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Prehistoric Plant Procurement, Food Production, and Land Use in Southwestern Tamaulipas, Mexico

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by

J. Kevin Hanselka

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ABSTRACT OF THE DISSERTATION

PREHISTORIC PLANT PROCUREMENT, FOOD PRODUCTION, AND LAND USE IN SOUTHWESTERN TAMAULIPAS, MEXICO

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Professor Gayle J. Fritz, Chairperson

In this dissertation, I examine plant use, food production, and land use in the Ocampo region of southwestern Tamaulipas, northeastern Mexico. In the early 1950s Richard S. MacNeish excavated in a series of dry cave sites within the study area and discovered evidence for the local adoption of domesticated plants and the subsequent development of a mixed foraging-farming economy that persisted for millennia, before culminating in the establishment of settled farming villages. This research remains central to discussions of early Mesoamerican agriculture. However, the spectrum of land use and wild plant utilization over the prehistoric sequence remains poorly understood, as MacNeish's Ocampo investigations focused on one aspect of a larger settlement pattern (cave occupations), and his results are incompletely published.

This dissertation expands on earlier work through an examination of curated plant collections from MacNeish's excavations and an archaeological survey near the Ocampo caves. Although most published sources acknowledge that wild plants comprised the majority of the local diet (especially during the early cultural phases), these sources often do not describe the species in question. Inspection of plant materials curated in several facilities in the United States and Mexico revealed a range of wild plants that are not mentioned previously in publication. Some curated specimens indicate that even

when local populations lived in permanent habitations in villages, plant resources were obtained from as far as 30 km away. Observations of present-day casual cultivation behaviors provided insights into how the earliest domesticated plants in the region (squashes and gourds) may have been incorporated into a primarily hunter-gatherer economy with minimal disruptions.

Archaeological survey of the study area revealed that during the peak of population density (ca. 2400-1000 B.P.), large agricultural villages were established not only in narrow river valleys but also on moderate mountain slopes and high summits, likely due to a general lack of level land. Traditional farmers here today practice slash-and-burn agriculture on steep hill sides as flat alluvial terraces and gentle slopes become less available, and it is probable that prehistoric villagers did the same. Even as large permanent settlements became abundant, caves continued to be used for a variety of pursuits, including base camps for wild plant harvesting, winter-season hunting camps, and burial of the dead. Major contributions of this work include: 1) insights into the non-agricultural plant component of early low-level food producing economies in the study area; 2) availability of an important archaeobotanical data set previously not accessible to the general archaeological community; 3) refined classification of previously identified remains in the curated archaeobotanical collections; 4) increased awareness of the range of site types and land use practices utilized by early food producers in the Ocampo region (through preliminary archaeological survey and artifact assemblages on discovered sites); 5) documentation and registration of discovered sites in the Instituto Nacional de Antropologia e Historia (INAH) *Registro Publico de Monumentos y Zonas Arqueológocos* ("Public Register of Archaeological Monuments and Zones"); and 6) historical contextualization of MacNeish's groundbreaking investigations in the Ocampo caves.

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Very special thanks go to the residents of Ciudad Ocampo and *ejido* San Lorenzo las Bayas, Tamaulipas, especially my two hard-working guides, Aquiles Puente Montalvo and Fermin Puente Castillo. Without their guidance I would never have located the archaeological sites necessary for my research. Also, I likely would have starved were it not for the hospitality of Mr. Puente Castillo and his family, who I lived with while in the field. I am greatly indebted to Jean Louis LaCaille Múzquiz of Ciudad Mante, Tamaulipas for organizing my initial reconnaissance to the study area, introducing me to the people who would become my guides and dear friends, and for the many wonderful conversations both in the field and in the city.

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I thank David Kelley, who as a young graduate student once assisted Dr. MacNeish in the groundbreaking Ocampo cave excavations, for his helpful comments and wonderful narratives. I also want to thank Drs. Robert J. Hard and Steve Tomka, former Master's thesis advisors at the University of Texas in San Antonio (UTSA), for their support and interest in my project. They were vital in my training as an archaeologist while I attended UTSA, and continue to be so today. Dr. Bradley J. Vierra of Statistical Research, Inc. in Albuquerque guided me through the aspects of lithic analysis that I employed on this project. Brian King and Timothy Schilling assisted me in the production of the study area maps used in this dissertation, and Dr. Sandi Copeland donated her valuable time to aid me for a brief period during the field survey. Julie McGilvray, Lindsey Naslenas, and Barbara Hanselka graciously helped me through the tedious and often frustrating process of formatting the final draft of this dissertation.

Of course, my many dedicated friends helped me through the roughest of times, particularly Kacy Markham and Brian King. My loving family has stood by me every step of the way; I send all my love and thanks to my parents Wayne and Lillian Hanselka, as well as my brother Kenneth Hanselka and sister Elizabeth McMaster and their families. Over the years my fellow graduate students have been a vital source of support, assistance, encouragement, and inspiration. I could not have accomplished the present work without my many classmates and dear friends both at UTSA during my Master's work and at Washington University in Saint Louis as we pursued our doctorate degree.

One of the most important figures in my research has been my good friend José Zapata, of the Texas Historical Commission. José first called my attention to the continuing research potential in Tamaulipas, and ever since has been central to developing my contacts and research in Mexico. His help in organizing the logistics of my fieldwork has been indispensable, and we have shared many adventures in the wilderness around Ocampo. I have no doubt that many aspects of my project would have been much more difficult if not impossible without his assistance. He is one of my greatest friends and colleagues.

Finally, this dissertation would have been possible without the groundbreaking investigations carried out in the Ocampo caves by Dr. Richard S. MacNeish. It is upon the earlier efforts of researchers such as Dr. MacNeish that present and future archaeologists must continue to build.

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Corrido de las Cuevas de "Los Portales"
("Ballad of the Portales Caves")

Vinieron de Canadá
Arqueólogos afamados
A explorar a Tamaulipas
Lugares muy apartados.

De México se trajeron
Permisos y dirección
En busca de Nacho Guerra
Para aquella expedición.

Lo encontraron en Victoria
Y salieron esa vez
El 26 de diciembre
Año de cincuenta y tres.

Se dirigieron a Ocampo
Para consequir los guías
Que conocieran el campo
Lugares y serranías.

Trajeron a Pancho Abundis
Y a don Miguel Salazar
El primero de "Canoas"
y el otro de "Guerra Leal."

Con estos "Gallos jugados"
Entre riscos y breñales
Se inició la expedición
A Cuevas de "Los Portales."

Llagaron al "Infiernillo"
En la primera jornada
La tarde lluviosa y fría,
La noche estuvo pesada.

Para sus bestias pastura
No había en el "Desfiladero,"
Pero llegó Juan Montalvo
Y las llevó a su potrero.

Ya instalado el campamento
Con gente de la región
Comenzó en la primera cueva
Hacerse la excavación.

Cada momento sorpresas
Flechas de muchos tamaños
Y envueltos en formas raras
Momias de cuatro mil años.

De noche en el campamento
Era una gran alegría
Juegos, canciones y cuento
Con fondo de picardía.

Café no debía faltar
Cigarros, frascos de fruta,
Pues en el caso contrario
Protestas había y disputa

Se rebeló Albino Ríos
Y sus razones expuso,
No puedo estar sin café
Lo tomo como agua de uso.

El cocinero Epigmenio
Les dijo ya con coraje,
Toman día y noche café,
Ya lo cargan hasta en guaje.

Coronado y Juan González,
Sin cigarros no se aguantan
Carpio y Cirilo Bermúdez
Si no hay duraznos no cantan.

Se quedaba Jesús Báez
Que no habíamos mencionado
Era el que traía tortillas,
Agua, conches y venado,
Y para contar corridos,
Deveras era planchado.

El arqueólogo acordó
Por ser quién dió el derrotero
A Cuevas de "Los Portales"
Nombrarles Javier Romero.

Aquí termino el corrido
Con mi felicitación
Para los hombres de ciencia
Que exploran esta región.

------- *Ramón I. Guerra (guide on the 1953-54 Ocampo expedition), dedicated to his friend Dr. Richard MacNeish; Pinal de la Vírgin, Municipio de Ocampo, Tamaulipas, March 1954* (Ramirez-Castilla 2007:124).

CHAPTER 1: INTRODUCTION AND STATEMENT OF PROBLEM

The prehistoric shift from mobile economies based on hunting and gathering to settled village life dependent on domesticated plants and animals is arguably one of the most far-reaching developments in human history. Maintenance of past and present state-level societies depends upon the ability to produce adequate food supplies to support large populations, and agriculture plays a key role in many current and future problems associated with population expansion and environmental deterioration (Winterhalder and Kennett 2006:1). Thus, the origins of food production and its subsequent impacts upon societies around the world are topics of longstanding archaeological interest.

Mesoamerica, the vast cultural region extending from central Mexico south and east to El Salvador and Honduras (Figure 1.1) (Sanders and Price 1968), represents one of several global cradles of plant domestication and the agricultural way of life (Bellwood 2005; Blake 2006; McClung de Tapia 1992; Smith 1998a). Current archaeological and genetic evidence traces the ancestry of maize (*Zea mays* ssp. *mays*) and several species of domesticated squashes (*Cucurbita argyrosperma* ssp. *argyrosperma, C. pepo* ssp. *pepo*) and beans (*Phaseolus vulgaris*, *P. acutifolius*, *P. lunatus*) to within the present-day political boundaries of Mexico (Benz 2001, 2006; Blake 2006; Chacón et al. 2005; Kaplan and Lynch 1999; Matsuoka et al. 2002; Piperno and Flannery 2001; Smith 1997a; Staller et al. 2006). Additional useful crops that originated in Mesoamerica include amaranths (*Amaranthus cruentus, A. hypochondriacus*), chili peppers (*Capsicum annuum*, *C. frutescens*), and cotton (*Gossypium hirsutum*), among a great many others (Mangelsdorf et al. 1964; McClung de Tapia 1992; Sauer 1969). Traditional and current conceptions broadly portray the forager-farmer transition in Mesoamerica as a process in which these various crop plants originated in widely scattered areas and were differentially incorporated into local diets as they dispersed across the landscape

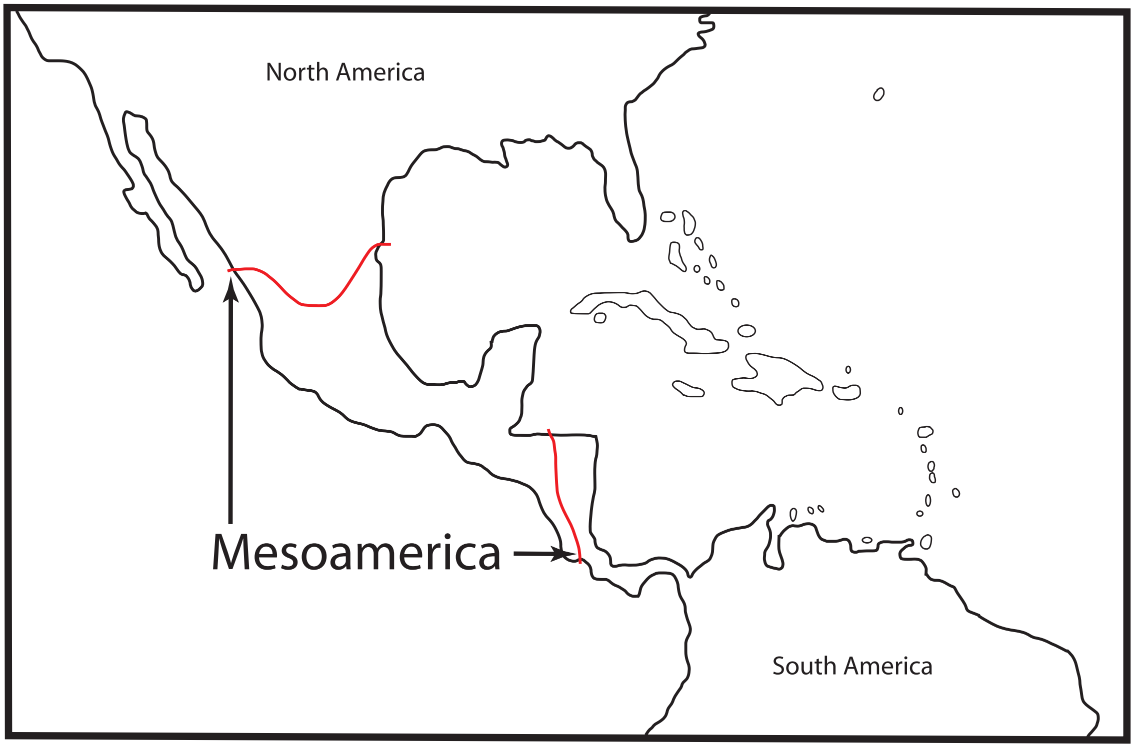

Figure 1.1. Map showing the boundaries of the Mesoamerican Culture Area (redrawn from Evans 2004:18, Figure 1.2.

(Flannery, ed. 1986; MacNeish 1964, 1967, 1992; Smith 1997b). Human group mobility gradually decreased as the use of agricultural products increased, and after an extended period, this trend culminated in widespread agricultural villages firmly grounded in the production of maize, beans, squash, and other crops. As will be elaborated upon in the next chapter, Richard S. MacNeish referred to this length of time between the first domesticates and the emergence of farming settlements as the Era of Incipient Cultivation (or EIA) (Smith 1997b). Reliance upon cultivated resources thereafter continued to increase as villages and societies grew larger and more complex. While this scenario likely reflects reality in a broad sense, several factors demonstrate the localized complexity of these processes and the need to examine them on a case-by-case basis. First, prehistoric mixed foraging-farming regimes across Mexico were

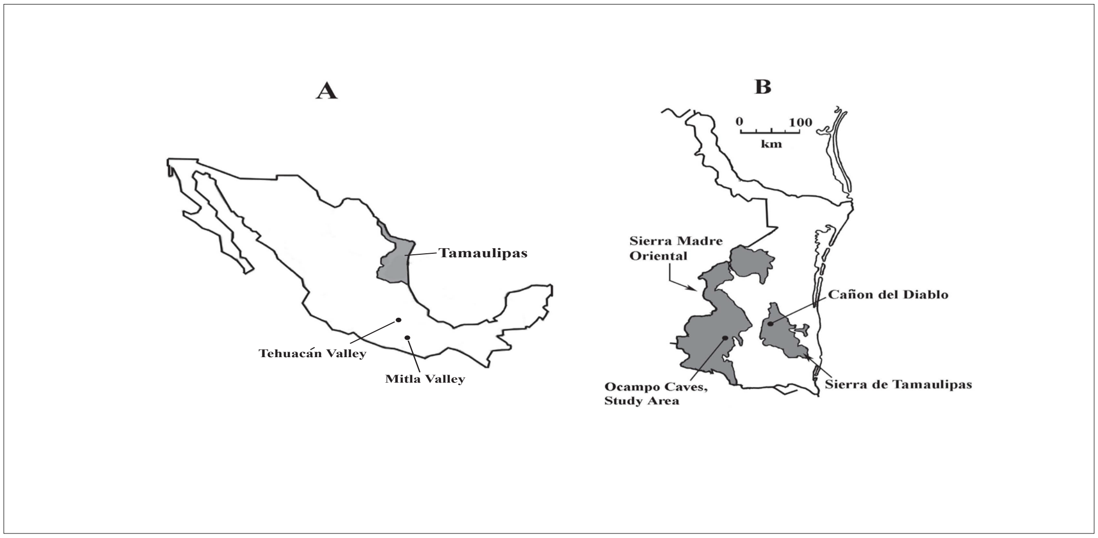

Figure 1.2. A: Map of Mexico, showing location of Tamaulipas and sites mentioned in the text; B: map of Tamaulipas, showing locations of mountain ranges, the Ocampo caves, and the Cañon del Diablo.

characterized by exceedingly rich adaptive diversity (i.e., Blake et al. 1992; Chisholm and Blake 2006; Hard and Roney 1998; Hard et al. 2006; Kennett et al. 2006; Smith 1998b, 2001a, 2005a). Also, multiple dispersal mechanisms likely contributed to the widespread occurrence of early Mesoamerican agriculture, including the regionally isolated, independent domestication of different crop plants; local adoption of introduced cultigens by indigenous hunter-gatherers in "pristine" regions; and the physical migration of farming villagers across long distances (Bellwood 2005; Bellwood and Renfrew 2002; Lesure et al. 2006). Therefore varying models of agricultural development will apply to different regions.

Southwestern Tamaulipas, Mexico (Figure 1.2), located on the northeastern border of Mesoamerica far beyond the domestication centers of major Mexican cultigens, represents a key example of prehistoric "low-level food production" (discussed further in Chapter 2, and see Smith 2001a). Such peripheral locations form an ideal laboratory for examining the secondary adoption of plants domesticated elsewhere into local economies, and the subsequent development of traditional food-production systems. Regarding Late

Archaic period research along the northern margins of Mesoamerica, Smith (2005a:302) points out that regions "… such as the Borderlands, which were outside a primary center of initial domestication, often provide the most promising opportunities to study and compare the full range of different developmental pathways taken early on by low-level-food-production societies." Early archaeological excavations in caves near Ocampo, Tamaulipas (Figure 1.2) resulted in a critical data set spanning a 9,000 year sequence, suggesting a very early economy based solely upon hunting and gathering, followed by a slow transition to food production with the sporadic arrival of different domesticated crop plants (Tables 1.1, 1.2), and culminating in complex societies highly dependent upon domesticated resources that subsequently declined prior to Spanish contact (Kaplan and MacNeish 1960; MacNeish 1958, 1964, 1971, 1992; Mangelsdorf et al. 1964; Mangelsdorf et al. 1967; Ramirez Castilla 2007; Smith 1997b; Whitaker et al. 1957).

Latin name	**Common name**
Cucurbita argyrosperma ssp. *argyrosperma*	Cushaw squash
C. moschata	Butternut squash
C. pepo ssp. *pepo*	Pepo squash
Gossypium hirsutum	Cotton
Lagenaria siceraria ssp. *siceraria*	Bottle gourd
Nicotiana rustica	Tobacco
Phaseolus lunatus	Lima bean
P. vulgaris	Common bean
Zea mays ssp. *mays*	Maize

Table 1.1. Domesticated plants recovered from the Ocampo caves.

Table 1.2. The Ocampo Caves: Cultural Chronology, Original Cultigen Sequence, Subsequent AMS Revisions, and Major Prehispanic Events.

Cultural Phase	Age range (in calibrated years B.P.) [a]	Cultigen sequence (as originally constructed in the 1950s) [b]	Revised sequence based on direct AMS dates (in calibrated years B.P.)	Major local prehispanic events
San Antonio	500 - 200			Spanish arrival (A.D. 1522) [h]
San Lorenzo	1100 - 500			
Palmillas	1900 - 1100	Cushaw squash [c] Lima bean [d] Tobacco [b]	Common bean (1285 B.P) [f]	
La Florida	2400 - 2000			
Mesa de Guaje	3600 - 3000		Butternut squash (2750 B.P.) [g]	Earliest known ceramics [h] Earliest known sites with evidence of substantial habitations [i]
Guerra	4400 - 3600	Butternut squash [c] Cotton [b]		
Flacco	5200 - 4400	Maize [e]	Maize (4405 B.P.) [g] Cushaw squash (5035 B.P.) [g]	
Ocampo	6000 - 5200	Common bean [d]	Pepo squash (6310 B.P.) [g] Bottle gourd (6440 B.P.) [g]	
Infiernillo	9000 - 7600	Bottle gourd [c] Pepo squash [c]		

REFERENCES: [a] MacNeish 2001; [b] Mangelsdorf et al. 1964; [c] Whitaker et al. 1957; [d] Kaplan and MacNeish 1960; [e] Mangelsdorf et al. 1967; [f] Kaplan and Lynch 1999; [g] Smith 1997b; [h] MacNeish 1958; [i] MacNeish 1992

In the present study I further explore the complexity of plant utilization and local agricultural development in Ocampo through a critical assessment of claims concerning plant subsistence made in previous publications and unpublished field notes, an examination of curated archaeological plant remains, and archaeological survey near the previously excavated cave sites. This research addresses the following primary questions:

- *What are some of the non-domesticated plants that contributed alongside cultigens to the local Ocampo economy*? Because previous inquiries into subsistence here centered on the early use of cultivated foods, non-domesticates were de-emphasized in the few available published discussions. For example, in describing the earlier cultural phases of the Ocampo region, MacNeish (1958:167-168) acknowledges that these people were primarily food gatherers, but only lists those plants that were supposedly cultivated. Unfortunately, the original excavators did not retain the majority of wild plant materials encountered in the deposits, and most of the contents of curated collections from the caves consist of domesticated plant parts (maize, beans, and various squash species). Therefore it is no longer possible to comprehensively reconstruct the portion of the Ocampo diet obtained from non-domesticated plants based on MacNeish's findings. However, an examination and inventory of the curated collections revealed the presence of diverse wild plants in the caves that were not previously publicized to the general archaeological community. Less solid evidence is in the form of unpublished field notes, which mention the discovery of the remains of plant types that were never discussed in published accounts. Here I explore how these data may add to an understanding of ancient economies in the region (from a basic standpoint) and the habitats visited for resources. For instance, remains of some plant types found in the cave deposits implicate mobility or trade at distances of up to 30 km.

- *How might the topographic locations and artifact assemblages of various site types reflect the nature of plant-related subsistence practices?* Site locations and patterns of settlement and mobility are directly influenced by the distribution and availability of valued resources and subsistence requirements (Binford 1980; Kelly 1995; Rocek and Bar-Yosef 1998). While most published accounts of the Ocampo sites focus on the caves themselves, the physical positions of various other site types on the landscape, and their respective artifact assemblages, are also informative of agricultural and plant-related subsistence strategies. In this study these possibilities were explored through an archaeological survey near the previously excavated caves. Because of time, personnel, and budget constraints it was not feasible to reconstruct a comprehensive settlement pattern or a representative sample of site types from multiple time periods in the region; however, the study of numerous discovered sites, including caves, settlements, and an open camp, exposed interesting aspects of plant-related subsistence. For example, the survey revealed that large villages, most likely supported by agriculture, were established in varied locations that may have required diverse farming practices. In addition, artifacts found on the surveyed sites clarify how different kinds of plant resources were collected and processed.

- *How does use of caves relate to the greater local subsistence/settlement system?* Cave occupations likely represent only one facet of a larger adaptive pattern. In spite of the presence of open air campsites and settlements, the Ocampo caves were occasionally used over a span of 9,000 years, even at the height of village life in the region. Activities ranged from use as longer-term base camps, to brief visits by small task groups, to interment of the dead and other ceremonial pursuits. It also appears that functions between cave sites varied: while some were the loci of multiple activities (e.g., the wet-season base camps Romero's and Valenzuela's caves), others seemingly served more specialized purposes (e.g., Ojo de Agua cave as a winter hunting camp); these selective functions apparently remained consistent for millennia. Cave-based activities (inferred from published discussions and from unpublished field descriptions of the deposits exposed during excavation) and their connections to other aspects of settlement are explored in order to situate use of the caves in a broader context.

This study makes several contributions to archaeology. First, while the collections are incomplete, the compilation of a relatively comprehensive inventory of the curated plant remains from the Ocampo caves introduces the general archaeological community to a range of plant types found in the caves that was previously unpublicized. Also, while the assessments of earlier analysts were generally accurate, in this dissertation I update the classifications applied to some specimens in the collections using more currently recognized nomenclature (though I did not alter the actual labels associated with the specimens), and through microscopic examination of some specimens was able to more specifically identify them (e.g., from family to genus level). Through a thorough investigation of MacNeish's excavations in the caves, the analysts he employed to assist him, a critical evaluation of the various publications regarding his work in Ocampo, and how this work has been and can be applied to past and present theories regarding prehistoric subsistence in Mexico and the origins and development of agriculture, the present research serves to historically contextualize MacNeish's groundbreaking investigations in the Ocampo caves. Finally, a major goal of the fieldwork phase of this research was to document and register previously unrecognized archaeological sites in the Instituto Nacional de Antropologia e Historia (INAH) *Registro Publico de Monumentos y Zonas Arqueológocos* ("Public Register of Archaeological Monuments and Zones"), thereby enhancing the formally recognized inventory of archaeological sites in the state of Tamaulipas and promoting future research.

The Ocampo Caves and their Role in Mexican Prehistory

Richard S. MacNeish conducted extensive surveys and limited excavations across much of southern Tamaulipas in the late 1940's and early '50s (MacNeish 1958). This work directly contributed to leading models of Mesoamerican agricultural development, and continues to be influential today. The Tamaulipas surveys were far-flung, and numerous archaeological sites were documented in widely dispersed areas, while detailed excavations centered on five rockshelters and two open sites in and near the Cañon Diablo, in the Sierra de Tamaulipas (Figure 1.2). However, for a three-month period in 1953-54, MacNeish and his team shifted focus to the mountainous country north of Ocampo in the Sierra Azul, a sub-range of the Sierra Madre Oriental in southwestern Tamaulipas (Figure 1.2). Decades earlier, local residents of this area had guided Mexican archaeologists Javier Romero and Juan Valenzuela to a series of caves near the Cañon Infiernillo, some with magnificent preservation of perishable materials (Romero and Valenzuela 1945). MacNeish predicted that these sites would hold considerable promise for deeply stratified deposits that would clarify the local cultural sequence, as well as well-preserved evidence for the early use of domesticated plants. He performed excavations in two caves that he named for the earlier explorers (Romero's cave, site number Tmc 247, and Valenzuela's cave, Tmc 248), and a third, Ojo de Agua cave (Tmc 274) (Flannery and Marcus 2001; MacNeish 1958, 1964, 1992; Smith 1997b). These excavations will be described in detail in Chapter Five.

The Ocampo Caves and Early Food Production

Based upon 17 occupation zones found in Romero's cave, eight occupations in Valenzuela's cave, and 12 in Ojo de Agua cave, as well as surface assemblages observed on survey, MacNeish formulated a sequence of nine cultural phases for the Ocampo region (MacNeish 1958; Smith 1997b). Phases were assigned age ranges based upon conventional radiocarbon dating of wood charcoal found within the cultural layers (Table 1.2) (MacNeish 2001). The cave deposits also yielded the desiccated remains of several early domesticated plant taxa (Tables 1.1, 1.2), which were assumed to date to the occupation zones in which they were found (MacNeish 1958, 1964, 1992).

Initial analyses suggested that bottle gourd (*Lagenaria siceraria*) and pepo squash (*Cucurbita pepo*) appeared during the Infiernillo phase (9000-7600 B.P.[1]), followed by common bean (*Phaseolus vulgaris*) in the Ocampo phase (6000-5200 B.P., called "Portales phase" in earlier publications [i.e., MacNeish 1956]), maize during the Flacco

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1 Archaeologists use multiple formats to portray radiocarbon dates. Throughout this dissertation, dates are presented in dendrochonologically calibrated years B.P. (before present, assumed to be the year 1950), including the error range as presented by the original authors. For example: Kaplan and Lynch (1999) present calibrated dates using a one-sigma error range; MacNeish (2001) uses an unspecified (but likely one-sigma) error range; and Smith (1997b) uses a two-sigma error range. For the sake of consistency, in cases where the calibrated date is originally presented in B.C./A.D. format (e.g., Smith 1997b), it is here converted to B.P. format by adding the standard date of 1950.

phase (5200-4400 B.P.), butternut squash (*C. moschata*) and cotton (*Gossypium hirsutum*) during the Guerra phase (4400-3600 B.P.), and cushaw squash (*C. argyrosperma* ssp. *argyrosperma* [previously *C. mixta*]), lima bean (*P. lunatus*), and tobacco (*Nicotiana rustica*) during the Palmillas phase (1900-1100 B.P.) (Kaplan and MacNeish 1960; Mangelsdorf et al. 1967; Whitaker et al. 1957)[2].

In recent decades archaeologists have become increasingly aware that relying on supposedly associated materials (e.g., wood charcoal) for determining the age of early cultigen remains is risky, because items of interest encountered in older strata may actually be intrusive from younger strata, leading to an over-estimation of age. Post-depositional disturbance can be particularly severe in cave sites. The ability of Accelerator Mass Spectrometry (AMS) radiocarbon dating methods to obtain dates directly from very small fragments has enhanced our knowledge of the earliest occurrences of various cultivated plants, in some cases demonstrating that cultigens once believed to have been quite ancient are actually much more recent, in others verifying the age determinations gained previously by indirect methods (Fritz 1994a, 1995; Long et al. 1989; Long and Fritz 2001; Piperno and Flannery 2001; Smith 1997a, 1997b, 2000, 2005b; Wills 1988). The application of AMS dating methods to the cultigen materials from the Ocampo caves resulted in significant revisions to the original sequence (Table 1.2), at least regarding most of the known domesticates (Kaplan and Lynch 1999; Smith

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2 As will be discussed in later chapters, chili peppers (*Capsicum annuum*), sunflower (*Helianthus* sp.), amaranth (*Amaranthus* sp.), large-seeded foxtail millet (*Setaria parviflora*), and other plants have been cited as additional evidence for local "incipient agriculture" in the Ocampo caves (Callen 1967a, 1967b; Austin 2006; MacNeish 1992:105; Mangelsdorf et al. 1964:443), though claims for their cultivated status are unsubstantiated. Also lacking in Ocampo is evidence for the cultivation of tree crops such as avocado (*Persea americana*), guaje (*Leucaena esculenta*), sapote blanco (*Casimiroa edulis*), sapote negro (*Diospyros digyna*), and ciruela (*Spondias mombin*), all of which were domesticated elsewhere in Mesoamerica (McClung de Tapia 1992:154-155). Wild versions of several of these trees do occur in southern Tamaulipas.

1997b). The oldest known remains of domesticated bottle gourd and pepo squash now date to at least 6440 B.P. and 6310 B.P. respectively, no earlier than the Ocampo phase. Cushaw squash was introduced earlier than previously expected (5035 B.P.), as early as the Flacco phase. The direct date on maize supported earlier assessments, with a date of 4405 B.P. verifying its arrival at least by the Flacco phase. The earliest known butternut squash now dates to 2750 B.P., following the Mesa de Guaje phase (3600-3000 B.P.), while the earliest common bean is far more recent than previously expected, with a direct AMS date of 1285 B.P., placing its arrival no earlier than the Palmillas phase. These changes indicate that some post-depositional disturbance had occurred in the caves over the millennia, yet the consistent, temporally-dispersed pattern supports the original conclusion that crop species were introduced sporadically and individually, and not as a complete assemblage or crop complex.

By the mid-1950s it was clear that none of the Ocampo cultigens had originated locally in Tamaulipas, but rather all had been introduced from elsewhere in Mexico. This led MacNeish to turn his attention to other regions where the true origins of agriculture could be discovered, and this decision resulted in his massive undertaking in the Tehuacán Valley (see Byers 1967). The results of his research in the Sierra de Tamaulipas were published in a landmark monograph (MacNeish 1958), but his findings in the Ocampo region were only briefly described in synthetic articles (MacNeish 1964; Mangelsdorf et al. 1964) and in a series of overview articles concerning the various domesticated plants recovered (Kaplan and MacNeish 1960; Mangelsdorf et al. 1967; Whitaker et al. 1957). For the most part the Ocampo excavations remain unpublished.

Settlement Patterns and the Ocampo Caves

Excavations in the Ocampo caves hinted at settlement and mobility practices in the region to a very limited degree. Thickness and extent of occupation layers in the deposits indicate that prehistoric visits were occasional and of varying intensities and/or durations. MacNeish interpreted these differences as reflecting either short-term stays by "microbands" (small family groups of about two to five individuals) or occasional, longer-term aggregations of "macrobands" (larger multi-family groups consisting of 15 to 25 persons) (Flannery 1986b:40). Macroband gatherings coincided with harvests of primary wild and domesticated crops, and were probably associated with social and ceremonial activities and exchanges (Marcus and Flannery 2004). The frequency of macroband visits to the caves seemed to increase over time, corresponding to apparently increasing dependence upon agricultural products. This pattern culminated in the appearance of settled villages in the Mesa de Guaje phase (3600-3000 B.P.), inferred from the appearance of ceramics in cave deposits, and larger open air sites with ceramics and circular house platforms of stacked limestone (MacNeish 1992:105). The available evidence suggests that some 2,500 years passed between the initial arrival of cultivated plants and these emergent village settlements.

However, open-air settlement patterns immediately associated with the Ocampo cave occupations are far from clear. Over the course of his project MacNiesh investigated hundreds of diverse sites in Tamaulipas to varying degrees, stating that 346 sites had been discovered by the close of the 1954 field season (MacNeish 1956:140, 1958:7). In his 1958 monograph, MacNeish describes excavations in seven sites in the Sierra de Tamaulipas, and then briefly introduces 59 surveyed sites that range across a very large geographical area; however, none of these are near the Ocampo caves (MacNeish 1958:20, 45-57). In other published accounts, brief mention is made of limited testing on open-air sites in the Ocampo vicinity (MacNeish 1956:141, 1992:105), but neither details of the excavations nor the locations of these sites are presented.

At the outset of this project in 2003, I obtained MacNeish's original Tamaulipas field notes from the Robert S. Peabody Museum of Archaeology, Phillips Academy, Andover, Massachusetts (Kelley 1954a, 1954b, 1954c; MacNeish 1954a, 1954b, 1954c, 1954d, 1954e, 1954f). According to an inventory of surveyed sites included among these unpublished notes, 72 sites (42 ruins and 30 camp sites, either on open ground or in caves) were visited during the 1953-54 field season while the team was excavating in Ocampo (MacNeish 1954a), but of these only 11 camp sites and five ruins can be presumed to be in the vicinity of the caves due to vague comments such as "In Canyon near Inf.[iernillo] caves," and "Down Canyon Inf. from Caves." It is possible that more detailed notes and possibly maps from this fieldwork survive somewhere, but I am unaware of their existence or possible location. Therefore, at present the only available information sources regarding other archaeological sites in the vicinity of the Ocampo caves include: 1) a brief published synthesis of Romero's and Valenzuela's reconnaissance in 1937 (Romero and Valenzuela 1945), which describes three cave sites (two of which later became known as MacNeish's Ocampo caves, the third of which was relocated and documented during the present study [site number Cav-3-05]), and one large village site, also recorded during this study (Cuiz-3-05); 2) unpublished and un-detailed field notes from MacNeish's project that mention some sites visited and their presumed age, but give no indication as to their whereabouts; 3) and several published accounts of MacNeish's research that briefly refer to such sites, yet again offer no great detail (MacNeish 1956, 1992).

In the 1950s, following the close of his Tamaulipas project, MacNeish (1956:141) openly admitted that settlement data is lacking for the Sierra Madre Oriental region of southwestern Tamaulipas: "In this region the artifact and subsistence complexes of each [cultural] phase are well known, but our survey was not complete enough to give adequate data on settlements for all the phases." Yet this did not hinder his attempt to generate a basic outline for prehistoric settlement patterns spanning all of northeastern Mexico, employing this limited data plus information gathered from the Sierra de

Tamaulipas, the humid lowlands in the Huasteca of southernmost Tamaulipas and northern Veracruz, and the arid coastal plain and dissected peneplain of northeastern Tamaulipas (MacNeish 1956). More recent salvage archaeology surveys in advance of highway construction projects have added to the data set for southwestern Tamaulipas, but these are far away from the Ocampo caves (Ramirez Castilla 2007).

I must clarify that I do not take issue with such pioneering research in this little-known region. However, any attempt to describe settlement patterns over such a large area while relying on scant and widespread data is bound to have only the most general conclusions. And even then such large scale results do little to illustrate how the Ocampo cave occupations fit into the local pattern of the drainage and hills in which they are situated. The particulars of non-cave elements of settlement directly associated with the Ocampo caves are unknown to the general archaeological community, partially because this phase of MacNeish's research never saw full publication and his available field notes are not specific in this regard. Although his team clearly surveyed for additional archaeological sites in the vicinity of the excavated caves, it is unclear how many were discovered and how they are distributed across the landscape. Another factor that contributes to our lack of knowledge that can be more readily addressed is the fact that so little subsequent research has been carried out in the study area.

Moving Out of the Caves

With good reason, previous investigators in the Ocampo region placed emphasis on archaeological sites in dry rockshelters and caves, because such settings are ideal for the preservation of fragile vegetal materials and were thus more likely to contain visible evidence of the presence of early cultigens. However, as will be clarified in Chapter Seven, MacNeish's unpublished documentation of the Ocampo research indicates that different cave sites often played varying roles in the subsistence strategy.

Also, temporary cave and rockshelter occupations may represent only one aspect of a larger settlement-subsistence system, and over-reliance on cave data may obscure other important elements of the local economy. Several studies from other parts of Mexico serve as examples.

The Tehuacán Valley, Puebla

In the 1960s, desiccated plant remains and paleofeces recovered from habitation floors within caves allowed reconstructions of ancient diet in the Tehuacán valley (Figure 1.2) (MacNeish 1967). More recent bone chemistry studies of skeletons interred within these very caves revealed isotopic signatures that are inconsistent with dietary reconstructions based on archaeobotanical assemblages alone (Farnsworth et al. 1985), demonstrating that "cave diets" are not necessarily representative of the greater adaptive pattern:

> Reliance on the cave material introduced several seasonal and locational biases into the dietary reconstruction. The occupation of the Tehuacán cave sites was, by and large, seasonal in nature and although every season is represented during every phase, the seasons were not equally represented in the samples obtained…. Of equally great concern is the fact that all the archaeological dietary information is derived from cave sites as opposed to other settlement types …. For the later phases, when sedentary villages were established, the cave sites would have to be considered a marginal or at least a specialized (and therefore a nonrepresentative) niche in relation to the total system (Farnsworth et al. 1985:109).

Furthermore, Farnsworth et al. (1985:112) point out that architectural features such as irrigation canals, found across the landscape in the Tehuacán Valley and dating to later phases, indicate degrees of agricultural intensification that are incongruent with interpretations inferred solely from archaeobotanical remains in caves.

The Mitla Valley, Oaxaca

The earliest directly dated evidence for both domesticated pepo squash (9975 B.P.) and maize (6300 B.P.) is from Guilá Naquitz rockshelter, in the Mitla Valley of central Oaxaca (Figure 1.2) (Piperno and Flannery 2001; Smith 1997a, 2000). The early food producing levels here were probably left behind by small family groups of four to six people (microbands) that occupied the shelter for short periods during lean seasons (Flannery, ed. 1986). A large open site known as Gheo Shih lies approximately 2 km to the south; Marcus and Flannery (1996, 2004) estimate that it was utilized by 25 to 30 people, likely during late summer months when resources were sufficiently abundant to support such a macroband and/or to encourage their aggregation for cooperative harvests. AMS dates from Gheo Shih indicate the site was used as early as 9670 B.P., demonstrating general contemporaneity with the preceramic, low-level food producing occupation of Guilá Naquitz. This pattern supports the scenario in which small family groups seasonally and temporarily used sheltered sites such as Guilá Naquitz and occasionally congregated with similar groups at more extensive open sites such as Gheo Shih for economic and ritual purposes over the course of the year (Marcus and Flannery 2004). Recent salvage archaeological research has unearthed similar patterns in nearby valleys, demonstrating that the seasonal use of small sheltered sites by family groups and the periodic aggregation of such groups into larger open camps is not an isolated phenomenon (Baudouin and Markens 2007; Martínez López and Reyes González 2007).

