any water in the immediate vicinity was saline. They would have been a less important vessel form some distance from the estuary, where potable water was more abundant.

The presence of ceramic artifacts in the pooled Cantón Corralito sample seems, with three exceptions, similar to the ceramic-artifact composition of Terminal-period El Varal. There were 30 solid figurine fragments (3 head, 6 torso, and 21 limb fragments), 3 (+1 possible) hollow figurine fragments, and 6 worked sherds (1 notched, 4 disc-shaped, and 1 rectangular). The cylinder seal from level 6 in San Carlos unit 10 is significantly larger and more elaborate than one from the bulldozer dirt at El Varal (Figure 11.6a). It is also earlier (which likely matters). Further, both of these objects are from outside the boundaries I have placed on the units to be compared.

Categories not present at El Varal are spatulas (Lesure 1998:Figure 9), of which there were five fragments in the Corralito sample, and ear spools (six pieces). Both of these categories of objects make rapid appearances and disappearances in the Early Formative sequence of Mazatán and are actually best known from the Cherla phase. They could easily be absent from El Varal for chronological rather than functional reasons. Absent in the pit 10 sample are ceramic masks like those of El Varal, one of which (Figure 11.8, bottom) derives from profile cleaning in the area of the midden under consideration. However, this is again (like the fancy cylinder seal from Corralito) outside the bounds of the units I have chosen for comparison.

Volumetric densities cannot be calculated for Corralito, but the frequency of figurines per 100 kg of sherds is 25.2—comparable to the 21.64 frequency measure for Terminal-period Varal (as against 2.2 for Early to Late Varal). It is the same story with worked sherds: 5.2 per 100 kg of sherds at Corralito, 7.5 for Terminal-period Varal, and 0.6 for Early to Late Varal (subsample only; see Chapter 11).

Obsidian, on the other hand, is more frequent in the pooled Cantón Corralito sample than in the Terminal-period El Varal sample (respectively, 5.4 g/kg of sherds compared to 1.5 g/kg). The value is 0.2 for Early to Late Varal. Amounts of obsidian entering the Mazatán area seem to have fluctuated over time, however (Clark and Salcedo1989; Clark 1994b), and thus the fact that much of the Cantón Corralito sample is earlier than the Varal sequence is a concern. Obsidian is least common (2.3 g/kg of sherds) in the latest Corralito stratum (10:2), the one that most definitely overlaps the Vásquez Mound occupation at El Varal.

Economic Differentiation?

It is the similarities rather than the differences that seem striking in the foregoing comparison of "domestic" refuse from a minor estuary and a large inland site. Still, the rough comparisons I have been making do not lend themselves to any convincing assessment of significance—and it is true that even in stratum 10:2 obsidian per kg of sherds was higher than in Terminal-period Varal.

Plausibly, the overall results could fit with the expectation for specialization: differentiation not in all categories but in certain categories where the differences were explicable in economic or political terms. Similarities of vessel-form assemblages and in frequencies of worked sherds and figurines may simply be indications that both were domestic assemblages—whereas obsidian (an imported commodity and a utilitarian tool) might be another matter. More subtle analyses are warranted.

Although no elaborate analysis has been conducted on the Varal and Cantón Corralito (unit 10) obsidian, counts and weights are available and it is thus possible to calculate average flake weight (total weight divided by number of pieces). Conceivably, access to obsidian might have been related to status. The inhabitants of Cantón Corralito, with (possibly) more obsidian than occupants of Varal, might have been more "wasteful"—discarding bigger flakes. Alternatively, perhaps the Corralito "consumers" were themselves producing something to exchange for estuary products—specifically, something requiring obsidian flakes as tools in the production process. They would thus have used obsidian in a different way from the occupants of El Varal, and it is certainly conceivable that average flake weight would diverge in the resulting assemblages.

Average obsidian flake weights among 48 lots from El Varal (all with more than 200 sherds) were normally distributed, suggesting that a T-test would be an appropriate method of comparison. The mean for 15 Terminal Varal samples (individual excavated lots of N95W0) was 0.81, with a variance of 0.20. The mean

for the four (larger) samples from Cantón Corralito was 0.66, with a variance of 0.04. The difference in means is not statistically significant ($p = 0.54$). Comparison with the entire Varal sample produces similar results. Modest further analysis of the obsidian thus does not yield any supporting evidence of economic differentiation (beyond the higher frequencies at Cantón Corralito, a pattern potentially chronological in origin).

The pottery assemblage provides an alternative potential source of evidence. If status was accrued by feasting or more small-scale presentation of food, we might expect a variety of attributes in the assemblage of the large inland site (Cantón Corralito) in comparison to the minor estuary site (Terminal-period Varal): larger serving vessels, the occasional appearance of very large serving or preparation vessels rarely used and thus rarely broken, more decorated vessels, and more exotic (imported) serving vessels. [For the logic involved, see Lesure (1998).] The patterns are mixed, but the balance of evidence does not favor significant differentiation between the Cantón Corralito and Varal Terminal-period assemblages.

Serving Vessel Size

Common serving vessels were the same size in the two assemblages. Rim diameters of simple open bowls are actually larger in the Terminal Varal sample (average, 32.3 cm; standard deviation, 8.6; range, 12–54; n = 146) than for that of Cantón Corralito (average, 26.1; standard deviation, 8.1; range, 12–53; n = 107). That difference, however, may be chronological: the means for Early- and Middle-period Varal, more closely coincident with the Cantón Corralito sample in time, are respectively 24.7 and 27.9.

Largest Serving or Preparation Vessels

Categories of large vessel potentially used in preparation/serving to groups of people include open dishes in the 50-cm-diameter range and large deep basins. Both are present in each case, and as previously noted the range in open bowl size is similar. The Cantón Corralito assemblage does, however, include a deep basin with a rim diameter of 59 cm. The largest basin from N95W0 was 37 cm in diameter. The largest recovered more generally at El Varal (from bulldozer backdirt) was 47 cm. Even though the Corralito vessel is represented by a single sherd, it needs to be considered relevant. We expect very large serving or preparation vessels to be rare in archaeological assemblages.

Decorated Vessels

Serving vessels decorated with incised or excised motifs are actually more common in the Terminal-period Varal sample (9.9 percent of bowl/dish rims) than among the four Cantón Corralito samples (0.6 to 9.5 percent of bowl/dish rims). Taking into consideration non-rim sherds bearing traces of motifs would yield comparable results.

The Cantón Corralito sample under consideration here clearly derives from a broader temporal span than that of Terminal-period Varal. It includes Cuadros diagnostics (Figure 17.1)—concentrated in strata 10:4 and 10:5—as well as Jocotal diagnostics, concentrated in strata 10:2 and 10:3 (Figure 17.2). The latter are directly comparable to decorated sherds from N95W0 at Varal (Figure 17.3; see also Figures 9.10 and 9.21 through 9.23). It is important not to exaggerate the importance of this result, however.

Motifs are very common (>23 percent of serving bowls/dishes) at Cantón Corralito in Cuadros-phase deposits across the modern highway from the San Carlos Mound area under examination here (Lesure 2000:206; Pérez Suárez 2002; Cheetham 2006). Jocotal-phase patterns of inter-site variation in decorated serving vessels are not well known, and it is as yet unclear to what extent the inter-site disparities in frequencies of decorated vessels suspected (but not yet, perhaps, proven?) for the Cuadros phase might continue into the subsequent Jocotal phase. I propose taking seriously the results for Jocotal, with the realization that future work might force a revision. If the upper strata of the Cantón Corralito sample are at all typical of Jocotal-phase domestic assemblages in large inland sites, the Terminal-period Varal assemblage is consistent with those norms—with no evidence of impoverishment.

Exotic Vessels

Exotic serving vessels in a paste diverging from that common in the collections are present in both cases, although they are rare enough that it is impossible to reliably assess frequencies. In the case of Cantón Corralito unit 10, there were three exotic rim sherds. One was a Tacaná White bowl. The other two were dishes of a fine gray paste—a type Clark at the time of my analysis had labeled "*Extranjero*" in his type collections at the New World Archaeological Foundation laboratory.

The N95W0 assemblage from El Varal included numerous fragments of decorated white-ware vessels

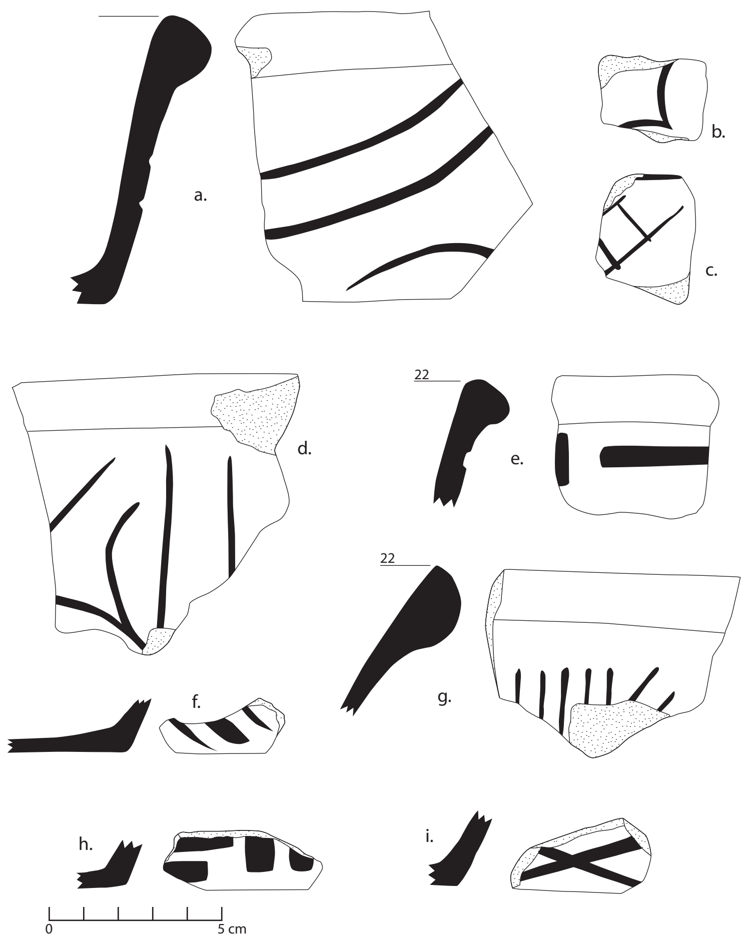


Figure 17.1. Decorated sherds from Cantón Corralito, San Carlos unit 10 (Cuadros-phase diagnostics).

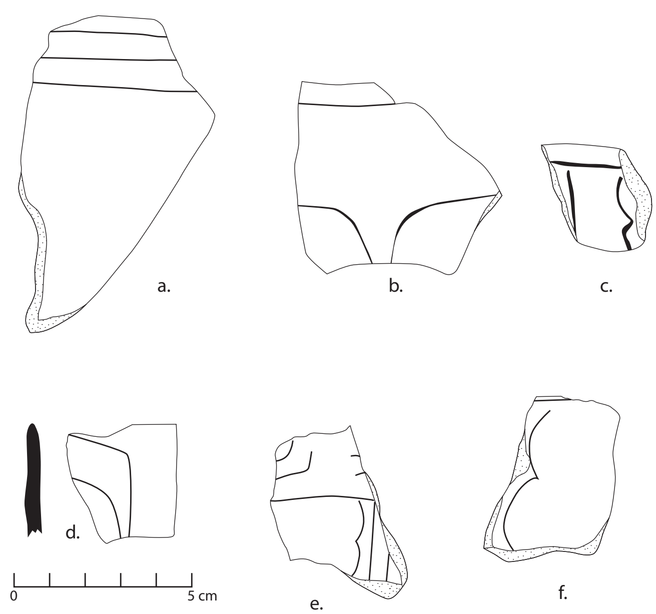


Figure 17.2. Decorated sherds from Cantón Corralito, San Carlos unit 10 (Jocotal-phase diagnostics).