These examples emphasize the importance of a holistic approach in addressing individual prehistoric foraging-farming economic systems. Accurate impressions of such economies cannot be formulated based on two or three sites that represent only one aspect of a greater adaptive pattern, particularly if these sites show evidence of mere snapshots of human occupation sometimes separated by several thousand years, as do the Ocampo caves. The regional variation among prehistoric farming systems requires that multiple facets of the local subsistence and settlement pattern be explored and documented. This dissertation represents initial steps in that direction for one important part of Mesoamerica.

A comprehensive reconstruction of settlement and subsistence patterns in a particular area is a huge undertaking, and was beyond the capabilities of the present project. However, a preliminary examination of multiple site types, their physical locations on the landscape, and their associated artifact assemblages can clarify some aspects of the range of resource extraction strategies employed in the past. Also, a close look at the diverse plant remains in curated collections and described in unpublished field notes can enhance understanding of the range of resources and habitats utilized by the prehistoric visitors to the Ocampo caves beyond the brief descriptions given in the few published accounts.

There are several reasons why I chose not to renew excavations in the Ocampo caves or other nearby sites, but rather to rely on previously excavated, curated materials and preliminary archaeological survey for the purposes of this dissertation. First and foremost, obtaining permits for the actual excavation of archaeological sites in Mexico is problematic, particularly regarding well-known or important sites such as these. INAH readily approved surface archaeological survey in this case because the fieldwork would not disturb subsurface archaeological deposits, and would identify, document, and register previously unrecognized sites. Also, although Smith (1997b) had already demonstrated the continued utility of the Ocampo cave plant collections, the contents, intactness, and usefulness of the entire previously collected data set remained unclear. I assert that a comprehensive inventory of these curated remains (particularly the wild plant materials) was a necessary first step before new excavations should be considered. A major goal of the present project was to first contextualize the unreported materials previously obtained by MacNeish, and in many ways it represents the preparation for future, more intensive investigations.

Organization of the Dissertation

This document is organized into ten chapters. A major goal is to place the Ocampo caves into the greater theoretical context of plant use and food production in Mesoamerica. Although previous archaeological research in Ocampo greatly influenced theoretical conceptions of early food production in Mesoamerica from the beginning, these and additional frameworks have been developed over subsequent decades, and this is the subject of Chapter Two. Chapter Three expands upon these frameworks by exploring the origins and dispersals of key Mesoamerican crop plants that comprised the assemblage in the Ocampo caves; emphasis is placed on the role of the Ocampo findings in these reconstructions. Because environment affects plant use and subsistence choices, and functions as a backdrop against which biological and cultural processes are played out, Chapter Four regards the physical setting of the study area. This includes the modern human occupation, as well as local geology, climate, vegetation, and fauna, and a summary of the available data for broad-scale climatic fluctuations and persistence of biotic communities in northeastern Mexico over the last ten millennia. Chapter Five highlights important previous archaeological research concerning ancient subsistence in the region, describing MacNeish's excavation methods, specimen cataloging system (relevant to the examination of curated collections discussed in Chapter Seven), and the methods by which he compiled the vegetal data into reconstructions of prehistoric diet and plant use. Chapter Six is a literature review of the few publications regarding plant use and changes in plant-related subsistence in the Ocampo region over time, citing the major classic sources on the subject. This discussion serves to point out the consistencies and discrepancies between major published accounts and examine these reconstructions in light of current archaeological and botanical knowledge.

In Chapter Seven I describe the contents of curated plant specimen collections from the excavations, and consider plants listed as present in the cave deposits in unpublished excavation notes. These two sources indicate the presence of various additional plant resources that were not included in the published accounts. In Chapter Eight I recount field survey findings, describing each recorded site and its context individually; site locations are evaluated in terms of access to natural resources such as plants and arable land. Results of artifact analyses are included on a site-by-site basis, as these can provide additional insight into organization of mobility and plant extraction activities. In Chapter Nine I pull together these various lines of evidence presented in previous chapters, as well as insights into local farming ecology gained from local knowledge and observations of present-day (yet largely traditional) cultivation practices, to arrive at a more comprehensive understanding of prehistoric land use and plant-human interaction in the study area. Concluding remarks and avenues for future research are then presented in Chapter Ten.

CHAPTER 2: THE OCAMPO REGION AND EARLY MESOAMERICAN FOOD PRODUCTION IN THEORETICAL CONTEXT

According to Minnis (1992:121), agriculture "… is the outcome of processes that can involve different factors," and other authors share this sentiment (Flannery 1973; McClung de Tapia 1992). Thus the development of food production can be expected to vary greatly from region to region, although different scholars have addressed this problem at different scales. In the previous chapter, I introduced the Ocampo caves and their contribution to early theoretical frameworks regarding the origins and spread of food production in Mexico. I also pointed out the limitations of the available data, and the need to understand various facets of local plant utilization, land use, and food production. A major goal of this dissertation is to assess the Ocampo caves within the greater context of Mesoamerica as a whole, in light of more recent theoretical and archaeological developments.

A vast body of research spans the last 60 years regarding the evolution of food production and the rise of sedentary life in Meso- and Central America (e.g., Bellwood 2005; Blake et al. 1992; Buckler et al. 1998; Flannery 1968, 1973, 1976, ed. 1986; Fritz 1994a; Hill 2001; Kennett et al. 2006; MacNeish 1958, 1964, 1967, 1992; Mangelsdorf et al. 1964; McClung de Tapia 1992; Niederberger 1979; Piperno et al. 2009; Staller et al. 2006; Stark 1981; Smith 1997a, 1997b, 2000, 2001b; Zizumbo Villareal and GarciaMarín 2010). In this chapter I summarize various theories of agricultural origins, change, and diffusion, particularly as applied to Mesoamerica (although the discussion also covers some more general approaches). These include MacNeish's early Era of Incipient Cultivation explanation (briefly introduced in the previous chapter), as well as more recent frameworks integrating processual approaches, evolutionary ecological theory, conceptual considerations of the often blurred dichotomy between hunting and gathering and agriculture, and the role of long-distance migration of agricultural populations versus group-to-group transference of cultigens or cultigen "packages" among preexisting economies. Other frameworks regarding shifts in settlement and general land use will be addressed as well, due to their relevance to the Ocampo circumstances and archaeological and environmental observations made in the field. Many of these frameworks are not necessarily mutually exclusive, and some will apply to particular locales but not to others. This extreme diversity across Mesoamerica points to "… the importance of localized developments for understanding the broader picture" (McClung de Tapia 1992:147).

Climate Change

Climate change has often been cited as a force driving the origins of agriculture and its subsequent spread, both globally and locally (see Gupta 2004). Deteriorating conditions may lead to frequent failures in wild harvests, encouraging hunter-gatherers to continuously experiment with cultivation in order to ensure sufficient food supplies, or climatic shifts may simply create new situations that provide opportunities for domestication. The "Oasis" or "Propinquity" theory was an early model for western Asian early agriculture in which large scale climatic change was a vital element. First proposed by Raphael Pumpelly (1908) and later popularized by V. Gordon Childe (1936), it proposes that as particular areas became increasingly arid at the end of the Pleistocene, animals and humans were drawn together in fertile river valleys; it was in these favorable environments that hunter-gatherers were impelled to domesticate plants. Flannery (1986a:9-10) summarizes some climatic models as they have been applied to the case in Mexico. On a very basic level, changing climate played an important role in the mass disappearance of megafauna from Mexico at the end of the Pleistocene; one model proposes that this forced human hunters to broaden their diets to include smaller game and plant foods, eventually leading to cultivation of some plants. However, Pleistocene faunal remains from Coxcatlán Cave in the Tehuacán valley indicate that those people also hunted a wide variety of small-bodied animals, and thus were not so dependent upon big game to render the extinctions so problematic. Other models propose that during the mid-Holocene "Altithermal" climatic period (5000-3000 B.C.), hot, dry conditions either a) depleted traditional foods and forced populations to take up food production, or b) delayed successful farming until after 3000 B.C. However, Pleistocene climate was cooler and drier than the Holocene, and there are no records for conditions so harsh that they would sufficiently damage Holocene vegetation communities to the point that farming would be obligatory. Also, the earliest Mesoamerican domesticates were not highly productive as food resources, and there was an extended period of several thousand years before any degree of reliance on these plants; these factors "… weaken any argument for a direct causal link between climatic change and domestication" (Pearsall 1995:191).

Although changing climate probably did not directly *cause* Mesoamerican hunter-gatherers to take up planting, such shifts likely set the stage for early cultivators in several ways (see Buckler et al. 1998). In southern Mexico the change from Pleistocene to Holocene conditions by about 10,000 years ago encouraged the vast expansion of thorn-scrub-cactus forest that supported many potentially domesticable plant taxa, and a number of these eventually came under cultivation (Flannery 1986a:10). Piperno and colleagues (2007) interpret pollen cores from the Iguala Valley in the central Balsas watershed (the general region of maize domestication) to indicate warmer and more humid conditions at the onset of the Holocene about 10,000 years ago. The once-dry lake beds filled up and became the focus of human activity, and interactions with diverse tropical forest species (including annual teosinte) intensified. Sometime between 10,000 and 5000 years ago indigenous populations began cultivating maize and squash along the lake margins. Most relevant here, although it may simply be coincidental, it is interesting to note that the tentative date for the beginnings of village-based agriculture in the Ocampo region, during the Mesa de Guaje phase (ca. 3600-3000 B.P.), coincides with the onset of wetter (albeit cooler) conditions early in the late Holocene than had been the norm in previous periods; the evidence for this change will be discussed more fully in Chapter Four.

Population Pressure

Overpopulation, in its various incarnations, is another element often cited as an impetus for the initial domestication of plants or the intensification of their use as a response to pressure on carrying capacity (e.g., Binford 1968; Boserup 1965; Cohen 1977). In one manifestation of this approach, it is concluded that agriculture emerged in many parts of the world during roughly the same time frame because hunter-gatherers had so saturated the globe by 10,000 years ago that the demand for calories had exceeded the productive potential of wild plants, leaving food production as the only alternative (Cohen 1977).

Binford (1968) postulates that hunter-gatherers living in optimal zones maintain equilibrium between population size and available food resources below the limits of the carrying capacity, through group fissioning when the population grew too large. However, the delicate balance would be affected when some change caused a drop in available resources, or when splinter groups impinged on other groups occupying marginal zones. The resulting pressure on food resources would have caused some to intensify their subsistence efforts through cultivation.

Although population pressure models are appealing, they very likely do not apply to the Mesoamerican case, where data indicate that population densities were quite low during the initial periods of plant domestication:

> Populations in highland Mexico were so small when agriculture began that phrases such as "over population," "food crisis," and "exhaust all possible strategies" appear to be exaggerations. Elsewhere [Flannery 1983:35] I have estimated that early Archaic populations in the Tehuacán-Oaxaca valleys consisted of no more than 1 person per 9-29 km ^{2}, and 'this figure includes only one of the valley areas, not the surrounding mountains' where so much foraging was done….. I calculate that a catchment circle with a 5-km radius would contain more plant food than the occupants of Guilá Naquitz could eat in their lifetimes (Flannery 1986a:11).

Thus, early agriculture in Mesoamerica was not likely a product of stress on food reserves due to high populations (McClung de Tapia 1992:162). This also seems to be the case for the adoption of plants domesticated elsewhere into the local Ocampo economy, where the available evidence indicates that populations were low over the course of the EIA, and that the use of domesticates was so low for several thousand years that they likely only played a supplemental role in a diet dominated by hunting and gathering. However, rising populations probably did affect later expansions in farming economies in Mesoamerica due to the tendency for large-scale food production to increase human numbers, and the subsequent need for more arable land. This notion has greatly influenced models for both small- and large-scale farmer migrations in Mexico.

Migration as a Means of Agricultural Dispersal

The idea that domesticates, sedentism, and the farming way of life dispersed primarily through the long distance, physical migration of populations that had already adopted such life ways, rather than by the diffusion of cultigen seed stock among different groups, is a recurring theme (Bellwood 1997, 2005; Bellwood and Renfrew 2002; Diamond and Bellwood 2003; Hill 2001; Merrill et al. 2009). Like other authors (e.g., McClung de Tapia 1992:156; Smith 2001a, 2005a:301), Bellwood (2005:148) distinguishes between the mere presence of a domesticated plant or animal in a local economy and a technically “agricultural” lifestyle. In his view, Mesoamerica may have experienced various spatially and temporally scattered domestication events, but true settled farming communities developed only in select areas and then subsequently spread across the landscape due to increasing population sizes, demand for cultivable land, and the ability of food-producing groups to absorb and/or displace foraging ones (Bellwood 2005:165-168).

Evidence for such movements of ancient populations is often sought in linguistic reconstructions (see Bellwood 2005; Bellwood and Renfrew 2002; Hill 2001). Bellwood (2005:239) quotes Witkowski and Brown (1978:942) regarding the hand-in-hand spread of food production and language groups across Mesoamerica: “Plausibly, plant domestication, which was beginning about the time Proto-Mesoamerican [Mayan, Otomanguean, Mixe-Zoquean, and others] was spoken, triggered a vast population increase leading to the linguistic diversity that presently characterizes those languages.” The research of Jane Hill (2001) complements Bellwood’s (1997) hypothesis for the case in western Mesoamerica, using reconstructed Proto-Uto-Aztecan (PUA) terms for maize cultivation and processing. Hill asserts that PUA speakers originated in central Mexico, and that some populations on the northwestern edge of Mesoamerica carried maize agriculture along with them on distant migrations northward into what is now the U.S. Southwest. This migration was supposedly motivated by rising populations and a need for new land; foraging societies that were encountered were either displaced or assimilated. Merrill et al. (2009) challenge this framework, and conclude that the PUA language group originated among foragers in the Great Basin rather than village farmers in Mesoamerica, and that the speech community fragmented into northern and southern divisions almost 9,000 years ago, long before the spread of maize agriculture across the Southwest. They favor a scenario in which maize spread across northwestern Mexico into the Southwest by group-to-group diffusion (Merrill et al. 2009).

Those people to first use domesticated plants in the Ocampo caves apparently lived in relatively low population densities, and there is no evidence to support claims that they came to this region across long distances. Further, MacNeish (1958:168, 1971:578) dates the rise of farming village economies in the Ocampo region to the Mesa de Guaje phase (3600-3000 B.P.), and interprets cultural remains between this and the previous Guerra phase (4400-3600 cal. B.P.) to indicate continuity between the two. In other words, pre-village Guerra evolved directly into settled village Mesa de Guaje. Also, based on characteristics of material culture, both MacNeish (1947:3) and Ramírez Castilla (2007) consider the villages of the mountains surrounding Ocampo to be a cultural development distinct from that of the Huastecs or other cultures to the south (see Figure 5.1), reflecting relatively independent origins. The characteristics of these prehistoric villagers will be discussed further in Chapter Four. In accordance with these lines of evidence it follows that neither individual domesticates nor the settled agricultural life way arrived in Ocampo by way of migrating farmers. However, some regional implications of migration are worth noting here.

Migration: The Origin of the Huastecs?

According to Aztec legend, the first inhabitants of Mexico arrived from the east by sea, and landed in the Huasteca, in the lowlands southeast of the study area (see Figures 4.1 and 5.1). These first Huastecs then spread south as far as Guatemala and west to the Central Plateau to settle at a place near Teotihuacán called Tamoanchan. Only upon disgracing himself in a drunken state did the chief of the Huastecs lead his people back to their homeland in northeastern Mexico, where their descendants still live today (Fray Bernadino de Sahagún, in Stresser-Peán 1971:586).

The ancestral linguistic connection between the Huastecs and other Maya speakers in far southeastern Mesoamerica has been a matter of much interest, as it presents the possibility that there were major migrations of populations into northeastern Mexico from regions far to the south (Manrique Castañeda 1989; Ruvalcaba Mercado 2005; Zaragoza Ocaña 2000). This view is supported by a general notion of language diffusion theory, which holds that linguistic variants are often concentrated in the region of origin, in this case the Maya culture area. In a map portraying language dispersals across Mesoamerica, Bellwood (2005:Map 10.11) illustrates the "Early Mayan" linguistic group as centered east of the Isthmus of Tehuantepec and south of the Yucatan Peninsula. Arrows depict the language group as expanding from this center to the north and the east, and northwest up the Gulf Coast of Mexico to the Huasteca.

According to Stresser-Peán (2006:32), Mayan speakers migrated from the south and arrived at the mouth of the Río Pánuco, central to the Huasteca and 200 km southeast of the study area, about 4,000 years ago. The timing of this purported arrival falls slightly before the beginning of the Mesa de Guaje phase in the Ocampo region, and is consistent with the hypothesis that migrating farmers from the south brought the concept and practice of village life into the region, although the actual domesticated plants began arriving thousands of years earlier. Even so, the local developments in Ocampo seem to have been independent of (though possibly inspired by) events in the Huasteca proper.

A number of theoretical alternatives have been proposed that conflict with the south-to-north migration origin scenario. One asserts that the Maya language originated in the north, and subsequent migrations to the *south* left the Huastecs behind in their prehispanic and current homeland (Cerda Silva 1939). Ruvalcaba Mercado (2005:255) asserts that the Huastec language has "some features" that developed earlier than in other Maya languages, and that this indicates north-to-south immigration. It has also been proposed that proto-Maya speakers were once continuous along the Gulf Coast of Mexico, and the Huastecs were later separated from other Maya by movement of central highland linguistic groups (e.g., Zoque, Mixe, Totonac, and Otomí) towards the Gulf Coast. This displacement may have taken place around 4,500 years ago, according to glottochronological analysis (Jimenez Moreno, in Stresser Peán 1989:188). Unfortunately, none of these alternative scenarios have supporting archaeological evidence, precluding testing of the hypothesis as to whether or not migrating populations brought the farming way of life into northeastern Mexico.

A scenario characterized by large-scale, long distance migration holds merit in other parts of the world, such as the colonization of parts of Europe by farming populations originating in southwestern Asia (Price et al. 1995). Migrations and expansions of sedentary farmers probably did take place in parts of Mexico as populations grew and more land was required. For example, Lesure and colleagues (2006) document expansion of agricultural populations into marginal areas less conducive to farming in upland central Tlaxcala. But the question is: *to what extent* were these movements responsible for the spread of agriculture and village life across vast regions? In Mexico, it is not likely that early spread of individual domesticated plants was due to such migrations, and evidence is inconclusive that physical migration of farming groups rather than trade and diffusion of seed stock and independent "invention" of sedentism was the *primary* means of dispersal of developed food production systems over long distances. As Lesure and colleagues (2006:475) put it, "The transition to agricultural lifeways in Mesoamerica likely involved both migrations and independent shifts, with the interrelations between the two involving questions of scale."

Sociopolitical Theories

A number of researchers emphasize the importance of socioeconomic factors, such as competitive feasting, alliance formation, and elite expropriation in promoting cultivation (Hayden 1995). Such socioeconomic competition models maintain that domestication occurred in rich environments where sedentary, complex hunter-gatherer societies had already been established. The first domesticates originally functioned as prestige items, as ambitious individuals intensified their production to demonstrate wealth and control over labor (Hayden 1995:282). Competitors sought to produce bigger, more numerous, and better plant foods, and as a result the crop species were eventually genetically modified to the point where cultivation produced returns competitive with those of collecting wild plant foods. Only once this was achieved did non-elite individuals begin cultivating these new domesticates as their primary food source, and the practice quickly spread into other regions.

Although such a scenario may account for the later domestication of some Mesoamerican crops, it was probably not the case for early cultigens such as maize and squash. As stated above, when the first known domesticates appeared in Mexico population levels were relatively low, and although some data demonstrate that preceramic Mexican peoples including those in Ocampo seem to have had lives that were culturally and ritualistically rich (MacNeish 1964; Marcus and Flannery 2004), there is no evidence to indicate that those people who domesticated maize and squash had reached the level of complexity implied by socioeconomic competition models.

MacNeish: The "Era of Incipient Agriculture"

In the 1960s, data from the Ocampo caves was combined with information from other excavated cave sites in the Tehuacán Valley (Byers 1967) and Guilá Naquitz rockshelter in the Mitla Valley of Oaxaca (Flannery, ed. 1986) to formulate a general scenario modeling the origins and spread of agriculture in Mesoamerica. Major crop plants apparently originated in divergent areas and times, and were incorporated into local foraging systems as they spread. By estimating relative dietary contributions among various foods over the course of the preceramic cultural phases, MacNeish (1958, 1964, 1971, 1992) recognized a pattern in which cultigen use gradually increased at the expense of wild resources, rather than drastically altering pre-existing subsistence strategies:

> It seems that the shift from food gathering to food producing was not accomplished by any sudden realization of the potential of an agricultural economy, but was more likely to have been a slow steady accumulation (usually by slow diffusion) of more and more domesticated plants that gradually replaced the wild vegetal foodstuffs. Thus time and energy for hunting and plant collecting become unconsciously usurped by agricultural activities such as clearing, planting, weeding, harvesting, and food preparation (MacNeish 1964:419).

Heavily influenced by Julian Steward's (1949) research in the Great Basin, MacNeish suggested that before and during the initial adoption of food production, people in Mexico typically lived and traveled in *microbands* (small groups, perhaps individual family units of 4 to 6 people); however, *macrobands* (larger groups of several related family units, possibly 30 to 35 people) occasionally formed for social or economic purposes when seasonally abundant plant foods allowed such aggregations. As localized dependence on plant cultivation increased, the frequency of macroband formation increased for the care and harvesting of crops; this trend eventually culminated in the establishment of settled agricultural villages:

> Is it not possible as the number of new agricultural plants utilized increased that the length of time that the microbands stayed in a single planting are also increased? In time could not perhaps one or more microbands have been able to stay at such a spot the year round? Then with further agricultural production is it not possible that the total macroband became sedentary? Such would, of course, be a village (MacNeish 1964:425).

The phrase *Era of Incipient Agriculture* (EIA) was applied to the extended period between initial domestication and the founding of maize-based village economies

(MacNeish 1964, 1992; Mangelsdorf et al. 1964; Smith 1997b, 1998a, 1998b); this title will be used for this period throughout this dissertation.

Archaeological data have largely upheld the EIA framework in a general sense, and it remains the most widely accepted scenario portraying the rise of food production and village life in Mesoamerica (Smith 1997b; Stark 1981), although with enhancement and elaboration. Even decades after its original formulation, however, MacNeish admitted that the EIA framework was primarily descriptive in nature and lacked *explanatory* elements:

> In a vague, unstated way, I felt that the development of agriculture had been slow and gradual and had been accomplished by seasonal, patrilineal bands -- as defined by Juian Steward -- who had collected plants susceptible to domestication and, by domesticating them, had maintained bigger groups (macrobands) that evolved into village agriculturists. Like Braidwood, we asked not *why*, but only *how*, it happened … (MacNeish 1992:11, emphasis in original).

This realization later led him to formulate his own explanatory models for the rise of agriculture and sedentism in several parts of Mesoamerica, as is discussed below (MacNeish 1992).

Flannery: Positive Feedback, Seasonality, and Scheduling

Following his work at Guilá Naquitz, Flannery (1968, 1973, ed. 1986) enhanced the EIA scenario using elements of ecological systems theory, proposing that domestication had originally emerged from preexisting foraging behaviors. Pre-agricultural groups in central Mexico regulated their foraging activities around a particular set of primary resources: maguey (*Agave* spp.), cacti, tree legumes, white-tailed deer, cottontail rabbit, and wild grasses (Flannery 1968). *Seasonality* (the availability of various food resources throughout the year) and *scheduling* (the cultural decision of how to organize time and labor between two or more resources whose availability conflict in time and space) interacted to maintain the *status quo* among resource extraction activities, so that the economy changed very little over a long period of time. Such interactions were regarded as "deviation-counteracting" systems (Flannery 1968:93).

"Deviation-amplifying" processes came into play when selection and intentional planting by hunter-gatherers produced beneficial genetic alterations in some plants useful to humans, but that were previously relatively unimportant in the system (e.g., wild grasses). Flannery (1968:94, 1973:296) suggests that these advances arose from attempts to balance productivity between wet and dry years by extending the natural range of useful weedy, pioneer annual grasses, such as *Setaria* spp. (foxtail millet) and teosinte. Thus a seemingly minor alteration resulted in a positive feedback loop in which the use of these plants was intensified as their utility improved, and plant and human became increasingly dependent upon one another. In Flannery's (1968:94) words "… positive feedback following these initial genetic changes caused one minor system to grow all out of proportion to the others, and eventually to change the whole ecosystem of the southern Mexican highlands." Scheduling and labor activities were altered in favor of the newly evolving plants over previously important wild resources, and macroband formation occurred more often and for longer periods of time until such camps were occupied year round (Flannery 1968:96; McClung de Tapia 1992:161).

MacNeish's Trilinear Theory

Several decades after his formulation of the EIA framework, MacNeish (1992) suggested a series of necessary and sufficient conditions (e.g., climatic and other environmental change, seasonality, accessibility of resources, storage, group size) that affected the varying transformations from hunter-gatherers to village agriculturalists around the world. In highland Mesoamerica, the earliest occupations consisted of

Hunting-Collecting Bands, highly mobile microbands whose hunting and gathering pattern was non-seasonally scheduled (MacNeish 1992:21). The natural environment was characterized by high ecological diversity, potentially domesticable plants within a variety of ecotones, multiple resources that cannot be extracted from a single base camp, and high seasonality punctuated by a period with few available foods. A reduction in food availability and increasing seasonality led to an increase in logistical mobility (see Binford 1980, discussed below), a broader spectrum diet involving seed collection and storage, and seasonally scheduled foraging activities. Thus Hunting-Collecting Bands developed into *Destitute Foragers*, who consumed and stored a wide variety of foods that were seasonally collected by macrobands (MacNeish 1992:24-25). Destitute Foragers started planting selected seeds near their campsites, likely as a buffer against harsh times, resulting in beneficial alterations in subsequent plant generations. The improving food resources allowed progress towards *Incipient Agricultural Bands* and, finally, settled *Agricultural Bands*:

> These conditions lead to larger populations (macrobands) and longer stays, which eventually lead to bigger fields (agriculture). Bigger fields, in turn, increase the time populations remain in an area so that they become base-camp macrobands with multi-season stays. These base camps next turn into year-round hamlets. This sedentary living then leads to an increase in population, which must be further augmented by an increased food production, until the procurement system is rescheduled to one that has *Agricultural Villages* (MacNeish 1992:27, emphasis in original).

MacNeish (1992:113-118) concludes that archaeological data and environmental conditions in both southern Tamaulipas and the Tehuacán Valley meet all the hypothetical considerations to support his framework for why Hunting-Collecting Bands became Village Agriculturalists in these two regions of highland Mexico.

Binford's Forager/Collector Continuum

Several decades ago, Binford (1980) proposed a distinction between *foragers*, hunter-gatherers that tend to live in small groups and "map onto" resources through frequent residential moves, and *collectors*, groups that establish a relatively long-term, continuously occupied base camp from which smaller, logistically-organized task groups venture out to acquire more distant yet valued resources. In other words, *foraging* brings the people to the resources, while *collecting* brings the resources to the people. The distribution of available resources largely conditions which strategy is used in a given habitat, although foragers and collectors are idealized categories, and in reality most groups fall somewhere along the continuum in between (Binford 1980:12). Although Binford's discussion of this concept was geared towards hunter-gatherer settlement patterns, Flannery rightly points out that it can easily be applied to early agriculturalists in Mexico as well: "And if collectors 'move goods to consumers with generally fewer residential moves' [Binford1980:15], then agriculture was the ultimate collecting strategy" (Flannery 1986a:14).

Thickness and extent of occupation layers in the Ocampo caves and other sheltered sites in the Tehuacán Valley indicate that prehistoric visits were sporadic and of varying intensities and/or durations. While MacNeish interpreted these differences as reflecting either short-term stays by microbands or occasional, longer-term aggregations of macrobands, these findings may also be indicative of various strategies along Binford's continuum. Caves may have occasionally served as primary camp sites of collectors, as seen in the excavations as thicker, more extensive occupation layers. Thinner layers or discrete occupations associated with artifacts and features representing special purpose activities may signify logistically organized camps related to primary camps located elsewhere. Under these circumstances the occupations would fall towards the "logistically organized collectors" end of the spectrum. One the other hand, Flannery

(1986b:40) places the preceramic occupation of Guilá Naquitz on the "residentially mobile foragers" end of the spectrum, because "… they appear to have changed residence several times a year as different resources became available." However, even these foragers practiced some degree of logistical mobility, in the form of all-male hunting parties.

MacNeish's and Binford's frameworks are not mutually exclusive, because small microband camps, multi-family macroband base camps, and various logistically-organized special purpose camps can be integrated into one larger yet flexible settlement pattern, as illustrated by Flannery (1986b:40-42) for the Oaxaca and Tehuacán preceramic periods.

Pre-Agricultural Sedentism

Discussions of early sedentism in Mesoamerica are inseparable from considerations of food production, because domestication, agriculture, and sedentarization were apparently interrelated processes in many regions. However, this probably was not the case universally. Stark (1981:345) acknowledges that sedentarization "… may have occurred independently of food production at some localities," and Niederberger (1979:137) writes that "… an agricultural economy is not a necessary condition for the establishment of village life." Excavations in the 1970s in the southern Basin of Mexico revealed that in some rich and productive parts of Mesoamerica, sedentary communities can develop without the benefit of agriculture (Niederberger 1979). The site of Zohapilco is located on an ancient lacustrine shoreline. In the words of McClung de Tapia (1992:159), during the Playa phase (7500-5500 B.P.), "The site was apparently occupied by macrobands of hunter-gatherers who appeared to have been semisedentary and, possibly, sedentary because of the abundance of food resources available from the lake, lakeshore, and surrounding piedmont zones."

Ideal conditions allowed for the preservation and recovery of the remains of teosinte, amaranth, goosefoot (*Chenopodium* sp.), and groundcherry (*Physalis* sp.); however, there is no direct evidence for the presence of maize or other domesticates during the early occupation of the site. Niederberger (1979) interprets the presence of very abundant natural resources, archaeological plant and animal remains representing multiple seasons (including dry-season duck and migratory waterfowl), and evidence of multi-seasonal activities around hearth areas to point to relatively permanent residency during the La Playa phase in the absence of notable food production. As unusual as this seems, it appears that such communities were not isolated phenomena. Other incidences of pre-agricultural sedentism have been proposed for the Soconusco region of coastal Chiapas (discussed more fully below) (Blake et al. 1992; Kennett et al. 2006) and coastal central Veracruz (Wilkerson 1975). Both locations are in very rich environments characterized by coastal, marine, and estuarine resources.

Some locales in Mesoamerica were characterized by resource abundance that favored long-term residency, but archaeological data presently suggest that these were probably not the rule. The available evidence from Guilá Naquitz, the Tehuacán valley caves, and the Ocampo caves indicates a prolonged period of relatively mobile lifeways in these regions long after the introduction of domesticated plants. However, the very arid conditions that favor good plant preservation in the highland cave localities also affect the human food quest and may promote less sedentary patterns in the absence of food production. The findings at Zohapilco and similar sites give further insight into the diversity in preceramic economies across Mesoamerica as a whole, and this picture will undoubtedly become more complex with the investigation of additional sites in rich habitats.

Behavioral Ecology

Optimization models and the concepts of behavioral ecology have proven useful for addressing the origins and diffusion of cultivated crops and their adoption into existing strategies and/or new regions (Kennett and Winterhalder 2006). Such approaches suggest that "…people selected an optimal adaptation to a region whether they were newly arrived immigrants or an indigenous population.…the dietary mix that yields the highest return rate will be selected" (Hard and Roney 2005:154). Therefore, because they focus on potential decisions based on costs and benefits of various subsistence alternatives, these models do not necessarily rule out larger causative processes such as environmental change, social demands, or migration, but rather complement them (Hard and Roney 2005:154; Winterhalder and Kennett 2006:10). Several recent applications to the adoption of food production include Winterhalder and Goland (1997), Piperno and Pearsall (1998), and Hard and Roney (2005); a recent volume edited by Kennett and Winterhalder (2006) provides an inclusive treatment of behavioral ecological concepts as applied to early agricultural case studies from around the world.

Piperno and Pearsall (1998:16) write that the behavioral ecological approach is "… the most appropriate way to explain the transition from human foraging to food production," and that this all important shift "… was driven by changing selection pressures on hunter-gatherer resource procurement and, ultimately, their search for successful adaptations in changing environments" (Piperno and Pearsall 1998:18). The concept they emphasize most in their study of agricultural origins in the New World Neotropics is the diet breadth model, which assumes that resources are ranked based on their relative return rates, usually in the form of calories gained per unit time/energy spent. The model predicts that as higher ranked resources become more difficult to procure the diet will expand to include additional lower ranked resources. The authors propose that following the termination of the Pleistocene, hunter-gatherers in the tropics were impelled to integrate a broader spectrum of low ranked foods in light of diminishing returns from higher ranked foods. They predict that "… following the diet breadth model, people would have started to cultivate some plants as soon as this practice increased the overall return rate" (Piperno and Pearsall 1998:237).

Kennett et al. (2006) use elements of behavioral ecology to explain the long-term resilience of low-level food production (diverse mixed economy incorporating both wild and domesticated foods; see below) following the introduction of maize on the Pacific coast of Chiapas in southern Mexico. This region is a mosaic of diverse biotic zones with correspondingly rich plant and animal resource assemblages. Maize apparently arrived here by 5000-6000 B.P., but over the following 2,400 years local humans remained "… foragers that may have supplemented their diets by cultivating morphologically wild plant species and some cultigens" (Kennett et al. 2006:103). Although gradual increases in maize use are noted throughout this period, maize-based economies are not recognized in the region until about 2600 B.P. Considering the paleoecology of the region, the authors first evaluate the productive potential of the natural coastal environment in the Soconusco in terms of calories per hour per person. They then do the same for traditional maize cultivation in lowland tropical environments (using ethnographic data on the Lacandon and Kekchi Maya) at several points in prehistory. They found that in the Soconusco setting maize horticulture ranked low in returns relative to wild resources.

According to the diet breadth model, as higher ranked prey items became less available the dietary regime expanded to embrace lower ranked food plants, including maize. Yet commitment to the new resource remained relatively low, likely because the efforts required by intensive maize cultivation made it less attractive than those related to foraging: "… the investment of time and energy in planting, weeding, watering, and harvesting decreased the energy gained from this cultigen relative to other wild alternatives" (Kennett et al.2006:135). Technological limitations may have also been a factor; the introduction of ceramics at 3800 B.P. would have facilitated the preparation of maize kernels for consumption, and may have been an initial impetus for increased dependence that continued throughout the Early Formative period (3500-2600 B.P.).

The mountain forests surrounding the Ocampo caves are seasonally rich in naturally-available plants and animals. Oak forests produce annual bumper crops of acorns, and abundant palms (*Brahea* sp.) generate edible fruits. Plentiful prickly pear cacti produce huge amounts of fruit in the summer. Also, agave and fleshy bromeliads grow thick on canyon walls. It would be interesting to evaluate the productivity of this environment, local maize production, and archaeological data within an optimization framework.

Kennett and colleagues' study illustrates the compatibility of behavioral ecological approaches with other frameworks discussed in this chapter. The authors use central place foraging theory to model the location of various settlement types in the Soconusco. Central place foraging theory holds that: "… all other variables being equal, foragers will select residential base locations that maximize net central place foraging returns given the pursuit, handling, and transport costs of different sets of resources in each biotic zone" (Kennett et al. 2006:116). This model and relevant archaeological data from the region revealed distinct residential and logistical land use patterns in Binford's (1980) sense. Also, as will be discussed below, it has been proposed that a major factor at play in the initial domestication of maize was the high sugar content of its stalk and its potential for making beer (Smalley and Blake 2003). Although Kennett et al. (2006:128) state that initial maize use in the Soconusco was due to expanding diet breadth they also acknowledge the possibility of a combination of this factor with the added benefit of its alcoholic properties. The Soconusco situation also complements concepts recently outlined by Smith (2001a, 2007a, 2007b, 2009), low-level food production and niche construction.

Low-Level Food Production and Niche Construction

Smith (2001a:23) argues that the word "incipient," used by MacNeish and others in reference to the period between initial plant cultivation and fully developed agricultural economies in Mexico, implies that agriculture is the inevitable culmination of an evolutionary trajectory; that once hunters and gatherers take up any form of food production, their society is destined to eventually settle into agricultural villages. While not likely the intent of earlier authors, this simple inference diverts intellectual attention and recognition from the wide range of successful adaptive strategies *between* gathering and cultivating, and the potential stability of mixed foraging-farming systems.

Smith (2001a) proposes what he feels to be a better classification for the in-between stages that he refers to as *low-level food production* (Smith 2001a, 2005a). Diverse mixed economies and the 6,000 year time lag between the initial domestication (or regional arrival) of cultigens and entrenched village agriculture across Mexico indicate that people of the EIA operated under wide-ranging environmental and cultural contexts, and locally integrated assorted wild, managed, and domesticated foods to varying degrees over a very long time span (Smith 1997b:379, 2001a, 2001b). "Low-level food producers" exhibit remarkable economic diversity (Blake et al. 1992; Ford 1985; Fritz 1990, 1999, 2003; Harris 1996; Rindos 1984; Smith 1998b, 2001a, 2005a; Zvelebil 1986, 1996; Zvelebil and Rowley-Conwy 1984), and can exist either in the form of non-agricultural societies that utilize domesticates to some degree, or they can be groups that manage and otherwise intercede in the life cycles of species that never become fully domesticated. The Ocampo EIA populations are clearly characterized as the former. Recognizing these patterns allows for an appreciation of low-level food production as a viable, often stable adaptation, not simply as a point along a one-way trajectory between two competing and incompatible subsistence strategies. Smith (2001a) maintains that economies consisting of 5 to 50 percent domesticated resources do not qualify as fully "agricultural," but rather are best characterized as low-level food producers.

Mesoamerican prehistory holds many relevant cases. Domesticated Mexican pepo squash presumably originated in the southern Mexican highlands, where it is directly dated alongside bottle gourd at Guilá Naquitz to about 10,000 years ago. Here these were the only cultigens used in an otherwise successful foraging system until the adoption of maize about 6,200 years ago (Flannery, ed. 1986; Piperno and Flannery 2001; Smith 1997a, 2000). Based on molecular evidence maize itself likely originated in the Central Balsas River Valley in southwestern Mexico (Doebley 2004). Recent archaeological and microfossil (starch grain, phytolith) data from this region has been interpreted to indicate its presence alongside a domesticated squash as early as 8,700 years ago; the initial cultivators of these plants are believed to have engaged in a variety of subsistence pursuits (Hastorf 2009; Piperno et al. 2009; Ranere et al. 2009). Maize and other domesticates diffused from their points of origin widely across the Mexican landscape where local ecology permitted, and were differentially adopted into diverse low-level food production systems. As discussed above maize arrived in the Soconusco region by 5,000 years ago, but for over 2,000 years remained only a minor component in a diet otherwise comprised of foraging and possibly the cultivation of non-domesticated plants (Kennett et al. 2006:103). Most relevant to the present study, fully domesticated bottle gourd (6150 B.P.) and pepo squash (6030 B.P.) appeared in the Ocampo region during the Ocampo phase (6000-5200 B.P.), followed by cushaw squash (5035 B.P.) and maize (4405 B.P.) during the Flacco phase (5200-4400 B.P.) (Smith 1997b). These cultigens were adopted into local economies otherwise dominated by wild resources long before the appearance of settled village agriculture.

It is important to note that low-level food producers of the EIA most likely did not draw the same dramatic distinctions between these various food classifications that we often make today, but rather recognized a continuum of plant resource procurement strategies requiring varying degrees of investment. Furthermore, some early domesticates, such as the bottle gourd, are primarily utilitarian rather than dietary in function. These points bolster the argument that the title of "farmer" is not always appropriate when it is based solely upon the presence and use of domesticated plants, as they may serve only a minor or utilitarian role in a larger diverse economy (Fritz 1999; Smith 2001a, 2005a).

Bellwood (2005:12, 25-27, 281) considers Smith's classification of low-level food production to be an end point rather than a category of richly diverse, stable adaptations, a situation in which previously agricultural groups resorted to lesser degrees of resource management after being pushed into marginal habitats by true farmers. However, while Bellwood's take is a viable possibility in some cases, I believe the two circumstances should be considered separately. Empirical evidence demonstrates that domesticated plants existed and were widely used in mixed economies across Mexico long *before* the prevalence of settled villages and large human populations, indicating that low-level food production probably was a viable and stable way of life for millennia, and this seems to have been the case in Ocampo.

More recently Smith (2007a, 2007b, 2009) applied the ecological concept of niche construction to low-level food production behavior as an explanation for the origin of domesticated species. Niche construction theory recognizes that many animals attempt to enhance their environments for their own purposes. Human beings have done so for tens of thousands of years (often with unforeseen consequences), and have developed a vast technology that has profoundly affected the entire world. Due to the magnitude by which we have altered our planet for our own "benefit," Smith (2007a) refers to humans as the ultimate "niche constructors" or "ecosystem engineers". He asserts that most current research on domestication focuses either on individual plant and animal species, or on very large scale causal variables, some of which (e.g., climate change, demography) were discussed above. The niche construction approach has the potential to address stages in between these extremes, the systems of human behaviors that drove new "human-plant/animal relationships of domestication" (Smith 2007a:1797).

A major component of the low-level food production concept is the diversity of interactions between humans and target species, ranging from simple collecting to tolerance, wild resource management, cultivation, and so on. Seen from the perspective of niche construction, cultivation and wild resource management (burning, sowing, irrigation, transplanting) are all efforts to improve peoples' circumstances, and sometimes these efforts led to the evolution of domesticated species. Different behaviors went into the development of different domesticates, and consequences varied between different types of interactions. For instance, the domestication of the dog and the bottle gourd in Asia sometime before 12,000 years ago "… did not so much involve deliberate human intervention as it did allow dogs and bottle gourds to colonize the human niche" (Smith 2007a:1798). The domestication of goats and other livestock in Eurasia involved control over animal reproduction and human appropriation of natural herd dominance hierarchies. Selection for desired traits and sustained replanting of fragments from parent plants resulted in domesticated varieties of root crops in the lowland Neotropics. In cases of domesticated seed-bearing plants, including those so important in ancient Mesoamerica, domestication involved selection of desired traits, storage and maintenance of seed stock, and sustained planting season after season. According to Smith (2007a:1798):

> Whatever the exact mixture of macro-evolutionary forces that were in play, humans identified potential domesticates within the broader context of niche construction strategies through endless auditioning and experimentation with a long list of possibilities. Domesticates would not have been different, necessarily, from the many other managed species in either requiring a greater investment in labor, or constituting a greater intellectual challenge. What set humans apart was their recognized potential for open-ended expansion and ever-increasing returns.

These approaches are broadly applicable to Mesoamerica in general and the study area in particular. The very long time frame and diverse diet with few domesticates of the EIA informs me that the Ocampo region was for a very long time occupied by populations that could be classified as low-level food producers. Also, as shall be discussed further in Chapter Nine, these people were possibly consistently creating artificial niches for themselves in order to maintain their likely mobile lifestyle, probably through the small-scale preparation of dispersed, casually sown plots of domesticates.

The concepts of low-level food production and niche construction are compatible with many other theoretical approaches discussed in this chapter. These patterns can be in play regardless of "macro" causal variables such as large scale climate change or problems associated with rising populations, and approaches such as behavioral ecology can be used to address the possible range of decision-making behaviors that went into the development of the human ecosystem. Finally, these approaches do not challenge the basic tenets of the EIA or other early models, but rather enhance the image of a "complex mosaic of regional development" envisioned by earlier authors (Smith 1998a:169).

Conclusion

It should be clear by now that the theoretical frameworks discussed in this chapter are not necessarily mutually exclusive. That domesticated crops existed in Mexico in general and Ocampo in particular for an extended period, in the absence of any reliable evidence for large populations and stable habitations (in most areas), certainly bolsters both the Era of Incipient Cultivation and low-level food production scenarios. There is some limited evidence for the existence of relatively sedentary communities in rich areas without the need for food production (Neiderberger 1979), though this does not apply to Ocampo. However, sedentary village life and agriculture do tend to promote population growth and demand for more cultivable land (Bellwood 2005), thereby encouraging physical migrations of farmers into marginal regions external to cradles of domestication, as has been documented in some parts of Mexico (Lesure et al. 2006). It is within the realm of possibility that thousands of years after the introduction of domesticates, following an extended period of local low-level food production, village agriculturalists migrated into the Ocampo region and quickly absorbed, replaced and/or co-existed with local hunting-gathering and low-level-food-producing groups. However, evidence for this scenario is presently lacking. Regardless of the mode of transference, the addition of domesticated plants and emerging sedentism in the Ocampo setting would have involved complex interactions between humans and their environment, and affected decision-making processes at the individual or small-group level based on costs and benefits of different subsistence alternatives (Winterhalder and Kennett 2006).

The broader scale explanatory frameworks summarized above concern the "how" and the "why" of agricultural origins and development in greater Mesoamerica. In the upcoming chapter I address the "who," the origins and evolution of specific key Mesoamerican crop plants, and introduce some archaeological data for their early presence and spread.

CHAPTER 3: THE OCAMPO CULTIGENS: THEIR ORIGINS AND DISPERSALS

The goal of this chapter is to introduce the various theories regarding the initial domestication of individual cultigens found in the Ocampo caves and their dispersal across the Mesoamerican culture area. It also includes brief discussions of a series of arguably wild plants present in the caves that have occasionally been cited as cultivated, often due to the fact that their close relatives had been domesticated elsewhere. A general timeline of the first "known" occurrences of these species across this vast region is provided, based upon directly dated macrobotanical remains (larger fragments of the plants either carbonized, desiccated, or waterlogged) and more controversial microfossil (pollen, phytoliths, starch grains) data. While the previous chapter placed the Ocampo caves within the greater theoretical context of the origins and spread of food production in general, this discussion will serve to place the Ocampo caves and their cultigen assemblage within a broader regional framework of the plants themselves.

The most secure evidence for the earliest appearance of the primary Mesoamerican domesticates, maize, squash, and beans, in key sites across Mexico and adjacent regions is based upon directly dated and securely identified macroremains (Table 3.1). However, a series of microbotanical techniques are increasingly impacting the sequence and our perception of the origin and spread of crops across Meso- and Central America, especially in regions not conducive to macrofossil preservation, such as the humid lowlands. Although this evidence is gaining a following, it is still controversial and in my opinion less secure than larger, directly datable remains that can be confidently identified. However, this evidence cannot be ignored, so this chapter begins with a discussion of the nature and issues associated with microfossil data.

Nature and Issues of Microfossil Evidence

Archaeologists and botanists generally agree that the most dependable evidence for the presence of maize in a given archaeological site consists of actual fragments of the plant itself ("macrofossils"), in the form of carbonized or uncarbonized cobs, cupules, kernels, leaves, and stalks. These are reliably recognizable as maize, and have the potential for being directly datable by AMS. Thus evidence for early Mesoamerican agriculture has traditionally favored the dry highlands of Mexico where preservation conditions for such materials are ideal. However, macrofossil remains decompose quickly in the humid, tropical lowlands that characterize many parts of Mexico and Central America, rendering these regions possible blank spots on the map of early maize distribution. A number of researchers working in such areas have resorted to microscopic particles ("microfossils"), in the form of pollen, phytoliths (silica bodies formed among plant cells), and starch grains, as evidence for the presence of prehistoric crop plants (Bryant 2007; Dickau et al. 2007; Holst et al. 2007; Pearsall 1994, 2002; Perry et al. 2007; Piperno et al. 2002; Piperno, Andres, and Stothert 2000; Piperno, Ranere, Holst, and Hansell 2000; Piperno and Pearsall 1998; Piperno and Stothert 2003; Pohl et al. 2007; Pope et al. 2001; Rue 1989; Siemens et al. 1988; Sluyter and Dominguez 2006; Staller and Thompson 2002; Webster et al. 2005; Zarillo et al. 2008).

Such evidence has spurred debate concerning the timing of origin and spread of domesticated plants, particularly maize, across Mesoamerica and Central America, and resulted in a controversial alternative chronological framework for these developments that is significantly different than that implied by directly dated macroremains. Two problematic issues are related to the microfossil evidence: 1) reliability of identification (how dependably can one distinguish between pollen, phytoliths, and starch grains of closely related plant taxa?), and 2) context (lacking adequate methods for directly dating

TABLE 3.1.—Squash, bottle gourd, bean, and maize sequences for three major EIA cave locales in Mexico (dates in calibrated years B.P.).

Domesticated taxa	**Oaxaca**	**Tehucán Valley**	**Ocampo**	**Possible region of origin**
Pepo squash	9975 B.P. [a]	7920 B.P. [e]	6030 B.P. [g]	Southern Mexican highlands
Cushaw squash	-----	-----	5035 B.P. [g]	Western Mexico, possibly Michoacán or Jalisco
Butternut squash	-----	-----	2750 B.P. [g]	Southern Central or northern South America
Bottle gourd	9920 B.P. [b]	7200 B.P. [e]	6150 B.P. [g]	Zimbabwe, Africa
Maize	6250 B.P. [c]	5550 B.P. [f]	4405 B.P. [g]	Central Balsas River drainage, southwestern Mexico
Common Bean	2100 B.P. [d]	2285 B.P. [d]	1200 B.P. [d]	Río Lerma - Río Grande de Santiago Basin, west-central Mexico

REFERENCES: [a] Smith 1997a; [b] Smith 2000; [c] Piperno and Flannery 2001; [d] Kaplan and Lynch 1999; [e] Smith 2005b; [f] Long et al. 1989; [g] Smith 1997.

such tiny residues, how can one be certain that pollen grains, starch grains, or phytoliths are truly in context rather than intrusive from other strata?).

Maize produces vast quantities of wind-dispersed, highly durable pollen grains. However, it is uncertain how precisely one can differentiate between the pollen of domesticated maize and that of some closely related grass taxa. In comparative studies Holst et al. (2007) found that gama grass (*Tripsacum* spp.) pollen can be visually separated from maize and teosinte, but the latter two cannot be reliably distinguished.

According to Bryant (2007) and Holst et al. (2007), starch grains represent the most reliable microfossil evidence for the presence of domesticated maize. Holst and colleagues found that domesticated maize starch grains can be dependably identified and distinguished from both gama grass and teosinte. The durable particles are recoverable from a wide range of contexts, including sediment deposits and the cracks and crevices of stone artifacts (Bryant 2007). The latter context is more secure than the former because such tiny particles can easily migrate through sediments and make radiocarbon dating problematic.

A number of researchers, many of them working in lowland settings, have interpreted microfossil evidence to indicate the early presence of domesticated crop plants. Much of this work emphasizes maize, but squash and a variety of root crops are also occasionally identified, and recent research has examined the domestication and dispersal of chili peppers (*Capsicum* spp.) based on starch grains (Perry et al. 2007).
In spite of the difficulties associated with microfossil analysis, such methods should clearly be developed as they hold great potential towards clarifying early agriculture in Mesoamerica. Bias towards dry, highland regions with high macrofossil preservation results in an incomplete picture of the prehistoric distribution of domesticates, and less ideal conditions are prevalent in humid regions of Mesoamerica where some major crop plants (including maize) are believed to have originated (McClung de Tapia 1992:156).

Microfossils may therefore represent our only relevant evidence in vital areas. However, we must proceed with caution, and refrain from making overzealous claims for major prehistoric cultural and ecological developments based on potentially misidentified specimens from unclear contexts (Sluyter and Dominguez 2006).

Key Mesoamerican Domesticates in the Ocampo Caves

A large number of plants were cultivated and/or domesticated in Mesoamerica (see Browman et al. 2005:315, Table 1; MacNeish 1992:87, Table 3.1; Mangelsdorf et al. 1964:434-435, Table 2; McClung de Tapia 1992). It is well beyond the scope of this dissertation to discuss them all, so I will focus on those that have been identified in the Ocampo caves: maize, beans, bottle gourd, several varieties of squash, cotton, and tobacco. Other plants from the caves that have been presented in publication as domesticated or "farmed" will also be treated, although their status as cultivated is doubtful. I will also briefly mention some wild plants identified in the caves that have been recognized in the literature as having the potential to be domesticated as they had been in other parts of Mesoamerica.

Cucurbits

Four member of the family Cucurbitacae (squashes and gourds) gained significant economic importance in prehispanic Mesoamerica: pepo (*Cucurbita pepo*), cushaw (*C. argyrosperma*), and butternut (*C. moschata*) squash, and the bottle gourd (*Lagenaria siceraria*). Of these, only pepo and cushaw squash were likely domesticated within the culture region, though all four are documented within the Ocampo cave deposits (Smith 1997b; Whitaker et al. 1957).

Bottle Gourd (Lagenaria siceraria). The bottle gourd is not typically a food item; rather, containers and other practical items are fashioned from its durable rind. For decades it has been known that it is not a New World domesticate; this plant is archaeologically demonstrated to have been cultivated and used by peoples across Africa and Eurasia, and seems to have been introduced into North and South America (Erickson et al. 2005). As wild populations were for many years unknown, the immediate wild ancestor remained a mystery, precluding the definition of a specific region of origin. Also, it was long a mystery how the plant came to be established as a cultigen among human populations in the Americas. It was hypothesized that bottle gourd fruits made their way from Africa across the Atlantic on ocean currents, and were eventually picked up and utilized by hunter-gatherers on the eastern coasts of Central and/or South America (Heiser 1985).

Recent morphological, genetic, and molecular studies have shed light on these two problematic aspects of origins and dispersal. In 1992, Mary Wilkins-Ellert discovered an unusual gourd plant in southeastern Zimbabwe (WIlkens-Ellert 2003). Morphological observations of this and several offspring plants and subsequent genetic analyses revealed that it is indeed a wild variety of *Lagenaria siceraria*, and therefore this part of southern Africa is a likely center of origin for the domesticated plant (Decker-Walters et al. 2004). Although its wild ancestor has been identified in Zimbabwe, domesticated forms were widespread throughout much of the ancient Old World (Decker-Walters et al. 2004; Erickson et al. 2005), and the North American varieties are genetically closer to Asian than African forms. This geographic affiliation and the very early presence and distribution of this species in the New World suggest that bottle gourds were first introduced into the Americas from Asia by Paleoindian or early Holocene groups, rather than floating over the Atlantic from Africa (Erickson et al. 2005).

We recognize archaeological bottle gourd as domesticated due to its widespread presence outside the native range of its wild ancestor in Africa (the result of human-aided diffusion) as well as "a substantial increase in fruit rind thickness and associated fruit durability" that results in better containers and reduces natural seed dispersal (Erickson et al. 2005:18,316). The bottle gourd's initial domestication was probably a direct result of both its usefulness as a container as well as its resilience with minimal tending (discussed further in Chapter Nine); these qualities also facilitated its widespread adoption by hunter-gatherers in countless habitats around the world.

Smith (1997a, 1997b, 2000, 2005b) has carried out extensive reassessments of the squash and gourd assemblages from the three key Mexican cave locales that most influenced reconstructions of early cucurbit origins and dispersals, including the Ocampo caves, Guilá Naquitz, and Coxcatlán cave in the Tehuacán valley. These studies involved verifying the initial identifications of various archaeological cucurbits (most often originally performed by Hugh Cutler and Thomas Whitaker [Cutler and Whitaker 1961; Cutler and Whitaker 1967; Whitaker and Cutler 1986; Whitaker et al. 1957]), as well as direct AMS dating of the supposedly earliest specimens. The earliest directly dated bottle gourd remains in North America were recovered from Guilá Naquitz, and date to about 9920 B.P. (Erickson et al. 2005; Smith 2000). By 7200 B.P. this species appears in Coxcatlán cave in the Tehuacán valley (Smith 2005b), verifying Cutler and Whitaker's (1967) earlier indirect assessment that the species appeared during the Coxcatlán phase (about 7800-6150 B.P.). Further evidence that bottle gourd was widely dispersed across the New World by 7,000 years ago comes in the form of a specimen recovered from a burial context at the Windover site in east-central Florida that produced a direct date of about 7290 radiocarbon years B.P. (Doran et al. 1990).

Although originally assessed to have arrived in Ocampo during the Infiernillo phase (9000-7600 B.P.), direct AMS dating revealed that the earliest known specimens here date to about 6440 B.P. during the Ocampo phase (Smith 1997b). Whitaker et al. (1957) report peduncles (fruit stems), seeds, and rind fragments of this species in the caves. As stated above, bottle gourd is primarily used to render containers, fishing floats, and other utilitarian items from the dried rind, but Callen (1968:642) identified bottle gourd seeds in paleofeces dating to the Mesa de Guaje phase (3600-3000 B.P.), indicating that it was at least occasionally eaten.

Pepo squash (Cucurbita pepo). Pepo squash was subject to two separate domestication events, one in the eastern United States and the other in Mesoamerica. The former occurred among wild populations of *C. pepo* ssp. *ovifera* sometime around 5000 B.P. (Decker-Walters et al. 1993; Sanjur et al. 2002; Smith 2006a). The progenitor species of the Mexican domesticate, *C. pepo* ssp. *pepo*, is unknown at present, but according to Sanjur et al. (2002) is closely related to *C. pepo* ssp. *fraterna* and is most likely native to southern Mexico. This is consistent with the existing archaeological evidence: direct AMS dating reveals that the hunter-gatherer inhabitants of Guilá Naquitz were cultivating it by about 10,000 B.P., so it is clear that Mexican pepo squash has a much longer history of cultivation than the eastern U.S. variety (Smith 1997a, 2006a). The next oldest macroremains are from Coxcatlán cave in the Tehuacan valley (7920 B.P.) (Smith 2005b). It was originally assessed that pepo squash arrived in Ocampo during the Infiernillo phase (9000-7600 B.P.), but AMS dating reveals a later arrival at 6310 B.P. (Smith 1997b). The plant was originally domesticated for its edible seeds, resulting in an increase in seed size; among archaeological specimens domesticated pepo squash is distinguished from wild squash based on seed length, with those exceeding a 12 mm threshold taken to represent cultigens (Smith 2006a).

Cushaw squash (C. argyrosperma, formerly C. mixta). Sanjur et al. (2002) have inferred that the wild ancestor of domesticated cushaw squash is most likely *C. sororia*, and that southwestern Mexico, in the region of Michoacán and Jalisco, is the most likely hearth for its domestication. Piperno et al. (2009) interpret the morphology and large size of *Cucurbita* phytoliths from Xihuatoxtla shelter to indicate the presence of a domesticated species in the Balsas River Valley by about 8700 B.P. Although they acknowledge the possibility that pepo squash had spread into the region by this early date, local climatic conditions are ill-suited to the growth of pepo; the putative wild ancestor of cushaw squash is native to the region, however, leaving it as the most likely candidate (Piperno et al. 2009:5023). This is interesting in that the earliest documented archaeological macroremains are from the Ocampo caves (5035 B.P.), well outside of its region of origin (Smith 1997b). Remains from Coxcatlán cave in the Tehuacán Valley have been directly dated to 2065 B.P. (Smith 2005b). Cushaw ultimately spread into the U.S. Southwest and even into the Ozarks by about 1,000 years ago (Fritz 1994b).

Butternut squash (C. moschata). This was an important food item and a widely grown domesticate at the time of European contact, ranging from the American Southwest to as far south as northern South America; although its putative wild ancestor remains unknown, butternut squash is presumed to have originated somewhere in the tropical lowlands of southern Central or northern South America (Piperno, Andres, and Stothert 2000:207; Piperno and Pearsall 1998:142). Based on mitochondrial DNA analysis Sanjur et al. (2002) conclude that the progenitor and probable center of origin for this species will likely be found in the latter region. As a lowland domesticate it is adapted to high levels of temperature and humidity and does not tolerate cold climates (Piperno and Pearsall 1998:142).

Dillehay et al. (2007) have recently reported butternut squash macroremains from archaeological sites on the western slopes of the northern Peruvian Andes that have been directly dated to about 10,403-10,163 B.P. and 8535-8342 B.P., and Piperno, Andres, and Stothert (2000:203) interpret large phytoliths consistent with those of butternut squash to indicate the presence of this species in coastal Ecuador at 7170 B.P. and 5180 B.P. Cutler and Whitaker (1967) report 37 seeds and four peduncles of butternut squash from caves in the Tehuacán valley, the earliest of which were originally assigned to the Coxcatlán phase (7800-6150 B.P.). Of these, 32 seeds and two peduncles supposedly came from Coxcatlán cave, though Smith (2005b:9440) failed to identify this species in his reassessment of the materials from this site. He acknowledges that these remains may have been separated from the rest of the collection prior to reanalysis, but maintains that the presence of this species in the Tehuacán valley has yet to be verified. Also, macroremains of butternut squash were conspicuously missing from Guilá Naquitz, though a single pollen grain that might represent this species was found in a layer dated to the middle Naquitz phase (about 7900 B.P.) (Whitaker and Cutler 1986:275). Whitaker and Cutler (1986:276) suggest that its absence (or minimal use) is due to its preference for hot, humid conditions and low tolerance for the cool nights and arid climate at Guilá Naquitz. The presumed earliest butternut squash remains in the Ocampo caves were initially assigned to the Guerra phase (4400-3600 B.P.), but AMS dating revealed that the earliest specimens, found in Romero's cave, are actually more recent (2750 B.P.) (Smith 1997b).

Maize

Maize has been subject to more scholarly research than any other New World crop (see Johannessen and Hastorf 1994; Mangesdorf 1974; Staller et al. 2005), and the details of its origins have been the topic of intense debate among botanists and archaeologists for over a century (McClung de Tapia 1992:148). A number of theories have been offered to explain its evolution, and a vast body of literature has accumulated regarding its origins. The major theories will be touched upon here, followed by a review of the data available for regional appearances of maize across Meso- and Central America.

Tripartite Hypothesis. Early theories opted for an extinct wild maize as the direct ancestor of the domesticated variety (deWet and Harlan 1972; Mangelsdorf and Reeves 1939). This view held that a now extinct wild form of corn had originally crossed with a gama grass, producing a teosinte grass (*Zea* sp.) in the first generation; the new hybrid then crossed and back-crossed, resulting in new, domesticated varieties of maize. Mangelsdorf, MacNeish, and Galinat (1964) cite the discovery of supposedly 80,000 year old fossil maize pollen deep beneath Mexico City as support for this model (Barghoorn et al. 1954), suggesting that maize far preceded the arrival of humans in the New World, and thus must have been originally wild. Further supporting evidence came from "wild" cobs recovered from Tehuacán Valley caves with uniformly paired spikelets and rachises and glumes with soft tissues (see Mangelsdorf, MacNeish, and Galinat 1964:542). More recently, Mangelsdorf (1986:77-78) altered the tripartite model, postulating that domesticated maize had originated from a cross between the hypothetical wild maize and perennial teosinte (*Z. diploperennis*), rather than gama grass. It has since been established that the "wild" cobs from the Tehuacán sites are actually fully domesticated (Benz and Iltis 1990).

Teosinte Hypothesis. As an alternative to the tripartite hypothesis, George Beadle (1939) proposed that the tropical grass teosinte is actually the wild ancestor of maize. The following factors serve to enhance this argument at the expense of the tripartite hypothesis: 1) maize and teosinte easily hybridize under natural conditions (gama grass and teosinte do not); 2) maize and teosinte have an equal number of chromosomes (n=10); 3) maize and teosinte share important anatomical features; and 4) maize and teosinte pollen grains are morphologically similar to each other (Beadle 1982; Galinat 1971; Iltis 1983; Iltis and Doebley 1984; McClung de Tapia 1992:148; Wilkes 1972). Following decades of controversy, Beadle's teosinte hypothesis has gained widespread acceptance among botanists and geneticists. Molecular studies have provided support, indicating that maize is likely the direct ancestor of an annual teosinte native to the central Balsas River drainage in southwestern Mexico, *Z. may* ssp. *parviglumis* (Bennetzen et al. 2001; Doebley 1990; Matsuoka et al. 2002).

Gama grass/Teosinte Hybrid Hypothesis. Based upon experimental crossbreeding between gama grass and perennial teosinte, Eubanks (2001a, 2001b; MacNeish and Eubanks 2000) recently offered an alternative scenario for maize origins suggesting that its development was more complex than a direct descent from an ancestral teosinte. Although teosinte continues to play a major role in this hypothesis, it was introgression between teosinte – gama grass hybrids that resulted in the proto-maize ear. Such experiments yielded offspring that are "virtually identical" to supposedly hybrid archaeological specimens found in Tehuacán and Ocampo (Eubanks 2001a, 2001b; MacNeish and Eubanks 2000).

Eubanks (2001a:24, Figure 2.3) illustrates this resemblance using a photo of the Ocampo pistillate inflorescence that "… closely resembles an inflorescence of *Tripsacum x Z. diploperrenis*." The photo also shows the label that was originally attached to the specimen by Mangelsdorf, indicating its context (site Tmc 247, Unit S10E15, Level 5), and classifying it as "Possible F_1 Corn x Teosinte." Although Eubanks writes that this specimen was excavated in Valenzuela's cave, it should be pointed out that the specimen is from not Valenzuela's (Tmc 248) but from Romero's (Tmc 247) cave, as indicated on its label. While Eubanks rightfully points out that there is a gama grass species (*T. dactyloides*) that is native to Tamaulipas, there are no populations of teosinte that are known to be native to the region. In spite of the interesting morphological resemblance between archaeological and cross-bred results of modern experiments, the evidence is overwhelmingly in favor of a direct teosinte ancestry.

Sugary Stalk Hypothesis. Teosinte is not a plant attractive for the dietary qualities of its grains, due to the inherent difficult and inefficient harvest, their high roughage content, the toughness of the fruitcase enclosing the grain, and their apparent unpalatability (Beadle 1980; Flannery 1973; Iltis 2000; Smalley and Blake 2003). Flannery (1973) points out that the use of teosinte as a food resource was primarily as a "starvation food" by some indigenous Mexican groups, and that prehistorically its use was often far surpassed by other wild plants and animals. This poses the question of why Archaic hunter-gatherers would have initially invested the time and effort required to start teosinte on the path towards domestication, if the grain was the primary desired product. Even once domesticated, maize was probably not highly valued for its grain, at least not initially: "There is more foodstuff in a single grain of some modern varieties of corn than there was in an entire ear of the Tehuacán wild corn" (Mangelsdorf et al. 1964:545). This is consistent with assessments that the small maize types in southern Arizona during the Late Archaic period provided low grain yields relative to more recent varieties (Diehl 2005).

Such considerations have contributed to the hypothesis that teosinte and maize were originally valued for the sugar content of their stalks and vegetative parts rather than for the nutritional qualities of their grains (Iltis 2000, 2006; Smalley and Blake 2003); adjustments to the productivity of the ear only followed later. Iltis (2000:23-24) states:

> While, so far, the archeological evidence of teosinte grain as food is overwhelmingly negative, there are other interesting facts that suggest the initial use of teosinte was as a source of sugar and as a vegetable, two nutritional virtues of this giant green grass that may have initiated deliberate, if somewhat haphazard, cultivation, leading eventually, in plants with mutated fruitcases, to the domestication of teosinte for its grain.

Smalley and Blake (2003) propose that the desire for sugar, possibly for the production of alcoholic beverages, not only encouraged the initial cultivation of teosinte but also contributed to the rapid geographical expansion of early maize:

> In summary, the initial spread of *Zea* from its homeland in Mesoamerica may have been extremely rapid because of a high demand for sugar. We suggest that long before *Zea* developed the large cobs with many rows of kernels that made it an attractive food staple, the ancestral sugar-producing plant passed along a chain of interconnected peoples extending into South America. It was the demand for sugar that encouraged *Zea*'s initial rapid spread. It seems unlikely that early *Zea*, with its small cobs and seeds, could have spread so far so fast without some other highly desirable feature (Smalley and Blake 2003:679).

The authors cite as supporting evidence for this scenario the extensive ethnographic record of maize stalk beer (*tesgüino*) production across Mesoamerica, bone chemistry signatures indicating a minor dietary role for maize over much of prehistory, and the abundant examples of chewed maize stalks, leaves, and husks ("quids") found in key archaeological cave sites throughout Mesoamerica and South America: "These remains demonstrate that the ancient peoples who used the caves occasionally snacked on the sweet juicy stalks and tender husks of the maize plant" (Smalley and Blake 2003:682). The Ocampo region is no exception, as Mangelsdorf (1974:156; Mangelsdorf, MacNeish, and Galinat 1967:37, 45) identified 151 chewed maize tassels, young ears, and stalks from Romero's cave, and I encountered many such specimens among the curated collections (see Chapter Seven).

It only takes a single gene mutation to render the teosinte grain more amenable to harvesting by softening the outer glume, slanting the grain outward, and flattening the cupule (Dorweiler et al. 1993); however, this mutation is so extremely rare (about one in four million) that it "… could only have been picked up by a fortuitous accident within a teosinte population already *well-known and used* …" (Iltis 2006:29, emphasis added) for other purposes, possibly for the sugar content of its vegetative parts. Once recognized and selected for, this mutation would have quickly rendered the grains more vulnerable to pests and therefore more dependent on the foragers who made the initial discovery.

Among the microscopic remains examined from preceramic archaeological sites in the Rio Balsas drainage, Piperno et al. (2009:5022) observed that the short-cell phytoliths typical of maize and teosinte stalks were absent both in the deposits and on ground stone tool residues. The authors interpret this to demonstrate that in fact "… the major focus of maize utilization was directed toward the cob of the plant" (Piperno et al. 2009:5022) and that domestication was indeed for its edible grain. However, the abundance of masticated quids (husks, stems, tassels) found in dry cave sites across Mexico point to the multiple uses of maize, and as Kennett et al. (2006:128) point out, various functions could contribute to its spread (and perhaps initial domestication), as in the case of the potential dual function of squashes as both a food and a utilitarian item (fishnet floats) (Fritz 1999; Hart 2004; Hart et al. 2004).

It is important to note that many of the classic descriptions of archaeological maize utilize modern "race" nomenclature (e.g., "Chapalote," "Nal Tel," etc.), and this is very apparent in discussions of the Ocampo remains (e.g., Mangelsdorf et al. 1967). However, many archaeologists today consider this taxonomy outdated (see Huckell 2006:105). These "race" names are used in the literature review in Chapter Six solely to illustrate the terminology utilized at the time these publications were written. However

I, like many others, consider these classifications largely irrelevant today, and that the names and concepts of maize races/varieties need to be reexamined.

The Maize Sequence. Testing of a cave site in Tehuacán in 1960 produced cobs then believed to represent a wild form of maize (Mangelsdorf, MacNeish, Galinat 1964). The ensuing excavation of five caves in the valley produced 23,607 fragments of maize; the earliest (Coxcatlán phase, 5200-3400 B.C.), 19-25 mm long cobs exhibited wild characteristics such as fragile rachises and relatively long glumes that partially enclosed the kernels (Mangelsdorf, MacNeish, Galinat 1964:541). These findings led early researchers to believe that in the Tehuacán valley they had found the cradle of maize domestication, and seemed to support the belief that the progenitor of the domesticate was a wild variety of maize. The earliest occurrence of "early cultivated" corn in the Tehuacán Valley was believed to also date to the Coxcatlán phase, but evidence was limited; it was more certain that maize was under cultivation during the Abejas phase (3400-2300 B.C.) (Mangelsdorf, MacNeish, Galinat 1964:544).

Research in the decades since has changed our perceptions of early maize use in the Tehuacán Valley. Morphological studies have shown that the early maize cobs from the Tehuacán caves were not wild but rather a primitive yet fully domesticated form (Benz and Iltis 1990). Also, the advent of AMS dating made it possible to directly date the supposedly earliest specimens (Long et al. 1989:1036), revealing that the oldest known specimen actually dates to about 5550 B.P., some 2500 years more recent than previously believed (Fritz 1994a, 1995; Long et al. 1989). Though MacNeish disputed the revisions until his death in 2001, 5550 B.P. presently stands as the earliest known occurrence of maize in the Tehuacán Valley.

In the late 1990s Bruce Smith performed similar reanalysis of the maize remains from the Ocampo caves and found that the earliest directly dated maize dates to 4405 B.P. from Valenzuela's cave (Smith 1997b), validating previous indirect assessments that maize had arrived during the Flacco phase (5200-4400 B.P.) (Mangelsdorf et al. 1967). The Tehuacán date of 5550 B.P. was the earliest direct date available for maize in Mexico until an AMS date of 6250 B.P. was obtained from a cob excavated by Flannery in the 1960s from Guilá Naquitz (Piperno and Flannery 2001).

Although directly dated macrofossils would seem to indicate that maize originated in the Mexican highlands, molecular data suggesting an origin in the central Balsas River drainage (Doebley 1990; Matsuoka et al. 2002) has attracted researchers to these humid lowlands in search of direct archaeological evidence. Here Piperno et al. (2009) interpreted archaeological and microfossil data to indicate the presence of maize and a domesticated squash (possibly cushaw) as early as 8700 B.P. (Hastorf 2009; Piperno et al. 2007; Ranere et al. 2009). Starch grains found on stone tools indicate the presence of maize in central Panama by 7800 cal. B.P. and in the Pacific lowlands of western Panama by about 7000 cal. B.P. (Dickau et al. 2007).

Pope et al. (2001) interpret pollen spectra from the waterlogged site of San Andres to indicate that settled village farming had developed on the southern Gulf Coast in Tabasco, Mexico by at least 7100 cal. B.P. Large and supposedly domesticated *Zea* pollen grains were found in contexts dated to about 7000 B.P, and a later study identified maize phytoliths at San Andres from about 7300 cal. B.P. onward (Pohl et al. 2007). However, Sluyter and Dominguez (2006) make a more conservative interpretation from a pollen core collected in the Gulf Coastal lowlands, arguing that in southern Veracruz, not far from San Andres, maize horticulture began *at most* 4500 years ago.

Zea pollen has been dated to 5500 B.P. in central Belize (Pohl et al. 1996) and to 4600 B.P. in northern Guatemala (Wahl et al. 2006). A pollen core collected from western Honduras has been interpreted to indicate the presence of slash-and-burn maize horticulture in this region as early as 5000 B.P. (Rue 1989). More recently, Webster et al. (2005) argue that charcoal and pollen spectra in several sediment cores from the Copán

Valley indicate land clearance, burning, and maize cultivation as early as 4600-4700 B.P. in western Honduras, "Assuming that the Petapilla pollen has been correctly identified as *Zea* and that it has not migrated down into the sediments …" (Webster et al. 2005:108). El Salvador has produced maize pollen dating to 4440 and 3710 B.P. (Dull 2004, 2006).

Much microfossil research on agricultural origins concerns tropical Ecuador (Pearsall 2002; Staller 2003; Staller and Thompson 2002; Tykot and Staller 2002; Zarillo et al. 2008). Pearsall (2002) cites microfossil data as evidence for maize use in Ecuador as early as 6000 B.P, and Zarillo et al. (2008) claim that direct AMS dates of maize starch residues on ceramic sherds confirm its presence at least by 5300-4950 B.P., and phytolith assemblages representative of maize cob chaff were extracted from sherd residues indicating its use in coastal Ecuador at 4200-2100 B.P. (Staller 2003). If accepted uncritically, microfossil studies such as these indicate that increased sedentism, major landscape alterations, and investment in maize agriculture began and spread throughout the humid lowlands of Meso- and Central America thousands of years earlier than macrofossils from highland dry caves suggest.

Beans

Several species of *Phaseolus* were domesticated prehistorically in North and South America, and although they were relatively late comers to New World agriculture, they ultimately were the final element to the greatly successful *milpa* system that became the foundation of complex Mesoamerican society. This system integrates complementary maize, beans, and squashes in the same fields. Because beans are rich in lysine (which is deficient in maize), their addition enriches the diet of peoples who combine the two plants. Beans also supply vital nitrogen to the soil as maize depletes it (Kaplan 1965), and thus play a major contributing role in the *milpa* system.

Wild beans experienced several major alterations under domestication, including: 1) increased seed coat permeability, facilitating cooking; 2) a transition from twisted pods to non-shattering, straight, flexible pods, diminishing seed loss during harvesting; and 3) a shift from a perennial to an annual growth habit in some varieties (McClung de Tapia 1992:153). However, the most-used indicator of domestication in archaeological bean remains is an increase in seed size. As the primary means of preparing beans for consumption -- soaking and boiling -- are not conducive to long-term preservation of remains, it is likely that these cultigens are underrepresented in the archaeological record (Kaplan 1981:246; Smith 1998a:161).

The domesticated species used in Mesoamerica include common (*P. vulgaris*), lima (*P. lunatus*), tepary (*P. acutifolius*), and scarlet runner beans (*P. coccineus*), the first being the most economically important. Only the first two of these were recognized in the Ocampo caves (Kaplan and Lynch 1999, Kaplan and MacNeish 1960). Although scarlet runner beans were also common in the Ocampo cave refuse, Kaplan interpreted these to be wild (Kaplan and MacNeish 1960:48). He failed to find local farmers at the time who recognized them as either wild or domesticated plants, and took this as evidence that the wild plants are now absent from the environment. However, Hernandez Sandoval et al. (1991) report that a wild species is presently recognized for its edible seeds in the mountain forests of southern Tamaulipas.

Lima bean (P. lunatus). Lima beans were presumably part of the Ocampo agricultural complex rather late in prehistory, but never attained much economic importance (Kaplan and Lynch 1999; Kaplan and MacNeish 1960:53). Only a few specimens were recognized in the Ocampo caves, and these primarily occur in contexts later than 1100 B.P. (Kaplan and MacNeish 1960:44, Table 2). The late adoption of lima beans is a consistent pattern throughout the Mexican uplands. Kaplan and Lynch

(1999:269) point out that “Indirect dates for *P. lunatus* in Mesoamerica are not earlier than about 1300 – 1400 B.P.” Also, the origin of this domesticate is unclear; the wild populations that are presumably the progenitors of cultigens lima beans have a range extending from Mesoamerica into South America (Debouck et al. 1987, cited in Kaplan and Lynch 1999:271).