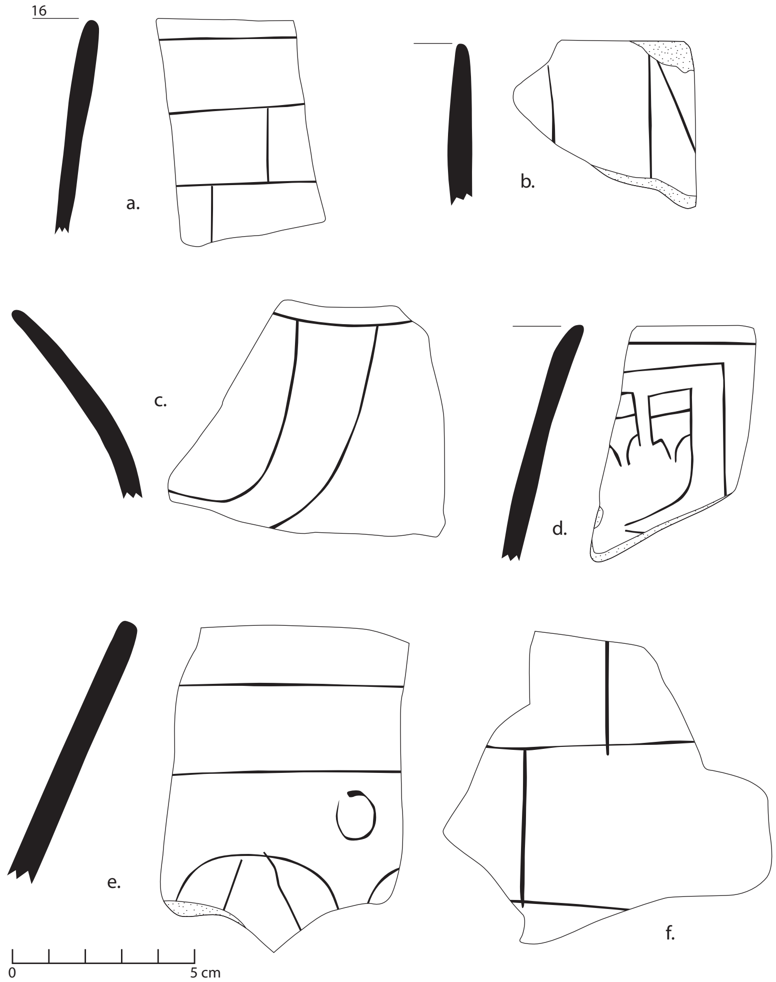


Figure 17.3. Decorated sherds from N95W0 at El Varal (Jocotal-phase diagnostics).

similar in form and decoration to Tacaná White but of a paste consistent with the bulk of the Varal collection and a white slip tending toward glossy rather than flat. Those appear to be locally manufactured imitations of Tacaná White and are thus not exotic. Five rim sherds, however, had the characteristic reddish paste and thick flat (rather than glossy) white slip of Tacaná. We suspect they were imports. There is thus no basis here for arguing for greater access to imports at Jocotal-phase Cantón Corralito. (Again, Cheetham's work will show that the Cuadros-phase occupation across the highway from the San Carlos Mound yields a different picture—but all of that occurred earlier than the occupation of the Vásquez Mound, and time likely matters.)

Conclusions on Social Heterogeneity

The sample of rim sherds from the large inland site of Cantón Corralito examined here was about a third the size of the overall sample analyzed from El Varal but twice that of the specifically Terminal-period Varal sample. At Cantón Corralito, erosion and fragmentation are something of a problem—and very different site formation processes have yielded a sample significantly more mixed. I have ended up comparing a Cuadros/Jocotal assemblage from the inland site to a temporally narrower and more homogeneous late Jocotal midden from Varal.

Given the results, it is important to emphasize that I am not suggesting that there was a complete lack of differentiation between the small late Jocotal hamlet at El Varal and large inland towns of the same period. It should also be emphasized that the comparison is focused on Jocotal materials, definitively the most relevant for understanding El Varal. The situation in the preceding Cuadros phase may well have been different. The basic comparison here is an interesting one because we can be confident that there was significant "political" differentiation, as evidenced by the sculpture fragment

John Clark remembers from San Carlos unit 10. The entire Mazatán region was likely integrated into a single political unit on the order of a complex chiefdom—with its paramount center during the Jocotal phase at Ojo de Agua, a couple of kilometers from the San Carlos Mound (Clark 1997). My interest is not in the public dramas of political spectacle—or in, in McGuire's (1983) terms, *inequality*—but in how the routines of daily life were organized (McGuire's *heterogeneity*).

More specifically, the idea is that specialization—a division of occupations in which producers and consumers are reciprocally dependent on each other—is likely to occur in a context involving further heterogeneity in social relations. The products themselves would move through what I have glossed as "economic" relationships extending beyond "social" relations such as kinship or alliance. I examined domestic refuse from two very different contexts within the Mazatán region, searching for hints of differing discard frequencies of various artifacts.

Systematic differences—particularly differences explicable in terms of the organized routines of daily life—would make a specialization argument more plausible for Early to Late El Varal, admittedly without providing any direct evidence one way or another. I recovered a few hints of differentiation. Obsidian is more abundant at Cantón Corralito than at Terminal-period Varal, although there is concern that at least part of that difference could be chronological. There is also one rim sherd from a very large basin at Cantón Corralito, plausibly a vessel used in feasting. The absence of ceramic spatulas and ear spools at El Varal is probably chronological. There was a nice cylinder seal in pit 10, but no mask like the one from the N95W0 profile at Varal.

Similarities between the refuse samples, on the other hand, are notable. Figurines appear in similar frequencies. Obsidian flakes are comparable in average size. The most common service vessels, open dishes, have a nearly identical size range and are actually larger at Varal than at Cantón Corralito (probably again due to changes over time). Exotic imported vessels and dishes or bowls decorated with incised or excised motifs are similar in frequency in the two cases. What is indicated here is a low level of heterogeneity. This result seems most consistent with the idea that any goods from El Varal would have moved between producer and consumer through established social relations activated for numerous other purposes, such as kinship or alliance.

Salt as Product

The case for salt as product at El Varal (Chapters 3 and 14) draws on various sources for support. There is documentation of late sixteenth-century aboriginal *sal cocida* salt making along the Guatemalan Coast (Coe and Flannery 1967:92), and observations of earthen mounds all along coastal Chiapas that appear to be waste heaps from such a process (Andrews 1983:62–63). Three Formative archaeological cases provide support for the overall argument at El Varal along with significant points of contrast.

The El Salado site is located beside the only salt spring identified by Santley's (2004) survey teams in the Tuxtla Mountains. The site has an Early Formative component overlapping in time with the occupation of El Varal, and a much larger Late Classic component. Santley identifies salt-making debris in both components. His argument rests on the presence of the salt spring and similarity in character of the two archaeological components, both of which diverge from typical assemblages of their respective epochs. Santley further notes densities of broken pottery among the highest known from the region; a vessel assemblage dominated by coarse ceramics in which tecomates are prominent; lack of architectural features, storage pits, and burials; evidence of burning on the exteriors of pots; and deposits of calcium carbonate on the interiors of vessels, thought to be the result of subjecting brine water to low heat. Santley's Early Formative component includes coarse-ware tecomates (for the most part undecorated, despite his illustration suggesting otherwise).

Unfortunately, Santley does not quantify the distribution of forms—and there are forms other than tecomates among the coarse wares, including deep basins and large rectangular trays. He suggests several scenarios for the production process, one of which would have involved sun evaporation of brine in the rectangular trays and subsequent reduction by cooking in tecomates. Reconstructions of the tecomates and trays based on upper-rim profiles in Santley (2004) appear in Figure 14.2.

The second case (from the Naranjo region of the Soconusco, some 45 km from El Varal) is the Guzmán Mound excavated by Nance. The mound is Late Formative in date, with occupation (200 B.C. to A.D. 150) beginning some 800 years after the abandonment of El Varal. The mound lies beside a salt flat, and its stratigraphy consists of layers of "gray loam" alternating with refuse layers containing sherds, burned earth, and

charcoal (Nance 1992:29)—strikingly similar to the pattern observed at El Varal. Pottery consisted overwhelmingly of crudely finished plain jars with slight necks and relatively open profiles or with distinct vertical necks and closed profiles. Reconstructions of the two forms based on upper-rim profiles in Nance (1992) appear in Figure 14.2.

The similarities of El Varal with these two cases are quite extensive. The site is located near a modern salt flat, probably the result of the drying of a former lagoon. Salt making would help account for the large amount of pottery, and perhaps (following Santley) for the calcium-rich concretions noted throughout the site—although Santley does not provide an explanation of how salt production would generate such concretions. Processing of a salt-rich earth on the upper mound surface and discard of the by-product would also account for the deposition of significant sediment layers along the sloping sides of the mound—layers for which we have come up with no other satisfying explanation. The alternating layers of sediment and sherd middens observed at El Varal also appear at Guzmán.

Productive techniques very similar to those observed in the sixteenth century would fit with the archaeological record of El Varal. In the dry season, a salt scum could have been collected from ground surface in the immediate vicinity of the site. Salt-laden earth would have been transported to the mound surface and placed in wooden troughs, or perhaps into old canoes. Lagoon water poured over the top would trickle out a perforation at the bottom as brine, which would then be reduced to salt by boiling in tecomates. The tecomates were made on-site and cached there while occupants were not in residence. During the dry season, pampa areas just inland from El Varal would have been a ready source of fuel.

Whereas the first two cases match the archaeological record of El Varal in numerous respects, a third case (at the southeastern extreme of the Soconusco some 70 km from El Varal but contemporary with the Vásquez Mound, and indeed a participant in the same Jocotal ceramic complex) is more of a contrast in terms of technology. The inhabitants of El Mesak likely produced salt using a method similar to the *sal cocida* method previously described. However, their boiling technology consisted of deep, relatively open-profile, and crudely fashioned conical jars (Figure 14.2).

Those jars dominate the Jocotal assemblage at the site [75 percent of "minimum number of vessels" in Op. 2-1.2 (Pye 1995:Table 9.4)]. In that operation, of the remaining forms, 26 percent were tecomates and 74 percent were of other forms—a distribution that would indicate permanent residence in the interpretive framework developed here for El Varal. Pye argues that brine from the local estuary was reduced to salt by boiling in the extremely crude but formally standardized Mesak jars.

The Question of Specialized Production

Salt was thus probably a significant focus of production at El Varal. How was production organized? One obvious possibility is part-time seasonal occupational specialization. In such a scenario, social units of production would have constituted a subset of households from inland communities. Those people would have produced salt at an estuary camp for some part of the year and transferred their product to nonspecialist consumers through exchange relations or perhaps tribute. Six observations lead me to reject that line of argument in favor of something closer to the collecting model.

1. *Production locales were overabundant in relation to probable levels of demand.* Salt is an important component of the human diet, particularly in diets lacking in meat—such as those that characterized high-density parts of Mesoamerica in Classic and Postclassic times (Andrews 1983; Williams 2002; Santley 2004). Still, it is not apparent why the inhabitants of Early Formative Soconusco would have been particularly in need of salt. Their consumption of fish and other animal foods would have furnished at least part of their dietary needs for the mineral.

   Perhaps an increasing reliance on maize agriculture at the end of the Early Formative might have created an elevated demand for salt (Pye 1995:312–313). Another possibility would be that salt was needed in the drying for storage of estuary products such as fish, although if fish were dried and salted at El Varal they were removed from the site with the heads attached (Chapter 15).

   Looking beyond El Varal itself, if we contemplate adopting salt making as a standalone explanation for the appearance of tecomate-dominant sites in Early Formative Soconusco we immediately encounter the problem that there seems to be too many such sites. The fact that cases are known from other parts of

the Soconusco (Pajón to the northwest, Salinas La Blanca to the southeast) suggests that the consumer base for any Varal salt production would have been the immediate inland area, particularly the Mazatán region. Yet there are other Early Formative estuarine sites in the vicinity of El Varal. Five were known before the current work of John Hodgson [Figure 14.3, and see Clark (1994a)], and it now appears that there are others—perhaps numerous others.

Of the five known nearby sites shown in Figure 14.3, two have been excavated and have tecomate-dominant vessel assemblages with occupations overlapping that of El Varal. If we assume a regional population of 10,000 (John Clark, 2007 personal communication); an average dietary need for salt of 10 g (Andrews 1983; Santley 2004:218), all of which (let us say) came in the form of manufactured salt rather than indirectly through the consumption of meat; a production rate, derived from Santley's Late Classic estimates, of 8 kg per salt maker per day; and a range of 25 to 75 production units (100 to 300 people) at El Varal (Chapter 14), we could suggest the following statistics.

With El Varal the only production site in the area, demand would have been sufficient for specialized production: the occupants would have had to work between 61 and 182 days to meet basic regional demand. However, if there were five contemporary salt-making sites of similar size the range would be 12 to 36 days—and if we raise that to a more likely site count of 10, the numbers fall further (to 6 to 18 days of work per year per site). These last numbers in particular do not fit with the lengthy stays for El Varal indicated by artifact analyses in Chapter 14. Basically, it is unlikely that there was sufficient demand to support specialized production of salt at numerous tecomate-dominant sites in the Pampa Cabildo. Production would have rapidly led to oversupply.

2. *Such duplication of production locales would be explicable in a situation of social homogeneity*. My comparison of domestic refuse from two very different Jocotal domestic contexts pointed toward broad social homogeneity ("mechanical solidarity" in the Durkheimian sense) rather than toward the heterogeneity postulated in the specialization model.

An overabundance of production sites does not make sense from the standpoint of the economics of specialization because the situation of supply outstripping demand is not sustainable for anything approaching an archaeological timescale. However, the pattern seems readily explicable under the "inefficient" economics of mechanical solidarity. If units of consumption each produced salt to meet their own needs, the resulting duplication of effort might well yield an apparent oversupply of salt-manufacturing sites.

3. *The boiling technology used was inefficient in comparison to other likely cases of salt production, even other Formative ones*. For a long time I resisted identifying salt as a product at El Varal because the restricted-mouth tecomate seemed an inappropriate vessel form when the goal was evaporation rather than prolonged simmering. The vessel assemblages apparently associated with salt manufacture at Guzmán (Nance 1992) and El Salado (Santley 2004) have helped convince me to revise that position.

Although open vessels are preferable for evaporating brine, variability among convincing cases of prehispanic *sal cocida* production (Nance 1992; Pye 1995; McKillop 2002; Santley 2004) suggests lack of any strong selection for a particular vessel form. Still, in terms of efficiency in evaporation the tecomate appears the least efficient of the various Mesoamerican technologies shown in Figure 14.2. Further, where occupational specialization seems supported by other types of indicators (in Figure 14.2, Mesak, Guzmán, Ycacos, and Sacapulas but not Early Formative El Salado) two vessel characteristics recur: there is some type of appropriately open-mouthed evaporation technology and the coarse ware involved in production is extremely crude.

Neither of these characterizes El Varal. We would expect *specialists* to have come up with something better than the tecomate. Even among utilitarian wares generally, tecomates at El Varal themselves were embarrassingly well decorated with multiple contrasting bands involving slipping, burnishing, brushing, plastic modification, and incised motifs (Figures 9.3 and 9.4). The Varal tecomates are not the excessively crude and strictly expedient tools regularly seen in known modern instances and convincing archaeological cases of salt manufacture. One is left to wonder

whether Varal tecomates might have been used for purposes other than reducing brine.

4. *There would have been plenty of available resources other than salt*. El Varal seems to have been occupied primarily in the dry season (Chapters 13 and 14). That should have been a good time to produce salt, but it is also the season in which aquatic resources would have been most scarce inland and at their peak in the estuary-lagoon system. People visited El Varal for weeks, even months, in significant numbers—time and personnel enough to supply themselves with salt and to perform many other tasks.

   It would have made sense for them to pursue a variety of estuary resources beyond salt. I propose that they did so. This position is supported by the residue study of potsherds (Chapter 16), which found that the Varal tecomates were probably used to cook a variety of content that overlapped the content of tecomates at the dish-dominant inland site of Cantón Corralito.

5. *Patterns at El Varal contrast with a more convincing case of specialization from Late Formative Soconusco*. Although general comparison of stratigraphy and vessel assemblages with the Late Formative Guzmán Mound (Nance 1992) helps clinch the case for salt production at El Varal, there are significant fine-grained contrasts. At El Varal, there were notably fewer formal hearth features, more nonproduction-related artifacts of all types, and a much greater frequency of faunal remains. The extraordinary paucity of animal bones at Guzmán is particularly striking: total vertebrate NISP of 4, or about 0.2 specimens/m^3, compared to 100 to 300 specimens/m^3 at Varal.

   At Guzmán, burning technology was more elaborate and production was spatially segregated from other activities such as food consumption. Late Formative salt-production sites in the estuaries of the lower Naranjo are characterized by a unique special-purpose ware that was at first difficult for archaeologists to place chronologically because of the lack of correlations with pottery from primary residential sites (Coe and Flannery 1967:91–92)—suggesting elaboration of technology specific to particular activities and, more generally, greater segregation of activities.

   Further, Late Formative salt makers were meeting the demand generated by a significant population that had withdrawn inland (to optimal areas for agriculture) and that included (somewhat farther afield) true urban centers such as Ujuxte (Love 2007:294–295). It appears likely that a good case for occupational specialization in salt production could be constructed for the Guzmán Mound. Further, the features of Guzmán that point most suggestively to specialization are also points of contrast with El Varal. If we take Guzmán to represent "specialist" salt production in Formative Soconusco, El Varal might well represent "unspecialized" production—with organizational arrangements closer to the collector model. El Mesak is an important third case still to be considered.

6. *A long-term perspective on the history of tecomate-dominant estuary vessel assemblages favors a link to collecting rather than to specialization*. Social hierarchy and political complexity evolved rapidly in Early Formative Soconusco [Chapter 1, and see Lowe (1977), Clark and Blake (1994), Clark and Pye (2000), Hill and Clark (2001), and Blake et al. (2006)]. The entire Mazatán region may have been politically unified in some system akin to a complex chiefdom early in the Cuadros phase, a century or so before occupation of the Vásquez Mound at El Varal (Clark and Blake 1989; Clark 1997; Clark and Pye 2000).

   It would seem not unreasonable, then, to look for some degree of social heterogeneity by the Jocotal occupation of El Varal. Yet the pattern of inter-site assemblage variation under examination here did not emerge gradually over the course of the Early Formative. Instead, tecomate-dominant sites such as Los Alvarez and Sandoval appear already in the Locona phase of 1700 to 1500 B.C. (Ceja 1974, 1998; Lowe 1977; Clark 1994a:111–113, 541). I suspect that the Locona-Ocós assemblage of the Martínez Mound at El Varal (Chapter 2) is also tecomate dominant, but we do not have enough evidence to verify this.

   The rapid emergence of the tecomate-dominant/dish-dominant distinction near the beginning of the Early Formative poses problems for an argument of social heterogeneity and specialization. Even though there appear to have been dramatic differences in residential architecture (probably linked to social hierarchy) during the Locona and subsequent Ocós phases, it has proven difficult to document differentiation in household artifact inventories (Lesure and Blake 2002).

One way of accounting for such results would be to posit significant social inequality but low heterogeneity. If that suggestion holds merit, initial Early Formative Soconusco would be a particular case of what McGuire (1983) saw as a general pattern. He suggested that archaeologists' notion of complexity lumped together two variables (inequality and heterogeneity) that should be disarticulated so that their interactions can be explored. He particularly suggested that significant inequality could emerge early, in situations of low social heterogeneity.

If I am correct to link the vessel-form distribution observed at El Varal to an adaptive pattern that emerged in the initial Early Formative in a situation of low social heterogeneity, the collecting model would seem more promising than specialization for characterizing the organizational arrangements involved. Important changes may well have been underway in the Jocotal phase if a shift to a greater focus on maize agriculture created rising demand for salt (Pye 1995:312–313).

It is in this light that the contrast between El Varal and El Mesak becomes particularly significant. The evaporation technology at El Mesak matches the type of orientation toward efficiency expected of specialized production (Figure 14.2). Use of Mesak jars in that case expanded gradually over the course of the Early Formative until the form dominated the assemblage by the Jocotal phase (Pye 1995). In other words, Mesak-jar dominance had a very different trajectory of development from that of tecomate dominance.

Mesak jars can be taken as a signal of specialized production of salt for the Jocotal phase. Such productive organization was emergent but still rare at the end of the Early Formative, much as we might expect in the context of a regional subsistence system still on the verge of significant further steps in the growing importance of maize. In the Jocotal phase, the sites of El Varal and El Mesak were probably organizationally distinct—the former pursuing adaptive patterns that were quite ancient and the latter presaging what was to come.

Conclusions

This chapter has taken up the question of salt as product. That is an attractive interpretation that would help account for various aspects of the archaeological deposits at El Varal (the pervasive evidence of burning, the quantity of ceramics, the quarried fill layers, and perhaps the frequent calcium-rich concretions). However, salt is not attractive as a sole product of the site's inhabitants. The site is well located for the collection of estuary subsistence resources, the vessel assemblage lacks crude open vessels appropriate for evaporation, and there seems to be too many similar sites in relation to estimated regional demand for salt.

I propose that the occupants of El Varal produced salt, but that they produced other things as well. Instead of using specialized salt-production vessels, they applied the same simple, generalized technology (particularly the tecomate) to a variety of tasks—perhaps (to build on suggestions from Chapter 15) because their production strategy was itself generalized. Acquisition of resources of all types was generalized, and organizational patterns involved a complex combination of foraging and collecting strategies—both moving people to resources and moving resources to people, depending on the product. Products flowed through generalized social obligations such as relations of kinship and alliance. In Chapter 18, these ideas are developed into a set of "concluding hypotheses" concerning inter-site assemblage variation in Early Formative Mazatán.

CHAPTER 18

Concluding Hypotheses

RICHARD G. LESURE

ALTHOUGH THE SALVAGE SITUATION dominated the investigation of El Varal, a clear archaeological problem emerged during the course of the work. The site fit an Early Formative "estuary" pattern in which the predominant vessel form was the tecomate. At contemporaneous sites a few kilometers inland, serving dishes predominated. Previous investigators have tended to formulate that archaeological pattern in social terms by suggesting that it derived from "specialized" production at estuary sites.

Those efforts have been rather casual, however, in that the actual products are only vaguely identified and the relations that would have obtained between producer and consumer are highly speculative. I have avoided any rush to shift the archaeological problem into social terms and have instead conceived the volume itself as a protracted effort at hypothesis formulation.

In overseeing the translation of more than a decade of analytical work (including indispensable contributions from coauthors) into the current text, I have tried to follow two principles. The first is a truism of scientific rhetoric: a problem-method-results structure facilitates clarity of communication, scrutiny by colleagues, and replicability. The second is Hodder's (1992) aspiration that the textual recounting of an archaeological investigation should attempt to convey the reality of the research process.

The intersection of these two, not entirely compatible, principles has produced an arc of emerging insight over the previous 17 chapters. It seems legitimately hermeneutic. However, it is studded with instances of analyses organized as evaluations of hypotheses. Although it might appear that I have embraced the interpretivist account of the research process as ultimately hermeneutic—relegating model testing to a mere proscriptive formula for drawing subsidiary conclusions—it should be remembered that this volume is itself conceived as merely one step in a larger, collective, and as yet unrealized explanatory trajectory.

The intended outcome here is a set of hypotheses that translate observed inter-site assemblage variability into social terms. Those will be tailored to Early Formative Soconusco and to the Mazatán region in particular, but they are intended also to forge a link between the archaeological problem and some body of comparative theory concerning economic organization in small-scale societies. They are thus to be relevant to wider inquiry into the Archaic-Formative transition in Mesoamerica as well as to the explanatory impulse in anthropological archaeology.

The task in this final chapter is to pull together those hypotheses. I first revisit my alternative theoretical

inspirations (the glance ahead to specialization or back to hunter-gatherer settlement and subsistence systems) and then review the six research topics of Chapter 1 in relation to that set of theoretical interests. That discussion, placed in the context of recent work on the nature of Early Formative adaptations in the Soconusco, provides the basis for a model of the organization of settlement, subsistence, and community in late Early Formative Mazatán. The chapter concludes with a consideration of patterns of temporal and spatial variability, including suggestions toward falsification of the proposed hypotheses.

Specialization, Collecting, and Foraging

Chapters 1 and 14 identified two strategies for exploring ancient economic organization. The first observes organizational variability along multiple distinct dimensions. The second approach identifies idealized models that synthesize recurring constellations of parameters. Each approach has its advantages and disadvantages, and there seems no reason not to use both. The research topics introduced in Chapter 1 and brought up in appropriate contexts throughout the volume fit into the spirit of the first approach. Chapter 14 introduced the second approach, identifying four idealized models (two inspired by theories of specialization and two by Binford's collecting/foraging distinction) for organizational patterns that could have produced the divergent vessel-form assemblages observed in Early Formative Mazatán.

Proposed interpretations of dish-dominant and tecomate-dominant sites from the perspective of each model were summarized in Table 14.1, and generalized archaeological expectations (centered on what might be found in the tecomate-dominant components of each hypothesized system) were brought together in Table 14.2. There was considerable overlap in expectations of the models, and I emphasized that the intent was to use them as conceptual tools for working out the specificity of economic organization in Early Formative Mazatán—holding out the possibility that more than one might apply when products were considered individually. Reserving that level of detail for the next section, it seems useful to begin here with an overall assessment of results from efforts in Chapters 14 through 17 to apply these models to the archaeological record of El Varal.

Table 18.1 reprises Table 14.2, with blackened cells in the table indicating best matches with the archaeological record of El Varal. The entirety of row 7 is in gray rather than black because the matches in that case depend on what product is considered.

Different aspects of the Varal archaeological record conceivably provide some support for each of the models. However, if we were to simply count positive cells collecting would win the count—followed by specialization with part-year residence, then foraging, and then full-year residence specialization. At the close of Chapter 14, I set aside full-year resident specialization based on Kennett and Culleton's seasonality evidence (Chapter 13) and the analyses of intra-site variation in features and artifacts.

A model based on Binford's notion of foraging as a strategy of moving people to resources cannot satisfactorily explain our inter-site assemblage variation (Table 14.1). Its expectations concerning site structure, overall artifact content, and domestic features and artifacts likewise do not match the Varal assemblage—indicating that if any use is to be made of this model it must be acknowledged that other things were going on. Still, Varal faunal remains consist of a spectrum of local resources—and the tecomate seems generalized rather than specialized. The foraging strategy of moving people to resources instead of vice versa proves to be a crucial point of reference in building an understanding of wild-resource collection strategies at El Varal, an argument begun in Chapter 15 and continued in this chapter.

The two models of most obvious interest for explaining inter-site assemblage differences in Early Formative Mazatán are specialization with part-year residence and collecting. Specifically, the occupants of El Varal might have been seasonal part-time *specialists* who maintained residences in some inland community. Their products would have moved to consumers through relationships beyond kinship, such as exchanges between households or patron-client interactions. Alternatively, those at El Varal might have been logistically organized *collectors* producing for a larger consumption unit of which they were themselves members.