Common bean (P. vulgaris). Common beans were by far the most abundant domesticated legume in the Ocampo caves (Kaplan and MacNeish 1960). Wild common beans have a very wide geographical distribution, ranging from northern Mexico to northern Argentina (Gepts 1996). Molecular studies have revealed that the common bean was domesticated independently both in the Andes and in Mesoamerica (Chacón et al. 2005; Gepts 1996), and recent research has further shown that the latter likely originated in the Río Lerma - Río Grande de Santiago Basin in west-central Mexico (Kwak et al. 2009). Common bean remains from Coxcatlán Cave in the Tehuacán Valley were once indirectly dated to 6975 B.P., but AMS application to this specimen proved it to be only 2285 years old (Kaplan and Lynch 1999; Smith 1998a:163), though it is still the oldest example of this species yet discovered in Mesoamerica. The oldest known domesticated common bean remains in Oaxaca date to about 2100 B.P. (Kaplan and Lynch 1999). It once seemed that the common bean was adopted in Ocampo somewhat early (6000-5200 B.P.), but AMS revealed that the earliest remains actually date recent (1285 B.P.) relative to other domesticates, a pattern that is consistent with other parts of Mexico (Table 3.1) (Kaplan and Lynch 1999).

Other Domesticates, Potential Domesticates, and Important Crops

Cotton (Gossypium hirsutum). Two different species of domesticated cotton originated in the New World, one in South America (*G. barbadense*) and the other in

Mesoamerica (*G. hirsutum*) (Browman et al. 2005). The latter emerged from wild populations of the same species likely in southern Mexico or Guatemala (Brubaker and Wendel 1994). The oldest known specimens date to about 5500-4300 B.P. in the Tehuacán Valley (Smith and Stephens 1971) and Pope et al. (2001) report pollen grains representing cotton in contexts dated to about 4500 B.P. at San Andres, Tabasco. Cotton fragments apparently first appear in the Ocampo cave deposits during the Guerra phase (4400-3600 B.P.), but no formal analysis is published for these remains (though they were likely identified by C. Earle Smith), nor have they been subject to direct AMS dating. While most published sources do not specify if the materials recovered occurred in plant parts (e.g., fiber, boll) or in processed form (e.g., textile, cordage) (e.g., Mangelsdorf et al. 1964:431), MacNeish (1958:168-170) lists various types of twilled cotton cloth and twisted cotton cordage in almost all cultural phases following its appearance. However, unpublished sources and curated remains indicate the presence of seeds in Ocampo, showing that the plant was indeed sown locally (and the seeds occasionally consumed; see Chapter Seven).

Tobacco (Nicotiana rustica). Genetically it seems that the tobacco utilized in ancient Mesoamerica originated in South America (Fritz 2006:445). Tobacco is believed to have been first cultivated in the Ocampo region during the Palmillas phase (1900-1100 B.P.) (Mangelsdorf et al. 1964). C. Earle Smith likely identified these remains, but no formal analysis has been published. Synthetic articles typically refer to its presence in Ocampo cultural phases simply with the word "tobacco" (e.g., MacNeish 1958), while some do refer to it as *N. rustica* (Mangelsdorf et al. 1964:431). Lacking any more detail, however, it is unclear how tobacco was recognized in the Ocampo cave deposits and how these materials were identified as domesticated. A wild tobacco (*N. glauca*) grows in the mountains near the caves, and leaves resembling those of this wild tobacco are curated (though labeled only "Solanaceae") among the wild plant collections from the Ocampo cave excavations (see Chapter Seven). While it certainly is possible that domesticated tobacco was grown by ceramic period villagers in Ocampo local wild tobacco might also have been smoked. Ceramic pipes are common on village sites in the Ocampo region and MacNeish (1958:169-170) lists cane cigarette butts as being present in the same phases as the tobacco plant materials themselves.

Some major economic plants were domesticated elsewhere in Mesoamerica but were found only in wild form in the Ocampo caves. Though present, prickly pear (*Opuntia* spp.), agave (*Agave* spp.), runner beans (*P. coccineus*), and the tree legume *guaje* (*Leucaena* spp.) are not assumed to have been grown by the Ocampo inhabitants; however, but the presence of other plant types is sometimes taken as evidence that they were locally farmed, though their status as domesticates remains debatable.

Amaranth (Amaranthus cruentus, A. hypochondriacus). Amaranth is recognized as a widely used wild food resource both today and in prehistory, but ethnohistoric and archaeological evidence shows that several species were domesticated in ancient Mexico (Sauer 1969). Amaranth most often appears in the archaeological record in seed form, but archaeologists often fail to distinguish it from the morphologically similar goosefoot (*Chenopodium* spp.); this, along with a cultural bias against the use of these seemingly weedy plants as a cultivated crop, has led to what is likely an under appreciation of the importance of domesticated amaranth in prehistoric agricultural complexes.

Wild seeds are black, but during the domestication process there is a reduction in seed coat thickness, rendering the seeds of cultivated plants white, yellow, or reddish. Based on well-preserved uncarbonized inflorescences, Sauer (1969) identified the remains of two domesticated amaranth species (*A. cruentus, A. hypochondriacus*) from

Coxcatlán Cave in the Tehuacán Valley. The former may have been in the region as early as about 6000 B.P., but was definitely established after about 4500 B.P.; the latter was found in levels dating to about 1500 B.P.; however, until direct AMS dates are obtained the antiquity of amaranth domestication remains unconfirmed.

Archaeological seeds are usually in charred condition, complicating recognition of domesticated status from seed color. However, Fritz (2007) recently recognized probable cultigen amaranth dating back as early as 3200 B.P. in Chihuahua, Mexico, beyond the northwestern perimeter of Mesoamerica. She accomplished this using scanning electron microscopy and measurements of seed coat thickness in carbonized archaeological specimens. Both cultivated species ultimately spread out of central Mexico into the southwestern U.S., and *A. hypochondriacus* was present in the Ozarks by at least 1000 B.P. (Fritz 2007). Callen (1970:238) reports amaranth seeds from some Ocampo cave paleofeces as early as the Flacco Phase (5200-4400 cal. B.P.), but does not specify the species, and nowhere is the color of the seeds indicated. Therefore MacNeish's (e.g., 1958:168) occasional claims that the plant was cultivated in the region are presently unfounded.

Chili pepper (Capsicum annuum, C. frutescens). Two domesticated species of chili pepper rose to economic importance within Mesoamerica. Multiple lines of evidence indicate that the most common variety cultivated in Mexico, *C. annuum*, was derived from wild forms in the central highlands (McClung de Tapia 1992:154; Perry and Flannery 2007), while *C. frutescens* likely originated in northern South America (Piperno and Pearsall 1998:154). Thus far the earliest dated remains are *C. annuum* from cave sites in the Tehuacán Valley; wild specimens here date to ca. 8500 B.P., and domesticated forms appear by ca. 6000 B.P. (indirect dates) (Smith 1967:248). Various domesticated species dispersed widely across the New World and often persisted once they were adopted into local diets (Perry et al. 2007).

Starch grains extracted from stone tools, ceramics, and sediments have been used to track the spread of chili peppers across Central America and the Caribbean (Perry et al. 2007), indicating their early presence in Ecuador (5050-6350 B.P.), Panama (5600 B.P.), Peru (3680-3969 B.P.), the Bahamas (969-1265 B.P.), and Venezuela (500-1000 B.P.). Perry et al. (2007) propose that chili peppers and maize formed an ancient agricultural complex that spread together during preceramic times, though peppers did not become established in the Guilá Naquitz area until rather late in prehistory, over 5000 years after maize (Perry and Flannery 2007). Until recently it seemed that chili peppers were a post-contact introduction to the southwestern U.S., but Minnis and Whalen (2010) now report a single carbonized *C. annuum* seed from a site in northwestern Mexico dating to A.D. 1200-1450.

Species identification of archaeological specimens often requires intact stems (McClung de Tapia 1992:154), although Perry et al. (2007) assert that one can differentiate wild versus cultivated forms based on starch grain size. Also, MacNeish (1992:115) claims to have distinguished wild and domesticated forms in the Ocampo caves based on seed color: black indicates wild, while red indicates domesticated. On the other hand, he elsewhere states that claims for a domesticated chili pepper in Ocampo were largely based on the apparent absence of wild peppers in the region today: "Although it is difficult to tell wild from cultivated varieties, the absence or scarcity of the wild species of *Capsicum* in highland Tamaulipas today suggests that the archaeological specimens of the plant found in that region are domesticates" (Mangelsdorf et al 1964:443).

In some synthetic treatments (e.g., MacNeish 1992:104), MacNeish briefly mentions the presence of chili pepper seeds in the Ocampo cave floor debris, but the only formal published analysis with reference to chili peppers in Ocampo is Callen's (1968, 1970) examination of paleofeces, in which he identified both seeds and fruit tissue (the color of the seeds are is not reported). While the presence of chili peppers in Ocampo is well documented, the evidence necessary to identify wild versus domesticated ones is not. Also, wild *chile pequin* (*C. annum* L. var. *glabriusculum*) grows in abundance in local mountain forests where it is still collected (Hernandez Sandoval et al. 1991), so the absence of the wild plant in the region cannot be used to qualify the archaeological remains as domesticates as stated in Mangelsdorf et al. (1964:443). While not outside the realm of possibility, the presence of domesticated chili peppers in prehistoric Ocampo has yet to be confirmed.

Manioc (Manihot sp.). As will be discussed in Chapter Six, manioc remains were attributed to several contexts in the Ocampo and Sierra de Tamaulipas caves (Callen 1970; MacNeish 1958; Mangelsdorf et al. 1964). There is one known species of domesticated manioc, *M. esculenta* ssp. *esculenta*, which apparently originated on the southern edge of the Amazon basin (Olsen and Schaal 1999). Piperno, Ranere, Holst, and Hansell (2000) interpret archaeological starch grains to indicate the presence of cultivated manioc in Panama by 7000-5000 B.P. and Chandler-Ezell et al. (2006) report manioc phytoliths dating to ca. 4800-4400 B.P. on coastal Ecuador. A pollen grain that may represent a domesticated plant was identified in Tabasco, Mexico, in contexts dated to about 5800 B.P. (Pope et al. 2001).

The domesticated species has not been documented as reaching northeastern Mexico in prehistory, but C. Earle Smith identified a single seed from La Perra cave, in the Sierra de Tamaulipas, as the manioc species *M. dulcis* (now regarded a synonym for *M. esculenta* ssp. e*sculenta*), and E. O. Callen reports starchy, manioc-like fibers in paleofeces from the Ocampo caves (MacNeish 1958:146; Piperno 2006:49; Smith

1968:259). Smith (1968:259) points out that manioc seeds closely resemble those of *Jatropha* and that the identification should be verified (I did not locate any apparent manioc remains among any of the curated materials I examined for the present study). Likewise, although the fragments found by Callen in Ocampo cave paleofeces resemble manioc, a positive identification has yet to be established. Finally, even if accuarately identified, C. Earle Smith communicated to Flannery (1973:273) that the manioc species he recognized among the Tamaulipas remains has never been domesticated. In spite of these questions some sources (e.g., Mangelsdorf et al. 1964:431) occasionally list manioc as "farmed" or "a possible domesticate" in Ocampo. According to Hernández Sandoval and colleagues (1991), present-day residents of the southern Tamaulipas mountain forests consider the roots of two wild species (*M. pringlei*, *M. subspicata*) edible, raising the possibility that non-domesticated species were gathered in the past.

While some wild manioc species have highly poisonous roots and are therefore of little use to humans, *M. pringlei*, native to Tamaulipas, actually contains relatively low levels of hydrogen cyanide, and there are ways to process such species to make them safe for consumption, particularly by grinding up the tubers and washing and drying away the toxins (Mabberley 1997:436; Nassar et al. 2008:25; Piperno and Pearsall 1998:125). Although this is intriguing, the use of manioc, wild or domesticated, in prehistoric Ocampo is not verified.

Foxtail Millet (Setaria spp.). Kaplan and MacNeish (1960) first mentioned the presence of foxtail millet in the Ocampo caves, but at the time it had been misidentified as *Panicum*. Not long after it was discovered to be actually *S. parviflora* (formerly *S. geniculata*). The earliest documented grains are in paleofeces of the Ocampo phase (6000-5200 B.P.) (Callen 1967a:287, 1967b:535, 1968:642), although elsewhere MacNeish (1992:104) claims it was present in the earlier Infiernillo phase (9000-7600

B.P.). Callen (1967b) noted that some grains were larger than those of wild varieties, and interpreted this to indicate that they were possibly cultivated. By 3400 B.P., 50 percent of the paleofeces still contained the grass, but the grains had diminished in size.

Smith (1967) identified grains of another species (*S. macrostachya*) in both caches and floor debris in Tehuacán Valley cave sites in levels dated as early as about 7500 B.P., but the grass appears to have decreased in importance by about 6500 B.P. and continued to decline until Spanish contact. All of these remains are indirectly dated, so lacking direct AMS dates the sequence of foxtail millet use in both Tehuacán and Tamaulipas is presently unclear.

The abnormally large Tamaulipas grains and the unusual abundance of grains in the Tehuacán deposits led some researchers to speculate that foxtail millet had been cultivated in both regions and had even been an incipient domesticate in the former (Austin 2006; Callen 1967a, 1967b; Smith 1967). Callen (1967b) suggests that morphological "evidence" for selection did not appear in Tehuacán because maize appears earlier there than in Tamaulipas. Foxtail millet remained the only important cereal for a much longer time period in Tamaulipas and was therefore on the road to domestication there while maize replaced it as the dominant grain earlier in southern regions.

Austin (2006:152) challenges the cultigen status of the Tamaulipas archaeological foxtail millet remains, pointing out that although the grass is a weedy species and would grow in close proximity to human camps, it is an unlikely domesticate due to its perennial growth habit, small spikes, and few seeds. He suggests the larger seeds may have come from octaploid wild plants, which would result in natural gigantism (Austin 2006:152). Heavy utilization likewise does not necessarily indicate cultivation, as the abundance of naturally occurring plants may be enhanced by climatic factors (Buckler et al.1998:158). Although its domesticated status is debatable foxtail millet was obviously a very important food and a dominant cereal in Mexico for millennia (Austin 2006; Kaufmann 2003; McClung de Tapia 1992).

Conclusion

The integration of various archaeological and genetic approaches has certainly revealed an intricate mosaic of food production products and systems across Mesoamerica over the last 10,000 years. There appears to be a staggered and regionally widespread emergence of various domesticated plants, "… an additive sequence of spatially and temporally distinct pulses, occurring over a span of perhaps 6,000 years or more" (Smith 2001b:1326). This scenario is consistent with the basic tenets of the Era of Incipient Cultivation as formulated by MacNeish (1964, 1992) and discussed in the last chapter. As these methods develop and more data is generated the situation will likely become even more complex.

Local environmental conditions serve as a backdrop for human activity, delineate resources and subsistence options available to populations, and influence cultural processes over time. In the next chapter I summarize the environmental situation surrounding the Ocampo caves. The chapter begins with a discussion of the present-day human occupation and economy, and local geology, topography, hydrology, and present-day climate. The second portion concerns the available data for paleoclimatic conditions in northeastern Mexico and adjacent regions over the course of the Holocene.

CHAPTER 4: ENVIRONMENTAL SETTING

Prehistoric human economy, settlement, and mobility are best understood within a localized environmental context, because climate and physical setting largely condition and constrain food resources available for gathering, local agricultural potential, shelter and clothing needs, and raw materials needed for tool production, to name just a few examples. Thus, the ecological situation must be considered when exploring changes in subsistence practices in southwestern Tamaulipas both in the past and the present.

Ocampo, southwestern Tamaulipas, is situated within the confines of the *Huasteca*, a vast geographical region in the northeast of Mexico centered on the watershed of the Pánuco River, inland from the city of Tampico, and including parts of the states of Veracruz, San Luis Potosi, Hidalgo, and southern Tamaulipas (Figure

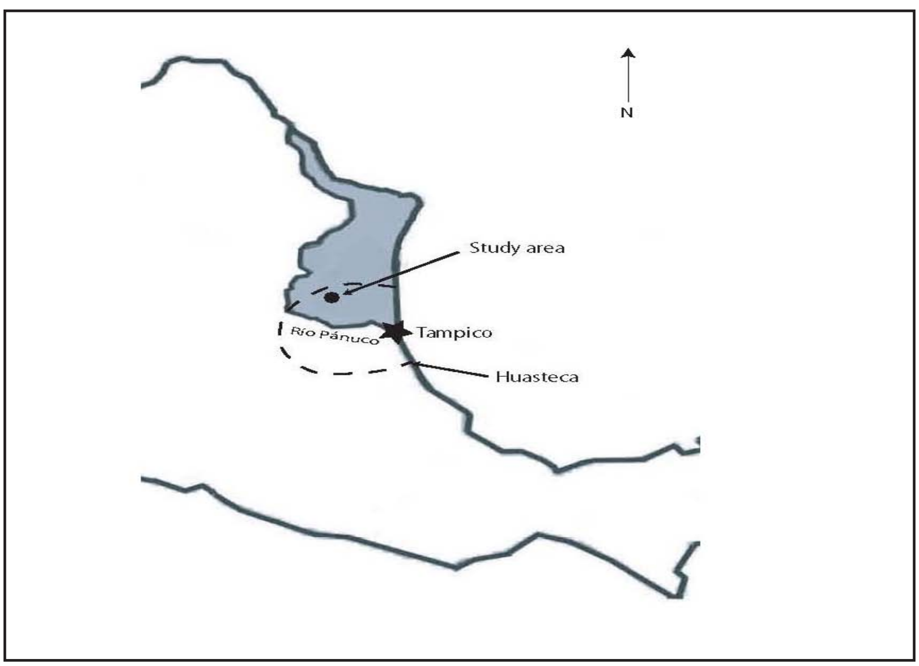

Figure 4.1. Map of northeastern Mexico, showing location of the study area and the general limits of the Huasteca environmental area.

4.1). The Huasteca is comprised primarily of humid lowlands, but as it abuts the eastern slopes of the Sierra Madre Oriental, hill country and low mountain ranges occur along its western perimeter.

The town of Ocampo is situated at the northern end of a narrow valley at the interface of the humid lowlands with the more rugged uplands to the north and west. A low mountain range extends southward to the east of Ocampo, separating the town from the main body of the lowlands, but this valley opens onto the lowlands about 80 km to the south of the town. Specifically, the present study area is in mountainous country surrounding the small farming community (*ejido*) of San Lorenzo las Bayas, about 30 km north of the larger Ocampo community (Figure 4.2). A narrow (often dry) river drainage serves as a natural corridor between the valley setting of the town of Ocampo and the rugged upland location of San Lorenzo las Bayas, the Ocampo caves, and the study area. This topographical boundary situation and the natural corridors between the humid lowlands and mountainous uplands afforded by canyons and narrow valleys has important implications for the prehistoric spread of cultivated plants and other imported products into the study area, as will be discussed further in Chapters Eight and Nine.

Present-Day Human Occupation

Today rural families in *ejido* San Lorenzo las Bayas and other nearby communities typically live in traditional single- to multi-room *jacales* (small houses of wattle and daub). Modern subsistence is primarily based on small-scale agriculture and animal husbandry. Most agricultural practices take place in the immediate vicinity of the *ejido*, where farmers plant maize, butternut squash, cushaw squash, and common beans in small yet formalized, rain-fed slash-and-burn *milpas* (cleared fields) in narrow valleys and on river terraces and hill slopes. However, more casual cultivation practices occasionally take place in the canyons some distance from the community; these modern

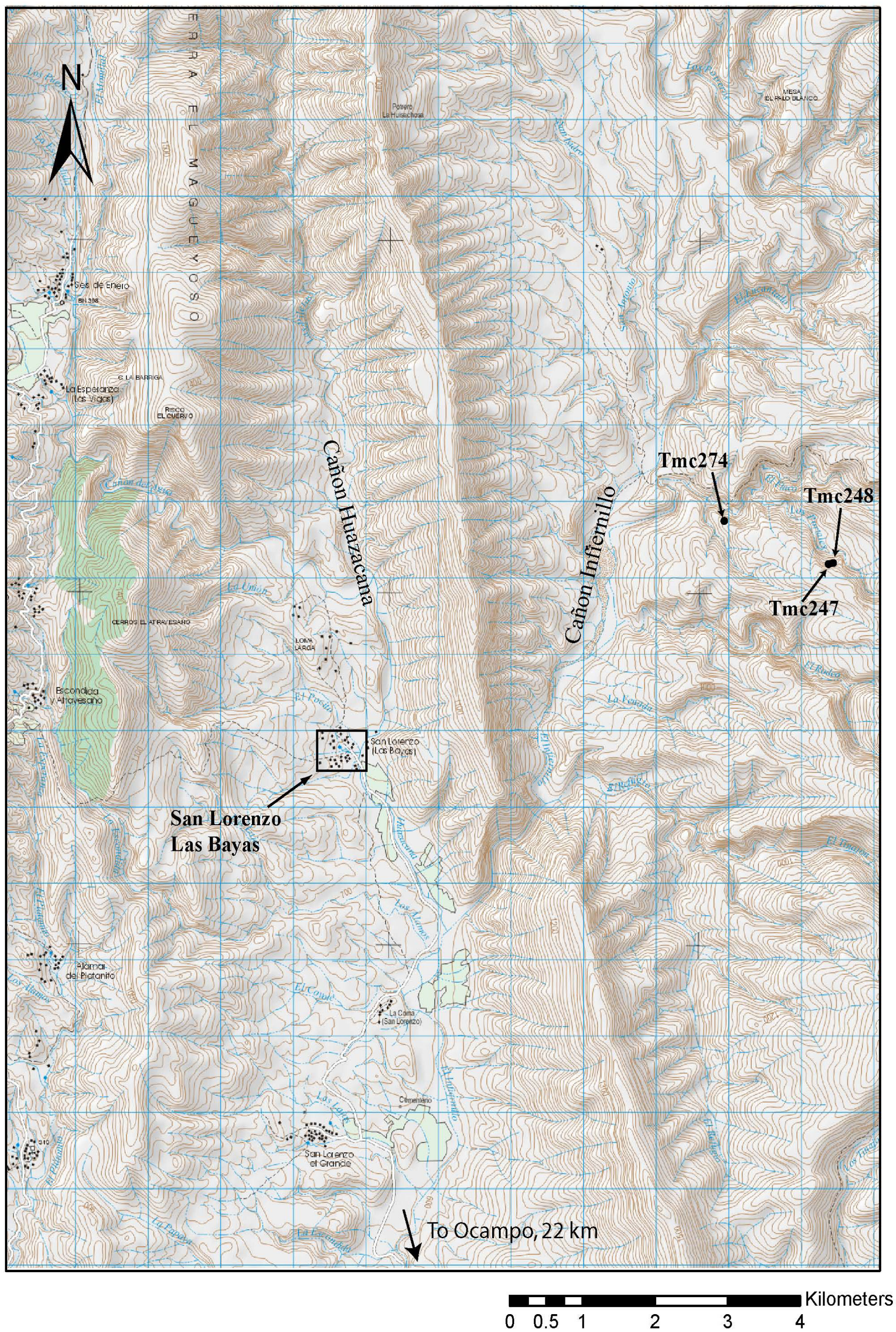

Figure 4.2. Map of study area, with locations of *ejido* San Lorenzo las Bayas and Romero's (Tmc 247), Valenzuela's (Tmc 248), and Ojo de Agua (Tmc 274) caves (recreated from INEGI 2002).

behaviors have implications for the early adoption of exotic domesticated plants by indigenous hunter-gatherers and low-level food producers, a topic that will be further considered in Chapter Nine.

Tilling of the rocky soil is accomplished by mule-drawn plow, and seed planting is done by hand at the onset of the rainy season in July; harvest occurs the following December. These crops are primarily for personal consumption, as their sale in local markets is unprofitable. Local farmers also raise pigs, chickens, goats, cows, mules, burros, and horses for personal use, sale, or occasional consumption. Bottle gourds and other useful and ornamental plant species are frequently maintained in home gardens. Abundant edible, medicinal, ornamental, and utilitarian wild plants in the region continue to be collected for home use or sale (Hernandez Sandoval et al. 1991; Sosa et al. n.d.), but hunting is presently unimportant in the local economy. When the opportunity presents itself, men take on government-sponsored jobs such as maintenance of local roadways.

Geology and Topography

The study area is situated between 600 and 1,400 meters above sea level (masl) in a small north to south oriented range known locally as the Sierra Azul (Figure 4.2) (INEGI 2002). Geologically the region is characterized by Early Cretaceous secondary limestone masses of sedimentary origin (Martin 1958:11; Sosa et al. n.d.), forming a topography exemplified by high mountains, steep hills, canyons and narrow valleys. The rugged karstic terrain has abundant sinkholes, caves, and rockshelters suitable for human habitation, as confirmed by plentiful rock art (primarily pictographs), artifacts, and burials. Caves are of particular archaeological value, as the often dry interiors and protection from the elements affords ideal preservation conditions for perishable materials such as bones, vegetal remains, textiles, and fecal matter. The limestone-derived soils typically have a depth of less than 40 cm, and those that have developed upon gentle slopes and in valley and ravine bottoms support slash-and-burn cultivation (Sosa et al. n.d.), both now and likely in the distant past.

This geological situation also provided indigenous populations with raw materials for the production of chipped stone tools, particularly fine-grained, compact limestone and poor quality chert. Igneous rocks, valued for the manufacture of ground stone artifacts such as axe heads, manos, and metates, are not immediately available in the study area; however, sources for such materials are known elsewhere in the Sierra Madre at no great distance (Aranda-Gómez et al. 2005; Barboza-Gudiño 1998, 2008; Kellum 1930).

Hydrology

The canyons of the study area are part of a drainage system connecting two major, eastward flowing rivers: the Río Guayalejo 25 km to the north and the Río Pánuco 90 km to the southwest. Within the study area proper, the two primary north-to-south flowing canyons are Infiernillo in the east and Huazacana in the west. Several smaller tributary canyons flow into the rugged Cañon Infiernillo from the east. Romero's, Valenzuela's, and Ojo de Agua caves are situated in the southern wall of one of these, the Cañon los Portales, about 6-7 km northeast of *ejido* San Lorenzo las Bayas (Figure 4.2). Cañon Infiernillo is eventually joined by the Cañon Huazacana just south of the *ejido*, and continues to flow southward towards Ocampo, where it flows into the Río Santa Barbara and ultimately becomes part of the Río Pánuco drainage system of far southern Tamaulipas and northern Vera Cruz.

Water may have posed a problem for prehistoric populations in this setting, as these canyons remain dry throughout most of the year (although they may become raging torrents during the summer rainy season). A few creeks persist during dry months, but otherwise at such times water occurs only as small springs and lingering, ephemeral

Table 4.1. Normal climatic data for Ocampo, Tamaulipas, 1961-2003 (Silva-Serna et al. 2007:Table 90).

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum mean temperature (°C)	23.1	25.0	29.4	32.2	33.5	33.1	31.9	32.1	31.0	28.6	26.1	23.6	29.1
Minimum mean temperature (°C)	9.8	10.8	14.4	18.4	20.1	21.7	21.3	21.2	20.8	17.6	14.1	11.1	16.8
Mean temperature (°C)	16.5	17.9	21.9	25.3	26.8	27.4	26.6	26.6	25.9	23.1	20.1	17.4	23.0
Precipitation (mm)	15.7	13.2	21.1	29.9	71.7	283.6	285.8	249.3	290.4	96.2	26.8	27.4	1411.3
Number of days with rain	4.2	3.2	3.1	4.2	7.2	13.3	14.1	14.8	15.0	8.2	4.1	4.7	95.9

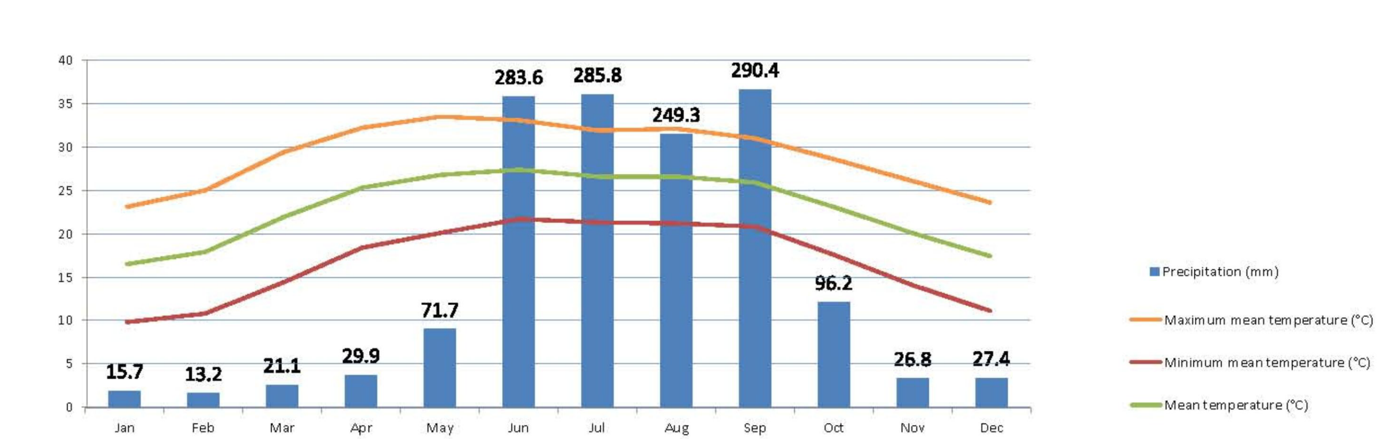

Figure 4.3. Mean monthly distribution of precipitation and temperature in Ocampo, Tamaulipas, 1961-

puddles in *tinajas* (natural depressions in boulders and bedrock). Excavated pits (*tanques*) found on some ancient village sites likely functioned as rainwater catchments (MacNeish 1947:3), demonstrating a cultural response to this predicament.

Present-Day Climate

There is highly localized variability in temperature and precipitation in the Huasteca due to extreme topographic relief and rain shadow effects (Puig 1991). While

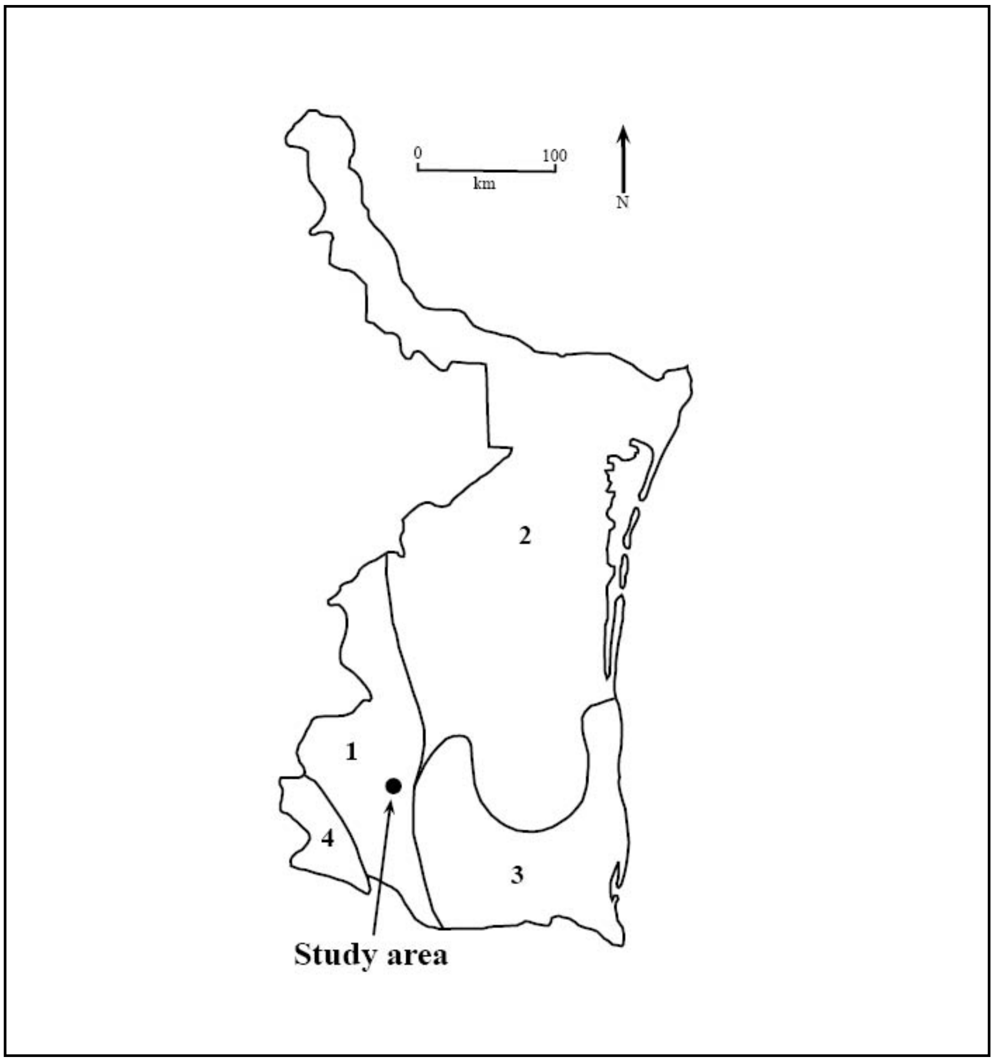

Figure 4.4. Biotic provinces of Tamaulipas: 1) Potosian; 2) Tamaulipan; 3) Veracruzian; 4) Chihuahuan (Redrawn from Alvarez 1963: Figure 2).

the coastal lowlands that comprise most of the Huasteca are primarily hot and humid, conditions in the more mountainous regions tend to be considerably more diverse. The climate of the study area and surrounding environs is classified as subhumid semi-warm with a summer rainfall pattern (Köppen index: [A]c[w0], [A]c[w1]). Table 4.1 and Figure 4.3 present climatic data gathered between 1961 and 2003 in the town of Ocampo. Annual rainfall here averages just over 1,400 mm, with distinct wet and dry seasons. The rains usually arrive in June with a drastic increase in precipitation (Figure 4.3). It is at this point that local farmers in San Lorenzo las Bayas traditionally plant their *milpas* with maize, beans and squash. The heavy rainfall typically persists until September, followed by an eight-month period of less precipitation. The highest mean monthly temperatures are around 27-33 °C and occur in May and June (Silva-Serna et al. 2007). Ocampo lies only 20 km south of the study area and is 300 m lower in elevation than the study area. Although differences in topography and exposure to moisture-laden air may result in some dissimilar microclimatic conditions, the data gathered from the Ocampo station is consistent with conditions observed in the study area.

Plant and Animal Life

Vegetation

The study area is situated within the Potosian Biotic Province as defined by Dice (1943), which consists of all portions of Tamaulipas that occupy the Sierra Madre Oriental (Figure 4.4) (Alvarez 1963). The province is generally characterized by pine-oak forest, but also includes cloud forest, chaparral, thorn forest, thorn scrub, and thorn desert. It is also defined by a distinct assemblage of mammals (Alvarez 1963:374-375). The Potosian is bordered to the northeast by the Tamaulipan Biotic Province (generally mesquite-grassland), to the southeast by the Veracuzian (tropical deciduous forest), and to the west by the Chihuahuan (desert or mesquite grassland) Biotic Provinces.

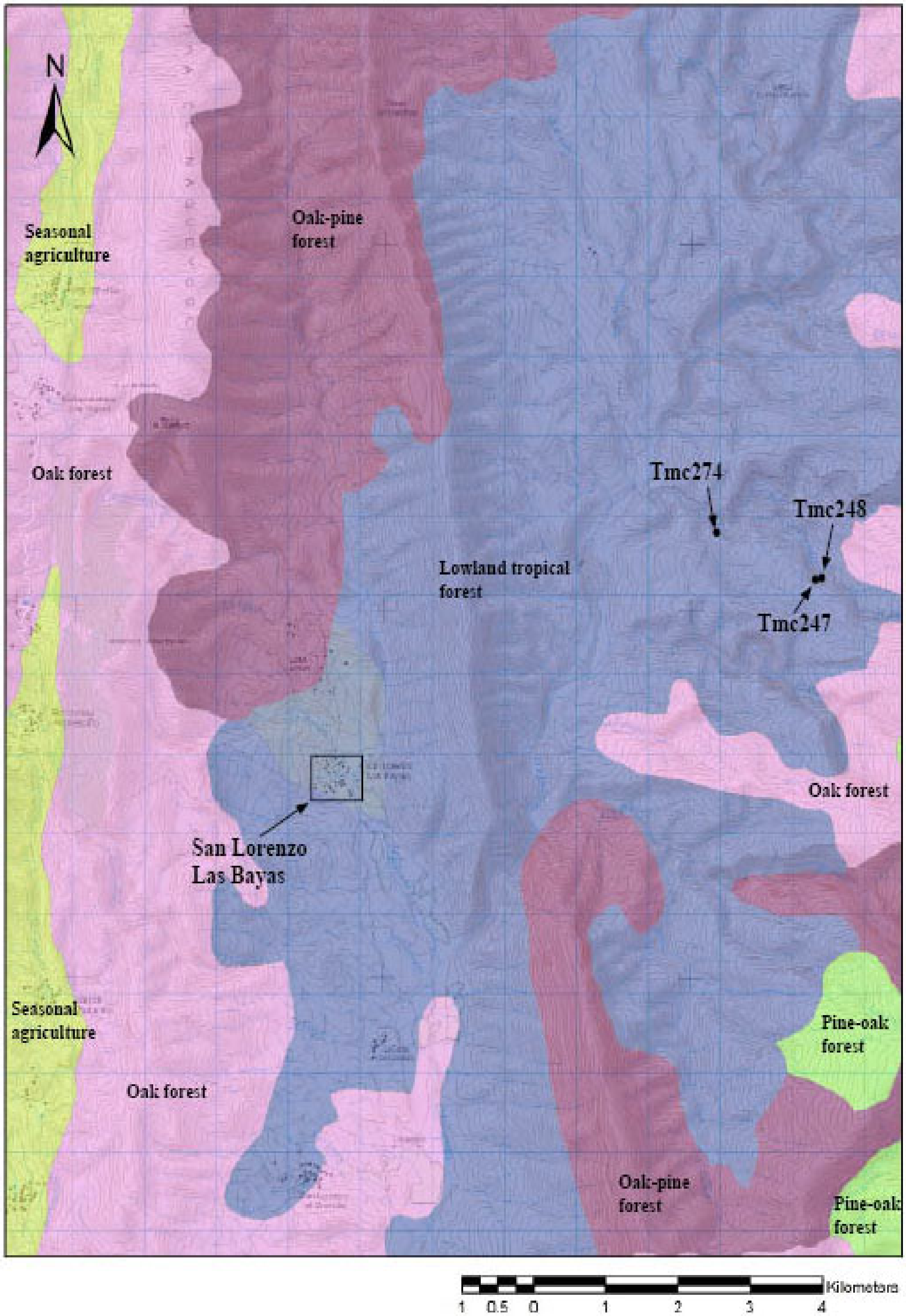

Figure 4.5. Vegetation zones of the study area. (INEGI 2002, 2003).