The two overlap considerably in their expectations for tecomate-dominant sites and are thus difficult to distinguish with the data at hand. The two most promising points of contrast in Table 18.1 are noted in rows 6 and 4. In the collecting case, we expect social homogeneity (Durkheim's mechanical solidarity)—whereas

Table 18.1. Summary of results regarding expectations of the different models from Table 14.2[a]

Expected Archaeological Patterns	Foraging	Collecting	Specialization Part-year	Specialization Full-year	Chapters
Interpretation of tecomate-dominant sites	*Location*	*Field camp*	*Production locale occupied part of the year*	*Production locale occupied permanently*	
1. Seasonality	**Site use may be seasonal**	**Site use may be seasonal**	**Site use may be seasonal**	Site occupied year-round	13, 14
2. Site structure	Little stratigraphic differentiation	**Marked stratigraphic differentiation**	**Marked stratigraphic differentiation**	**Marked stratigraphic differentiation**	3, 14
3. Overall artifact content	Few artifacts	**Artifacts potentially numerous**	**Numerous artifacts**	**Numerous artifacts**	14
4. Artifacts involved in production	**Generalized rather than specialized tools**	Tool kit may be special-purpose	Tool kit likely to be special-purpose; standardization and efficiency possible concerns	Tool kit likely to be special-purpose; standardization and efficiency possible concerns	9, 14, 17
5. Domestic features and artifacts	Few	**Fewer than at dish-dominant sites, with frequencies dependent on group size and length of stay**	**Fewer than at dish-dominant sites, with frequencies dependent on group size and length of stay**	Similar to dish-dominant sites (but need separation from residues of production)	14
6. Differences between domestic assemblages	**Homogeneous, few differences**	**Homogeneous, few differences**	Potentially heterogeneous, due to occupational differentiation	Potentially heterogeneous, due to occupational differentiation	17
7. Wild resources represented	Spectrum of locally available resources	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)	Evidence of emphasis on one or a few specific resources (but consider inhabitants' meals)	14, 15, 16, 17

a. Positive results indicated by black or gray shading.

occupational specialization implies more developed social heterogeneity (Durkheim's organic solidarity). Although my evidence was limited and in the future those results should be examined with a much larger data set, available data on domestic differentiation in the Jocotal phase point to homogeneity rather than to heterogeneity (Chapter 17). In the case of productive technology, the evidence is stronger but the expectations weaker. In the specialization case, a special-purpose tool kit with themes of standardization and efficiency would seem likely. In the collecting case, tool kits may also be special purpose and elaborate, but the economic logic favoring standardization and efficiency is weaker. Salt is the only potential product plausibly subject to specialized production at El Varal (Chapters 15 through 17). It seems telling, then, that the technology in this case (the tecomate) is not well designed for efficiency in this particular task (Figure 14.2, and see Chapter 17) but seems instead generalized in purpose. The technology of salt production is a better match for the expectations of *foraging* than for collecting or specialization, although in regard to collecting I suggested that technology *might* be special purpose (Table 18.1, row 4). Chapter 17 presented a broader list of reasons for favoring the collecting model over specialization for understanding salt production at El Varal.

My basic argument is thus that the occupants of El Varal were seasonally mobile villagers with permanent residences a few kilometers inland on the Coatán Delta. They maintained the estuary site as a dry-season field station to facilitate the harvesting of a range of resources that then moved from producer to consumer via generalized social relations (kinship, alliance) rather than specifically economic ones (exchange, tribute). Tecomates were the most archaeologically visible component of their technology. Visitors to El Varal manufactured those and other vessels at the site itself and cached them there when not in residence.

The suggestions emerging here from a tortuous review of evidence from El Varal converge to a marked degree on suggestions by Arnold (1999) concerning Early Formative residential mobility and the tecomate as a vessel form. From comparisons between Early and Late Formative occupations at La Joya in the Tuxtla Mountains (Veracruz), Arnold sought to explain the prominence of tecomates in the earlier assemblage

and the disappearance of that vessel form by the later one. He noted evidence for settlement mobility and a relative unimportance of maize in the early occupation, including lack of mounded construction, buildup of deposits in a palimpsest fashion, one-handed as opposed to two-handed *manos*, lack of burials, and absence of storage pits.

He proposed that the tecomate be understood in this context as a "multipurpose container whose design constituted a weighted compromise responding to several performance requirements," among which was an "adaptation that included nonagrarian residential mobility" (Arnold 1999:158). He noted cross-cultural studies of pottery shape that suggested that rounded bases correlated with greater diversities of foodstuffs (although other associations of rounded bottoms did not all support his thesis) and proposed that tecomates were an appropriate design for stews left on the fire unattended.

He noted the surprising attention to decoration among the utilitarian vessels and explained it by proposing that pots made for use in a variety of social situations might be decorated to meet the most decoration-intensive purpose they could be called upon to perform. Specifically, if vessels were cached at sites visited only part of the year such decoration might essentially constitute labels of ownership.

These are all very useful ideas, and the proposals developed in this chapter concerning the social role of the tecomate in Early Formative Mazatán follow them in spirit. I wholeheartedly endorse Arnold's basic characterization of tecomates. A significant difference between his case and that under examination here is that I am looking at two components of a single settlement system rather than at two points in time. I comment briefly in the following on the issue of tecomate decoration.

Research Topics Revisited

A return to the research topics outlined in Chapter 1 provides a point of departure for elaborating specific understandings of economic, subsistence, and settlement organization in Early Formative Mazatán.

Site Setting

El Varal was located within the estuary system of the Mazatán region, an area dominated by deltaic deposits of the Coatán River but also including the river itself, a strip of brackish estuary along the ocean, and to the northwest and extending considerably inland the freshwater Hueyate Swamp. Two sources of temporal variation in the site setting are worth emphasizing. First, there were annual fluctuations in the water table. During the rainy season, freshwater entered the estuary. Isotope studies by Kennett and Culleton record the oscillations in salinity in the shells of *Polymesoda radiata* expected of seasonal alternation between wet and dry seasons in a lagoon setting (Chapter 5). During the rainy season, at least early in the occupation and perhaps throughout, the mound was an island. During the dry season, the immediate vicinity dried and was baked in the sun (Chapter 3). We do not know how far the water receded. During the earlier part of the occupation in particular, the site could have been an island even during the dry season.

The second source of temporal variation was the progressive siltation over 200 years of the lagoon, which early in the occupation surrounded the site (Chapters 3, 5, and 14). The mollusk shells indicate that the lagoon had many of the characteristics of lagoons from the Acapetahua region described by Voorhies (2004). Such features are currently unknown in the Mazatán region (Chapter 1). The layers of beach-like sand in the "sandy edges" within the Vásquez Mound *were* beaches: sediments in these layers were sorted by waves in the lagoon.

No such depositional environment has existed at the site since abandonment of the mound. More recent deposits are clayey and rich in organics. They were probably deposited in a vegetated and seasonally inundated pampa setting. This localized transition in conditions of sedimentation seems to have been underway during the course of the Jocotal-phase occupation. During that time, the primary species of mollusk exploited shifted from marsh clams to species characteristic of more marine conditions. Isotopic studies of the latter did not reveal evidence of annual oscillations in salinity.

Resources in the catchment would have included fish, shellfish, and crustaceans from the estuary-lagoon system, the lower Coatán River, and the ocean beach; salt from seasonally inundated areas exposed in the dry-season sun; and terrestrial animals of various types in the pampa areas. The faunal assemblage indicates that a spectrum of available resources was brought to the site, with an emphasis on the estuary-lagoon system.

We have much less information on plant resources. In particular, it remains unclear whether crops might

have been grown in the vicinity of the site during the dry season. Areas covered seasonally by the lagoon would probably have been too salty, but the owner of the site planted two successive crops in 1992 (one beside the drainage canal in the early dry season and one in the canal bed itself during the late dry season; see Chapter 14). It is possible that crops could have been planted along natural drainages just inland from the site.

Permanence of Occupation

Evidence of various types indicates that from the Early through Late periods El Varal was occupied only part-time, probably on a seasonal basis. A strong dry-season emphasis during that time, with some wet-season representation, is indicated by the isotopic studies of *P. radiata* (Chapter 13). The Terminal period by contrast represents a year-round occupation. The assemblage then was dish dominant and similar to a sample of domestic refuse from the inland site of San Carlos (Chapter 17).

Chapter 14 compared Terminal artifacts and features to those of the Early and Late periods (see also Chapters 3 and 9 through 11). Both assemblages contained the same categories of artifact, indicating significant periods of occupation and/or large groups of people. There was more divergence in the occurrence of features. Over the great expanse of Early to Late profiles exposed, evidence of habitation structures was generally absent—except for a single possible Middle-period case (Chapter 3). Pits, common in excavations of Locona-Cherla deposits at Paso de la Amada and probably used for storage, were rare along the Varal profiles. Those identified seem smaller than their inland counterparts. Burned features were confined to the Early to Late periods. Small platforms, and possibly all of the burials, were instead Terminal in date. All of these patterns would be consistent with a shift in the Terminal period from temporary task-specific visits to permanent occupation. Quantitative analysis of domestic artifacts reveals dramatic rises in the frequency of several domestic artifacts (obsidian flakes, figurines, grinding stones, and worked sherds) at that time (Chapter 14).

Size and Nature of the Group Occupying El Varal

The site of El Varal consists of two mounds with a total occupied area of about 1 ha. The Martínez Mound is 7 m high and 50 by 80 m in horizontal extent. It is Locona and Ocós in date. The Vásquez Mound, vaguely round and with a diameter of 90 to 100 m, is 5 m tall at its center. This second mound is composed to a great extent of debris generated by human activities over 200 to 250 years. Production of residue in such volume would usually imply considerable numbers of people, although bulk salt production with the *sal cocida* process proposed here (Chapters 3, 14, and 17) might generate deceptive quantities of debris in relation to actual numbers of people.

Still, several observations point to sizable groups of occupants. Pottery was produced on-site in great quantities (Chapter 16). Finally, although frequencies are depressed, all of the same categories of artifacts identified in dish-dominant assemblages are found in the tecomate-dominant occupation of the Early to Late periods (Chapter 14). In Chapter 14, I used the ratio of tecomates to dishes in the Terminal-period deposits to separate a hypothesized domestic assemblage (vessels used by occupants for meals) from a special-purpose assemblage (tecomates beyond normal domestic needs, used in the processing of salt or other resources). I then estimated how many people might have been required to produce just the domestic assemblage over the course of 200 to 250 years. Although several parameters needed to be estimated to perform the calculations, I proposed that we need to think in terms of at least 200 people occupying the site seasonally on a yearly basis. Actual numbers could have been greater.

The group occupying El Varal was thus the size of a small village. The diverse array of artifacts (albeit in frequencies lower than at permanent habitation sites) probably indicates that the occupying group was itself diverse, including multiple ages and both sexes—perhaps entire families. This would seem consistent with a specialization model if certain families (the units of production) produced goods for transfer to others (the units of consumption). The collecting model, by contrast, posits visits by specially organized task groups whose goal would have been to process resources for transfer to inland villages. We would have expected them to leave extraneous family members behind. Discussion in Chapter 15, in particular, raised another possibility here: what about a foraging strategy in which people from dish-dominant sites are moved to resources rather than resources to people?

Distinctiveness of Activities at Different Sites

Our basic goal is to explain inter-site assemblage differences in behavioral terms. What was distinctive about activities carried out at tecomate-dominant sites—or for that matter at dish-dominant sites? The extensive

similarities between Terminal-period refuse from El Varal and the unit 10 sample from San Carlos–Cantón Corralito (Chapter 17) are consistent with a claim that both can be considered "typical" domestic assemblages.

Further, the fact that the shift to a dish-dominant assemblage in the Terminal period is associated with a rise in frequencies of other domestic artifacts (obsidian, figurines, worked sherds, grinding stones) helps substantiate the idea that tecomate-dominant assemblages were created by an elevated rate of breakage of tecomates rather than by a decreased use of dishes. Thus, tecomate-dominant assemblages were the result of people using tecomates beyond their typical domestic needs—as expected if production beyond the immediate needs of site inhabitants was the main motivation of the occupants.

In other words, there was some distinctive activity or activities conducted during the Early through Late periods at El Varal—activities not conducted during the Terminal period or at Cantón Corralito. Judging from the prevalence of burned features and the pervasiveness of burned earth more generally, those activities involved the regular use of fire. Most likely, something was cooked in tecomates. Such a pattern could be consistent with specialized production. One note of concern for the cause of specialization is that no other archaeologically recoverable tools seem to have been involved in these special activities.

In comparison with dish-dominant sites, the tecomate-dominant occupation at El Varal is characterized mainly by absences: few structures, few pits, few or no burials, no residential platforms, and depressed frequencies of standard domestic artifacts. There are no candidates for specialized tools beyond the tecomate. As far as I have been able to discern, the metric characteristics of tecomates are in addition identical at dish-dominant and tecomate-dominant sites (Chapter 9). The tool kit used for any "specialized" activity in the Early through Late periods was thus not itself specialized in any discernible sense.

The tecomate as a vessel form was actually an ancient one in the Soconusco. Viewed from the perspective of its history (Figure 9.25), it was in that sense generalized rather than specialized in its potentialities. As Arnold (1999) suggests, its design was suited to a variety of functions. Indeed, that is one of the sources of the long-standing interpretive problem with inter-site assemblage differences in Early Formative Soconusco. It is also a contributor to the long delay between fieldwork and publication in the case of the current volume. Tecomates *could* have been used for a variety of things. What were they actually used for?

Products and Productive Activities

The problem of what the occupants of El Varal produced cannot be completely separated from the question of relations between producers and consumers. It seems likely that site occupants processed resources beyond their own immediate needs for transfer to inland villages. If so, we would hope to recover evidence of that activity and the product or products involved. Complications are generated by the fact that producers would have needed to feed themselves while in residence ("task-group provisioning," Chapter 15) and by the possibility that nonproducers sometimes showed up to join the fun.

Under this last scenario ("subsistence-oriented seasonal mobility"), a certain core group of occupants might have come for lengthy dry-season stays—with the occupying group regularly augmented by additional visitors who came for meals at the site. Such a scheme would be a blend of collecting and foraging strategies because the core site occupants would have produced for others but at least part of their product would have been consumed forager fashion (by moving people to resources). I focus here on the issue of production for storage/transport, returning to the issue of on-site meals and their participants in the following section.

Chapters 14 through 17 considered a variety of possible products potentially destined for transport to inland sites. Many of them seemed difficult to rule out yet not satisfactory as *the* product of El Varal. I have always been skeptical that tecomates themselves were the product. An inquiry by Carballo and his collaborators into that possibility, although not definitive, provides empirical support for the claim that the pottery at both dish-dominant and tecomate-dominant sites was mainly manufactured on location (Chapter 16).

Voorhies (Voorhies et al. 1991; Voorhies 2004:147–157) has championed shrimp as possibly subject to bulk production in Soconusco Archaic sites. It is an attractive possibility for a focus of activity at El Varal: shrimp swarm in local lagoons during the dry season (Voorhies 2004:150–151), when the site seems to have been occupied (Chapter 13). Shrimp are still produced in bulk in Chiapas today, the method involving brief boiling (a positive point given our tecomates) followed by sun drying (Lindner 1944:79; Voorhies 2004:152).

Lindner (1944) reports a million pounds produced annually in the Chiapas estuaries in the early 1940s,

and Voorhies (2004:150) cites a variety of other statistics—all confirming the potential for significant bulk harvesting. In February and early March, the local men helping us with the excavation of El Varal used cast nets to catch shrimp in the canal running through the center of the Vásquez Mound (Figures 14.8 and 14.9). Perhaps it is that personal experience at the site itself that leaves me loath to dismiss the possible harvesting and drying of shrimp for transfer to inland sites as an activity of the occupants of El Varal.

Still, although shrimp remains have been recovered at archaeological sites outside the Soconusco, Wake did not identify any in the limited set of available flotation heavy-fraction samples (Chapter 7). Further, one piece of evidence (despite its various limitations) recommends against any claim that Varal was a specialized shrimp harvesting site: our residue studies suggest that the Varal tecomates were probably used to cook a variety of foods substantially overlapping with those cooked in tecomates at the dish-dominant inland site of Cantón Corralito (Chapter 16).

Mollusks could have been steamed open (perhaps in tecomates) and sun dried for transfer to other sites. The Archaic shell middens seem to derive from that practice (Voorhies 2004:45–48, 129–141, 406–408). Although mollusks are the most numerous class of faunal remains at El Varal, they do not appear in the same volumes as those observed at the Archaic sites. In general, there do not seem to have been sufficient shells to back up an argument for bulk processing of mollusks for storage. Possible exceptions are several dense deposits from the Late shell phase, although see discussion in Chapter 15 of skepticism even concerning those, based primarily on the presence of the diminutive bivalve *Amphichaena kindermanni*. Our workmen considered that shellfish good only for soup. I would suggest that it and other mollusks whose shells appear in the deposits were cooked in tecomates and eaten on-site.

Although drying would seem the most likely means of preserving fish—with contemporary precedents on the Chiapas Coast that include sea catfish (Lindner 1944:76), the dominant family at El Varal—we have also considered the possibility of another type of fish product, specifically, that involved in Smith's (1997) gefilte fish hypothesis. The latter has the advantage of requiring tecomates and potentially of removing bones from the archaeological record, but the storability of such a product is in doubt and there is no ethnographic precedent. It is proposed specifically to account for archaeological patterns encountered at El Varal.

Both of these possibilities are difficult to examine archaeologically. Plausibly, inhabitants could have left extra cranial bones of fish at the tecomate-dominant production center. In Chapter 15, we looked for such a pattern in a comparison of identified sea catfish (Ariidae) elements from El Varal and Paso de la Amada. We were not able to find systematic differences in skeletal parts represented, although there is a lot of "noise" in the data at this level of detail due to greater fragmentation of the Paso sample. Thus, although I think it likely that fish were processed for storage at El Varal I can point to no clear evidence of any such practice as opposed to immediate consumption of fresh fish.

Sea catfish seem the most likely option. They were important at all three Early Formative sites examined in Chapter 15 and were likely harvested more than 5 km from Aquiles Serdán and perhaps Paso de la Amada. That fish was dried along the coast of Chiapas during the twentieth century, although it was hardly the most important one reported by Lindner (1944). Voorhies (2004:408–409) notes that the Huave of coastal Oaxaca dry fish today without removing any bones. The entire skeleton would enter the archaeological record at the inland consumption site.

In contrast to the fish-product scenario, the case for the manufacture of salt at El Varal appears strong. Late sixteenth-century aboriginal salt making along the Guatemalan Coast involved scraping up salt-laden earth and placing it in wooden troughs (Coe and Flannery 1967:92). Water poured over the earth would trickle out below as brine, which was then boiled and reduced to salt. At El Varal we have pervasive evidence of burning, many broken cooking containers, and homogeneous deposits of sediment that seem likely to be the debris of that production (Chapter 3).

I have repeatedly suggested that tecomates were used to cook things other than salt, and our residue study (Chapter 16) seems to support that idea. Still, even if we were to say that tecomates were only used for salt half of the time production of salt would have been significantly greater than site occupants would have been able to consume during their dry-season stays. I suspect that they used salt to preserve sea catfish for consumption during a stretch of resource scarcity in the late dry season and early rainy season. However, no particular piece of evidence can be cited in support of this idea. Production of salt for transport to and use at inland sites must be considered likely. How was production organized and how did the product reach consumers?

Relations Between Producers and Consumers

Although I suspect production for preservation and storage of fish (and, even more speculatively, shrimp)—after all, without such production the big interest in salt on the part of people whose diets contained plenty of fresh estuary fish, crabs, and mollusks would remain puzzling—it is impossible to rule out consumption only of fresh fish and there is no archaeological evidence at all of shrimp. To explore relations between producers and consumers, it seems wise to focus on activities we can be confident were actually taking place: a surplus production of salt and the localized harvesting and consumption on-site of a variety of wild foods.

The relationship of producers to consumers is really the crux of the difference between the collecting and specialization models. In the former case, producers and consumers are part of the same consumption unit and products move through "social" relations. In the latter, units of production and consumption are distinct—with products moving between them in "economic" relations. Social relationships generally tend toward homogeneity in the former case and heterogeneity in the latter (Chapters 14 and 17).

Chapter 17 argued the case against specialized salt production. Production locales in the Pampa Cabildo seem to have been overabundant in relation to my estimate of how much demand for salt there might have been in Early Formative inland communities. Whereas the economics of production for exchange would seem unworkable in this case, those of collecting—each consumption unit producing its own salt—would involve considerable duplication of effort and might well yield the apparent excess of salt-producing sites we find in this case. Mechanical solidarity in salt production would imply low overall social heterogeneity, consistent with the results of detailed comparison of two Jocotal-phase domestic assemblages—one from an inland town and the other from an estuary-edge hamlet.

The vessel chosen by the occupants of El Varal for the reduction of brine to salt (the tecomate) would have been adequate to the task, but it was strangely inefficient from the perspective of specialized production. On the other hand, the tecomate could be used to cook a variety of other things—and there would have been plenty of aquatic resources available in the lagoon and lower estuaries during the dry season, when those same resources would have been unavailable a short distance inland. A comparison with what appears to be a Late Formative salt-production site in the Naranjo region of the Soconusco reveals various contrasts understandable as indicative of specialized production at the Late Formative site and lack thereof at El Varal. Finally, a long-term perspective on the history of tecomate-dominant vessel assemblages at estuary sites favors a link to collecting rather than to specialization—in part because the pattern emerged rapidly near the beginning of the Early Formative period.

Salt production was therefore organized in a fashion closer to the collecting than the specialization model, with consumption units arranging for their own needs directly and products flowing from producer to consumer through generalized social channels such as those of kinship. What, though, about food consumption at El Varal? Were participants at meals simply members of the task groups there to produce salt (task-group provisioning) or were people other than producers showing up for meals in the estuary (subsistence-oriented seasonal mobility)?

One way of exploring this issue is to compare Early Formative and Archaic sites. The vertebrate remains at the Archaic estuary sites seem likely to be the debris of meals by task-group members engaged in the bulk harvesting of marsh clams. Although we do not have faunal remains from an Archaic residential base, we can compare the faunal remains from El Varal with those of Archaic estuary sites and inland Early Formative sites to see if there is reason to view our site as an Early Formative analog of the Archaic estuary field station (Chapter 15).

The occupants of El Varal ate a spectrum of wild animal foods available in the estuary-lagoon system (with a possible extension to the ocean beach primarily to obtain shellfish). The faunal remains left behind are numerically dominated by mollusk shells, like the remains left by the Archaic visitors to the Acapetahua Estuary and Hueyate Swamp. Still, differences with the Archaic faunal assemblages outweigh the similarities. The shellfish themselves represent a variety of species, probably consumed on-site rather than dried for transfer to residential bases.

The wider diet breadth among the shellfish extends as well to crabs, important at El Varal [as well as at Salinas la Blanca; see Coe and Flannery (1967:77)] and present as well inland at Paso de la Amada—but unimportant in the Archaic sites (Voorhies 2004:147). The same pattern does not extend to vertebrates, however (Figure 15.1). There is greater evenness of representation among the top-ranked genera (dominated in all cases by fish) at the Archaic sites than at El Varal.

In this sense, El Varal falls clearly among the other Early Formative sites. Dish-dominant and tecomate-dominant Early Formative sites seem to have shared a basic set of fishing practices that differed from those of the Archaic visitors to the estuary.

In summary, subsistence of the occupants of El Varal was similar to that of people at dish-dominant sites—with differences (greater reliance on shellfish and crabs, less on terrestrial fauna) explicable in relation to resources most directly accessible in the immediate site catchment. It is possible to perceive an "Early Formative character" to subsistence at dish-dominant and tecomate-dominant sites in that the faunal assemblages from these sites are more similar to each other than any one of them is to the Archaic sites.

Although that finding is a strike against the idea that the subsistence remains from El Varal derived solely from the expedient meals of salt producers, it is hardly definitive. A bigger challenge to a task-group provisioning interpretation is the number of people postulated for the occupying group at El Varal as well as their apparent diversity (Chapter 14). There would appear to have been more people at the site than necessary for the production of salt. If I were arguing for specialized production, it would be possible to envision entire families shifted to the estuary to produce salt—but at this point I have set aside the specialization model.

What about bringing the families of task-group members to the estuary? This would involve postulating a mixture of foraging and collecting strategies because people would have moved to resources. The idea has certain attractions. Tecomate-dominant sites are not far from the dish-dominant sites hypothesized to be the locations of permanent residences. If we imagine an inland community maintaining a tecomate-dominant field station in the estuary, the estuary outpost was only slightly outside (and even potentially within) a normal daily foraging radius from the permanent base. From many communities much of the necessary travel could have been effected by canoe, even in the dry season. Could people have simply been moved to fresh resources rather than resources to people?

We could come up with different variants of such a scheme: repeated brief visits by entire consumption units or (more plausible given the overall character of the Early to Late assemblage) long-term dry-season residence by a task group and regular visits by larger numbers of people. A variety of estuary resources could have been collected and cooked in tecomates, in a manner identical to that used "back home" at dish-dominant sites—yielding the similarity of lipid signatures noted in Chapter 16. Such a scheme would also fit comfortably with the similarity in processing inferred for the fish assemblages at El Varal and Paso and the similarities in character of the vertebrate fauna at all Early Formative sites in comparison to those of the Archaic. Finally, it would help account for the foraging signature that emerged from the comparison of fish taxa represented at Varal and Paso (Chapter 15).