The landscape in and around the study area is a rich mosaic of vegetation zones. Broadly speaking, the study area consists primarily of lowland tropical forest (Figure 4.5), a patchy mix of low- and mid-sized semi-deciduous tropical trees (Claudia Gonzalez-Romo, pers. comm., 2006). Trees such as shaving brush tree (*Pseudobombax ellipticum*) and *chaca* (*Bursera simaruba*) characterize this zone, which generally spans across areas of steep rocky slopes, canyons, and cliffs. Characteristic shrubby elements include thorncrest century plant (*Agave lophantha*) and the bromeliad guapilla (*Hechtia glomerata*), and typical herbaceous plants are arrowhead vine (*Syngonium podophyllum*) and richweed (*Pilea serpyllifolia*) (Valiente Banuet et al. 1995). The lowland tropical forest interlaces with oak forest (e.g., *Quercus canbyi*, *Q. emoryi*, *Q. germana*, *Q. laurina*, *Q. sartorii*) on hill slopes in the eastern portions of the study area, which in turn mingles with pine species (e.g., *Pinus oocarpa*, *P. patula, P. pseudostrobus, P. teocote*, *Pseudotsuga menziesii*) at higher altitudes to the northwest and southeast. At the highest elevations in the southeastern portion of the study area pines become dominant over oaks. Cycads (e.g., *Dioon edule*), palms (*Brahea berlandieri*, *Chamaedorea elegans*), cacti (e.g., *Opuntia leucotricha*, *Opuntia* spp.), and bromeliads (e.g., *Bromelia pinguin*, *H. glomerata*) are also scattered throughout the oak, oak-pine, and pine-oak forest settings.

There are areas of lush gallery forest (e.g., *Ficus cotinifolia, Guazuma ulmifolia*, *Populus mexicana*) along drainage margins, and patches of grassland, thorn scrub (e.g., *Acacia* spp., *Pithecellobium ebano, Yucca treculeana*), and weeds (e.g., *Amaranthus hybridus, Chenopodium* spp., *Helianthus annuus*) on alluvial terraces adjacent to seasonally dry river beds. Invasive cane (*Arundo* sp.), native to the Old World, has colonized large parts of such settings in recent history. Agaves (e.g., *A. americana, A. lechuguilla, A. lophantha*), bromeliads (e.g., *B. pinguin*, *H. glomerata*, *Tilandsia usneoides*), and cacti (e.g., *N. euphorbiodes*, *Opuntia* ssp., *Stenocereus marginatus*) cling to rocky canyon walls and steep slopes. As will be clarified in upcoming chapters, archaeological materials indicate that many plant species present in the region today fulfilled food or utilitarian needs for prehistoric populations.

The area immediately surrounding San Lorenzo las Bayas is characterized as introduced pasture (Figure 4.5). Although historical farming and grazing practices have likely affected vast portions of the study area, the vicinity of the present community has been most greatly disturbed through deforestation, grazing, and planting of introduced species of forage grasses. The neighboring valley and adjacent slopes over the hills to the west of San Lorenzo las Bayas is primarily used by other communities for seasonal agriculture (Figure 4.5). In 1985, the state of Tamaulipas established El Cielo Biosphere Reserve to protect 1445 km^2 of tropical cloud forest and associated vegetation zones (Puig 1993; Ramirez Castilla 2007:26-27; Sosa et al., n.d.). The western boundaries of the preserve border the present project's study area on the east.

Fauna

Due to the unique environmental setting, animal life in the El Cielo region has received considerable scholarly attention. Sosa et al. (n.d.) report that the terrestrial vertebrate assemblage consists of 65 reptiles, 24 amphibians, more than 80 mammals, and 182 seasonal and indigenous bird species. The abundance and diversity of birds have rendered the region a popular destination for bird watchers and impelled detailed ornithological studies (Sutton and Pettingill 1942; Webster and Webster 2001). Comparable studies have been conducted of the varied local reptile and amphibian species (Martin 1958). Among the common mammals are ocelot (*Felis pardalis*), jaguar (*F. onca*), opossum (*Didelphis* spp.), white-tailed deer (*Odocoileus virginianus*), peccary (*Tayassu tajacu*), and armadillo (*Dasypus* spp.). The tropical *tejón*, or coatimundi (*Nasua narica*), is also present, as are various small carnivores and rodents that range northward into the United States (Sutton and Pettingill 1942). We know that the prehistoric inhabitants of southern Tamaulipas hunted many of these animals based on faunal assemblages recovered by MacNeish (1958, 1992).

Paleoclimate of Northeastern Mexico and Adjacent Texas

A number of scholars have posited a general, gradual inclination towards warmer and drier conditions in northeastern Mexico and southern Texas over the last 10,000 years (Bryant and Schafer 1977; Hester 1982; Nickels and Mauldin 2001; Quigg and Cordova 2000). However, regional studies indicate variable, finer-scale climatic fluctuations within this larger trend. MacNeish (1958: Table 30) used soil studies, geomorphology, and archaeological animal and plant remains to formulate a sequence of climatic fluctuations in southern Tamaulipas since 11,000 B.P., and Mónica Bopp-Oeste examined pollen from Romero's cave, gaining limited insight into local climatic within the study area (Figures 4.6, 4.7) (Brown 1991:75). Other pollen sequences near Xicoténcatl, Tamaulipas (about 40 km east of Romero's cave) and elsewhere in the Huasteca (González Quintero 1986) provide evidence, but these are not securely dated. Finally, Metcalfe (2006) and colleagues (Metcalfe et al. 2000) synthesize multiple lines of evidence to elucidate climatic trends in northern Mexico. The following discussion is based largely upon these sources, and selected sequences are displayed in Figure 4.6 for areas indicated in Figure 4.7.

Late Pleistocene (18,000 – 10,000 B.P.)

The pollen sequence in the Cuatro Cienegas Basin, Coahuila, seems to indicate a colder, wetter climate in northeastern Mexico during the late Pleistocene than that of today (Meyer 1973). A review of Mexican paleoclimatic data led Metcalfe et al. (2000) to conclude that such wet conditions were due to higher levels of winter precipitation in northern Mexico at this early date, while summers were relatively cool. Pollen spectra

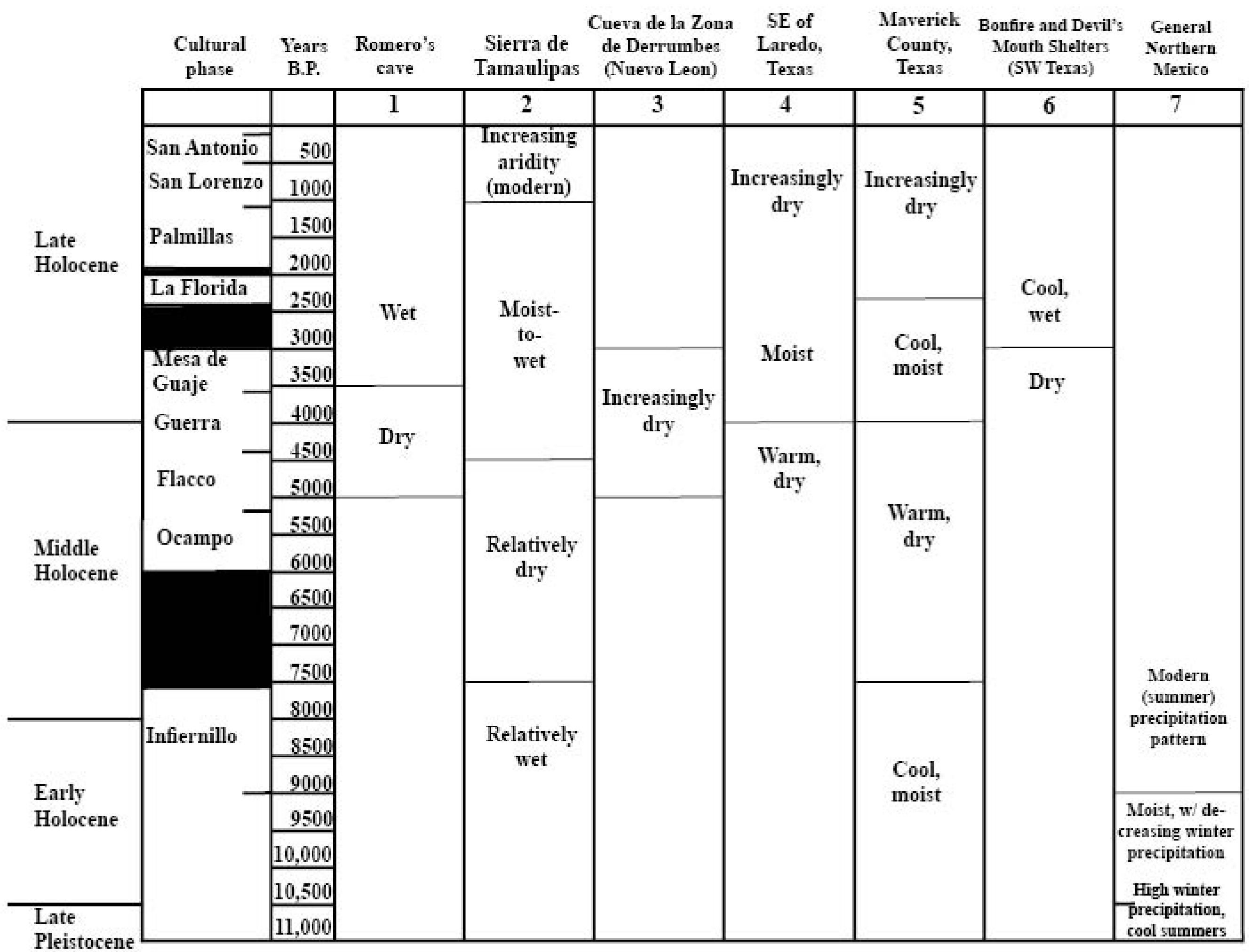

Figure 4.6. Paleoclimatic timeline for southern Texas and northeastern Mexico, from selected sources; locations for Sequences 1-6 are indicated on Figure 3.7 (References: 1: Bopp-Oeste [cited in Brown 1991]; 2: MacNeish 1958; 3: Bryant and Riskind 1980; 4: Quigg and Cordova 2000; 5: Nordt 1998; 6: Bryant 1966, 1969; 7: Metcalf et al. 2000)

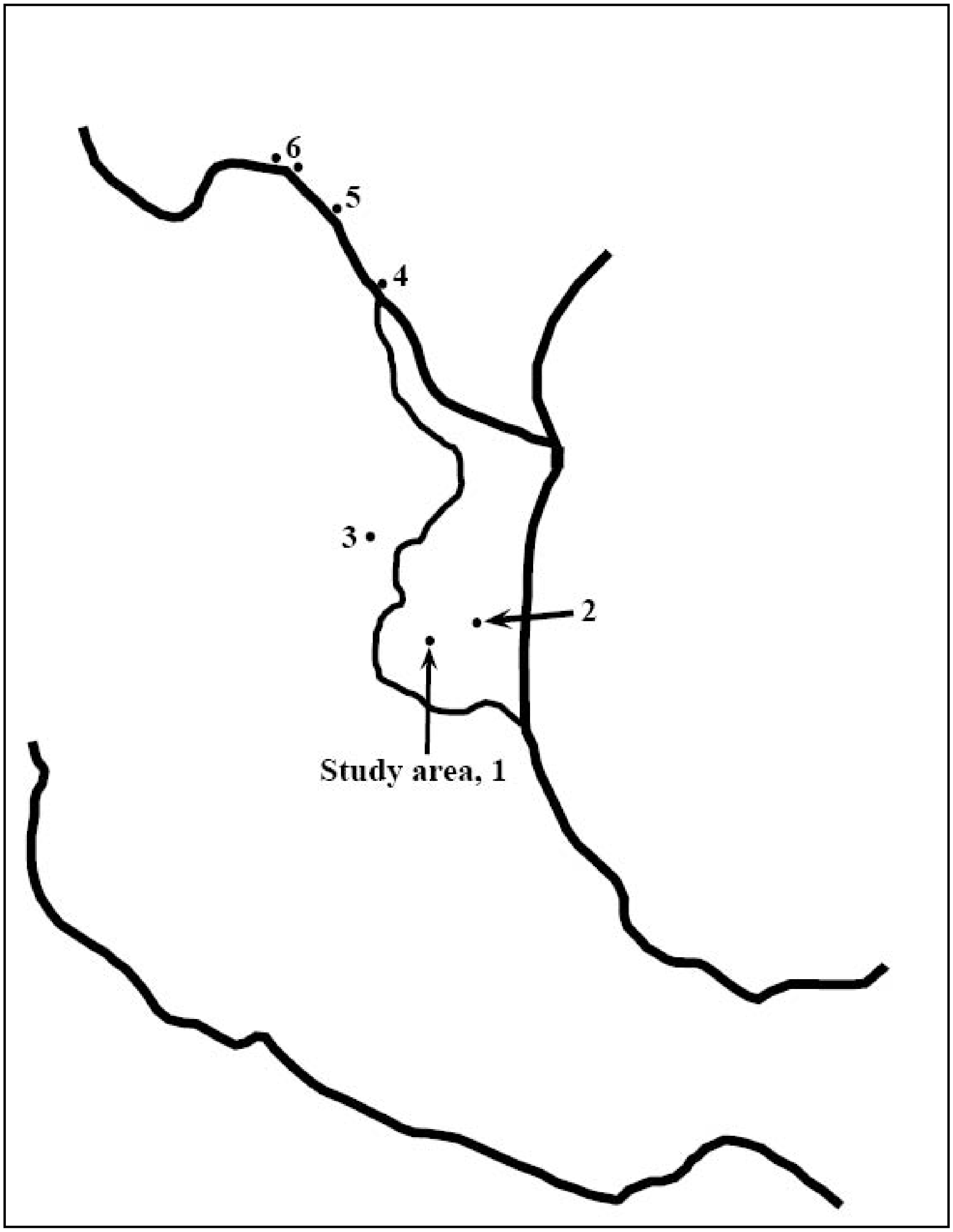

Figure 4.7. Map showing locations of select regional paleoclimatic data sets (1-6) summarized in Figure 4.6.

from bogs in central Texas and oxygen-isotope data from south Texas reveal a shift to increasingly warmer temperatures by about 15,000 years ago (Bousman 1992, 1994; Nickels and Mauldin 2001:35).

Early Holocene (10,000 – 8,000 B.P.)

Based on multiple data sets, MacNeish (1958: Table 30) proposed a sequence of climatic fluctuations in southern Tamaulipas since 11,000 B.P. He characterized the first major period (11,000-7500 B.P.) as relatively wet. Metcalfe et al. (2000) have since indicated that while the region remained moist during the early Holocene, rainfall patterns typified by decreased winter precipitation from that of the Pleistocene and approximating those of today were established in northern Mexico sometime after 9000 B.P.

Supporting evidence for a cool, moist early Holocene comes in the form of plant remains from Baker Cave, in southwestern Texas (Hester 1982), geomorphology and soil $\delta^{13}C$ signatures in Maverick County, Texas (Figures 4.6, 4.7) (Nordt 1998), grass phytoliths from northwest Texas (Fredlund et al. 1998), as well as grass and tree phytoliths from central Texas (Robinson 1979). In spite of the general consensus of a moist early Holocene, some data indicate regional variability. Changes in landform stability in an upland setting northwest of Laredo, Texas, led Nordt (2000) to conclude that dissection and erosion characterized the area prior to 8330 B.P., indicating a dry, harsh period. This was followed by a period of more benign conditions characterized by sediment deposition up to 6310 B.P. (Figures 4.6, 4.7).

Middle Holocene (8,000 – 4,000)

MacNeish (1958: Table 30) characterized the environment in southern Tamaulipas between 7500-4500 B.P. as relatively dry. Bopp-Oeste concluded from Romero's cave pollen that the markedly arid increment lasted until more recently, spanning between about 5000-3500 B.P. (Figure 4.6) (Brown 1991:75). These interpretations are generally consistent with Nordt's (1998) isotope analyses in Maverick County, southern Texas: from 7500-4000 B.P., the $\delta^{13}C$ signature likely reflects a generally warmer, xeric period (Figure 4.6). Sotol (*Dasylerion wheelerii*) appears in Baker Cave at ca. 4600 B.P., indicating continually increasing aridity at the site over previous times (Hester 1982:112-113). An increasing frequency of xeriphytic plant species at the expense of mesiphytic species throughout a pollen sequence spanning 5000-3000 B.P. at Cueva de La Zona de Derrumbes, southwestern Nuevo León, Mexico, once again reflects increasingly dry conditions during the middle Holocene (Figures 4.6, 4.7) (Bryant and Riskind 1980).

Significant environmental stress may have accompanied dry, harsh conditions in northeastern Mexico. Geomorphological work at the large open site of Boca de los Potrerillos, on the eastern margin of the Sierra Madre Oriental in Nuevo León, revealed a major erosional contact dating to approximately 4800 B.P. Apparently many sites in Nuevo León were subject to major erosional events during the period between about 5600-4800 B.P. (Turpin et al. 1994:350-351). Nance (1992:142) noted a distinct reduction in human occupational intensity at La Calsada rockshelter, Nuevo León, between 7500 and 4800 B.P, and speculated that this may at least partially relate to climatic deterioration. In spite of overwhelming evidence for generally drying conditions during the middle Holocene, Metcalfe et al. (2000) point out that a number of pollen records from Mexico indicate that the period between 6000-5000 B.P. was quite variable, and that relatively wet conditions prevailed in many regions around 6000 B.P.

Phytoliths from southeast of Laredo seem to indicate that prior to about 4000 B.P. there is a surge in calcium oxalate crystals in the soil, probably reflecting an increase in the relative abundance of cactus species (Quigg and Cordova 2000, cited in Quigg et al. 2002:19). These decrease around 4000 B.P., coinciding with an increase in Panicoid bilobate grass phytoliths, possibly indicating a shift to more mesic conditions (Figures 4.6, 4.7) (Quigg and Cordova 2000). Quigg et al. (2002:19) point out that the resurgence of moist conditions in this part of southern Texas around 4000 B.P. generally coincides with the termination of the Altithermal documented in regions to the north.

Late Holocene (4,000 – 0 B.P.)

According to MacNeish (1958: Table 30), sometime around 4500 B.P. the climate in southern Tamaulipas shifted from dry to relatively moist-to-wet, a situation that lasted until approximately 1000 B.P. Bopp-Oeste's (Brown 1991:75) interpretation of Romero's cave pollen is consistent with this, citing evidence for an improvement in climatic conditions after 3500 B.P. following millennia of aridity (Figure 4.6). Bopp-Oeste suggests that this climatic amelioration corresponds to the period when nomadic hunter-gatherers in the Ocampo region transitioned into semi-sedentary low-level food producers with cultigens (Brown 1991:75), and the corresponding onset of the Mesa de Guaje phase in the Ocampo sequence and the associated rise of village-based agriculture (see Chapter Six) is in agreement with this interpretation.

Nordt's (1998) isotope study of soils in Maverick County in south Texas supports to climatic amelioration scenario. After about 4000 B.P., there was a decrease in local C_4 vegetation with a coincident increase in C_3 plants and a decrease in channel erosion. Nordt interprets this to suggest that 4000-2200 B. P. was cooler and more mesic than previous times (Figure 4.6). Bryant (1966, 1969, cited in Quigg et al. 2002) reports pollen analyses from Bonfire Shelter and the Devil's Mouth site in southwestern Texas. High frequencies of pollen representing chenopodium, amaranth, and xeriphytic herbs indicate relatively dry conditions before about 3000 B.P. Between 3000 and 2300 B.P. there was a resurgence of pine, grass, and sedge, at the expense of joint fir (*Ephedra* sp.), chenopodium, amaranth, and other dry-adapted species indicating a shift to cooler, more mesic conditions (Figures 4.6, 4.7) (Bryant 1966, 1969).

Dering (2000) came to similar conclusions from his *ecologically diagnostic xylem analysis* of mesquite wood charcoal fragments from a Late Archaic encampment south of Laredo. Derring (2000:352) used a vulnerability index based on the "...the measurement of xylem vessel diameter and density of xylem vessels in a transverse section of wood." Reference collections of mesquite wood from regions with very different amounts of annual precipitation show that xylem vessel diameter is greater, and vessel density lower, in areas characterized by high moisture. In more arid regions, xylem vessel diameter is smaller, and vessel density greater (Carlquist 1975, 1977, both cited in Derring 2000). Based on samples from two occupations (3000 B.P. and 2000 B.P.), Derring concluded that the environment during the former was characterized by drier conditions, and that effective moisture in the area had increased by 2000 B.P.

The deposition of undifferentiated silts at Boca de los Potrerillos between 1280 and 980 B.P. suggests low energy sedimentation indicative of particularly benign climatic conditions, although the area has been experienced a marked decrease in moisture since about 1400 years ago (Turpin et al. 1993). This scenario is consistent with MacNeish's (1958: Table 30) findings in southern Tamaulipas, where about 1000 years ago a shift occurred towards drier conditions approximating the current regime. Archival data supports continued desiccation in the Boca de los Potrerillos area into the Historic period (Turpin et al. 1993:317-319); at present the site is situated in a barren desert (Turpin 1994:333). Nordt's (2000) work near Laredo produced similar conclusions (Figures 4.6, 4.7).

This shift to roughly modern conditions also occurred around the same time in more tropical lowland regions south of the study area. Based on associated ceramics, González Quintero (1986:19) places a pollen core recovered taken from the site of

El Lomerío in northern Vera Cruz, about 150 km southeast of Ocampo, between the Protoclassic and Classic periods (roughly 1500-1200 B.P.). The pollen spectra seem to indicate a subtropical climate (experiencing tropical conditions at some times of the year or nearly tropical conditions all year round) with moderate temperatures early on, followed by a relatively dry episode and a significant drop in temperature, and finally a shift to the modern tropical (hot and humid) climate and a rise in temperature above those of previous times (González Quintero 1986:22).

Summary

To review, proxy paleoclimatic measures in southern Texas and northeastern Mexico seem to indicate a large scale, gradual yet continuous tendency towards warmer and drier conditions after the cool, wet Pleistocene. While conditions remained relatively cool and moist over the early Holocene, things warmed up during the middle Holocene and rising aridity became the norm. The early part of the late Holocene is characterized by a transition to cooler and moister conditions, but between 2000 and 1000 years ago effective moisture once again began to decrease and this desiccation continues today in many regions. To the south of the study area, warm, humid conditions characteristic of the majority of the Huasteca lowlands were seemingly established by 1200 B.P. Finally, multiple lines of evidence indicate that these larger regional patterns were punctuated by smaller-scale local fluctuations, resulting in a quite variable and complex climatic history in the region.

It is interesting to note that the onset of cooler, wetter conditions early in the late Holocene closely coincide with our current understanding of the beginnings of village-based agriculture in southern Tamaulipas, and decreasing effective moisture and harsher conditions following 1500 B.P. seemingly coincide with a cultural "decline" and decreases in agricultural dependence observed in the archaeological record during the final cultural phases (discussed further in Chapter Six). However, much more work remains done regarding both the reconstruction of paleoclimate in northeastern Mexico and the clarification of the cultural sequence, so the degree to which these developments are related is unclear.

Persistence of Biotic Communities

Notwithstanding climatic shifts described above, isotope, archaeobotanical, and zooarchaeological studies show that biological communities similar to those of today have remained somewhat consistent in northeast Mexico and southern Texas throughout the Holocene (Jones 1999; Presley 2003). Phytolith studies from southeast of Laredo, Texas, suggest little variability in vegetation communities over the past "several thousand years" (Jones 1999:C-1). Grass phytoliths dominate this assemblage, and the predominance of C_4 Chloridoid and Panicoid grasses "...agrees well with the modern vegetation types and argues for environmental continuity through Holocene times" (Jones 1999:C-9).

Stable carbon and nitrogen isotope analyses were performed on an 80 cm-deep soil core from an upland site also southeast of Laredo, resulting in a record spanning from 8200 B.P. to present (Quigg and Cordova 2000). The overall sequence revealed an environmental scenario generally similar to a modern southern Texas upland grassland community, reflecting a C_4-dominated mixture of C_3 forbs and C_4 grasses. The evidence indicates that from about 5600 B.P. up to recent historical times, there was a slight general increase in the $\delta^{13}C$ signature from -19.7‰ to -17.6‰, possibly reflecting a general warming and drying trend in the region that is consistent with other studies (Figures 4.6, 4.7) (Quigg and Cordova 2000, cited in Quigg et al. 2002). Quigg et al. (2002:19) point out the $\delta^{13}C$ record does not reflect any major changes in the vegetation or the kinds of plants around the site, but rather subtle changes in plant frequencies and composition within the community.

Pollen records and a lack of geological evidence for large Pleistocene lakes in the Cuatro Cienegas Basin, Coahuila, Mexico led Meyer (1973:994) to conclude that "… local habitats on the basin floor were much like they are at present during the last 30,000 - 40,000 years." An examination of the archaeofaunal record of the region demonstrated that the range of animal species characteristic of the Tamaulipan Biotic Province has persisted as far back in time as the archaeological record allows (Presley 2003), and the presence of many contemporary plant and animal species in southern Tamaulipas archaeological cave deposits verifies their persistence in the region (MacNeish 1958).

Thus, the broad-scale climatic shifts described above would not have drastically changed the kinds of plants and animals accessible to prehistoric populations, but rather would have influenced alterations in their frequency, availability, and distribution over space. These changes may have also necessitated or enhanced opportunities to intensify on the use of introduced domesticated plants due to shifts in subsistence returns.

Conclusion

Against this backdrop of rugged topography, diverse flora and fauna, and climatic variation and stability human cultures rose and fell in the mountains of southwestern Tamaulipas. While our knowledge of these developments is still in its infancy, several major archaeological projects have shed considerable light upon them. In the upcoming chapter I recount the groundbreaking research that has led to our current understanding Ocampo prehistory, which will be thoroughly discussed in subsequent chapters in order to renew our comprehension of human-plant interactions within the study area.

CHAPTER 5: CULTURAL GEOGRAPHY OF TAMAULIPAS AND PREVIOUS RESEARCH

The space within the modern political bounds of the state of Tamaulipas has a rich and diverse history of human occupation. In his comprehensive treatment of the archaeology and prehistoric cultural history of Tamaulipas, Ramírez Castilla (2007) divides the state into five distinct cultural regions (Figure 5.1). The two northernmost groups, the Northern Plain and Laguna Madre (Figure 5.1, 1 and 2), are characterized by primarily mobile hunter-gatherer cultural features throughout the prehistoric sequence. The regions to the south (the Huasteca, Tula Valley, and the Mountain Region [Figure 5.1, 3, 4, and 5]), while having a distinctly Archaic, hunter-gatherer life-way in earlier periods, eventually developed Mesoamerican traits such as intensive agriculture, ceramics, and sedentary occupation of villages with plazas and house and temple platforms (Taylor 1966:89). In this context, "Huasteca" refers to the distribution of the Huastec people (introduced in Chapter Two), rather than the larger *geographical* region of the same name that encompasses the study area (Chapter Four). As far as cultural elements are concerned, the Mountain Region is most relevant to the present study area (Figure 5.1, 5) (Ramírez Castilla 2007:111-162).

The Mountain Region culture area corresponds to the Potosian Biotic Province described in the previous chapter, and spans the mountainous Sierra de Tamaulipas and Sierra Madre Oriental westward to the state boundaries of San Luis Potosí and Nuevo León. Although characteristic preceramic elements are encountered here, the Mountain Culture region is defined by traits of the Mesoamerican (post-3,500 B.P.), including:

- Monumental architecture, constructed of limestone slabs without mortar. Circular stone house or temple platforms with stairs are distributed (often irregularly)

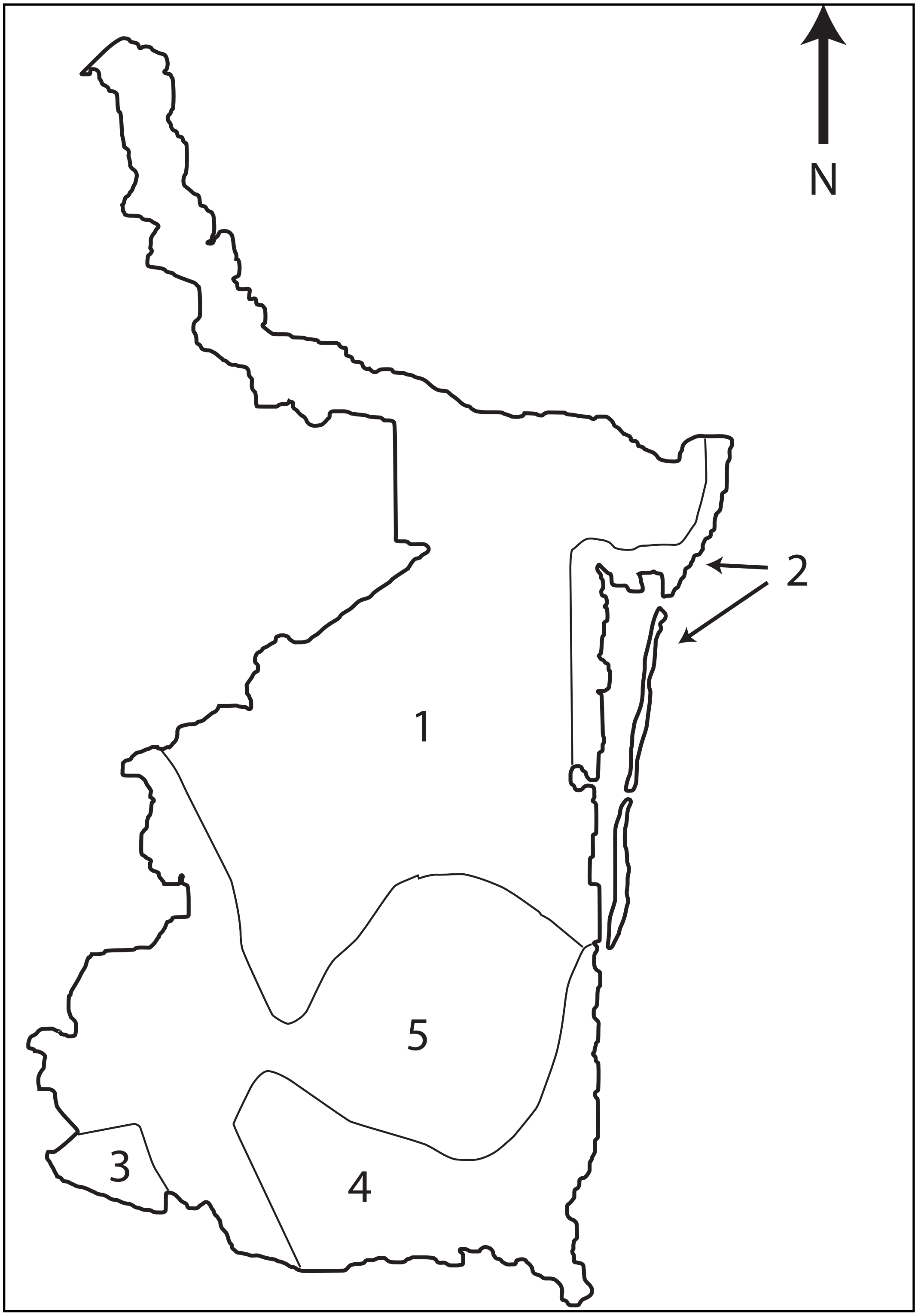

Figure 5.1. Cultural regions of Tamaulipas: 1) Northern Plains; 2) Laguna Madre; 3) Tula Valley; 4) Huasteca; 5) Mountain Region (redrawn from Ramírez Castilla 2007:34, Figure 8).

across open spaces, forming villages of various sizes. These sites may have few as one structure or as many as 600 platforms, corridors, and walkways. Hemispherical *temascales* (ritual structures, possibly sweathouses) are present.

- Rudimentary ceramics with gypsum temper and (occasionally) anthropomorphic or zoomorphic decoration molded in the paste; the polished slip is usually red to brown.
- Frequent ceramic pipes with anthropomorphic or zoomorphic bowls.
- Circular stone pectorals, worn as a breast plate or amulet.
- The dead are interred in cemeteries or within house and temple platforms, and are accompanied by burial offerings. Re-interments are covered with inverted vessels (Ramírez Castilla 2007:43).

These traits exemplified the region during the Classic Period, although groups with markedly different lifestyles occupied these uplands long before the rise of the Mountain Culture. Much of our knowledge of this region emerged from the work of R.S. MacNeish in the 1940s and 1950s. The remainder of this chapter is a discussion of the archaeological project and methods that have led to the current consensus of culture history in the Ocampo region.

The Ocampo Cave Excavations

As introduced in Chapter One, MacNeish's pioneering excavations in the Ocampo caves resulted in a general cultural historical framework for southwestern Tamaulipas that in more recent research has been largely upheld, despite adjustments to the timing of the known arrival of various domesticated plants (Kaplan and Lynch 1999; Smith 1997b). Because of the importance of this work and the fact that it produced the plant specimens that have such a strong bearing on the present study, here I briefly describe the methods that were used to obtain these materials and to arrive at this chronological sequence.

Excavation Techniques

With the exception of some necessary site-specific deviations, MacNeish and his crew typically used similar excavation techniques on different cave sites in both the Sierra de Tamaulipas and Ocampo regions (MacNeish 1958:7-8). Initially, a five foot square (2.3 m^2) was placed along the cardinal directions on the site and excavated by shovel in 6 inch (15.24 cm) levels, and the sediments were screened through ¼ inch mesh. This initial test was performed in order to determine the depth of refuse, the nature of the strata, and the types of cultural material present. If it was determined that the site held further research potential, a grid of stakes was then laid out across the site in five foot intervals, again along the cardinal axis. A stake near the center of the grid was designated 0-0, and those to the north, south, east and west were numbered accordingly by feet. For example, a stake 10 feet north and 15 feet east of the center stake was referred to as N10E15. Each square in the grid was named by the stake in its southeast corner (MacNeish 1958:8). The layouts of Romero's, Valenzuela's, and Ojo de Agua caves are shown in Figures 5.2, 5.3, and 5.4 (Kelley 1954a; MacNeish 1954b, 1954c).

The main excavation proceeded with more care than the initial test. Alternate squares in alternate trenches were excavated first; this technique was used so that "… all profiles at all five foot axes could be seen and recorded on the cross-section drawings" (MacNeish 1958:8). Later, the adjacent squares between those previously excavated were removed to form long trenches, the profiles of which were photographed and illustrated. When a homogeneous stratum was greater than 6 inches deep, vertical slices were peeled off by shovel. A trowel and brush were used when discernable strata or features were present, and again all sediments were sifted through ¼ inch screens. MacNeish

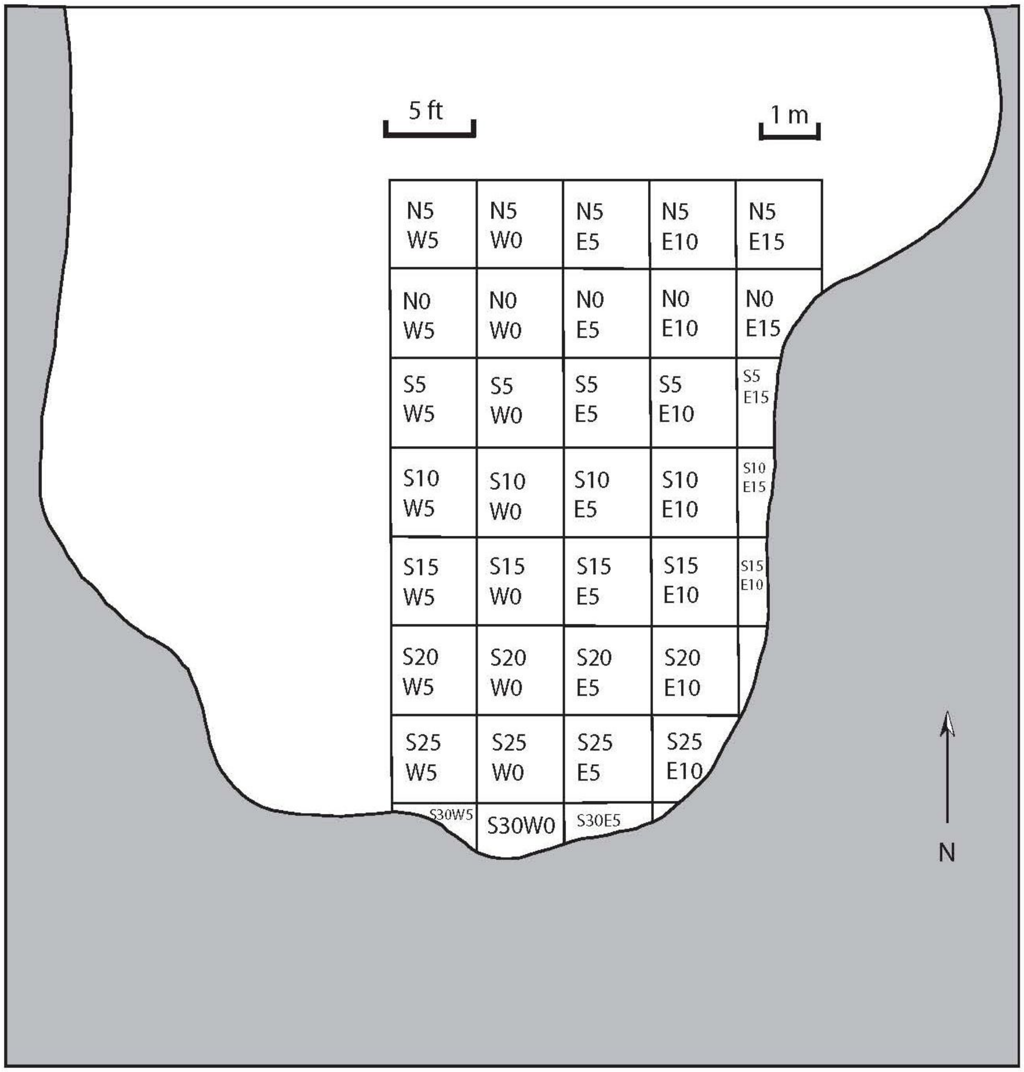

Figure 5.2. Floor layout of Romero's cave (Tmc 247), showing locations of delineated excavation units (redrawn from MacNeish 1954b).

eventually came to call this method of excavating alternate grid squares by natural or cultural levels "the La Perra method," named after one of the more important cave sites in the Sierra de Tamaulipas (Flannery and Marcus 2001:7; MacNeish 1958).

Cataloguing System

As artifacts and vegetal specimens were collected in the field, they were

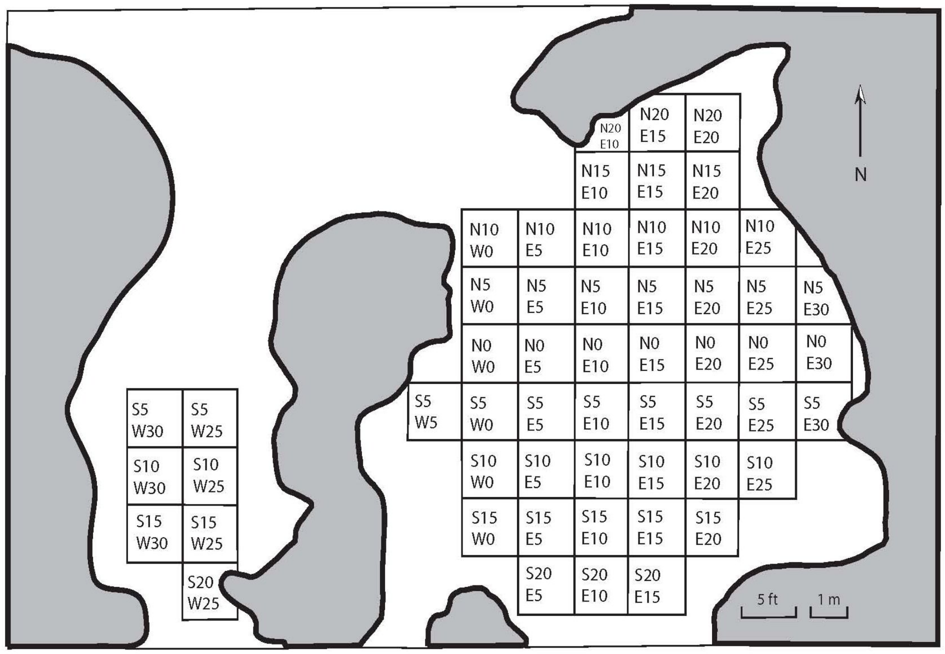

Figure 5.3. Floor layout of Valenzuela's cave (Tmc 248), showing locations of delineated excavation units (redrawn from Kelley 1954a).