Conclusions on Research Topics

Based on the results for each research topic, the settlement-subsistence system in late Early Formative Mazatán might be characterized as follows. There were permanent settlements (with dish-dominant vessel assemblages), generally located a few kilometers inland of the estuary on the Coatán Delta. It appears that at least some people living in such sites maintained bases of operation in the estuary—camps (with tecomate-dominant vessel assemblages) to which they returned year after year. Still, the estuary bases were only occupied seasonally, by people who maintained permanent residences elsewhere.

The parties occupying estuary sites were large and diverse, and at least some people spent weeks or even months there each year—generating substantial quantities of broken pottery. If the dry-season occupation argued here for El Varal was actually the norm, this would have been an ideal time of the year for harvesting a variety of estuary resources—including salt, fish, and shrimp. Further, by the later dry season aquatic resources would not be generally available inland on the Coatán Delta (except for the river itself).

Although salt production appears to have been a particular focus of activity at the tecomate-dominant sites, Early Formative visitors to the estuary pursued a variety of other attractive resources. I have proposed that this effort was organized as a mixture of collecting and foraging strategies. Dry-season visitors to the estuary produced storable surpluses (salt, perhaps fish, more speculatively shrimp) for transfer inland, but entire consumption units also spent time at the site in the dry season—foraging for a variety of estuary foods and consuming those at their estuary camp.

This set of arguments provides the ground on which I will construct my "concluding hypotheses." The main thing missing at this point is the larger adaptive logic of this Early Formative system. I work toward identifying such logic in the next section by returning

to a simplistic formulation (proposed in Chapter 1) concerning the theoretical dilemma we faced in the work on El Varal.

Should we explain inter-site assemblage variability in Early Formative Mazatán by looking ahead to societal complexity or back to hunter-gatherer strategies of settlement organization? I have at this point opted for the backward look for understanding a pattern of estuary use that at the time of the Vásquez Mound at El Varal was already an ancient one in the Soconusco—dating back half a millennium to the Locona phase (Ceja 1974; Lowe 1977; Clark 1994a). The dish-dominant/tecomate-dominant pattern did not emerge over the course of the Early Formative, but instead appeared fully formed near its beginning. We may therefore ask whether it might be possible to draw on larger understandings of the Formative transition to grasp the adaptive logic of the system.

The Early Formative Adaptive Shift in Soconusco

As noted in Chapter 1 (see also Chapter 15), our understanding of Late Archaic (3500 to 1900 B.C.) adaptive patterns in the Soconusco has been primarily formulated by Voorhies and colleagues (based on work in the Acapetahua area), with important recent additions focused on coastal Guatemala by Neff et al. (2006). The Archaic pattern in the Acapetahua region appears to have involved the logistical use of estuary resources by mobile populations maintaining inland residential bases on the coastal plain. The best-documented use of estuary resources is the marsh clam (*P. radiata*), dried in bulk and transported to base camps to feed a unit of consumption beyond the task group producing the resources (Voorhies 2004:406–408). The Archaic inhabitants were also cultivators who grew maize, probably on what was in the Soconusco the optimal location—the interior coastal plain (Jones and Voorhies 2004; Kennett et al. 2006). Based on evidence of differently timed human-induced deforestations and reforestations among the coastal Guatemalan study regions, Neff et al. (2006:304–305) characterize the Archaic pattern as one of extensive land use in which low populations exploited one area until yields declined. They then moved on.

The Early Formative began simultaneously (on an archaeological timescale) at about 1800 ± 100 B.C. in various parts of Mesoamerica, both highland and lowland. The shift is traditionally thought to have involved three basic elements: the appearance of ceramics, greater sedentism, and a shift in subsistence focus from wild foods to agriculture. The first two of these do seem to characterize the Soconusco Early Formative, with the Barra phase perhaps transitional in terms of sedentism. By the Locona phase, platform architecture and ceramics recovered in significant quantities help support claims for permanent sedentary communities—although some type of tethered mobility (or the scheme described in the following section) seems plausible. The third traditional element of the Early Formative, a shift toward agriculture-focused subsistence, is less clearly part of the Formative adaptations in the Soconusco (Blake et al. 1992a, 1992b; Smalley and Blake 2003; Chisholm and Blake 2006; Kennett et al. 2006; Neff et al. 2006).

As noted in Chapter 1, there seems to be some discordance in the available data. My position is that Early Formative adaptations involved an increase in the social importance of cultigens sufficient to explain the shift toward sedentism. It appears, however, that maize was not a dietary staple. Blake et al. (1992a, 1992b), Love (1999), and Rosenswig (2006) see the transition to the Middle Formative (ca. 1000 B.C.) as a watershed event involving an adaptive reorientation toward agriculture—whereas Kennett et al. (2006) portray a more gradual transition culminating in a fully agricultural focus by the Late Formative (400 B.C.). In the course of identifying widespread human-induced deforestation and thus possibly intensified cultivation in the Early Formative, Neff et al. (2006:308) lay emphasis on an increased diet breadth in circumstances of climate-induced ecological stress during the early second millennium B.C.

Drawing primarily on Blake et al. (1992a), Kennett et al. (2006), and Neff et al. (2006), the Early Formative adaptive shift can be characterized as follows. Most obvious is the appearance of ceramics, which seems to have been associated with a relocation of residential bases from the more interior coastal plain to savanna lands closer to the estuary. That shift is notable because the best lands for agriculture were actually on the coastal plain. The Early Formative residential bases were thus relocated *away* from the most desirable agricultural lands.

Still, at least by the Locona phase—and possibly as early as Barra—those residential bases were more permanent than they had been in the Archaic. Kennett et al. (2006) and Neff et al. (2006), building on Blake et al. (1992a), agree that these shifts were motivated by

intensification and an expanded breadth of diet—the expansion involving particularly aquatic resources of the estuary-lagoon systems along the coast. Neff et al. (2006) emphasize the role of technological innovation in allowing the successful use of more estuary resources, more intensively. Based again on Blake et al. (1992a:Figure 6), they mention particularly net weights and fishhooks as examples of Early Formative technological developments. One final point is the phenomenal *success* of the Early Formative adaptation, leading as it did to rapid population expansion in the Soconusco and the neighboring Guatemalan Coast (Neff et al. 2006:306).

These ideas on the Archaic-Formative shift contribute considerably to the formulation of "concluding hypotheses" for El Varal, with two qualifications. First, the idea that technological innovation played an important role in the Early Formative adaptive shift is quite helpful, but Neff et al. (2006) do not emphasize what may have been the most significant innovation: pottery. More specifically, the rounded-bottom utilitarian tecomate that allowed direct heating of content may have been a key innovation that in the context of the Archaic technological repertoire opened up a spectrum of estuary resources for exploitation.

Second, if (as suggested in this volume) the appearance of the tecomate-dominant/dish-dominant division of sites emerged toward the beginning of the Early Formative at the time of appearance of rounded-bottom utilitarian tecomates and was generated by a pattern of seasonal movement in which tecomate-dominant sites were estuary outposts and dish-dominant sites permanent residential bases, something is missing from the characterization just presented of Early Formative adaptive patterns. If the estuary was the overwhelming source of sustenance at that time, why would people move *near* the estuary instead of *to* the estuary? I propose that dish-dominant sites were inland from the estuary because of the demands of crop cultivation. The Early Formative readaptation was thus a compromise between two sources of food: domesticated/terrestrial and wild/estuary.

Hypotheses

Based on current understandings of Early Formative adaptations in the Soconusco and the new data presented here from El Varal, I would propose the following nest of hypotheses to account in social terms for inter-site assemblage variation in that period. The observed variability derives, ultimately, from a fundamental shift of strategy with respect to the estuary toward utilization of an expanded variety of resources. Although recovery technologies such as nets and fishhooks were likely involved (perhaps explaining the shift in evenness among top-ranked species revealed in Figure 16.1), processing technology was a more important variable in determining the nature of the Early Formative settlement system. [On recovery versus processing as limiting factors in the production of dried shrimp, see Voorhies (2004:152).]

In the specific historical-technological context of Late Archaic Soconusco, rounded-bottom ceramic tecomates placed over direct heat opened up for exploitation a range of estuary resources hitherto of only minor significance. Early Formative visitors to the estuary used the tecomate as a *generalized* rather than specialized tool, applicable to the processing of a variety of resources.

Tecomates could be used to reduce briny water to salt for condiments at meals or for preservation of foods such as fish or shrimp. They could be used to boil shrimp before drying. Indeed, it may be that the suggestions of Voorhies (Voorhies et al. 1991; Voorhies 2004) concerning the potential for bulk processing of shrimp hold better for the Early Formative than for the Archaic. Clams would have been relatively easy to exploit given Archaic heating technologies, and bulk processing emphasized that resource. The introduction of the cooking pot, however, may have made clam processing obsolete by providing effective technology for the bulk processing of an alternative resource (i.e., shrimp).

That suggestion would be consistent with the abandonment of the shell mounds at about the time of the Locona-phase introduction of rounded-bottom cooking pots, the burning of shells identified at Archaic sites but not El Varal, and the stronger dry-season emphasis at El Varal (Chapter 13) than at the Acapetahua estuary sites (Kennett and Voorhies 1996; Voorhies et al. 2002). It also seems compatible with carbon-isotope values for estuary shrimp, which differ from those of marine shrimp (Chisholm and Blake 2006:167 and Appendix 2). Still, the tecomate could be used to boil any number of foods for immediate consumption. Those included fish, crabs, and shellfish—and, given the results of our residue studies (Chapter 16), one should not forget Coe and Flannery's (1967:102) suggestion: tamales.

One might have expected Early Formative peoples seeking to intensify aquatic and terrestrial resources to have elaborated on the logistic pattern of estuary utilization that characterized the Archaic: they could have sent larger parties, perhaps, to process a greater variety of foods and/or to help transport them to villages 20 km inland on the coastal plain. Villages could then have been established in the most productive areas for intensified agriculture. Yet these are not the choices Early Formative peoples made. Why not? There would surely have been costs involved in realizing the potential of the tecomate to open underutilized resources to human exploitation.

If a wider spectrum of foods was subject to processing for storage and transfer to permanent residential bases, transport costs would have risen—conceivably favoring relocation toward the vicinity of the resources. However, reliance on tecomates for immediate consumption of estuary food would have been an even more important factor promoting settlement reorganization: when you put the crab on to boil you need to have your consumers at hand. Use of direct heating in ceramic vessels would thus have favored a shift toward the foraging strategy of moving people to resources compared to the more strongly logistic Archaic strategy of estuary exploitation.

Yet the Early Formative peoples also did not choose full foraging in which entire groups shifted continually around among residential bases. Instead, they moved close to (but not simply "to") the estuary and established permanent residential bases. In the Mazatán area, significant investment in earthen platforms and substantial residential architecture (Blake 1991; Lesure 1997a; Blake et al. 2006) date to the same phase as the appearance of the rounded-bottom cooking pot. It would appear that immediate consumption of estuary resources was not the only factor governing settlement patterns. An important second factor was probably the concerns of cultivation: the availability of arable land and the need to reside in proximity to gardens or fields in which significant labor had been invested.

The Early Formative adaptation would thus have involved intensification on two fronts. Intensification of cultivation focused on greater inputs of labor in the tending of gardens and fields, thus favoring sedentism. At the same time, the tecomate was used to diversify and intensify the exploitation of wild foods in the estuary. Realization of the two goals together required reciprocal compromises. The estuary strategy favored relocation toward the source of the resources, but there was insufficient arable land in the estuary itself.

As a result, the productive potential of the landscape was altered—and Early Formative peoples sought out new locations for settlement, areas in which they could simultaneously achieve acceptable returns from their terrestrial and aquatic intensification strategies. They established permanent settlements on arable land, planting crops and elaborating residential architecture. Still, the strategy of locating the settlements as close to the estuary as possible allowed for considerable mobility by individuals (in estuary-focused task groups) and by larger groups—entire units of consumption.

This flexibility in the relative positioning of people and resources—the ability to shift back and forth between collecting and foraging—allowed the full potential of the tecomate to be realized. Still, depending on the spatial relations between permanent residential base and estuary it could well have been advantageous to establish satellite outposts in the estuary itself: field camps where task groups engaged in bulk processing could reside, temporary stopping-off points in fishing excursions direct from the residential base, or even locations on which large numbers of people could descend for a collective fish boil.

Use of these estuary outposts was thus highly flexible. Still, they were not generally relied on as permanent living quarters and there was little investment in habitation structures. People manufactured pottery (much of it elaborately decorated) at the sites, but the assemblage was oriented toward productive tasks rather than toward consumption. Further, those tasks involved a heavy use of tecomates for cooking. The result is the inter-site differences in vessel form distribution observed in the archaeological record of Early Formative Soconusco.

Relations between producers and consumers were closer to those envisioned in the collector than the specialization model, with estuary task groups drawn flexibly from larger consumption units and products moving primarily through relations of kinship or alliance. Such a scheme would work best where social units of production and consumption were larger than the nuclear family. Although nuclear families as basic social units are part of received wisdom on Early Formative Mesoamerica, that image is based largely on highland cases. Interestingly, there are hints of something potentially quite different in Early Formative Mazatán. First, there are the large buildings (sometimes on platforms) we have interpreted as residences (Blake 1991; Clark

1994a; Lesure and Blake 2002; Blake et al. 2006). It is thus possible that actual *residential units* were of a larger scale than the nuclear family, although the evidence for typical as opposed to high-status residences is frustratingly fragmentary. Alternatively, social units intermediate in scale between residential units and the community as a whole are suggested by the widely scattered distribution of Locona platforms at Paso de la Amada (Lesure 1997a).

Although these issues need to be pursued at inland sites (not with a data set like that of El Varal), I would offer the following speculations. The Early Formative strategy of dual intensifications (wild-aquatic and domesticated-terrestrial) was based on a social unit of production and consumption larger than the nuclear family. Some type of kin unit on the order of 20 to 100 people in size would be consistent with the size and arrangement of platforms at Paso de la Amada.

Groups of this scale could have strategically positioned their members across multiple coastal habitats with great flexibility for whatever duration was necessary (days, weeks, perhaps months), the kin bond providing the individuals involved considerable confidence in benefiting from the collective effort. If I am right about the scale of such units, estuary outposts were used by multiple production units—probably entire inland communities. Dozens of individuals, representing numerous kin groups, would have resided long-term at the outposts during the dry season—producing storable surpluses but also hosting regular visits by larger numbers of people. With residential bases and estuary stations located 4 to 8 km from each other, frequent moves back and forth would have been a possibility.

What social rules governed rights to resources? The close spacing in the vicinity of El Varal of estuary outposts maintained contemporaneously by inland communities implies a nodal rather than territorial approach to issues of access and ownership. The estuary sites themselves, with their tell-like accumulations attesting to occupation over centuries, may have served to legitimize access for communities whose permanent centers were actually some distance from the estuary. Elaborate decorations on utilitarian tecomates at Varal catch one's attention when considered from the perspective of my claims for part-year residence. Could they be symbols of ownership, as suggested by Arnold (1999)? I would make an alternative suggestion. The information we have collected in Chapter 9 concerning design elements and their frequencies indicates strong similarities with the design repertoire of distant Salinas la Blanca in the Naranjo region. Such large-scale homogeneity would seem more consistent with *collective* rather than with *individualizing* social referents for the signs. If pottery decoration was related at all to resource access, I suspect that the signs on pots helped reinforce a shared identity that legitimized the right of all constituent individuals to estuary products.

The foregoing constitute my conclusions/hypotheses concerning El Varal. I finish by commenting on variability in the system just outlined, making a few suggestions on how my hypotheses might be falsified and touching briefly on the implications of my interpretive constructs should they prove durable.

Variability

Variable manifestation of the proposed adaptive strategies constitutes a topic for future investigation. I restrict consideration here to a few brief comments on spatial and temporal variation.

Spatial Variability

Although tecomate-dominant sites are known in several areas within the Soconusco, a clear contemporaneous dish-dominant/tecomate-dominant distinction has been most clearly documented in Mazatán. Other areas seem to exhibit the pattern of inter-site variability to different degrees. Is it possible to identify the variables that determined how salient an Early Formative dish-dominant/tecomate-dominant distinction will be in different parts of the Soconusco?

A notable feature of the Mazatán region is how ideally it is suited to the dual intensifications suggested here. The Coatán Delta provided arable lands penetrating what would otherwise be unfarmable estuary. Rapid expansion of population in this area from the Locona phase may have resulted from how ideally suited the area was to the flexible combination of sedentism and mobility favored in Early Formative strategies. At the same time, the resultant population density may have contributed to the emergence of a particularly stark dish-dominant/tecomate-dominant assemblage pattern. Elsewhere, in situations of low population density, gardens may have been safer from intruders or farming more extensive. Productive activities could conceivably have been conducted from permanent bases very close to the estuary without satellite field camps.

Temporal Variability

I will confine myself to four brief suggestions on temporal variability in the adaptive pattern I have proposed. First, there is the issue of wet-season versus dry-season use of the estuary in the transition from Archaic to Formative. Kennett and Voorhies (1996) found that Archaic visitors to the Acapetahua Estuary processed marsh clams in both wet and dry seasons, but that toward the end of that period there was a shift toward mainly wet-season use. On the basis of Kennett and Culleton's analysis of Varal shells (Chapter 13), we posit mainly dry-season use of the Early Formative estuary outposts (although obviously Locona data would be helpful).

Some comments on the apparent reversal are in order, especially in that Kennett and Voorhies explained the Archaic shift as related to the needs of cultivation at inland sites. I suspect that reversal can be explained with reference to the possibilities opened up by the tecomate (e.g., salt production in the dry season, and perhaps shrimp harvesting) and by the particular mobility strategy chosen by Early Formative peoples: expanding dry-season use of the estuary while at the same time maintaining investment in agriculture may actually have been a significant goal in Early Formative adaptations.

A second issue is adaptation in the Barra phase as opposed to the preceding Late Archaic or subsequent Locona. Flat-bottomed Barra tecomates would not have been particularly useful cooking pots, and to my knowledge Barra pottery has not been identified at tecomate-dominant estuary sites. It may be that the characteristic Early Formative adaptation described here began only with the Locona phase (although the presence of Barra beneath Locona at numerous sites in the Mazatán region recommends continued attention to this issue). It is intriguing, though, to find Neff et al. (2006:309) arguing that "key elements of the Early Formative adaptation arose within a localized region." They consider Mazatán "close to the Early Formative epicenter." However, citing Arroyo (2004) they note that in the Tecojate and Sipacate areas of Guatemala it is possible to trace a developmental sequence leading to red-rimmed Locona tecomates from the Barra-equivalent Madre Vieja complex.

I wonder, though, whether a single area is necessary. Could it be that the rounded-bottomed cooking pot was an invention of peoples along the central Guatemalan Coast, whereas the particular combination of sedentism/mobility that allowed simultaneous intensification of estuary and terrestrial resources was forged in Mazatán after the acceptance (through diffusion) of the red-rimmed round-bottomed tecomate? Under such a scenario I would predict a Barra-phase adaptive pattern for Mazatán and Acapetahua more similar to that of the Archaic than to Locona-Ocós patterns.

A third issue concerns continuities of adaptive pattern between initial Early Formative (1700–1300 B.C.) and late Early Formative (1300–1000 B.C.). The possibilities here are poorly understood, and I think an anecdote may best characterize the state of the issue. Tomás Pérez and I had worked for weeks on the Vásquez Mound profiles without seeing any sherd older than the Cuadros phase, so I scoffed at John Clark's suggestion that the adjacent Martínez Mound was probably Locona-Ocós in date. Clark's argument was that the smaller-but-taller mound at Sandoval (equivalent in shape to our Martínez Mound) dated to those earlier phases, whereas the broader-but-lower mound there (similar in shape to our Vásquez Mound) was Cuadros/Jocotal. To prove his point, Clark wandered over to the Martínez Mound and came back an hour later with a handful of Locona sherds. The apparent similarities in the sequences of these two estuary sites constitute an intriguing topic for future investigation, particularly given the political turmoil and transformation that occurred between the Ocós and Cuadros phases (Clark 1997).

Finally, there is the issue of how to explain changes at the end of the occupation of El Varal—changes that coincide (coincidentally or not) with the end of the Early Formative. The implications of the transformed occupation at El Varal in the Terminal Period—and, soon thereafter, abandonment—must remain uncertain until richer comparative evidence becomes available from other Early Formative estuary sites. One possibility is that changes observed at El Varal (Chapter 14) were the result of resource stress generated by overexploitation. The Vásquez Mound sequence is late in a 900-year arc of expansion and bust in the Mazatán region. Population collapse in the area immediately postdates the occupation of El Varal. There is good reason, though, to suspect political causes (Blake and Clark 1999)—and one wonders whether the brief Terminal-period occupation at El Varal might represent a refugee group resisting the hegemony of a burgeoning La Blanca. Still, the possibility of collapse due to ecological stress should also be considered. Plausibly, the Late-period return to shellfish harvesting—most intriguingly the two massive deposits of *A. kindermanni*, a low-ranked resource if there ever was one—could have been a symptom of such stresses.

Toward Falsification: Some Suggestions

Because I have portrayed my conclusions as hypotheses, it is only fair to include some suggestions concerning how they might be falsified. It should be clear that I am not arguing for a rigid division between tecomate-dominant and dish-dominant sites. Rather, those archaeological manifestations were generated by an adaptive strategy developed by Early Formative peoples of the Soconusco. The elements of the adaptive strategy are the critical factors (not any intention on the part of Early Formative peoples to create inter-site assemblage variability!), and interactions between strategic elements could well yield different archaeological patterns outside Mazatán. As noted in the previous section, archaeological patterns of assemblage differentiation may vary depending on Early Formative population densities and the spatial relations between arable land and estuary access. Yet another factor, evident in Figure 9.25, is the general change over time in the importance of tecomates in "typical" domestic assemblages. Although more subtle details of inter-site assemblage variation and their behavioral causes certainly require further investigation, the following seem to me the most promising avenues of investigation in the effort to prove my suggestions here wrong.

1. My logic requires a step up in cultivation of crops in the Early Formative in relation to the Archaic. This is because I derive the impetus for sedentism primarily from the concerns of agriculture. Whether this can be squared with the isotopic evidence from human bones is not altogether clear.
2. Another issue is the centrality to Early Formative adaptations of the rounded-bottom ceramic tecomate placed over a direct source of heat. I have insisted particularly that the tecomate was a *generalized* rather than specialized tool. Considerable variability, at multiple temporal and spatial scales, in the specific resources harvested at Early Formative estuary outposts would tend to support this interpretive construct. Conversely, evidence for focused production of some single resource—particularly if the same pattern could be documented at multiple sites or traced through time (Locona through Jocotal)—would cast doubt on my construct.
3. On a related point, I have been favoring the idea that direct heating in the rounded-bottom tecomates was itself the critical innovation that made generalized exploitation of estuary resources so effective. A related but significantly different version would be the suggestion that direct heating and rounded-bottom vessels were intermediary innovations that allowed effective production of salt and that it is really *salt* that must be regarded as the critical factor in the Early Formative readaptation. The logic of this idea is attractive, but based on the evidence produced here I find it unconvincing. It seems to revive the issue of inefficiency associated with the choice of vessel form. There is also the problem that I have produced no actual evidence that foods were salted for transfer inland, even though I have repeatedly suggested that that was taking place. I opt here for a generalized use of the tecomate and accord importance to meals at estuary sites in dry-season subsistence. Documentation of considerable movement of storable products inland might undermine this position.
4. The most speculative of my hypotheses concerns the social unit of production and consumption in Early Formative villages of the Soconusco. I claim that a kin unit larger than the nuclear family was central. Although I cite some evidence from Paso de la Amada in support of this idea, the data can be interpreted in different ways. If nuclear families were the primary productive unit and did not regularly cooperate as part of a larger productive group, the proposals here might have to be reformulated.
5. Finally, after weighing the two options at considerable length I have opted to look "back" to hunter-gather settlement and subsistence systems instead of "forward" to specialization. I am claiming that the patterns evident at El Varal did not constitute specialization in the organizational sense and were instead part of a durable adaptive pattern forged in the Soconusco about the time of the transition to the Formative. Tecomate-dominant sites of the Locona and Ocós phases have been documented but not well published. When the faunal remains of such sites are examined, if the adaptive pattern inferred is fundamentally different from that characterized here my assumption of general continuity of adaptation from Locona through Jocotal could be jeopardized.

Implications

In contrast to the proceeding, assume that I am right in my reading of the archaeological record of El Varal. What are the larger implications of these findings? As was Binford's (1983) original intent, I have treated foraging and collecting not as an evolutionary sequence but as strategies that manifest themselves in variable fashion given local distributions of resources and historically specific conditions such as the technology applied to recovery and processing.

The Early Formative adaptive shift in Soconusco involves something of a shift toward foraging strategies in the use of estuary resources. Early Formative peoples expanded the variety of resources harvested from the estuary and moved their residential bases closer so that they could realize a variety of opportunities opened up by their new processing technology—opportunities enhanced by maintaining a greater flexibility in the reciprocal positioning of people and resources than had characterized Archaic use of the estuaries. Logistical collecting was, however, still important: task groups resided long-term in estuary camps, where they likely engaged in bulk production of salt and probably fish (perhaps even shrimp) for storage. This mix of strategies emerged from the goal of intensification and the possibilities of newly available technology, but it was also worked out in relation to another domain of emphasis—that of cultivated plants.

In my proposed interpretive construct, the tecomate-dominant/dish-dominant distinction in Early Formative Soconusco does not relate to specialization in the organizational sense. The pattern observed at El Varal represents the persistence of a general set of adaptive strategies that was half a millennium old by the time of the occupation of the Vásquez Mound and that needs to be explained with reference to the transition from Archaic to Formative in the area rather than to societal complexity and social heterogeneity.

Still, it is likely that this extended notion of community involving considerable individual mobility between multiple locations provided the ground from which true occupational specialization emerged over the course of the Formative. The El Mesak case described by Pye (1995) appears to be a case of "site specialization" and probably actual organizational specialization, contemporaneous with the occupation of El Varal. At El Varal, we glimpse the durable Early Formative adaptation toward the end of its run. At El Mesak we see later Formative adaptive patterns toward the beginning of their gradual and (judging from the fate of El Mesak) halting emergence.