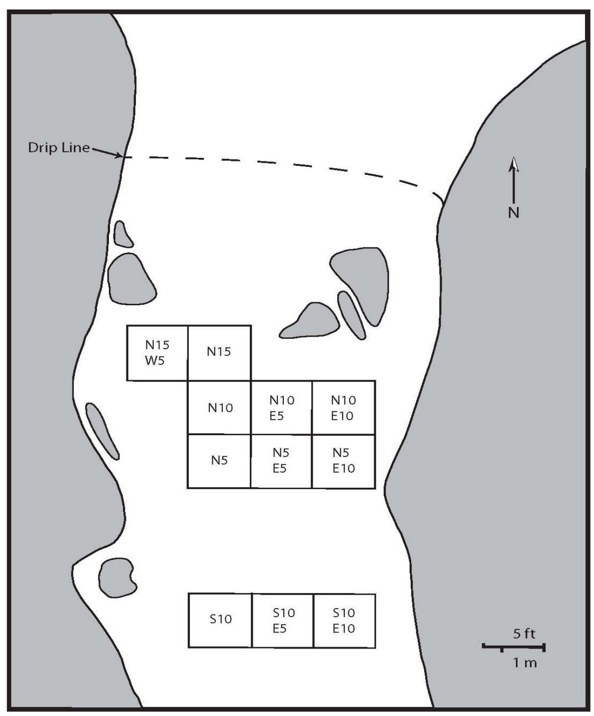

Figure 5.4. Floor layout of Ojo de Agua cave (Tmc 274), showing locations of delineated excavation units (redrawn from MacNeish 1954c).

sequentially assigned field catalog numbers (Romero's: 1-323; Valenzuela's: 1-152; Ojo de Agua: 1-119) using a two part numerical system. A numerator indicated the archaeological site from which the specimen came, and the denominator specified the context (square, level, feature). These numbers and their corresponding contexts are listed in the original field catalogs, which I obtained from the R.S. Peabody Museum of Anthropology, in Andover, MA (Kelley 1954c; MacNeish 1954d, 1954c). To illustrate from a random example, catalog number 247/29 indicates that the specimen came from Romero's cave (site number Tmc 247), Square S30W5, Level 1, Occupation 16 (context 29). As catalog numbers were in most cases written directly upon the specimen in India ink or otherwise kept in association with the specimens, their numerical designations are readily observable in the curated museum collections to this day. This system proved very useful for reconstructing the excavational contexts of items in the curated assemblages by comparing their labels with the original field catalogs.

Development of the Cultural and Subsistence Sequence

MacNeish and his crew detected 17 occupations among 21 strata in Romero's cave, another 8 occupations among 10 strata in Valenzuela's cave, and 12 occupations among 13 strata in Ojo de Agua cave (Kelley 1954a; MacNeish 1954b, 1954c; Smith 1997b). By perceived changes in the frequencies of different artifact "types" throughout the strata, MacNeish formulated a series of cultural "phases" for the Sierra Madre region (Table 5.1): "I have assumed that a phase represents the preserved material remains of a single group of people at what, for heuristic purposes, is considered a moment in time (or, more realistically, a limited span of time within which neither very many nor very significant changes can be discerned)" (MacNeish 1958:9). A separate yet related sequence was devised from similar methods employed in the Sierra de Tamaulipas investigations (Table 5.1).

Table 5.1. Cultural Sequences of Southern Tamaulipas.

Sierra Madre Chronology		Sierra de Tamaulipas Chronology		Tampico-Pánuco (Huastec) Chronology	
Cultural Phase	Age range (in calibrated years B.P.) [a]	Cultural Phase	Approx. age range B.P. (insecurely dated) [b]	Cultural Phase	Approx. age range B.P. (insecurely dated) [c]
San Antonio	500 – 200	**Los Angeles**	750-200	**Period VI**	700-430
San Lorenzo	1100 – 500			**Period V**	950-700
		La Salta	1450-950	**Period IV**	1250-950
				Period III	1750-1250
Palmillas	1900 - 1100	**Eslabones**	1750-1450		
				Period II	1850-1750
La Florida	2400 - 2000	**Laguna**	2600-1750	**Period I**	2450-1850
				Aguilar	2850-2450
				Ponce	3150-2850
Mesa de Guaje	3600 – 3000			**Pavón**	3450-3150
Guerra	4400 - 3600	**Almagre**	3950 - 3450		
Flacco	5200 - 4400				
		La Perra	4950 - 3950		
Ocampo	6000 - 5200				
		Nogales	6950 - 4950		
Infiernillo	9000 - 7600				
		Lerma	9950 - 8950		
		Diablo	13,950 - 11,950		

REFERENCES: [a] MacNeish 2001; [b] Ramírez Castilla 2007:118-123; [c] Ramírez Castilla 2007:188-196.

Food remains also contributed to the differentiation between phases. The vegetal contents of floor debris and ancient fecal matter provided insights into shifts in subsistence patterns throughout the sequence. These materials were examined by Hugh Cutler and Thomas Whitaker (gourds and squash), Walton Galinat and Paul Mangelsdorf (maize and its relatives), and Lawrence Kaplan (beans). E.O. Callen examined the abundant paleofeces recovered from the caves. These studies resulted in a number of landmark specialized reports (Callen 1968, 1970; Kaplan and MacNeish 1960; Mangelsdorf et al. 1956, 1967; Whitaker et al. 1957); these and other publications will be further discussed in the next chapter.

In an early document published shortly after the actual excavations, MacNeish (1957:28) indicated that Robert Dressler, then of the Gray Herbarium, was undertaking the analysis of the macroremains of wild plants; however, Dr. Dressler communicated to me in 2010 that due to some confusion at the time he never took part in the Ocampo project. It is most likely that C. Earle Smith, who identified the plants from the 1949 excavations, actually performed the analysis of the Ocampo wild plant remains, but of this I am not certain (he also likely identified the remains of supposedly cultivated tobacco and cotton). Finally, the abundant textile and cordage artifacts were examined by Irmgard Johnson (MacNeish 1998). In an unpublished manuscript (that was to be submitted to the American Philosophical Society for publication as a Bulletin) in preparation at the time of his death, MacNeish (1998) colorfully recounts Mangelsdorf advising him on to whom to submit the various classes of plant materials from the Ocampo caves, indicating that the amaranth should be sent to Jonathan D. Sauer, but it seems this never took place. As will be made clear in Chapter Six, the only place Ocampo amaranth remains are formally reported is in Callen's (1968, 1970) paleofecal analysis. The wild plant and textile analyses were never formally published, although the findings are often summarized in synthetic accounts.

Reconstructing Subsistence in the Tamaulipas Caves

In multiple articles MacNeish recounts shifts in the relative proportions of different food classes throughout his sequence, but the specific means by which he reconstructed these shifts in the Ocampo caves are not given in detail. However, it can be safely assumed that these methods were similar to those he used for the Sierra de Tamaulipas cave sites:

> All that our data allow us to do is to calculate the bulk or volume of food that the ancient inhabitants brought into the caves. It is assumed that these remains… reflect the relative volumes of types of food consumed and exploited. These foods may be separated into those obtained by hunting, by gathering, and by agriculture. From one horizon to another the proportions of each of these three major categories of foodstuffs change. It seems reasonable to conclude that these changes reflect shifts in subsistence activities (MacNeish 1958:140-144).

His chosen unit of measure was the liter. Once the animal and plant remains had been taxonomically identified and quantified, he calculated the volumes of individual food types present in each occupation phase in terms of liters, then compared the proportions of hunted, gathered, and cultivated foods relative to one another. Although MacNeish (1958:140) acknowledged that relative proportions do not necessarily directly translate to relative importance of competing foodstuffs in the food quest, the resulting figures were taken to reflect very general trends in subsistence change over time. Important additional insights were provided by analysis of paleofeces found in the Ocampo cave deposits (Callen 1965, 1967b, 1968, 1970), although "only about half of the Tamaulipas [fecal] material has actually been processed to date" (Callen 1965:337).

Dating the Past in Southern Tamaulipas

The cultural chronologies of the Sierra de Tamaulipas and Ocampo regions are compared in Table 5.1. MacNeish had to rely on direct as well as indirect dating methods in the Sierra de Tamaulipas (MacNeish 1958:193-194): radiocarbon dates from Layers 1 and 3 of site Tmc 174 and another from Floor X of Tmc 81 constitute the only direct dates from these phases (Crane and Griffin 1958:1103; MacNeish 1958:194). MacNeish argues that artifacts and rock art of the most recent prehistoric occupation (the Los Angeles phase) could be directly associated with the Pasitas, a local historic indigenous group. The Pasitas were exterminated by a neighboring group, the Jaumave, in 1780; therefore this date is a relatively reliable estimate for the end of the Los Angeles phase (MacNeish 1958:193-194). Other phases were indirectly dated based on soil and geomorphological anaylyses, zooarchaeological data, and the presence of ceramic types that were also found in more securely-dated contexts, particularly in the Ocampo caves. MacNeish (1958:9) himself accepted that these methods were "… not so exact, but they allowed a good estimate of the relative age of my phases."

Fortunately the Ocampo cave excavations produced ample organic material suitable for radiocarbon dating, so the local sequence there is more securely dated than in the Sierra de Tamaulipas (while still problematic). MacNeish (2001:102-103) reports 36 radiocarbon dates taken from specimens found within the Ocampo caves. Fifteen of these are AMS dates obtained from Smith's (1997b) recent study of maize, squash and gourd from Romero's and Valenzuela's caves, while those remaining are conventional radiocarbon dates taken in the 1950s: 10 on charcoal by the University of Michigan, 10 on legume remains by the University of Arizona, and one on corn by the University of Chicago. While nine of these dates appear "unacceptable" to MacNeish, he felt that the remaining 27 provided a "good solid chronology" for his phases.

This report was a reaction to challenges against his early maize dates from Coxcatlán and San Marcos caves in the Tehuacán Valley during an NSF-funded project by the University of Arizona, who had also previously dated the Ocampo legume remains (Fritz 1994a, 1995; Long et al. 1989; Long and Fritz 2001). MacNeish used the

Ocampo caves as three examples of sites that had "good chronology" but had deviant, "unacceptable" dates, most of which were provided by the Arizona radiocarbon lab. The impression is that MacNeish was attempting to cast doubt on the credibility of his challengers. He initially asserted that the recently-tested Tehuacán maize remains had been contaminated by a preservative called bedacryl, leading to inaccurate AMS dates (MacNeish 2001; MacNeish and Eubanks 2000); I feel that Long and Fritz (2001) effectively argued that this was not the case. Regardless, MacNeish himself notes that the bedacryl argument would not have held for the Ocampo remains: "Obviously, the legumes from Tamaulipas were not contaminated by bedacryl, which was not then in use [in the 1950s]" (MacNeish 2001:103). Rather, he falls back on another source for the "unacceptable dates" from Tehuacán, Ocampo, and other sites, one bordering on an accusation of incompetence: "… the extraction of the specimens for dating was done in such a manner by the Arizona radiocarbon laboratory that they became contaminated" (MacNeish 2001:104). The logic of this argument is unclear, as Long and Fritz (2001:88) point out that "MacNeish himself was asked to select the 12 Tehuacán cobs to be dated" by the very study that produced the "unacceptable" assays.

I believe another explanation is more likely. It is both interesting and vindicating that 27 out of 36 radiocarbon dates from the Ocampo caves "… fall in a neat, chronological order that confirms the trends of artifacts and ecofact types that compose the well-documented sequence of phases" (MacNeish 2001:103). However, this statement is based on the assumption that the stratigraphy within a cave site should be "neat." The La Perra technique used in the Ocampo caves was designed to allow "… control of the stratigraphic context so any intrusion may be detected in the units being excavated and in their vertical profiles" (MacNeish 2001:99). However, cave deposits are notoriously complex, due to fine, easily shifted sediments and the frequent use of caves by excavating animals such as rodents and subsequent human visitors. Rodents often prefer sheltered sites to make their homes, digging burrows and disturbing archaeological sediments so that small items are relocated from their original contexts. Also, in prehistory later human visitors excavated burials, storage pits, and earth ovens in cave sites, displacing the remains left by earlier inhabitants. Of course, there are always the disruptive activities of looters that are of great concern.

I do not doubt the skill and meticulousness of MacNeish and his colleagues, but I also agree with Flannery (1973:272) when he states: "… while an archaeologist looks the other way for one minute, a pack rat can bury an intrusive bean 50 cm deeper in his favorite dry cave." Regardless of the excavators' expertise, some nonconforming dates are to be expected, hence the necessity for direct AMS dating of particular items of interest.

Addressing the Ocampo Cultigen Sequence with Modern Analytical Methods

Although MacNeish (2001) cites Smith's (1997b) AMS applications as support for the integrity of his chronology, this study and that of Kaplan and Lynch (1999) resulted in notable revisions (Table 1.2). Smith (1997b:375-377) spends several pages reconciling the results of his AMS study of the Ocampo cucurbit and maize materials against the findings of the original analyses (Mangelsdorf et al. 1967; Whitaker et al. 1957). He acknowledges that there is close agreement between his earliest AMS dates on maize (4405 cal. B.P.) and the indirect assignment of this taxon to the Flacco phase (approximately 5200-4400 b.p.). There is similar congruency between the original assessments for butternut squash and those of Smith's later AMS study. An AMS date (presented in Table 1.2) reflects that this species definitely arrived in Ocampo by 2750 cal. B.P., during the Mesa de Guaje phase. However, the original analysts also report a peduncle which "probably" represents this taxon in the earlier Guerra culture (Whitaker et al. 1957:357). Smith did not identify any butternut squash peduncles from Guerra phase contexts in the museum collections during his study, so the insecurely identified specimen aside, both Smith and the earlier authors agree that butternut squash was *definitely* in the region by the Mesa de Guaje phase, if not earlier.

Of the remaining cucurbit taxa there are discrepancies between Smith's results and those of the earlier authors. He states that the 3,200 year difference between his Flacco phase AMS date on cushaw squash and the earlier judgment that this species did not arrive until much later Palmillas times rests on a "…difference of opinion regarding the taxonomic assignment of a single peduncle" (Smith 1997b:375). While he did not dispute the identification of the original Palmillas specimen, Smith examined an additional butternut squash peduncle not originally identified as such that produced a direct AMS date of 5035 cal. B.P., placing the earliest known occurrence squarely in the Flacco phase.

In his reexamination of the supposedly Infiernillo and Ocampo phase bottle gourd specimens, Smith (1997b:375) found no Infiernillo specimens and only three bottle gourd rind fragments from Ocampo contexts in the collections, rather than the two from Infiernillo contexts and the 87 from Ocampo layers reported by Whitaker et al. (1957). One rind fragment, supposedly from an Infiernillo context (248/80) within Valenzuela's cave, was found to represent thin-walled *Cucurbita* and not *Lagenaria*; in addition, the actual stratigraphic context of the specimen was highly suspect. Whitaker et al. (1957) attributed seven seeds and one rind fragment representing pepo squash to Infiernillo contexts. However, once again Smith's perusal of the Ocampo collections failed to reveal these actual specimens. He suggested that six pepo seeds found in Occupation 4 (which was occasionally mislabeled Occupation 3 in the field catalog) in Romero's cave *could have* been mistakenly counted among those of Valenzuela's cave. Occupations 3 and 4 of Romero's cave are attributed to the Ocampo phase, while Occupation 3 of Valenzuela's cave is of the Infiernillo phase. It is not beyond the realm of possibility that the Romero's cave pepo specimens were accidentally tabulated as belonging to the Infiernillo phase of Valenzuela's cave, and that the remains from Occupation 4 unintentionally tabulated as belonging to the Infiernillo phase. Two of these six seeds definitely produced Ocampo phase AMS dates, and these were in agreement with early dates on two other seeds from Valenzuela's cave (Smith 1997b:376-377).

These are feasible explanations for the variable results between past analyses and more recent direct-dating efforts, and both MacNeish (2001) and Smith (1997b) interpret the AMS results as attesting to the depositional integrity of the Ocampo caves. However, these suggestions do not rule out the probability that post-depositional disturbance has occurred in the caves. Kaplan and Lynch's (1999) discovery that common bean remains once believed to date to the Ocampo phase actually date much later to Palmillas times (1285 cal. B.P.) lends support to this interpretation: "The strong disagreement between these… dates and their contexts suggests that these samples were intruded from upper levels to lower and older levels" (Kaplan and Lynch 1999:269).

Conclusion

The timing of the arrival of various domesticated plants in Ocampo has been subject to some revisions, and there have been some criticisms of MacNeish's cultural chronology (which will be further discussed in the next chapter). However, most subsequent research in southern Tamaulipas has utilized MacNeish's sequence, and it remains the currently accepted one for the study area. Therefore the remainder of this dissertation will be considered within its framework, though it should be considered preliminary.

In the next chapter I recount what has been said in published literature regarding plant-related subsistence over the cultural sequence in the Ocampo caves based upon the recovery and interpretive methods outlined above. The purpose of this discussion is simply to outline what each of a series of “classic” articles asserts. I critically assess them in comparison to one another, pointing out inconsistencies between them, and attempt to reconcile these discrepancies. I then further explore the literature in light of more recent botanical and archaeological research (including the above-mentioned AMS studies). Later in the dissertation I factor in insights gained through an examination of the archived collections of excavated plant remains (as these were never published in their entirety), field notes and reports from the original expedition, and the results of an archaeological survey recently I performed around the caves.

CHAPTER 6: PAST EVALUATIONS OF PREHISTORIC PLANT UTILIZATION AND DIET IN OCAMPO

In this chapter I review the "classic" literature on prehistoric plant use and food production in the Ocampo caves over time (Callen 1968, 1970; Cutler and Whitaker 1961; Kaplan and MacNeish 1960; MacNeish 1958, 1971, 1992; Mangelsdorf et al. 1967; Mangelsdorf et al. 1964; Whitaker et al. 1957). These published perspectives were based on results of the excavations outlined in the previous chapter. Some are formal reports of individual specialized analyses of the Ocampo cave plant materials (e.g., cucurbits, legumes, maize and its relatives, paleofeces), and these also contain introductory sections with more general lists of other plant resources attributed to different time periods. Other publications synthesize these specific analyses (and presumably unpublished ones) and integrate them with personal observations, interpretations, and speculations made by MacNeish.

Although present-day researchers look to these sources for information on early food production in Ocampo, there are inconsistencies between various sources, and much of the literature is incomplete. Besides a few formal analytical reports, most of the sources are generally synthetic in nature. Although I feel this is in many ways a strength rather than a weakness, much of the literature does not give the level of detail necessary to back up many of the claims made in the synthetic articles. For instance, as mentioned in Chapter Three, the presence of chili peppers in Ocampo is documented in Callen' (1968, 1970) paleofeces analysis, but the evidence presented is not enough to establish that the remains represent domesticated plants, as has been asserted in some synthetic treatments (e.g., MacNeish 1958). Also, other researchers who cite these reviews may not be aware of the inconsistencies or tenuous claims in the primary literature. For example, Dhillon (1992:112) counts amaranth and sunflower among the plants cultivated by populations in southern Tamaulipas, as MacNeish has indicated in several places; however, as yet there is no unequivocal evidence that these plants were not actually wild. As a starting point, it is therefore necessary to point out where confusion currently lies in order to clarify plant procurement and food production in Ocampo so that readers do not accept any one publication's claims uncritically.

Ten major works published between 1957 and 1992 are the primary sources used here. The discussion is organized according to MacNeish's cultural phases; under the heading of each phase are descriptions of what each major publication states regarding plant-related subsistence in the caves during that phase. The literary sources are presented chronologically by date of publication to reflect possible changes in perception over time. By separately treating individual publications within the cultural divisions, consistencies and discrepancies between them are made apparent. If a particular source is not mentioned under the heading of a particular time period, it simply did not refer to that cultural phase.

- Whitaker et al. (1957): One of several "specialist reports" of the Ocampo vegetal remains; it contains descriptions of the cucurbit materials recovered from the cave deposits, including numbers of specimens (rind fragments, seeds, peduncles) identified per time period. The introduction also includes brief summaries of more general subsistence practices per phase.
- MacNeish (1958): A landmark monograph reporting the results of the Sierra de Tamaulipas survey and excavations. Within the regional "Comparisons" section (pp. 165-193), MacNeish describes cultural developments and shifts in subsistence in the Ocampo region.
- Kaplan and MacNeish (1960): Presents the results of Lawrence Kaplan's analysis of the prehistoric legume remains from the Ocampo caves, including

numbers of specimens (primarily pod valves) found per time period. The introductory sections also include more general discussions of subsistence throughout the sequence.

- Cutler and Whitaker (1961): An overview article concerning the chronology and distribution of cultivated cucurbits in the New World, including the sequence in the Ocampo caves; much of it reiterates information found in Whitaker et al. (1957).
- Mangelsdorf et al. (1964): A landmark synthetic article describing the early history of key Mesoamerican crop plants as it was understood in the early 1960s. At that time, most knowledge of early agriculture in Mexico had been interpreted from the Ocampo cave discoveries.
- Mangelsdorf et al. (1967): A major report that emerged from Mangelsdorf and Galinat's analysis of the Ocampo maize and its relatives. The analysis reported in this article encompassed 12,014 stalk fragments, leaves, husks, cobs and cob fragments, quids, tassels, and tassel branches representing maize, gama grass, and teosinte. All but one of the specimens came from Romero's cave; a single early cob is from Valenzuela's cave (the remaining Valenzuela's cave specimens remain unanalyzed and are curated at the Harvard Herbarium). The report includes specimen counts of maize parts (cobs, stalks, leaves, husks, tassels, quids), once again tabulated by cultural phase. The cobs are classified under a series of various types or "races" based on morphology, and the terminology employed here is also used in other sources (e.g., Mangelsdorf et al. 1964). Today this taxonomy is largely considered out-dated (Huckell 2006:105), as will be elaborated upon at the conclusion of this chapter.
- Callen (1968): A presentation of the paleofecal evidence for diet in prehistoric Mexican cave sites, including those in the Tehuacán Valley and Ocampo.

This analysis was left incomplete, and the Ocampo materials are only briefly discussed, but a table is included presenting the percent occurrence of bone and seven plant taxa in the paleofeces per cultural phase.

- Callen (1970): Another article presenting Callen's important insights gained from his incomplete analysis of the Ocampo cave paleofeces. It contains a more thorough discussion of the Ocampo materials, and includes the same "Results" table as Callen (1968), as well as brief mention in the text of additional taxa per time period. This chapter is an updated second edition of a piece originally published in 1963 at an earlier stage in the analysis.
- MacNeish (1971): A synthesis of the archaeology of southern Tamaulipas as it was understood by the 1970s. The cultural attributes of both the Ocampo and the Sierra de Tamaulipas regions are combined into a general regional sequence, including changes in subsistence over time.
- MacNeish (1992): An ambitious book in which MacNeish attempts to formulate models for the development of agriculture and sedentism in various parts of the world. Chapter Three concerns Mesoamerica, and the first six phases in the Ocampo sequence are described, including perceptions of subsistence. The time periods following the Mesa de Guaje phase are characterized by entrenched agriculture in settled villages, and are therefore beyond the scope of the book. This is the final publication in which MacNeish synthesizes his Ocampo findings, so it is the latest consulted in this discussion.

The purpose of this chapter is to relay what has been portrayed in these sources regarding plant use in the Ocampo caves, and how this was understood by the early 1990s. Consistencies and discrepancies between these sources will be made apparent in the discussion.

In individual descriptions of different time periods I often employ direct quotes in order to demonstrate unclear wording, but there is yet another source of confusion: nomenclature. There is no standardization between the various sources regarding plant names. Occasionally scientific names are used with either genus and species or genus alone, but often these more formal classifications are interspersed with common names that are inconsistently used and sometimes even misspelled. In Table 6.1, I have standardized the common names of different plants mentioned in the literature (as well as those mentioned in unpublished field notes and found in curated collections, to be discussed in the next chapter); this table includes the various names as they appear in the original publications, as well as plant family, scientific name, and the common name selected for employment throughout the text of this dissertation. For the sake of consistency this latter name is used in the descriptions taken from various sources (except where they are directly quoted). Table 6.2 summarizes the plants that various publications list as having been present and used during each cultural phase.

The Cultural Phases: Archaic, or "Era of Incipient Agriculture"

Infiernillo (8950-6950 B.P.)

The first four phases in the Ocampo scheme represent a characteristic "Archaic" occupation, characterized by a mobile hunter-gatherer lifestyle and broad-spectrum diet, but with some initial use of cultigens, or "incipient agriculture." MacNeish (1992:103) recognized the earliest phase in the sequence, the Infiernillo, within five occupation layers in the caves (Romero: n=1; Valenzuela: n=3; Ojo de Agua: n=1). Four of these indicated brief microband visits, while numerous hearths associated with Occupation 2 of Valenzuela's cave suggested a short-term macroband occupation. MacNeish attributes the Infiernillo phase to his "Class II" type of settlement pattern, which "…is represented by seasonally nomadic (or semisedentary), food-collecting bands who lived in seasonal

Table 6.1. Names of plants attributed to the Ocampo cave occupations.

Plant family	**Scientific name**	**Name used here**	**Name used in references**
Agavaceae	*Agave* sp.	Agave	Agave (G,E,H,I,J,N)
	Yucca sp.	Yucca	Yucca (K,L,M,N)
Amaranthaceae	*Amaranthus* sp.	Amaranth	Amaranth (B,C,I,J), *Amaranthus* (H,N)
	Froelichia sp.	Snake-cotton	Froelichia (K,L,M)
Apocynaceae	*Thevetia* sp.	Thevetia	*Thevetia* sp. (N)
Arecaceae	Unknown	Palm	Palm (K,L,M)
	Brahea berlandieri	Hesper palm	*Brahea* (N)
	Sabal sp.	Sabal palm	Sabal (M)
Asphodelaceae	*Aloe* sp.	Aloe	Aloe (G,J)
Asteraceae	*Aster* sp.	Aster	*Aster* sp. (N)
	Carthamnus sp.	Safflower	*Carthamnus* sp. (G,H)
	Helianthus annuus, H. annuus var. *lenticularis*	Sunflower	Sunflower (C,I,J)
	Tithonia sp.	Tithonia	*Tithonia* sp. (N)
	Verbesina sp.	Verbesina	*Verbesina* sp. (N)
Bombacaceae	*Ceiba pentandra*	Ceiba	*Ceiba pentandra* (N)
Bromeliaceae	*Bromelia* sp.	Bromelia	*Bromelia* (K,L,M,N)
	Bromelia penguin, Hechtia glomerata	Guapilla	Huapilla (K,L,M), Hechtia (K,L,M,N)
	Tillandsia usneoides	Spanish moss	Spanish moss (G,H)
	Tillandsia sp.	Fleshy bromeliad	Fleshy bromeliad (G,H,N)
Cactaceae	*Echinocactus* sp.	Echinocactus	*Echinocactus* sp. (N)
	Opuntia sp.	Prickly pear	*Opuntia* (C,E,G,H,J)

Table 6.1, continued.

Plant family	Scientific name	Name used here	Name used in references
	Unknown	non-Opuntia, unspecified cactus	non-Opuntia (G,H)
Chenopodiaceae	*Chenopodium* sp.	Goosefoot	Chenopodium (N)
Cucurbitaceae	*Cucurbita* sp.	Unknown / wild squash	*Cucurbita* (A,B,G)
	C. argyrosperma	Cushaw squash	*C. mixta* (A), Walnut squash (C,E)
	C. foetidissima, Cucurbita sp.	Buffalo gourd, wild squash	*C. foetidissima* (A,D,E), Wild squash, Wild pumpkin
	C. moschata	Butternut squash	*C. moschata* (A,B,D), Warty squash (C,I,J), Squash (C), Cushaw (E)
	Cucurbita pepo ssp. *pepo*	Pepo squash	C. pepo (A,B,C,D,G,H), Pumpkin (B,C,E,I,J) , Summer squash (E)
	Lagenaria siceraria ssp. *siceraria*	Bottle gourd	Bottle gourd (A,B,C,E,H,I), Gourd (B,C,I,J), *Lagenaria* (A,D,N, L). *siceraria* (A,C,N)
Euphorbiaceae	*Manihot dulcis*	Manioc	Manihot (B,I), Manioc (E), Cassava
Fabaceae	*Acacia* sp.	Acacia	*Acacia* sp. (N)
	Caesalpinia sp.	Caesalpinia	*Caesalpina* [sic.] (K,L,M)
	Canavalia / Phaseolus	Bean	Bean (A,G,H)
	Canavalia sp.	Jack bean	Jack bean (A,D,G)
	Enterolobium sp.	Enterolobium	*Enterolobium* sp. (N)
	Erythrina sp.	Coral bean	*Erythrina* sp. (N)
	Indigofera sp.	Indigo	Indigo (I)
	Inga sp.	Inga	*Inga* sp. (N)

Table 6.1, continued.

Plant family	Scientific name	Name used here	Name used in references
	Leucaena edulis	Guaje	*Leucaena edulis* (N)
	Lonchocarpus sp.	Lonchocarpus	*Lenchocarpio* [sic.] (K,L,M)
	Phaseolus coccineus	Runner bean	Runner bean (B,C,E,H,I,J,K)
	Phaseolus lunatus	Lima bean	Lima bean (A,B,C,D,E,I)
	Phaseolus vulgaris	Common bean	Common bean (A,B,C,D,E,G,H,I,J), *Phaseolus vulgaris* (C), Kidney bean (K)
	Pithecellobium flexicaule, Pithecellobium sp.	Texas ebony	*Pithecellobium flex*. M, *Pithecellobium pueb* M, *Pithecellobium* (M)
	Prosopis sp.	Mesquite	Mesquite (G)
	Quercus sp.	Acorn (oak)	Acorn (J)
Juglandaceae	*Juglans* sp.	Walnut	*Juglans* sp. (N)
Malvaceae	*Gossypium hirsutum*	Cotton	Cotton (A,B,C,D,E,I,J,N)
Pinaceae	*Pinus* sp.	Pine	*Pinus* sp. (N)
	Pinus cembroides Zucc.	Mexican pinyon	*Pinus cembroides* Zucc. (N)
Poaceae	*Arundo sp.*	Carrizo	*Arundo* sp. (N)
	Panicum sonorum	Panic grass	*Panicum sonorum* E,I, *Panicum* (B,C,I)
	Setaria sp., *S. geniculata*	Foxtail millet	*Setaria* G,H,J, Seteria [sic] (I)
	Tripsacum sp.	Tripsacum	Tripsicum [sic] (I,J)
	Zea mays ssp. ?	Teosinte	Teosinte (C), Río Balsas teosinte (J), Teocentli (A,B), Teosenti (I)
	Zea mays ssp. *mays*	Maize	Corn (A,B,C,D,I,J), Maize (E,F,G)

Table 6.1, continued.

Plant family	Scientific name	Name used here	Name used in references
Polypodiaceae	*Adiantum* sp.	Maidenhair fern	*Adiantum* sp. (N)
Polyporaceae	Unspecified	Fungus	Polyporaceae (N)
Portulacaeae	*Portulaca* sp.	Portulaca	*Portulaca* sp. (N)
Ruscaceae	*Dasylirion* sp.	Sotol	*Dasylirion* sp. (N)
Rutaceae	*Esenbeckia berlandieri*	Jopoy	*Esenbeckia berlandieri* (N)
Solanaeceae	*Capsicum annuum, C. frutescens*	Chili pepper	*Capsicum* (G,H,I,J) , Chili pepper (C,E,I), Chili (C), Chile (J), Pepper (B,C,E,I,J)
	Datura sp.	Jimson weed	*Datura* sp. (N)
	Nicotiana rustica	Tobacco	Tobacco (A,B,C,I), Nicotiana (C)
Sterculiaceae	*Guazuma ulmifolia*	Aquiche	*Guazuma ulmifolia* (N)
Zamiaceae	*Dioon edule*	Chestnut dioon	*Dioon edule* (K,L,M)

References:
Publication: A: Whitaker et al. 1957; B: MacNeish 1958; C: Kaplan and MacNeish 1960; D: Cutler and Whitaker 1961; E: Mangelsdorf et al 1964; F: Mangelsdorf et al. 1967; G: Callen 1968; H: Callen 1970; I: MacNeish 1971; J: MacNeish 1992.
Unpublished field notes: K: MacNeish 1954b, L: 1954c; M: Kelley 1954a.
N: Curated collections.

Table 6.2. Plants attributed to the Ocampo caves in publication, by cultural phase.

Taxon:	**San Antonio (500-200 B.P.)**	**San Lorenzo (1100-500 B.P.)**	**Palmillas (1900-1100 B.P.)**	**La Florida (2400-2000 B.P.**	**Mesa de Guaje (3600-3000 B.P.)**	**Guerra (4400-3600 B.P.)**	**Flacco (5200-4400 B.P.)**	**Ocampo (6000-5200 B.P.)**	**Infiernillo (9000-7600 B.P)**	**Comments:**
Agavaceae										
***Agave* sp.**	W	W			W	W	W	W	W	
***Yucca* sp.**							W			
Amaranthaceae										
***Amaranthus* sp.**		W	W		W	W	W			
Asphodelaceae										
***Aloe* sp.**					W*	W*	W*			* African genus, identification questionable.
Asteraceae										
***Carthamnus* sp.**								W		
Helianthus annuus			U		U	U	U			Claims for cultivation unsubstantiated, identification challenged.
Cactaceae										
***Opuntia* sp.**	W	W			W	W	W	W	W	
Cucurbitaceae										
***Cucurbita* sp.**					U					
C. argyrosperma		D	D							
***C. foetidissima*, *Cucurbita* sp.**	W	W	W		W	W	W	W	W	
C. moschata	D	D	D		D	D*				* Early presence questionable.
C. pepo* ssp. *pepo	D	D	D,U	D	D	D	D	D	D,W	
Lagenaria siceraria	D	D	D	D	D	D	D	D	D	
Euphorbiaceae										
Manihot dulcis		W	W							
Fabaceae										
***Canavalia* sp.**	W				W*			W		* Not identified in formal analysis.
***Canavalia sp* . / *Phaseolus* sp.**					U					
***Indigofera* sp.**	U*									* Only mentioned once, no other evidence discussed.
Phaseolus coccineus		W	W				D	W	W	
P. lunatus		W	W		W*					* Not identified in formal analysis.
P. vulgaris	D	D	D	D	D	D		D		
***Prosopis* sp.**					W					
Fagaceae										
***Quercus* sp.**							W	W		
Malvaceae										
Gossypium hirsutum	D		D	D	D	D				
Poaceae										
Panicum sonorum			U*			U*	U*	W*		* Reclassified as *Setaria parviflora?*
Setaria parviflora					U	U	U	U	U*	* Presence in Infiernillo phase conflicts with other sources (Callen 1967a:287, 1967b:535, 1968:642); also, claims for cultivation unsubstantiated.
***Tripsacum* sp.**		W	W			W	W	W*		* Not formally reported.
***Zea mays* ssp. ? (teosinte)**			W		W*	W				* Classified as a cultigen, but not likely.
Zea mays* ssp. *mays	D	D	D	D	D	D	D	D*		* Supposedly observed in paleofeces, but not reported by Callen.
Solanaceae										
Capsicum annuum/C. frutescens	U	U	U	U	U	U	U	U	U	Claims for cultivation unsubstantiated.
Nicotiana rustica	D	D	D							

W = Wild, D = Domesticated, U = Undetermined status.

camps of from ten to sixty people and had a simple material culture" (MacNeish 1956:144).

Whitaker et al. (1957). In the introductory section of this article the authors state that "A few pods of jack beans (probably wild) and squash 'rinds' and seeds…" were found in the latest Infiernillo levels (p. 352). Specifically the authors attribute two bottle gourd rind fragments and one rind and seven seeds of pepo squash to Infiernillo contexts. The authors acknowledge that the pepo squash peduncles and seeds from these early layers are relatively small as compared to present-day varieties, and suggest that the fruits may have been gathered while still green (p. 357). However, B. Smith (1997b) has established that both domesticated pepo squash and bottle gourd were actually not present in Ocampo at this early date, but rather appeared in the subsequent Ocampo phase.

Also among the remains were six seeds representing a wild squash. The authors suggest that *Cucurbita foetidissima* (buffalo gourd) is a likely candidate for these as well as wild seeds and rind fragments of later periods, but point out that the true taxonomic identity is uncertain:

> The wild *Cucurbita* species are difficult to distinguish from seeds and rinds alone. Positive identification requires specimens which include leaves and flowers…. Since *Cucurbita foetidissima* is the most widespread and the most variable of all the wild species, and as it grows in the vicinity of Ocampo… we have given this name to the material from the caves even though it possibly comes from other wild species of this group (Whitaker et al. 1957:356-357).

Later authors continued to implicate buffalo gourd use during Infiernillo times in spite of the insecure identification (MacNeish 1992:104); however, as the authors' reasoning cited above has merit, this identification will be used in the present document, with the understanding that this classification is tentative and any reference to *C. foetidissima* or buffalo gourd may actually indicate a similar wild species. As opposed to the domesticated cucurbit species found in the caves, buffalo gourd/wild squash remains consist entirely of seeds and rind fragments; no peduncles were recovered. Whitaker et al. suggest that this was due to the practice of gathering the fruits at maturity, when the peduncle separates easily from the fruit body and therefore was not transported back to the caves (p. 356).

MacNeish (1958). In this source MacNeish (p.167) simply states that Infiernillo peoples "… were basically nomadic food-gatherers who did considerable hunting." However, "… even at this stage, small amounts of their food, such as gourds (*Lagenaria*), domesticated squash (*Cucurbita pepo*), peppers and *small runner beans (perhaps wild), were domesticated*" (emphasis added). The latter, contradictory statement about runner beans is ambiguous: were they actually wild or were they domesticated? This source is consistent with Whitaker et al. (1957) in accepting the presence of domesticated bottle gourd and pepo squash as early as Infiernillo times, and that these cultigens served only to supplement wild hunted and gathered foods.

Kaplan and MacNeish (1960). In the introductory sections of this report on the Ocampo legume materials, Kaplan and MacNeish (p.35) summarize Infiernillo subsistence somewhat similar to MacNeish (1958), claiming that local nomadic family bands were essentially plant collectors and sometimes hunted, but had access to domesticated bottle gourd and the pepo squash. Several more species, which "could have been domesticated" but were collected included runner beans, prickly pear, and chili peppers. The latter two were formally reported in Callen (1968), discussed below. These supplemented a wide variety of wild plants not mentioned.

In the text and tables the only legume remains reported from Infiernillo contexts are 14 pod fragments representing runner beans (p. 44). The initial inclusion of this taxon among the Ocampo cave remains of any time period came as a surprise to Kaplan and MacNeish (p. 49), due to "…the failure of this species to persist into historic times in this region." However, as mentioned in Chapter Three, a wild variety of this species is now known to be present in the mountains of southern Tamaulipas (Hernández Sandoval et al. 1991). The authors note several factors that challenge the domesticated status of these remains, such as "… the extreme age of the remains and their occurrence long before the practices of ceramic cooking and agriculture, and by the apparent lack of selection for pod characteristics found in modern cultivated varieties" (p. 50).

Cutler and Whitaker (1961). In agreement with Whitaker et al. (1957), these authors claim the presence of bottle gourd (rinds) and pepo squash (seeds) in the Ocampo caves by Infiernillo times. However, they acknowledge that the cultivated status of pepo squash at this early date is open to question, and that the small seeds "… may have come from weeds, or camp-follower plants, instead of true cultivated plants" (p. 477). They also note that wild *Cucurbita* (possibly buffalo gourd) is also present in Infiernillo contexts.

Mangelsdorf et al. (1964). Once again, the Infiernillo phase here probably represents the introduction of domesticated plants in southwestern Tamaulipas. Pepo squash is considered the "best case for a cultivated plant at this early time" (p. 430). The authors note that this species was apparently first utilized in the Ocampo caves for its edible seeds. While a number of smaller seeds were likely from wild plants, a few larger, possibly cultivated specimens were also identified. At the time of this writing, these Ocampo remains represented the earliest "domesticated" pepo squash documented anywhere. On the other hand, bottle gourd and chili peppers are described as “possibly wild or possibly domesticates” (p. 430). A number of wild plants apparently provided the bulk of the Infiernillo diet, but agave, prickly pear, runner beans, and buffalo gourd are the only ones mentioned.

Callen (1968). Here Callen reports that he identified agave leaf tissue in 40 percent, prickly pear in 65 percent, and bean in 60 percent of the Infiernillo phase paleofecal specimens. He found chili pepper seeds and fruit tissue in 60 percent of the feces of this phase, but makes no speculation as to whether they were domesticated or wild, and the level of detail in the data he provides gives the reader no clue to this. Callen does not mention the presence of chili pepper in the non-fecal detritus, though he notes that prickly pear also occurred in the non-feces floor refuse of this phase, alongside bottle gourd, pepo squash, and runner beans (p. 642).

Callen (1970). The Infiernillo data Callen reports here (p. 237) are consistent with those presented in Callen (1968).

MacNeish (1971). In this synthetic article MacNeish (p. 575) estimated that the Infiernillo diet focused more on plant foods than on animal protein (collecting: 50 to 70 percent; hunting: 45 to 25 percent), based on the contents of paleofeces and floral and faunal remains found among living floor debris; an additional less than five percent supposedly came from “… incipient agriculture of pumpkins, peppers, and, in the latter stage, gourds.” He goes on to note that agave, runner beans, and prickly pear were collected (though potentially capable of being domesticated) alongside “… other wild plant remains” that are not specified (p. 575).

MacNeish (1992). In his ambitious assessment of early agriculture in Mesoamerica, MacNeish estimated a diet of roughly equal parts animal and plant resources in Ocampo during Infiernillo times, and wrote that "storage pits full of wild plant remains" were found in later Infiernillo levels (pp. 103-104). Wild plants apparently included runner beans, wild pepo squash (based on small seeds), agave, and prickly pear. Although MacNeish (p. 104) here claims that "a few" seeds of foxtail millet were also present in levels attributed to the Infiernillo phase, Callen (1967a:287, 1967b:535, 1968:642) directly points out more than once that this taxon was found only in paleofeces and not in the floor debris, and that its earliest appearance in the feces is during the subsequent Ocampo phase (6000-5200 b.p.). Regarding cultigens, MacNeish states: "One pumpkin seed in the latest Infiernillo level is larger and may be from cultivated and/or domesticated pumpkin, while two gourd rinds and pepper seeds were *definitely* from domesticated and/or cultivated plants…" (p. 104, emphasis added).

Summary of the Infiernillo Phase. To sum up, stratigraphy and conventional radiocarbon dates led early researchers to conclude that "incipient cultivation" began during the Infiernillo phase with the first use of domesticated bottle gourd, pepo squash, and chili peppers. Some sources state this with conviction (e.g., MacNeish 1958), while others are more hesitant regarding individual species, and there is some lack of consistency among them. Smaller specimens among the Infiernillo pepo squash seeds were interpreted to possibly represent "weeds or camp-followers" (Cutler and Whitaker 1961), although some larger specimens were taken to indicate cultivation. Recent AMS analysis has shown that both bottle gourd and pepo squash do not appear until the later Ocampo phase.

Chili peppers are described by at least one source (Kaplan and MacNeish 1960:35) as collected from the wild (though *capable* of being domesticated), while others refer to this plant as a true cultigen. Mangelsdorf et al. (1964:430) describe both bottle gourd and chili peppers as "possibly wild or possibly domesticated," but MacNeish (1992:103) refers to these same species as "definitely domesticated." The only place chili peppers are formally reported are in Callen's (1968, 1970) paleofecal analysis, but does not speculate on their domesticated status. Claims that chili peppers were farmed in Ocampo are open to debate.

Cultivated plants were believed to have supplementary roles in a diet dominated by wild plant species, with a smaller proportion of nutrients provided by hunting. Agave, prickly pear, wild runner beans, and wild squash (probably buffalo gourd) are among the plants collected; at least one source (MacNeish 1992:104) includes foxtail millet among these, but others directly state that it was absent until the subsequent phase (Callen 1967a:287, 1967b:535, 1968:642). Several sources cite the use of "a wide assortment" (Kaplan and MacNeish 1960:35) or "other" (MacNeish 1971:575) wild plants that are not specified.

Ocampo (5950-4250 B.P.)

In very early years following the excavations this time period was known as the Portales phase (MacNeish 1956), the name was changed to "Ocampo" in later publications. Six excavated occupation layers in Romero's and Valenzuela's caves as well as surface assemblages of several unexcavated cave and open-air sites were classified as dating to the Ocampo phase (MacNeish 1992:104). Most of these appeared to be short-term microband habitations, but some "were large enough and had enough hearths to be macroband seasonal camps" (MacNeish 1992:104). The majority of the excavated floors appear to represent short-term occupations in the spring or summer, but one of the macroband occupations in Romero's cave may have lasted from spring into the fall. MacNeish (1956:144) includes this phase in his Class III settlement pattern type, characterized as "… semisedentary, incipient agricultural bands who lived in camps or caves and who had a simple material culture characterized by large (dart) points, mullers [crude ground stone implements for crushing plant foods], large amounts of chopping or pounding tools, nets, baskets, and twined blankets." Other characteristic artifacts of the Ocampo phase include Abasolo, Almagre, Tortugas, and Nogales projectile points; chipped stone discs; choppers; gouges; large end scrapers; thick and thin side scrapers; mortars; grinding stones; atlatls; shell beads; and woven baskets and mats (MacNeish 1958:168, 1971:577, 1992:104).

Whitaker et al. (1957). The authors of this report classify the Ocampo phase inhabitants as basically wild plant collectors, but "… remains of pods of jack beans, common beans, and quite a bit of squash suggest some planting" (p. 352). More recent AMS studies show that the common bean did not arrive until much later (Kaplan and Lynch 1999). Specifically regarding cucurbits, the authors report 87 rind fragments from bottle gourd in levels attributed to the Ocampo phase, 19 rind fragments and three seeds from buffalo gourd, and 15 rind fragments and 13 seeds from pepo squash (p. 356).

MacNeish (1958). Here MacNeish also classifies the Ocampo phase peoples as basically plant collectors who supplemented this with very few foods obtained by hunting (p. 167). However, these people apparently also "cultivated" bottle gourds, pepo squash, common beans, chili peppers, and small runner beans. MacNeish also points out that the La Perra phase peoples in the Sierra de Tamaulipas to the east (which he considers to be roughly contemporaneous with the late Ocampo phase) had maize at this time (p. 168).

Kaplan and MacNeish (1960). Kaplan and MacNeish refer to Ocampo phase populations as semi-nomadic plant collectors who obtained small proportions of their diet from hunted animals and domesticated plants (p. 35). Wild plants used as food include runner beans (of which Kaplan identified four pod valves) and prickly pear. The plants that composed their “incipient agriculture” included bottle gourds, pepo squash, chili peppers, and two varieties of common beans (six pod valves are reported from these levels – p. 44). Kaplan and MacNeish interpret this seemingly very early appearance of domesticated common bean to possibly support the hypothesis that they were sparingly cultivated during early pre-pottery times, followed by an expansion of their use with the widespread use of ceramic vessels which facilitated their preparation for consumption through boiling (p. 53).

The authors suggest the possibility that maize also first appears during this phase due to the presence of minute particles of cobs and leaves in relevant paleofeces (p. 35), although larger, more securely identified, remains were not located in the floor refuse. They suggest that if the fragments in the feces are indeed maize, that small primitive or green ears had been masticated and completely digested, preventing the preservation of cobs or kernels in the occupation detritus. However, Callen (1968, 1970), who actually analyzed the paleofeces, makes no mention of maize particles in Ocampo phase specimens.

Cutler and Whitaker (1961). Although Cutler and Whitaker report in this article that pepo squash was present in the Ocampo cave levels of the Infiernillo phase, they are seemingly reluctant to positively refer to these earliest specimens as representing domesticated plants. However, here the authors acknowledge that this species was certainly cultivated by the Ocampo phase (p. 477). This is the only mention specifically made of the Ocampo phase in this article, although wild *Cucurbita* (likely buffalo gourd) is listed as present throughout the sequence, including Ocampo times. At the time of writing, domesticated Mexican pepo squash was believed to have originated in northern

Mexico because "… a botanical variety (*C. pepo* var. *ovifera*) of pepo is almost identical with a weedy, wild plant (*C. texana* Gray) found in Texas" (p. 477).

Mangelsdorf et al. (1964). Regarding the Ocampo phase these authors report the appearance of yellow and red large common beans, and that they were "indisputable domesticates" and doubtlessly cultivated (p. 430). They also acknowledge that pepo squashes of this period are of a larger seeded variety than those of the preceding phase, and that there is no doubt that they are now cultivated in the Ocampo phase. The authors also report that a new grass, *Panicum sonorum* (panic grass), appeared in the Ocampo sequence at this time (although these remains were later reexamined and identified as foxtail millet [Callen 1963, 1967b, 1968]).

Callen (1968). In this article Callen reports the presence of prickly pear (found in 84 percent of the feces), chili pepper (41 percent), agave 49 percent), and bean (20 percent) in Ocampo phase paleofeces. However, the remains of three new species were identified in feces of the Ocampo phase that were not present during Infiernillo phase feces. The major constituents listed above are now supplemented by pepo squash (seven percent). Foxtail millet grains were found in 32 percent of the fecal specimens, and were later more specifically identified as *S. geniculata* by C.E. Hubbard of Kew Botanical Gardens (this species is now known as *S. parviflora* [Austin 2006]). Some of the foxtail millet grains are described as "definitely much larger," seemingly indicating a conscious selection for larger grains (p. 643). A new plant to appear in the feces was *Carthamnus* (safflower). Callen also notes the appearance of common beans in the cave floor refuse, alongside prickly pear, bottle gourd, squash, and jack bean (p. 642).

Callen (1970). This more recent report of the Ocampo phase paleofeces is consistent with Callen (1968), but contains more detail. The relative percentages of various species in the assemblage are identical to those of the previous report. Prickly pear, chili pepper, agave, and bean are again listed; for the first time pepo squash seeds were identified in Ocampo phase paleofeces directly indicating their use as a food item. Again the consumption of foxtail millet is definitively recognized during the Ocampo phase (p. 237; see also Callen 1967a:287, 1967b:535). Callen indicates that these grains were consumed in quantity; their color suggested that they had been roasted, and many of them had been split or broken. He again reports the presence of safflower seeds in Ocampo paleofeces (p. 237); the seeds of this member of the sunflower family are edible and high in oil content, and the plant is a known source of red dye. Callen does not mention the minute maize particles found in Ocampo phase paleofeces briefly discussed by Kaplan and MacNeish (1960:35). He does however note that the same plants present in the floor debris during the preceding phase (prickly pear, bottle gourd, pepo squash, and runner beans) were also recognized among Ocampo phase floor debris, with the addition of the common bean (p. 237).

MacNeish (1971). In this synthetic treatment MacNeish correlates the Nogales phase of the Sierra de Tamaulipas with the early part of Ocampo and the La Perra phase with late Ocampo, so he discusses early and late Ocampo separately. MacNeish estimates that gathered plants comprised 70 to 80 percent of the subsistence during the early Ocampo phase. He mentions several wild, collected plants of this period that could have been domesticated but were not, including agave, foxtail millet, prickly pear, and runner beans (p. 575). Although the identification of the Ocampo phase panic grass had been revised to that of foxtail millet for almost a decade by the time this article was published, here MacNeish mentions the presence of panic grass in the deposits of the early Ocampo phase. He states at this time five to eight percent of the diet consisted of domesticated plants, including bottle gourds, chili peppers, large and small pepo squash, and yellow seeded common beans (pp. 575-577).

Late Ocampo phase subsistence consisted of about 15 percent from hunting, 70 to 76 percent from gathering, and 10 to 15 percent from cultivation (p. 577). Gathered plants included amaranth, panic grass, prickly pear, runner beans, gama grass, and agave. Late Ocampo phase domesticated plants included bottle gourds, two varieties of pepo squash, chili peppers, and long red and yellow common beans. Though absent in the Ocampo region at this early date, two varieties of maize date to the contemporary La Perra phase in the Sierra de Tamaulipas (p. 577).

MacNeish (1992). Here MacNeish estimates that over 60 percent of the diet during the Ocampo phase came from plant gathering, while dependence on animal protein decreased from 40 to 20 percent (p. 104). Agave, prickly pear, runner beans, wild pepo squash continue to be used and acorns are now reported. The use of domesticated plants increased throughout the phase from five to more than 25 percent. Bottle gourds and chili peppers continued in use, and two varieties of common beans appear. MacNeish states that particles of maize were observed in Ocampo phase paleofeces. Both wild and cultivated plant foods were stored in the caves in numerous pits.

MacNeish cites archaeobotanical evidence for conscious human selection for seed size among some taxa during this phase. Pepo squash seeds at the beginning of Ocampo were apparently relatively equal parts large and small, but by the end of the phase all were large, suggesting intentional selection for larger seeds. MacNeish notes a similar pattern among foxtail millet grains: over time “very large” grains came to dominate over smaller ones, once again suggesting selection and cultivation (p. 104). This is consistent with earlier observations by Callen (1967a, 1967b); however, the status of the Ocampo foxtail millet as an incipient domesticate remains unclear, as discussed Chapter Three.

One source of confusion is in Table 3.4, on page 114 of this book. Here MacNeish counts white sapote (*Casimiroa edulis*) among the cultivated plants in use during the Ocampo phase. Although a non-domesticated white sapote (*C. pringlei*) is a characteristic component of lowland tropical forest ("*selva baja caducifolia*") in the study area and is known to locals for its edible fruits (Hernández Sandoval et al. 1991), MacNeish's table is the only location where this fruit tree crop is listed among the plants used by ancient inhabitants of the Ocampo caves and it is not mentioned at all in the text of that book. A possible explanation for its inclusion is that it is merely a typo in the table. Cultivated plants attributed to the Tehuacán Valley excavations are also presented in this table, and Abejas phase findings are positioned adjacent to the Ocampo phase plants. It is conceivable that the "X" marking the presence of white sapote in Ocampo was misplaced and intended to indicate its occurrence in the Tehuacán Valley and not Tamaulipas. C. E. Smith (1967, Table 26) reports white sapote remains in Abejas phase contexts in Tehuacán, so this explanation is not beyond the realm of possibility. Regardless, I know of no direct evidence for the use of cultivated white sapote in the Ocampo region in prehistory, though this certainly does not rule out the use of locally available wild species.

Summary of the Ocampo Phase. While these sources at least entertain the possibility that incipient agriculture was initiated in the study area during the preceding Infiernillo phase, the authors clearly accept that by the Ocampo phase local populations were farming bottle gourd, pepo squash, and common beans; once again chili peppers are often counted among the domesticates. Recent AMS studies verify that the earliest known bottle gourd and pepo squash do indeed date to the Ocampo phase, and not to the Infiernillo: pepo squash has been directly dated to 6310 B.P. in Valenzuela's cave, and bottle gourd from this same site produced a direct date of 6440 B.P. (Smith 1997b). However, common bean has been demonstrated to have arrived much later (Kaplan and Lynch 1999).

At least one source (Whitaker et al. 1957) lists jack beans among plants that were possibly cultivated. Kaplan and MacNeish (1960) do not report the presence of this taxon among the analyzed bean remains, but Callen (1968, 1970) does suggest that the bean fragments in the paleofeces may be either *Phaseolus* or *Canavalia*. A wild variety of jack bean (*C. villosa*) is presently utilized for food and medicine by people in the Ocampo region (Hernández Sandoval et al. 1991), so its prehistoric use in the caves is not beyond the realm of possibility, though there is presently no evidence that it was cultivated.

Some authors also claim that maize particles were observed in Ocampo phase paleofeces (e.g., Kaplan and MacNeish 1960:35; MacNeish 1992:104). However, Callen (1968:643, 1970:238) specifically states that maize does not appear in the Ocampo region until the Flacco phase, which follows the Ocampo phase, and only mentions the genus *Zea* as being found in several paleofeces from the much later Mesa de Guaje phase (Callen 1968:654). It must be pointed out that only a fraction of the Ocampo cave paleofeces was ultimately analyzed, and it is entirely possible that the excavators did indeed observe maize particles in older samples that Callen did not have the opportunity to examine.

People of the Ocampo phase continued to rely heavily on gathered plants such as agave, prickly pear, wild pumpkin/squash, safflower, acorns, wild runner beans, and foxtail millet (although there are claims for minor cultivation and selection). Some sources cite the presence of panic grass as well as foxtail millet, while others maintain that foxtail millet grains in the paleofeces were initially mistaken for panic grass and do not acknowledge the presence of the latter at all. Finally, MacNeish (1992:103) includes gama grass among the list of plant foods gathered during the Ocampo phase, although this is not mentioned in the formal report on maize and its relatives (Mangelsdorf et al. 1967).

Flacco (4250-3750 B.P.)

Seven excavated occupation floors in caves and two surface sites explored by MacNeish represent the Flacco phase (MacNeish 1992:104). Both surface sites and one excavated cave floor were interpreted as macroband camps (the latter had "many" food storage pits), whereas the rest of the cave floors represented temporary microband occupations (MacNeish 1992:104-105). Characteristic material culture includes Flacco and Gary stemmed projectile points, twilled baskets, coiled bags, milling stones, mullers, and mortars (MacNeish 1992:105).

Whitaker et al. (1957). These authors state that although the majority of the Flacco phase diet consisted of (unnamed) wild plants, "… a fair number of bean pods, beans, and fragments of squash, as well as one or 2 [*sic.*] fragments of very primitive (Bat Cave?)[3] corn were found" (p. 354). Regarding cucurbit remains specifically, they report four bottle gourd rind fragments; 67 rind fragments and six seeds of buffalo gourd; and 38 rind fragments, 11 seeds, and six peduncles of pepo squash from these cultural levels (p. 356).

3 "Bat Cave" corn was defined as morphologically very similar to primitive cobs recovered from the archaeological site of Bat Cave, New Mexico in 1948, and is described in Mangelsdorf (1974:151).

MacNeish (1958). In his very brief discussion of Flacco phase characteristics (p. 168), MacNeish refers to populations of this culture as "… food-gatherers who did some farming or gardening of common beans, peppers, runner beans, panicum, amaranths, gourds, squash, and Bat Cave type of corn, and a very little hunting and snaring." Gathered plant foods are not named.

Kaplan and MacNeish (1960). The description of the general Flacco phase diet in this report (p. 37) is consistent with that of MacNeish (1958:168), discussed above. The people of this phase are described as semi-nomadic food-gatherers; although they did some hunting and/or trapping, they depended more on "incipient agriculture." Among those plants farmed or gardened were: squashes and bottle gourds, chili peppers, two kinds of common beans (in fecal matter), amaranth, panic grass, and runner beans. These cultivated foods apparently comprised some 20 percent of the total diet. Specific to the legume analysis presented in the report, 13 runner bean valves were identified from Flacco phase levels (p. 44).

Mangelsdorf et al. (1964). The only mention in this synthetic article of the Flacco phase is to acknowledge the appearance of the "Bat Cave" (*Chapalote*) type of maize in this time period (p. 431).

Mangelsdorf et al. (1967). While this analysis was largely limited to the maize remains recovered from Romero's cave, the earliest specimen reported here is a single primitive cob classified under the type *Pre-Chapalote* from a Flacco phase level in Valenzuela's cave (p. 39). During his survey of the unanalyzed maize specimens from

Valenzuela's cave, Smith (1997b:370) also noted the presence of leaf and stalk fragments and more cobs from this phase. Mangelsdorf and colleagues also report a single fragment of gama grass from Flacco contexts in Romero's cave. The nutritious grains of this grass, while difficult to remove from their hard shells, were seemingly gathered for consumption during Flacco times.

Callen (1968). Here Callen reports the presence of agave leaf tissue (in 62 percent of the fecal samples), aloe (18 percent), bean (12 percent), chili pepper (54 percent), squash (23 percent), prickly pear (82 percent), and foxtail millet (40 percent) in the Flacco phase paleofeces (p. 643). Callen also discovered seed particles which he identified as "*Helianthus*" (sunflower); these materials were more specifically identified in his subsequent report (Callen 1970, see below). Finally, he notes the appearance of maize in the region during Flacco times, though he directly states that this domesticate was not recognized in the fecal material of this time period by the time the analysis was suspended.

Callen (1970). Here Callen largely reiterates his previously published findings. Excluding *Aloe*, the same plants and percentage occurrences presented in Callen (1968) are once again published here, but possible yucca and amaranth are now mentioned as present in the paleofeces (p. 238). The seed particles attributed to a variety of sunflower are now more specifically identified as *H. annuus* var. *lenticularis*, and were "… found in only two coprolites of the 68 examined from this phase" (p. 238). As will be discussed further below, this identification presently plays a role in a debate over the presence and use of sunflower in prehistoric Mesoamerican economies.

MacNeish (1971). Here MacNeish likens the Flacco phase diet to the one he describes for the Ocampo phase, with the exception of an increase in reliance on agriculture (20 percent) at the expense of gathering (65 percent), as well as the appearance of the Bat Cave race of corn (p. 577).

MacNeish (1992). By the early 1990s MacNeish asserts that during the Flacco phase gathered plants comprised 50 percent of the diet while the use of cultivated foods had increased to about 40 percent. Contents of feces suggest that meat contributed 10 to 20 percent of the diet. The known meat proportion includes deer, skunk, coatimundi, and jaguar. The gathering of agave, aloe, prickly pear, foxtail millet, gama grass, acorns and "other plants" continues.

Summary of the Flacco Phase. Although estimates of relative dietary contributions vary between sources, they seemingly agree that Flacco phase populations were still primarily plant gatherers that did a little hunting, yet with an ever-increasing reliance on cultivated plant foods. Use of domesticated bottle gourd and pepo squash continued; the presence of maize in this period has now been verified by a direct AMS date of 4405 B.P. in Valenzuela's cave. Common beans are often cited as present, but AMS indicates a much later arrival. Recent AMS studies indicate that cushaw squash once believed to have arrived in the much later Palmillas phase, actually appears as early as the Flacco phase: a specimen from Romero's cave produced a direct date of 5035 B.P. (Smith 1997b).

Some sources also assert the gardening or farming of chili peppers, runner beans, panic grass and/or foxtail millet, and amaranth, but others refer to some of these as resources gathered along with agave, aloe, buffalo gourd, prickly pear, acorns, gama grass, and yucca. Sunflower seed particles were identified in Flacco phase paleofeces, but this classification is presently being challenged (as will be discussed below). Also, the identification of aloe is open to question as it is an Old World (African) genus (Judd et al. 2002:263).

Guerra (3750-3350 B.P.)

Four excavated components in Romero's cave, representing two microband camps and two macroband camps, were attributed to the Guerra phase. These visits were apparently rather lengthy (up to four seasons). Two additional sites out in the open also suggest macroband occupations, and wattle and daub fragments on one surface site hint at relatively stable open air settlements (MacNeish 1971:577, 1992:105). Altogether the evidence seems to suggest a trend towards longer occupations by larger groups of people. Artifacts include Matamoros, Catan, and Palmillas corner-notched points, simple baskets and nets, and twilled mats.

Whitaker et al. (1957). Here the authors characterize the general Guerra diet as one consisting of both wild and domesticated plants: "Besides wild food plants, bean pods, common beans, corn of the Bat Cave type, much squash and gourds, and some fragments of woven cotton were found" (p. 354). The Guerra phase represents the earliest appearance of cotton[4] in the Ocampo region. The authors do not specifically name which wild plants were used.

Cucurbit materials were abundant in the Guerra phase cultural deposits. In these levels the authors identified 43 bottle gourd rind fragments; 10 rind fragments and one seed of buffalo gourd; and 30 rind fragments, 39 seeds, and three peduncles of pepo squash (p. 356). Also, a single peduncle was recovered that was judged to *probably* represent butternut squash; the authors note that this species was definitely present by

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4 It is unclear who identified these remains as cotton, though the analyst was most likely C. E. Smith.

the subsequent Mesa de Guaje phase. At the time, the Ocampo cave specimens of this species were the earliest yet recognized in North America. However, Smith (1997b) did not relocate any curated specimens from Guerra phase levels that he recognized as this species, and direct AMS dating of confidently identified specimens indicates a later introduction.

MacNeish (1958). Here MacNeish refers to Guerra phase people as "… agriculturalists who grew Bat Cave type corn, squash, gourds, peppers, common beans, small runner beans, and cotton (and perhaps *moschata* squash)" (p. 168). He notes that they also did a little hunting and a "great amount of plant collecting," but does not mention specifically any of the wild plant foods utilized.

Kaplan and MacNeish (1960). Kaplan and MacNeish recognize a general shift in subsistence between the Flacco and Guerra phases. They refer to Guerra peoples as having a semi-sedentary settlement pattern; cave occupations and survey findings suggest the existence of small villages. Although populations of this phase continued to procure a "vast amount" of wild resources, the majority of the nutrition was obtained through cultivated products. Cobs of Bat Cave type maize were the most prevalent remains found, alongside "… gourds, several varieties of pumpkin, squashes (*Cucurbita moschata*), peppers, common beans, amaranths, *Panicum* and cotton …" (p. 36). Regarding the analysis of bean remains, Kaplan reports only one common bean valve from Guerra levels (p. 44).

Mangelsdorf et al. (1964). In this survey article the authors state that cotton arrived "… as early as 1,700 B.C. in Tamaulipas," placing its appearance within the Guerra phase (p. 443). At the time this was the earliest known archaeological evidence for Mexican cotton (p. 440). The authors also echo the sentiment of Whitaker et al. (1957:357) that a peduncle from a Guerra phase layer may represent butternut squash (although here they refer to it as cushaw squash, a term used in the present document for *C. argyrosperma*, not *C. moschata*) (p. 436). Also, buffalo gourd was found in all levels, including Guerra.

Mangelsdorf et al. (1967). These authors report that maize parts become more abundant in Guerra contexts than during their initial appearance in the Flacco phase (p. 37). Stalks (n=6), leaves (n=1), husks (n=2), and tassels (n=4) were recovered from these levels in small amounts, as were abundant cob fragments unclassified as to race or type (n=55). Almost 200 identifiable cobs were attributed to the Guerra phase, including specimens classified as "Pre-Chapalote" (n=14), "Early Chapalote" (n=46), and "Tripsacoid Chapalote" (n=127). In addition, several fragments of gama grass (n=1), teosinte (n=2), and "maize-teosinte hybrids" (n=2) were also reported from these levels.

Callen (1968). Here Callen reports that agave (in 50 percent of the samples), bean (17 percent), chili pepper (36 percent), squash (33 percent), prickly pear (64 percent), and foxtail millet (42 percent) persist in the Guerra phase paleofeces, though the tissue he identified as aloe in previous phases is now absent (p. 643).

Callen (1970). Callen also refers to the above mentioned "fundamental shift in diet" in the Ocampo region. From the contents of the paleofeces and the same percentage occurrences presented in Callen (1968), he interprets a drop in the consumption of agave, prickly pear, chili pepper, and animal resources (bone, seven percent) during the Guerra phase from previous time periods, and an increase in the use of beans, squash, and foxtail millet. Although other sources indicate that maize appeared earlier during the Flacco phase, Callen here states that maize cobs first appear in floor refuse attributed to the Guerra phase, but that no maize was observed in the analyzed feces (p. 238).

MacNeish (1971). Here MacNeish estimates that the Guerra phase diet consisted of about 30 percent agriculture of "Domesticated gourds, peppers, pumpkins of two varieties, *Cucurbita moschata* (warty squash), yellow and red beans" (p. 577). Cotton was also used. Ten percent of the diet came from meat, while the remainder was obtained through gathering of undisclosed wild plants.

MacNeish (1992). MacNeish cites Callen's paleofecal analysis as evidence that agricultural products contributed 25 to 50 percent of the Guerra peoples' diet: "In addition to such older domesticates as gourds, pumpkins, common beans, chile, sunflower, amaranth, and corn, domesticated plants included Río Balsas teosinte, cotton, and warty squash" (p. 105). Such produce was often found in the excavations in Guerra phase storage pits. Maize apparently increasingly dominated the diet, and about half of this is *Tripsacoid chapalote*, defined by Mangelsdorf (1974:155) as "… probably the product of hybridization of Chapalote [maize] with corn's closest relative, teosinte."

Copious amounts of wild plants indicate that gathering was still important (40 to 50 percent of the diet); gathered species included agave, prickly pear, runner beans, and aloe. Foxtail millet is still present, but the larger seeds identified from earlier times are now absent, and MacNeish suggests that the grass was no longer cultivated because maize was increasingly productive at this point.

Summary of the Guerra Phase. According to these sources Guerra phase populations were basically agriculturalists who grew maize, common beans, bottle gourd, and several varieties of pepo squash. While Whitaker et al. (1957) are somewhat cautious in claiming the presence of butternut squash at this early time and some others follow suit (MacNeish 1958, Mangelsdorf et al. 1964), other publications (Kaplan and MacNeish 1960; MacNeish 1971, 1992) matter-of-factly include this species among the lists of domesticates. Smith (1997b) has recently demonstrated that this domesticated species is indeed not known to be present during the Guerra phase, but rather the earliest known specimens date to later Mesa de Guaje times.

According to the published accounts cotton first appears in the sequence in this phase in the form of woven textile fragments. Other supposedly cultivated plants include panic grass, Río Balsas teosinte, amaranth, chili peppers, and sunflower. MacNeish (1958) lists small runner beans among those plants cultivated, but later (1992) states these were collected from the wild.

They also collected "a vast amount of wild plants" (Kaplan and MacNeish 1960). Among the wild food plants listed are teosinte, gama grass, agave, prickly pear, buffalo gourd, and foxtail millet. This last one is believed to be collected rather than cultivated by the Guerra phase, as the larger grains initially interpreted to reflect selection are now absent. It was suggested that more productive maize crops came to replace the cultivated foxtail millet in economic importance. Although MacNeish (1992) states that aloe is among the collected resources, this plant is absent from Callen's lists of remains found in paleofeces, where it was present in previous phases.

Up to this point the Ocampo cultural phases are classified as representing a typical "Archaic" adaptation, characterized by relatively high mobility and a broad-spectrum diet emphasizing diverse plant foods and small to medium sized game animals. MacNeish's formulation of this Archaic sequence in southwestern Tamaulipas has not been unanimously accepted. Walter W. Taylor (1960a 1960b, 1966) was particularly vocal in his objections, asserting that the Archaic manifestations between Ocampo and the

Sierra de Tamaulipas were not divergent enough to rationalize two separate sequences; further, he believed that such great continuity existed in Archaic life-ways and artifact inventories in Ocampo that the division of this period into four separate cultural phases is unwarranted, and that these and the corresponding "phases" in the Sierra de Tamaulipas should be combined into one (Taylor 1966:89). In spite of such criticisms, however, MacNeish's schemes remain the most widely used for these regions. The phases following Guerra witnessed the decline of Archaic life-ways in Ocampo, and the advent of settled farming villages, ceramics, and other elements characteristic of the Mountain Culture described in the previous chapter.

The Cultural Phases: Mesoamerican, or "Mountain Culture"

Mesa de Guaje (3350-2350 B.P.)

Mesa de Guaje phase aspects were recognized in microband and macroband occupations in Romero's cave, one open macroband campsite, and one large open site with circular house platforms consisting of stacked limestone walls and rubble-filled interiors. These platforms apparently served as foundations for *jacales*, or huts of wattle, daub, and thatch. Along with these stable habitations, ceramics make their initial appearance (MacNeish 1992:105). Such developments and a significant contribution from cultivation to the diet led MacNeish to conclude that village agriculture had arrived in the Ocampo region by this period (MacNeish 1992:105).

Whitaker et al. (1957). Whitaker and colleagues generally classify the people of this phase as "… agriculturalists and grew corn (with teocentli), jack, common, and lima beans, squash, gourds, and cotton" (p. 354). In their analysis of the cucurbits they specifically identified 17 rind fragments and two seeds of bottle gourd, six rinds and 11 seeds of buffalo gourd, two rinds, 96 seeds, and two peduncles of pepo squash, and two peduncles of butternut squash from Mesa de Guaje contexts (p. 356).

MacNeish (1958). Here MacNeish only briefly describes the subsistence practices of Mesa de Guaje populations. He describes them as "… farmers growing a number of varieties of corn including Breve de Padilla, *teocentli*, squash, *Cucurbita pepo*, common beans, gourds, and cotton… as well as peppers, lima and runner beans, and *moschata* squash" (p. 168). He indicates they also did some plant gathering but hunting and snaring were relatively unimportant activities.

Kaplan and MacNeish (1960). The authors here assert that people of the Mesa de Guaje phase were definitely living in villages. In terms of general diet, they estimate that over 50 percent of the nutrition at this time was derived from agricultural products, especially maize. Many of the maize specimens show introgression with teosinte, although actual teosinte grains are reported as well. Among the other (supposedly cultivated) species mentioned are squash (including pepo), bottle gourds, amaranth, chili peppers, cotton, and sunflower (p. 37). The authors also report the identification of two varieties of common beans (n=19) from the analysis of the legume materials (p. 44).

Cutler and Whitaker (1961). Cutler and Whitaker report that butternut squash was adopted by the villagers of the Mesa de Guaje culture (p. 479); they also note that these people also utilized corn, jack, common and lima beans, and cotton.

Mangelsdorf et al. (1964). The Mesa de Guaje phase is specifically mentioned only briefly in this synthetic article, first to state that butternut squash was definitely in use by this time period (p. 436), and then to indicate that although bottle gourd rind had been found in deposits dating as far back as the Infiernillo phase, the seeds of this species did not appear in the sequence until the Mesa de Guaje phase. This is in accordance with Whitaker et al. (1957).

Mangelsdorf et al. (1967). Abundant maize remains were attributed to the Mesa de Guaje phase in this report. Cobs were particularly plentiful, and represented a variety of races: Pre-Chapalote (n=2), Early Chapalote (n=56), Tripsacoid Chapalote (n=307), Chapalote (n=25), Breve de Padilla (n=19), and Palomero Jalisciense (n=4). Fifty-three fragments of unknown race were noted as well. In addition to cobs, stalks (n=11), husks (n=42), tassels (n=15), and quids (n=5) were also recovered and documented, as were seven fragments of teosinte and one classified as a maize-teosinte hybrid.

Callen (1968). Ultimately Callen thoroughly analyzed some 43 Mesa de Guaje paleofeces (p. 653). His table of results indicates the presence of agave (in 60 percent of the samples), aloe (four percent - absent in the Guerra phase), bean (30 percent), chili pepper (46 percent), squash (34 percent), prickly pear (41 percent), foxtail millet (37 percent), and animal protein (bone, 37 percent) during this period (p. 643). However, the analysis also revealed consumption of some other type of cactus (non-*Opuntia*), sunflower, mesquite, Spanish moss, and fleshy bromeliad of the same genus. Callen also reports *Zea* sp. (maize or teosinte) in paleofeces for the first time; it was observed in four out of 43 Mesa de Guaje fecal specimens (p. 654).

Callen (1970). Callen asserts that the sample of Mesa de Guaje paleofeces is "… large enough to be completely representative of the diet" during this time frame (p. 238). The percentage occurrences presented in this article in Table B match those of Callen (1968), although further details are given. Mesa de Guaje paleofeces were found to contain, in decreasing order of frequency, agave, *Phaseolus*, mesquite, various, non-

Opuntia cactus fruit tissue, chili pepper, foxtail millet, bone, squash, prickly pear, and sunflower. Maize is reported from Mesa de Guaje paleofeces, as is bottle gourd in seed form (the latter constitutes the oldest record of bottle gourd seeds being used as human food) (p. 239). Amaranth, aloe, Spanish moss, and fragments of another, more succulent *Tillandsia* were also identified in the feces; apparently the fleshy leaf bases of the latter bromeliad were consumed (as locals continue to do today).

MacNeish (1971). Here MacNeish estimates that some 40 percent of the diet during the Mesa de Guaje phase consisted of agricultural products, including; "… gourds, peppers, two varieties of pumpkins (*Cucurbita pepo*), yellow and red seeded beans, warty squash (*Cucurbita moschata*) … Bat Cave and hybridized corn, teosenti [*sic*], and sunflower" (p. 578). Cotton was also used. An additional 50 percent of the diet came from wild plant collecting, while hunting made up the final ten percent.

MacNeish (1992). This source offers minimal information about Mesa de Guaje subsistence, besides stating that "… the preserved foodstuffs indicate that almost 50 percent of their diet came from agricultural plants …. Village agriculture … had definitely arrived in the Sierra Madre" (p. 105). As the book solely concerns the origins of agriculture and the steps leading up to village life, it only addresses those time periods up to the Mesa de Guaje phase.

Summary of the Mesa de Guaje Phase. It was during the Mesa de Guaje phase that people in the Ocampo region began settling into relatively stable villages, and by this time food production had evolved into a major subsistence strategy. These populations apparently grew several varieties of maize and common beans, as well as pepo and butternut squash. The latter's presence at this time has been verified by an AMS date of 2750 B.P. from Romero's cave; presently this is the earliest known occurrence of this species in the Ocampo caves.

Bottle gourds were also cultivated, and paleofecal evidence indicates for the first time that the seeds of this plant were consumed. Cotton, introduced during the previous phase, remained an economically important crop plant in Mesa de Guaje. Although some authors list jack, lima, and runner beans among the cultivated plants, these bean species were not identified in Kaplan and MacNeish's (1960) analysis of the Mesa de Guaje legume remains. Mangelsdorf et al. (1967) report teosinte remains from these contexts, and this grass is mentioned as a food resource in several other sources, all of which list it among the cultivated crops (though its status as such is not likely). Other crops listed as "farmed" in the literature, but that were equally likely non-domesticates, include amaranth, sunflower, and chili peppers. Buffalo gourd remained an important non-domesticated resource that could have served either a dietary or a utilitarian function.