APPENDIX A

Pottery Types and Forms by Lot

Pottery Type	Vessel Form	P3-01	P3-02	P3-03	P3-04	P3-05	P3-06	P3-08	P3-09	P3-20	P3-21	P3-22	P3-23	P3-24	P3-25
Arenera	Dishes and bowls	1	1												
	Unidentified Jar														1
Culebra	Dishes and bowls	1	1			1	1	1				1	5		2
	Tall-necked jar											2			
	Unidentified										1				2
Guamuchal	Tall-necked jar													1	
	Plain tecomate	2	3	2	5	3	3		3	5	4	1	12	6	15
Méndez	Olla					1									
	Plain tecomate		3			2	2	2	2		3	8	7	5	20
	Slipped tecomate														1
Michis	Plain tecomate											1			
Pampas	Dishes and bowls		2			1		3					2		2
Siltepec	Dishes and bowls	1	2		2	2	1	1	4			1	5		2
	Olla					1									
	Tall-necked jar						2	1							2
	Stool/pot rest								1						
	Unidentified		1				1				1				
Tacaná	Dishes and bowls						1								
Tilapa	Dishes and bowls										2	1		1	2
	Slipped tecomate		1												
	Unidentified		1												
Unidentified	Basin		1												
	Dishes and bowls	1			1			1	1						
	Unidentified jar				1										
	Tecomate		2		1		2			1			6	2	1
	Plain tecomate											2	2		
	Unidentified							3	1	1			1		
Unidentified unslipped	Plain tecomate		6	7	5	7	3	4	6		4	1	10	3	6
	Unidentified													1	
Xquic	Dishes and bowls				1						1		1		
	Unidentified jar						1								
	Tall-necked jar						2								
	Slipped tecomate		1											1	
Total		6	25	9	16	18	19	16	18	7	16	18	51	20	56

Pottery Type	Vessel Form	P3-26	P3-27	P3-28	P3-29	P3-30	P3-31	P3-32	P3-33	P3-34	P3-35	P3-36	P3-37	P3-38
Arenera	Dishes and bowls		1											
	Tall-necked jar					1								
Culebra	Dishes and bowls	3	7		1	1		2		2			1	
	Tall-necked jar	1	2											
Guamuchal	Plain tecomate	14	40		2	3	3	2	6	3	8		5	2
Méndez	Plain tecomate	30	26	1		2	1	3	1	4	4	1		
	Slipped tecomate	1												
Michis	Plain tecomate					1				3				
Pampas	Dishes and bowls	5	7		1	3			1	3				
Siltepec	Dishes and bowls	2	4								1			
	Tecomate	1												
	Unidentified								1					
Tilapa	Dishes and bowls		2			3				1	2			
	Slipped tecomate		2			1				3	1			
Unidentified	Basin							1						
	Dishes and bowls		1					1			2			
	Tecomate	5	17			1		2	1	2	1		2	
	Slipped tecomate									1				
	Unidentified												1	
Unidentified unslipped	Plain tecomate	4	8	1	1	6			3	3	2		2	1
Varal	Dishes and bowls		1			2								
Xquic	Dishes and bowls	2	3						2					
	Olla		1											
	Tall-necked jar	2								1				
	Slipped tecomate	1							1		1			
Total		71	122	2	5	24	4	11	16	26	22	1	11	3

Pottery Type	Vessel Form	ST-00	ST-00.1	ST-02	ST-03	ST-04	ST-05	ST-06	ST-07	ST-08	ST-09	ST-10	ST-12	ST-13	ST-14	ST-15	ST-16
Arenera	Basin													1			
	Dishes and bowls						2						1		2		
	Slipped tecomate	1					2								1		
Conchas R/W	Dishes and bowls	9	68														
	Olla	1	1														
	Slipped tecomate	1															
	Unidentified		1														
Culebra	Dishes and bowls	6	10	2	6	1	2	2	1	3	3	1		3	3		
	Unidentified jar		2														
	Jar		1														
	Olla							1	1						1		
	Tall-necked jar	3	4										1	1	1		
	Slipped tecomate	1					1	1									
Guamuchal	Plain tecomate	10	45		6	13	21	17	10	1	1		11	23	20	6	
Méndez	Tall-necked jar							1			1						
	Plain tecomate	3	5	1	6	2	18	2	8	4	4	1	5	17	11	3	
Michis	Plain tecomate																
Pampas	Dishes and bowls								1						3	2	
Unidentified (red rim)	Dishes and bowls	5					2			1							
	Tall-necked jar	2						2					1	1			
	Tecomate	5		1		3	4	5	3	1	1	1	2	5	6	3	
Siltepec	Basin													1			
	Dishes and bowls	16	70	2	9	3	7	2	2	5			2	18	9	1	
	Unidentified jar		1														
	Olla			1			1							1			
	Tall-necked jar	2	4		1	1	2	1							1		
	Stool/pot rest		1														
	Tecomate			1													
	Slipped tecomate		1														
	Unidentified	1															
Tacaná	Dishes and bowls		9	1	2		1	1		1							
	Tall-necked jar			1													

Pottery Type	Vessel Form	ST-00	ST-00.1	ST-02	ST-03	ST-04	ST-05	ST-06	ST-07	ST-08	ST-09	ST-10	ST-12	ST-13	ST-14	ST-15	ST-16
Tilapa	Dishes and bowls						1										
	Tall-necked jar														1		
Unidentified	Basin		4														
	Dishes and bowls	25	4	1		3	4	2			3					1	
	Olla	2	2					1				1					
	Tall-necked jar	5				1			1					1	3		
	Stool/pot rest		2														
	Tecomate	11	28		2	6	12	9	3	3	1	2	4	11	14	4	1
	Plain tecomate															1	
	Unidentified							1	1								
Unidentified unslipped	Plain tecomate	1															
Varal	Dishes and bowls													1			
Xquic	Dishes and bowls	24	21			1				1							
	Unidentified jar																
	Olla		1					1					1				
	Tall-necked jar	2	4		1		2		1	3	1		2		2		
	Stool/pot rest	1															
	Slipped tecomate						2	1			1					1	
	Unidentified		1														
Total		137	291	11	33	34	84	50	32	23	16	6	30	84	78	22	1

Pottery Type	Vessel Form	ST-17	ST-18	ST-19	ST-20	ST-22	ST-23	ST-24	ST-25	ST-26	ST-27	ST-28	ST-29	ST-30	ST-31	ST-32
Arenera	Dishes and bowls			1			1	3	4		1		1			
	Slipped tecomate								1		1					
Culebra	Basin								1							
	Dishes and bowls	1			3	2	3	6	3	2	4	2	12	3	5	
	Tall-necked jar			1	1	1					1		2			
	Slipped tecomate							1							1	
Guamuchal	Olla										1					
	Plain tecomate	5	6	12	7	13	7	12	23	8	9	7	33	4	4	
Méndez	Tall-necked jar						1				1					
	Plain tecomate	7	3	4	7	8	10	10	9	1	13	4	11	4	4	
Pampas	Dishes and bowls		1	1			3	5	2				9	2	7	
	Tall-necked jar													1		
Unidentified	Slipped tecomate							1								
(red rim)	Dishes and bowls					1		3					1			
	Tall-necked jar													1		
	Tecomate	1	1	3	3	1	4	3	5	3	6	1	8	1	1	
Siltepec	Basin															
	Dishes and bowls	1		1		1	3	1	2		2		2	2		
	Tall-necked jar	1				1							1			
	Slipped tecomate								1							
Tacaná	Dishes and bowls								1		1					
Tilapa	Dishes and bowls			1							2			1	1	
	Slipped tecomate						2		1				3			1
	Unidentified									1						
Unidentified	Dishes and bowls	1				1	3	2	4		2		2		1	
	Tecomate	1	4	8	3	2	2	8	7	4	5	3	8	2		
	Plain tecomate				1			1	2					1		
	Unidentified						1							1		
Unidentified unslipped	Tall-necked jar													1		
	Plain tecomate														2	
Varal	Dishes and bowls								1					1		
	Olla						1									
	Tall-necked jar													1		
Xquic	Dishes and bowls			1			1	1	2				3		2	1
	Unidentified jar												1			
	Tall-necked jar													1		
	Slipped tecomate										1		5		1	
Total		18	15	33	25	31	42	57	69	19	50	17	102	27	29	2

Pottery Type	Vessel Form	ST-34	ST-37	ST-38	ST-39	ST-40	ST-41	ST-42	ST-43	ST-44	ST-45	ST-46	ST-47
Arenera	Dishes and bowls	1							1	1			1
	Slipped tecomate	1											1
Culebra	Basin												
	Dishes and bowls	4			2	1	1		6	3			1
	Tall-necked jar	1											1
	Plain tecomate	1											
	Slipped tecomate	1			1	1	1		1	1			
Guamuchal	Olla						1			1			
	Tall-necked jar								1	2	1		
	Plain tecomate	15	10		15	8	11	3	15	22	5	12	4
Méndez	Plain tecomate	5	2		21	3	5	1	4	5	2	3	7
Michis	Plain tecomate												1
Pampas	Dishes and bowls	9			5	1					2		2
	Tall-necked jar	1											
Unidentified (red rim)	Tecomate	5											
Siltepec	Dishes and bowls				4				1				
	Olla						1						
	Tall-necked jar				1		1			1			
Tilapa	Dishes and bowls	1	2		1				1		1	5	3
	Tall-necked jar						1						
	Slipped tecomate	2	1		2					1			1
Unidentified	Dishes and bowls	1				1							
	Unidentified jar			1									
	Tall-necked jar	2											
	Tecomate	13			3		1	1	2	1	1	1	
	Plain tecomate	1	2										
	Slipped tecomate		1		3				2				1
Xquic	Dishes and bowls	1		1	1				1	1	2	1	
	Tall-necked jar	2				1			2		1		
	Slipped tecomate	1	1		3	2	1			1			1
Total		68	19	2	62	18	24	5	37	40	15	22	24

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The Soconusco region, a narrow strip of the Pacific coast of Mexico and Guatemala, is the location of some of the earliest pottery-using villages of ancient Mesoamerica. Mobile early inhabitants of the area harvested marsh clams in the estuaries, leaving behind vast mounds of shell. With the introduction of pottery and the establishment of permanent villages (from 1900 B.C.), use of the resource-rich estuary changed. The archaeological manifestation of that new estuary adaptation is a dramatic pattern of inter-site variability in pottery vessel forms. Vessels at sites within the estuary were about seventy percent neckless jars—"tecomates"—while vessels at contemporaneous sites a few kilometers inland were seventy percent open dishes. The pattern is well-known, but the the settlement arrangements or subsistence practices that produced it have remained unclear.

Archaeological investigations at El Varal, a special-purpose estuary site of the later Early Formative (1250–1000 B.C.) expand possibilities for an anthropological understanding of the archaeological patterns. The goal of this volume is to describe excavations and finds at the site and to propose, based on a variety of analyses, a new understanding of Early Formative assemblage variability.

Progress in interpretation faces a dilemma: to explain assemblage variability among early sedentary peoples of the Soconusco, should we look "forward" to specialization and societal complexity or "back" to hunter-gather strategies of settlement organization? The weighing of these two interpretive options becomes a central theme of the volume.

In the end, the Varal evidence indicates that the Formative re-adaptation in Soconusco was a compromise between two sources of food: domesticated/terrestrial and wild/estuary. The Early Formative of the region was characterized by an expanded diet breadth, probably promoted by an introduction of the simple, rounded-bottom cooking pot—the tecomate. Rounded-bottom cooking pots allowed direct heating of contents. This innovation opened up new resources for exploitation.

Early Formative peoples used the tecomate as a generalized rather than specialized tool, important in salt production but applicable as well to the processing of a whole variety of foods. Use of tecomates to produce foods for immediate consumption favored a strategy of moving people to resources, in contrast to earlier practices of processing marsh clams in bulk for transport to inland sites. Yet Early Formative peoples moved close to, but not simply "to" the estuary, establishing permanent villages from which they could both travel to the estuary and cultivate crops.

Estuary outposts such as El Varal were therefore not permanent living quarters and there was little investment in the construction of residences. People manufactured pottery on-site, much of it elaborately decorated, but the assemblage was oriented toward productive tasks rather than consumption. Further, those tasks involved a heavy use of tecomates for salt production and cooking. Those activities are ultimately the source of the inter-site differences in vessel forms observed in the archaeological record of Early Formative Soconusco.

RICHARD LESURE, an associate professor of anthropology at the University of California, Los Angeles, specializes in the social consequences of sedentism and agriculture in ancient Mesoamerica. He has conducted archaeological fieldwork on the coast of Chiapas and in the highlands of Tlaxcala, Mexico. His interests include the emergence of social inequality, variability in organization and beliefs across early Mesoamerica, and interpretive challenges in the study of prehistoric art.

ISBN: 978-1-931745-79-6

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