Callen's analysis of paleofeces provided important insights into Mesa de Guaje diet. This work revealed direct evidence for the consumption of agave, beans, chili peppers, sunflower, bottle gourd seeds, squash, prickly pear, and foxtail millet. As mentioned above, bottle gourd seed fragments in feces indicate the use of the seeds as food. This is the only time period for which maize is documented in the Ocampo cave paleofeces. Other plants identified in the feces include aloe, amaranth, mesquite, and fruit tissue of some type of cactus that is not *Opuntia*. Spanish moss fragments were often found clinging to the outside of feces, but their presence *within* the feces as well indicates ingestion. The succulent leaf bases of another fleshy bromeliad of the genus *Tillandsia* were also consumed.

La Florida (2350-1750 B.P.)

Kaplan and MacNeish (1960:37) liken the La Florida phase to the Late Formative period of Mexico. Villages with plazas and numerous circular masonry house and temple platforms apparently became common during this phase; other characteristics included hand-modeled figurines, stemmed points, corner-notched points, obsidian prismatic blades, and ceramic bowls with tripod feet (Kaplan and MacNeish 1960:37). This phase was recognized only during surface survey and not in the excavated layers in the caves (Kaplan and MacNeish 1960:37; MacNeish 1971:578), so very little can be said with certainty regarding subsistence at this time. Some (e.g. MacNeish 1971:578) speculate on the La Florida diet based on supposedly contemporary excavated Laguna components with preserved foodstuffs in the Sierra de Tamaulipas. However, the La Florida phase is only minimally treated in the published literature, and most sources exclude it entirely.

Mangelsdorf et al. (1964). The authors describe subsistence in the Sierra de Tamaulipas during the Laguna phase, which is roughly contemporaneous to the La Florida of the Ocampo region, as including three types of hybridized maize (Nal-Tel, Breve de Padilla, Dzit-Bacal). Also found in Laguna deposits was manioc (*Manihot dulcis* [*M. esculenta* ssp. *esculenta*]), which is described as a "… possible domesticated plant, closely related to the *M. esculenta* of the South American lowlands, but with a separate and local history of cultivation" (p. 431). Elsewhere, however, the authors state that the Tamaulipas variety was not likely domesticated (p. 443), as C. Earle Smith (the original analyst) communicated to Flannery (1973:273). As discussed in Chapter Three, it is now clear that there is only one form of domesticated manioc, and this originated in South America. The edible roots of wild species (*M. pringlei*, *M. subspicata*) are presently collected in the mountain oak forests of the Ocampo region (Hernández Sandoval 1991), but the identification of these remains in the caves remains questionable.

MacNeish (1971). Here MacNeish suggests that diet in the La Florida phase can be likened to that of the similar and roughly contemporary Laguna phase of the Sierra de Tamaulipas, which did have excavated components with preserved foodstuffs (p. 578). MacNeish interprets cave remains from this region to show a diet consisting of approximately 40 percent domesticates, 51 percent from gathered wild plants, and about nine percent from hunted resources during this period. He considers these people to be basically agriculturalists: "Domesticated plants included gourds, pumpkins, manihot, peppers, beans (large red variety), cottons [*sic*], three races of hybridized corn (*Breve de Padilla*, *Dzit-Bacal*, and *Nal-Tel*) and possibly earlier *Nal-Tel* (unhybridized) types" (p. 578). He goes on to suggest that the other plants known from the Mesa de Guaje phase may have persisted into the La Florida phase, but the sample was too small to indicate this with certainty.

Summary of the La Florida Phase. Due to a lack of excavated components, not very much can be concluded regarding subsistence during the La Florida phase. It can be assumed that since villages with plazas and temples were growing in number during this time period, agriculture was likely an important strategy. MacNeish extrapolated from supposedly contemporary findings in the Sierra de Tamaulipas that the La Florida phase people utilized a diverse assemblage of domesticated plants (including various maize types, gourds, pepo squash, common beans, chili peppers, and cotton), yet still gained a large proportion of their diet from primarily gathered wild resources. Although manioc is occasionally cited as a domesticated plant, there is no evidence of this, and if present at all it is more likely represents a wild variety such as *M. pringlei* or *M. subspicata*.

Palmillas (1750-1050 B.P.)

The Palmillas phase was recognized on survey, in three excavated components in two human occupation zones in Romero's cave, and three occupations in Ojo de Agua Cave. Population levels peaked and material culture was at its most elaborate during this phase; large settlements included circular masonry platforms and truncated "pyramids" surrounding a central plaza; these once served as foundations for wattle and daub structures. Ball courts were occasionally located on large sites. The Palmillas phase is considered by some sources to represent the "cultural apogee" of the Ocampo region (Kaplan and MacNeish 1960:37; MacNeish 1958:169; Whitaker et al. 1957:354).

Whitaker et al. (1957). Here the authors state that Palmillas phase subsistence was based on agriculture, and the period witnessed the introduction of tobacco, though the plant parts present are not indicated anywhere (see Chapter Three). The analysis revealed 104 bottle gourd rind fragments, nine rinds of buffalo gourd, five rinds, two seeds, and five peduncles of pepo squash, one butternut squash peduncle, and a single peduncle of cushaw squash (*C. argyrosperma*, formerly known as *C. mixta*) (p. 356). The authors emphasize that the latter species is only found in this phase in the region; at the time it was believed to be the earliest yet recorded (p. 357).

MacNeish (1958). MacNeish characterizes the Palmillas phase populations as primarily dependent on agriculture, though they also did "a little" food-gathering and hunting. These people "… grew several varieties of corn (including Breve de Padilla), pepo, moschata, and mixta squash, gourds, chili, tobacco, runner beans, sunflowers, panicum, tobacco [*sic*], amaranths, manihot, lima beans, six varieties of common beans, and some cotton" (p. 169).

Kaplan and MacNeish (1960). Here the authors assert that the Palmillas phase represents the peak of agricultural diversity in the Ocampo region (p.37). This period witnessed the greatest diversity in bottle gourds, butternut, pepo, and cushaw squash. Several varieties of maize were present as well as teosinte grains. Lima, runner, and three varieties of common beans were also found in these levels. Amaranth, manioc, panic grass, chili pepper, sunflower, tobacco, and cotton are among the other supposedly cultivated plants (pp. 37-38). Regarding agricultural produce, "In bulk, these species represent almost half the plant material found; in terms of food value, however, they represent a much larger proportion" (p. 38). Of legume remains specifically, Kaplan lists runner beans (n=11) and lima bean (n=1) specimens; although three varieties of common beans are mentioned in the introductory sections, Table 2 in the report only tabulates two varieties (n=220).

Cutler and Whitaker (1961). At the time this article was published, the Ocampo cave cushaw squash remains from the Palmillas levels were believed to be the oldest yet recovered (p. 481).

Mangelsdorf et al. (1964). Common beans (black, small red), lima beans, and cushaw squash are here reported to have appeared in the Ocampo sequence during the Palmillas phase (p. 431).

Mangelsdorf et al. (1967). Maize cobs were abundant in Palmillas contexts. Mangelsdorf and colleagues report cobs of various races: Early Chapalote (n=24), Tripsacoid Chapalote (n=457), Chapalote (n=116), Breve de Padilla (n=188), Palomero

Jalisciencse (n=11), and Harinoso de Ocho (n=3). Another 49 cob fragments were unidentifiable to race. Maize stalks (n=5), leaves (n=2), husks (n=70), tassels (n=307, and masticated quids (n=63) were also reported from Palmillas phase levels, as were individual fragments of gama grass and teosinte.

Callen (1968). Although Palmillas levels in the Ocampo caves produced no paleofeces, Callen here notes that the floor refuse contained "plentiful *Manihot*" (p. 654), though he does not specify the plant parts that were observed.

MacNeish (1971). Here MacNeish states that "domesticated plants" present during the Palmllas phase included "… several varieties of corn, pumpkin, moschata and mixta squash, gourds, chili peppers, probably tobacco, runner beans, sunflowers, panicum, amaranths, manihot, lima beans, six varieties of common beans, and cotton" (p. 578). Such agricultural produce contributed an estimated 45 percent of the Palmillas diet; wild plant collecting constituted an additional 50 percent, while the remainder came from hunting and snaring.

Summary of the Palmillas Phase. Palmillas is understood as the cultural apogee of the Ocampo region, during which people constructed large villages with numerous circular masonry house platforms and pyramids that supported habitations and temples of wattle and daub. Populations were greatly dependent on agriculture for their sustenance. Various races of maize, gourds, pepo squash, and butternut squash were grown. These sources indicate that for the first time cushaw squash appears on the scene; however, B. Smith (1997b) has shown with AMS that it arrived at least several thousand years earlier.

Although originally believed to have arrived as early as the Ocampo phase, Kaplan and Lynch (1999) have demonstrated through AMS that the earliest known presence of common bean is actually in the Palmillas phase, with a direct date of 1285 B.P. in Romero's cave. As many as six varieties of common beans have been reported as in use during Palmillas, though Kaplan and MacNeish (1960) only document two varieties. Domesticated tobacco appears in the sequence. Cotton is also regarded as being locally cultivated.

Other plants often attributed to cultivation include chili peppers, sunflowers, panic grass, amaranth, lima beans, runner beans, and manioc (which according to Callen [1968] was "plentiful" in the Palmillas floor refuse), but the status of these plants as domesticates is questionable. At least three sources (Kaplan and MacNeish 1960; MacNeish 1958, 1971; Mangelsdorf et al. 1964:431) list manioc among the cultivated or "possibly domesticated" plants of the Palmillas phase, although it is pointed out elsewhere (once even in the same publication [Mangelsdorf et al. 1964:443]) that it was probably not domesticated. Flannery (1973:273) eventually wrote that: "The species was one which has never been domesticated, but overeager archeologists continue to cite it as an example of cultivated manioc." Even so, these materials should be re-examined to verify their identification as manioc in the first place; no remains classified as manioc were located during my examination of the curated Ocampo cave plant collections. Regarding runner beans, Kaplan and MacNeish once again hypothesize that the remains in the Ocampo caves represent non-domesticated forms, based on their reappearance in Palmillas times after an extended absence:

> We would hardly expect a cultigen absent for 2,000 years to be reestablished merely with the return of favorable climatic conditions…. An indigenous plant, on the other hand, might have formed relic communities in protected locations becoming more generally distributed and available for human use at the end of the thermal period (Kaplan and MacNeish 1960:50).

This lends support to other evidence against domestication in runner beans cited earlier, that is the apparent absence of characteristics that indicate selection that are observed in modern cultivated runner beans (Kaplan and MacNeish 1960:50). Finally, again the role of sunflower as a domesticated plant in Tamaulipas is questionable and is central to a larger debate concerning this plant's place in prehistoric Mexican economies in general.

In spite of high dependence on agriculture, wild plant collecting seemingly continued to be of great importance during Palmillas times. It is most likely that many of the plants often claimed to have been farmed were actually gathered from the wild. These include amaranth, panic grass, and manioc, and even so panic grass has since been re-classified as foxtail millet and the identification of manioc, wild or domesticated, is questionable (Smith 1968:259). Buffalo gourd or some other wild cucurbit continues to be used as a food and/or utilitarian resource, and there is limited evidence for the use of both teosinte and gama grass.

San Lorenzo (850-450 B.P.)

San Lorenzo appears to represent a cultural "decline" in the Ocampo region. Villages were still the typical settlement pattern, although sites are fewer in number and these have no pyramids or obvious ceremonial structures. Sites are smaller with few stone architectural structures, although wattle and daub structures continued in use. According to MacNeish (1971:579), material culture was also simpler than previous times, with more poorly made and fewer varieties of ceramics. Although populations occupied villages during the San Lorenzo phase, excavated occupation layers indicate frequent use of caves as camp sites.

Whitaker et al. (1957). Whitaker and colleagues describe the general subsistence of the San Lorenzo phase as being similar to that of the previous phase, although the cultural materials were significantly poorer (p. 354). The analysis of San Lorenzo phase cucurbits revealed 235 rind fragments, one seed, and one peduncle from bottle gourd, 40 rind fragments and two seeds from buffalo gourd, 31 rinds, 45 seeds, and ten peduncles from pepo squash, and six rinds and three peduncles from butternut squash. Table 1 in the article also lists two possible cushaw squash seeds from San Lorenzo contexts.

MacNeish (1958). Here MacNeish's description of San Lorenzo phase subsistence is limited to the statement that these people were farmers who "… grew almost the same plants as those of the Palmillas phase" (p. 169).

Kaplan and MacNeish (1960). Here Kaplan and MacNeish view the "sedentary agricultural" San Lorenzo phase as a continuation of the preceding culture, but with a "degeneration in culture and agriculture" (p. 38). They note a lesser diversity in cucurbit and bean variability, though the same "kinds" (species?) remain. Other cultivated crops include "one or two" races of maize, and "… amaranths, peppers, cotton, and tobacco" (p. 38). Teosinte is now absent. The bow and arrow and a corresponding diversity of arrowhead types appear during this phase. The legume analysis identified runner (n=21) and lima (n=3) bean valves, and common beans (n=456) are particularly abundant (p. 44). According to Table 2 of this report, San Lorenzo levels contained the greatest frequency of these legumes of the entire sequence.

Cutler and Whitaker (1961). Table 2 in this article shows wild *Cucurbita* to be present in Ocampo throughout the sequence, so by implication non-domesticated fruits of this genus were collected by San Lorenzo phase peoples.

Mangelsdorf et al. (1964). Like Cutler and Whitaker (1961), the authors here state that wild squash, possibly buffalo gourd, was recovered from all cultural levels in the Ocampo caves including those of San Lorenzo times (p. 433).

Mangelsdorf et al. (1967). Here the authors report abundant maize remains recovered from San Lorenzo levels. Maize cobs are especially numerous, and represent such types as: Early Chapalote (n=2), Tripsacoid Chapalote (n=356), Chapalote (n=122), Breve de Padilla (n=279), Palomero Jalisciense (n=15), Harinoso de Ocho (n=10), Nal-Tel (n=17), and Tuxpeño (n=3); another 71 fragments are unidentified. Other plant parts present include stalks (n=12), leaves (n=2), husks (n=60), tassels (n=904), and chewed quids (n=39). One fragment of gama grass was recovered as well.

Callen (1968). From San Lorenzo paleofeces Callen reports agave leaf tissue in 80 percent of the samples, bean (47 percent), chili pepper (67 percent), squash (33 percent), and prickly pear (87 percent). He also briefly mentions that manioc occurred in 11 of 15 examined paleofeces, and classifies this plant as "the most frequently eaten plant material in the [paleofeces]" (p. 654). Unfortunately, he does not describe the morphology of the manioc remains.

Callen (1970). In this article Callen reiterates his findings regarding contents of San Lorenzo paleofeces presented in the previous report (Callen 1968). Here, however, he also elaborates on the importance of manioc in this phase: based on remains found in floor debris and in paleofeces, this resource became "one of the dominant plants" of the San Lorenzo diet (p. 239). Manioc was a dominant or co-dominant element in 10 out of 15 San Lorenzo paleofecal specimens (which is inconsistent with the 11 out of 15 samples mentioned in Callen [1968]). While the specific manioc parts are not described, presumably it was root fragments that were consumed and therefore found in the paleofeces. C. Earle Smith identified a single manioc seed in Laguna phase floor debris La Perra cave, in the Sierra de Tamaulipas (MacNeish 1958:146), but acknowledges that the specimen could actually represent a related genus (Smith 1968:259).

MacNeish (1971). Here MacNeish maintains that domesticates comprised 40 percent and hunted resources 10 percent of the Ocampo during the San Lorenzo phase (p.579), thus an estimated 50 percent of the diet consisted of gathered plants. Many plant species present in the preceding Palmillas phase persisted into San Lorenzo times, but "… some varieties of *Zea mays* and *Cucurbita pepo*, as well as panicum, teocenti [*sic*] and sunflower …" drop out of the sequence (p. 579).

Summary of the San Lorenzo Phase. Although village sites decreased in size and complexity during the San Lorenzo phase, these peoples were still largely agricultural, with many of the same domesticates present in the previous Palmillas phase (although with lesser diversity within species). Gourds and pepo and butternut squash were still cultivated, and two seeds that possibly represent cushaw squash suggest the use of this domesticate as well. Common bean remains are abundant, and maize is prominent, in various races. Cotton, tobacco, amaranth and chili peppers are also listed among the farmed or gardened crops, although I take some issue with such claims for the latter two plants, as will be discussed more below.

Gathered plants still provided a substantial proportion of the diet. Cucurbit materials suggest the continued use of buffalo gourd or a similar wild squash for food, and limited evidence for the use of gama grass exists, though teosinte is now absent, as are panic grass and sunflower. Kaplan identified runner and lima bean valves. Manioc is apparently a prominent food item in San Lorenzo times, but as was made clear above it is most likely a gathered plant and not a domesticated one. Direct evidence for the consumption of prickly pear and agave came from paleofecal remains.

San Antonio (450-210 B.P.)

Open sites of the final phase in MacNeish's sequence, the San Antonio phase, are numerous but small. They seem to have been small hamlets or *ranchos* consisting of only a few oval-shaped wattle and daub huts. Caves often served as camp sites. Ceramics were of an even poorer quality than in the preceding San Lorenzo phase, and there is even less diversity in general material culture than in earlier times. The bow and arrow, which first appeared in the preceding San Lorenzo phase, is now dominant over the atlatl and dart. According to MacNeish (1971:580), "Generally speaking, this phase seems to be much less complex and sophisticated than the previous three or four phases." This final phase in the Ocampo sequence lasts beyond Spanish contact and up into historic times; Chapter Nine contains a more thorough discussion of aboriginal life-ways and subsistence practices in northeastern Mexico during the Proto- and early Historic periods.

Whitaker et al. (1957). The authors here describe the San Antonio phase as a continuation yet less complex incarnation of the previous culture (p.354). During the analysis of the cucurbit materials 151 rind fragments and one peduncle of bottle gourd, nine rinds and three seeds of buffalo gourd, three seeds and three peduncles of pepo squash, and one rind, one seed, and three peduncles of butternut squash were identified (p. 356).

MacNeish (1958). Here MacNeish describes San Antonio phase peoples as "basically agriculturalists," who did "considerable food-gathering" (p. 170). The people of this phase supposedly grew "… Breve de Padilla corn, squash (*pepo*), gourds, runner and common beans, cotton, and tobacco … walnut squash (*moschata*), and chili" (p. 170).

Kaplan and MacNeish (1960). The San Antonio phase appears to represent a further cultural "degeneration" from previous times. These people were apparently sedentary agriculturalists who lived in small farming hamlets or *ranchos* (p. 38). Though gourds, pepo and butternut squash, cotton, and tobacco persist, maize diversity had fallen to a single race. It is stated in the text (p. 38) that "there are only four kinds of beans" during this phase, but only three are presented in Table 2 (two common bean varieties [n=75] and runner beans [n=1]) (p. 44).

Mangelsdorf et al. (1967). Maize remains were abundant in San Antonio phase deposits. Cobs included Early Chapalote (n=5), Tripsacoid Chapalote (n=299), Chapalote (n=108), Breve de Padilla (n=350), Palomero Jalisciense (n=7), Harinoso de Ocho (n=19), and Nal-Tel (n=23). Another 229 cob fragments were unidentifiable. In addition to cobs, other maize parts included stalks (n=13), leaves (n=4), husks (n=45), tassels (n=6,869), and masticated quids (n=44)

Callen (1970). Callen states that only one paleofecal specimen was recovered and examined from San Antonio phase contexts; it contained only agave and prickly pear.

MacNeish (1971). This source also points out that diminishing varieties of domesticated plants were used during the San Antonio phase: "Domesticated plants are limited to one or two varieties of corn and beans, peppers, *Cucurbita pepo* and *C. moschata*, gourds, cotton, tobacco, indigo [*Indigofera* sp.], and possibly canavalia beans"

(p. 579). Such plants provided an estimated 40 percent of the diet; an additional 42 percent came from gathered wild plants, and 18 percent from hunted or snared animals.

Summary of the San Antonio Phase. The San Antonio phase was still characterized by relatively high dependence on agriculture, though settlement was largely limited to small, dispersed farming hamlets known as *ranchos* and temporary cave occupations. Gourd, pepo and butternut squash remained in use, as did maize. Although MacNeish (1958) mentions only one maize race (Breve de Padilla) in San Antonio times, and Kaplan and MacNeish (1960) also state maize diversity had dwindled to a single race, Mangelsdorf et al. (1967) document seven maize races in San Antonio contexts. Farming of common beans, cotton and tobacco persists, chili peppers, jack beans, and indigo are supposedly gardened (though I take issue with the latter; see below).

Although around 40 percent of the diet at this time is estimated to have come from gathered plants, there is very little information regarding what these plants were. Cucurbit remains demonstrate that buffalo gourd is still collected in San Antonio times, and agave and prickly pear particles were observed in the single paleofecal specimen recovered from San Antonio levels.

Discussion

Several problematic patterns have emerged in this review of the literature concerning plant use in Ocampo. One of the most palpable is the occasional, direct inconsistency between major sources. For instance, MacNeish (1992:104) reports the presence of foxtail millet seeds in deposits attributed to the Infiernillo phase; though he doesn't state it directly, he presumably means in the floor detritus. However, Callen (1967a:287, 1967b:535, 1968:642) specifically states that this grass was found only in paleofeces and not in the floor debris, and that its earliest appearance in such form is later, during the Ocampo phase.

Another issue arises when potentially wild plants are stated with conviction to have been "cultivated" or "farmed" in the region. Chili peppers, amaranth, manioc, and foxtail millet have all been described in publication as cultivated in Ocampo. While the former three plants are known to have been domesticated and economically important elsewhere in Meso- , Central, and South America, as discussed in Chapter Three (pp. 70-74) there are issues related to their domesticated status in Ocampo and the remains in the caves likely represent wild varieties. Also as discussed in Chapter Three, foxtail millet, which was hypothesized to have been cultivated in Ocampo based on larger-sized grains found in some levels, has not been confirmed to have been a domesticated plant here or elsewhere in Mexico.

Yet another plant often attributed to cultivation in Ocampo is the sunflower (e.g., Kaplan and MacNeish 1060; MacNeish 1958, 1971, 1992). Common sunflower was domesticated in prehistoric times, evidenced by archaeological recovery of achenes that are larger than the upper size limits of wild populations. It has long been widely accepted that the center of this event occurred in eastern North America (Smith 2006b); previously it was not known to have been cultivated in prehistoric Mexico. However, this has been challenged in recent years by the discovery of large sunflower specimens directly AMS dated to about 4,500 B.P. at the San Andres site on the southern Gulf Coast of Mexico (Lentz et al. 2001). The two specimens in question include a "… carbonized sunflower seed and a partially carbonized achene" (Lentz et al. 2001:370). This discovery led these researchers to argue that Mexico was the center of origin for the domesticate and that sunflower cultivation had subsequently spread to other parts of North America. Genetic studies ultimately revealed that extant domesticated sunflower varieties did indeed arise from populations in eastern North America (Harter et al. 2004), convincing the original analyst to retract his initial identification and that the remains were most likely bottle gourd seeds (Heiser 2008b). However, Lentz et al. (2008) continued to argue for an independent Mexican domestication citing archaeological, ethnohistoric, ethnographic, and linguistic evidence. Other authors defended the eastern North American origin from various angles, and the evidence is overwhelmingly in favor of this scenario (Blackman et al. 2011; Brown 2008; Heiser 2001, 2008a, 2008b; Reiseberg and Burke 2008; Smith 2008). Both Heiser (2001:470) and Smith (2006:12,228) acknowledge the possibility for a secondary, minor and short-lived domestication event in Mexico, but point out that supporting data is lacking. If this indeed did happen, the Mexican domesticate was apparently economically unimportant and quickly went extinct. Based on these arguments, it is highly unlikely that the sunflower remains discovered in Ocampo (if they are indeed sunflower, see below) represent cultivated forms.

A related topic involves claims that cotton was actually farmed in the Ocampo region. This is definitely possible, but from the limited information presented in the published literature it is unclear. These sources either only mention cotton as present and/or farmed, or describe the archaeological remains as in the form of finished textile fragments and cordage (not seeds or other raw plant remains). This suggests another very real alternative: that cotton products were actually imported in their finished form and the plant itself was not grown locally. However, information gained from unpublished documentation and museum collections has shed certain light on this matter, as will be discussed in the next chapter.

Similarly, MacNeish (1971) states that indigo was farmed during the San Antonio phase, but I have found no other evidence for this and in fact this is the only reference I have found in the literature concerning this dye plant in Ocampo. It is possible that its presence is insinuated through dyed patterns on textiles. Among the Ocampo cave plant collections housed at the Instituto de Prehistória in Mexico City, there is a large fragment of textile (likely of agave fiber) with geometric patterns rendered in some bluish pigment; its provenience is uncertain, but it is believed to come from Romero's cave and date to "about 1400 A.D." (see p. 194 in the upcoming chapter). If this is the case, it presents the possibility that the plant itself was not locally cultivated but rather its dye arrived on imported textiles.

There is also the potential problem of misrecognition of remains in the early analyses. For example, the identification of sunflower in the Ocampo caves has recently been called into question as part of the debate on domestication outlined above. In his examination of the economic importance of sunflower in prehistoric Mexico, Heiser (2001, 2008a) inquires whether even the wild plant was present in Mexico prehistorically, much less 4,000 years ago:

> Other than the problematic San Andrés specimens, sunflower has been identified tentatively in only two other archaeological contexts in Mexico. There is a single isolated report of sunflower in the archaeological record of northern Mexico, and this identification needs to be confirmed. If the Ocampo Caves (Tamaulipas) specimen excavated by MacNeish and identified by Callen as wild sunflower can be located, its taxonomic assignment should be verified, as various species of *Tithonia* and *Viguiera*, close relatives of *Helianthus*, are sometimes mistaken for sunflower..... I have not been able to locate the specimens in any of the places where MacNeish-Callen material is known to be stored. (Heiser 2008a:12).

I also failed to locate any sunflower specimens during my examination of the Ocampo collections, though I did find a stem assigned to *Tithonia* among the materials at the Instituto de Prehistória attributed to Occupation 6 (Guerra phase) in Romero's Cave. While he definitely questions the presence of domesticated sunflower in prehistoric Mexico, Heiser (2008a:9) does acknowledge that "… the wild sunflower may have grown in northern most Mexico in early times." Recent identification of a carbonized sunflower achene on a Late Archaic village site in northwestern Chihuahua (not yet reported at the time of Heiser's review) confirms this (Adams and Hanselka, in press), and early presence and use of the wild plant in southern Tamaulipas is a distinct possibility.[5] However, the Flacco and Mesa de Guaje materials identified by Callen (1968, 1970) should be located, reexamined, and verified to help clarify this matter.

Other problematic issues involve more current botanical knowledge that calls past interpretations into question. At the time some sources were written, some plants, such as runner beans and chili peppers, were believed to be absent in wild form in the vicinity of the caves. The apparent absence of the latter has even been cited as evidence that the archaeological remains represent domesticated plants (Mangelsdorf et al. 1964:443). However, it is now known that both these plants are present and even abundant locally in the wild.

As mentioned in Chapter Three, another botanical issue concerns the maize "race" nomenclature used in many of the published sources. Mangelsdorf et al. (1967) and others classify maize cobs found in the Ocampo caves using taxonomy that many archaeologists today consider outdated. As Huckell (2006:105) puts it:

> Looking at the ways in which classification of archaeological maize has developed, it is hard to miss the obsession with the classification of prehistoric maize by the use of modern race identifications. It is common, for example, to read in the older literature that the maize from a particular site is "Chapalote" or "Nal Tel." The often uncritical way in which these names have been applied, usually without supporting criteria, has resulted in the widespread use of names that impose an identity with a suite of associated features and behaviors that precludes objective evaluation (Huckell 2006:105).

In her discussion, Huckell (2006:105) cites Mangelsdorf, MacNeish, and Galinat's (1967) description of the Ocampo cave maize as probably the most "exhuberant expression" of

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5 During our fieldwork in the vicinity of the caves we noted a few isolated wild sunflower plants in fallow agricultural fields and along roadsides and dry streambeds, but my impression is that they are not abundant in the area.

this largely obsolete nomenclature. Therefore, the “races” assigned in that article, used in others, and relayed in this chapter should not be considered as relevant at this stage.

Conclusion

Much of the early literature on Ocampo was written during a time when early farming and the origins of agriculture were of primary concern, leading to a de-emphasis on the non-domesticated portion of the plants used. Although many synthetic treatments acknowledge that wild plants often held a primary role in the Ocampo diet (particularly early in the sequence), mention of the specific wild plants is often neglected in favor of the supposedly domesticated ones, through the use of general phrases such as “They also did a great amount of plant collecting….” (MacNeish 1958:168). Some articles (e.g., MacNeish 1992:103-105) do mention wild plants used, and Callen’s (1968, 1970) analysis of paleofeces revealed some non-domesticated plants that were consumed. However, I am certain that the assemblage of wild plants used in this region surpasses those discovered in the paleofeces (especially because the analysis was left incomplete), and other lists based on floor debris are partial and unverifiable. So the broader spectrum of *non-domesticated* plants used in the caves across time is unclear when relying on published accounts.

My primary goal in this dissertation is to render a “current state of knowledge,” a conservative synthesis of what can be said with confidence regarding Ocampo human-plant relationships in prehistory. In the upcoming chapter I expand beyond the classic sources reviewed here using unpublished manuscripts and field excavation notes, and curated archaeological plant collections obtained from the previous cave excavations; these sources contain wild plant taxa not previously mentioned in publication.

CHAPTER 7: CURATED PLANT COLLECTIONS AND UNPUBLISHED DOCUMENTATION

Of course a major source of information from the Ocampo excavations was the large volume of vegetal remains preserved under the desiccated conditions in Romero's, Valenzuela's, and (to a lesser degree) Ojo de Agua caves. MacNeish submitted these diverse materials to a series of specialists for analysis, and the results of some of this work were published to varying degrees, but those of other plant classes were not published at all. As stated in previous chapters, Paul Mangelsdorf and Walton Galinat studied and published on the remains of maize and its relatives (Mangelsdorf et al. 1967), while Hugh Cutler and Thomas Whitaker analyzed and published on the cucurbit assemblage (Whitaker et al. 1957). Lawrence Kaplan studied the remains of beans and other legumes, and produced a report of the results (Kaplan and MacNeish 1960). E. O. Callen performed a partial analysis of the abundant human paleofeces recovered from the caves, and several reports were issued from this work (Callen 1967b, 1968, 1970); the feces were found to contain both wild and domesticated plant particles. As elaborated upon in the previous chapter, it is clear from the series of formal reports that domesticated plants were given priority; the same is true of the more general synthetic treatments.

Although most of the published works acknowledge that abundant wild plant remains were recovered alongside the cultivated ones, no formal report was ever released of what kinds of plants composed the non-domesticated assemblage from the floor refuse (as has been mentioned, Callen found some wild plant parts in the paleofeces, and he specifies them in two brief reports). In fact, based on the literature it is somewhat unclear who actually performed the analysis of the wild remains. C. Earle Smith is credited for analyzing the wild plants from the Sierra de Tamaulipas excavations (MacNeish 1958). In the introductory sections of an unpublished monograph about the Ocampo excavations that MacNeish was composing at the time of his death, he recalls how Mangelsdorf advised him to send the various plant classes to different experts: " 'Okay, Scotty, there are beans, these should go to that young botanist in Chicago, Larry Kaplan… that looks like cucurbits, get it ready to send to Cutler at the St. Louis Botanical Gardens – these gourds should go to Whittaker [*sic.*] in California – these wild plants to Smitty [C. Earle Smith] or Dressler – this amaranth to Sauer,' and on and on" (MacNeish 1998:20). In publication MacNeish (1957:28) directly states that "… Dr. C. Earle Smith, then a student of Dr. Mangelsdorf, identified the 1949 materials [from the Sierra de Tamaulipas excavations], while Dr. Robert Dressler of the Gray Herbarium has undertaken the 1954-55 plant material [from Ocampo]." Dressler's involvement, however, never came to pass (see Chapter Five, pg. 115). Barring further information, it is safe to assume that C. Earle Smith was involved in the analysis of the Ocampo wild plant remains at least to some degree. Also, if Jonathan D. Sauer ever did analyze the Ocampo cave amaranth remains, these were never reported either.

Besides the published accounts discussed in the last chapter, two additional sources enrich the picture of prehistoric plant use in the Ocampo caves. Unpublished reports, field excavation notes, and field specimen catalogs compiled by MacNeish (1954b, 1954c, 1954d, 1954e, 1954f) and then graduate student David Kelley (1954a, 1954b, 1954c) mention various plants encountered in the cultural strata, some of which were never reported in the published literature. Also, abundant plant remains from the actual excavations are now housed at various curation facilities in the United States and Mexico; these collections also contain some plant taxa that have never been mentioned in print as present in the cultural levels.

Unpublished Excavation Notes

Unpublished documentation, including field reports (Kelley 1954a; MacNeish 1954b, 1954c), excavation notes and square (unit) descriptions (Kelley 1954c; MacNeish 1954e), and field specimen catalogs (Kelley 1954b; MacNeish 1954d, 1954f), regarding excavations in Romero's, Valenzuela's, and Ojo de Agua caves were obtained from the R. S. Peabody Museum of Anthropology in Andover, Massachusetts. In the excavation notes for each site, the cultural zones encountered are described in detail, including the nature of the sediments, the contents (artifacts, animal bones, plant materials), the cultural phase to which each zone was attributed, and interpretations about the nature of each occupation. The square descriptions summarize the deposits encountered in each unit excavated, while the artifacts and ecofacts associated with each provenience are listed in the field specimen catalogs[6]. This documentation holds some reference to plant materials encountered during the excavations, which may or may not have made their way into the published sources described in the previous chapter or into curated museum collections. These unpublished sources therefore provide additional insight into plant items found in each cultural zone and information on cultural context such as the function of individual site occupations.

The notes for Romero's and Valenzuela's caves are more detailed and complete than those for Ojo de Agua cave, as this latter site was less thoroughly investigated than the others. For instance, in the following discussion, the reader may note that volumetric data are not provided for most of the layers in Ojo de Agua cave, and that maps

6 The field catalogs tabulate specimens of individual plant types from specific contexts. In some cases, the plants are actually named (e.g., "huapillas," "squash rind," bean pod fragment"); unfortunately, however, in most cases the plant remains are listed as "plant type 1," "plant type 2," and so on. I was unable to locate any sort of code sheet to translate this system for any of the sites or occupation zones.

delineating the horizontal extent of the occupation zones are not present here because they were absent from or unclearly labeled among the field notes.

Examination of Curated Plant Collections

As was made clear in Chapter Six, the plant subsistence remains recovered from the Ocampo caves are incompletely and inconsistently published. Wild plant taxa have previously been discussed only in brief, synthetic form (i.e., MacNeish 1992) and in Callen's (1968, 1970) study of paleofeces, in which very few wild plant types were represented. The corn, bean, and cucurbit materials were initially examined in the 1950s and 1960s, and broad overviews of these collections are published (Kaplan and MacNeish 1960; Mangelsdorf et al. 1967; Whitaker et al. 1957), but these reports do not provide the totality of the data; they present counts of plant parts organized by MacNeish's cultural phases (and sometimes not all time periods are represented), rather than by the specimens' contexts in the original excavations. Therefore the known curated plant materials from previous excavations in the Ocampo caves were examined to supplement and enhance the existing literature.

Materials and Methods

Smith (1997b) has demonstrated the continuing investigative potential of the curated Ocampo plant collections. It was not necessary to personally visit the collection of legume remains analyzed by Lawrence Kaplan and curated at the Smithsonian Institution, as Dr. Kaplan compiled a detailed inventory of his analysis; this inventory was provided to me by Dr. Bruce Smith of the Smithsonian Institution Archaeobiology Program, and is used here with Dr. Kaplan's permission. Otherwise I examined the collections in their respective curation facilities whenever possible (Table 7.1). Before inspecting the contents of the collections it was necessary to reconstruct the proveniences

Table 7.1. Curated plant materials from the Ocampo caves and locations of the collections.

Material	**Analyst (s)**	**Sites included**	**Extent of Analysis**	**Quantification reported?**	**Reference**	**Location of Collection**
Beans and related taxa	Lawrence Kaplan	Tmc 247, Tmc 248, Tmc 274	Identification / analysis of pods/ fragments, and a few fragmentary seeds	Counts, by plant part and time period	Kaplan and MacNeish 1960	Smithsonian Institution, Washington, D.C. (SI)
Maize and related taxa	Paul Mangelsdorf, Walton Galinat	Focused on Tmc 247, but one specimen from Tmc 248 included	Identification / analysis of cobs, stalks, leaves, husks, tassels, and quids	Counts, by plant part and time period	Mangelsdorf et al. 1967	Harvard Herbarium, Boston (HH)
Squashes and gourds	Thomas Whitaker, Hugh Cutler	Tmc 247, Tmc 248, Tmc 274	Identification/ analysis of rind, peduncles, seeds	Counts, by plant part and time period	Whitaker et al. 1957	Illinois State Museum, Springfield (ISM)
Wild plants	C. Earle Smith?	Tmc 247, Tmc 248, Tmc 274	Unspecified sample of assemblage; extent of analysis unknown	None	Synthetic articles (e.g., MacNeish 1964, 1992)	Departamento de Prehistoria, INAH Consejo, Mexico City (INAH)

from which individual specimens were recovered during excavation. As discussed in Chapter Five, MacNeish's crew excavated the caves in six inch (15 cm) levels within 5 ft^2 (1.5 m^2) units; each level in each unit was assigned a two-part field specimen number, consisting of the site number followed by a sequential field provenience designation. In many cases these numbers are either written directly on their corresponding archaeobotanical specimens or on labels included with each item. I reconstructed the original excavation provenience of the archaeobotanical materials in the collections by cross-checking field specimen numbers associated with each item against the field specimen catalog, excavation notes, and unit/level descriptions described above (Kelley 1954a, 1954b, 1954c; MacNeish 1954b, 1954c, 1954d, 1954e, 1954f).

Once this was accomplished the assemblage was documented by describing, measuring, counting, weighing (to the nearest tenth of a gram), and photographing hundreds of individual specimens, and formulating an inventory of their field catalog numbers and contexts in the excavations. For specimen identification I relied for the most part on the judgement calls of the original analysts, as most specimens are labeled to varying taxonomic levels. However, with a 10x hand lens and a 60x binocular microscope it was occasionally possible to either identify previously unlabeled items or to further classify some specimens to finer taxonomic levels.

As a result, several identifications differ from those indicated on the labels associated with the specimens. In most cases these changes are not intended to suggest that the original analysts were wrong in their assessments; rather, some plant specimens are reclassified because close inspection under magnification allowed identification to a finer level. For example, examination of several specimens of fibrous leaf fragments labeled "Liliaceae" revealed imprints of small, sharply recurved or hooked spines. This allowed the identification of the leaf fragments to be refined to *Dasylirion*, or sotol; the imprints remain from when the narrow leaves were compressed tightly against one another while developing in the stem. Also, microscopic examination of fibrous leaf fragments and knots also classified broadly as Liliaceae revealed very finely serrated margins that are consistent with species of *Yucca* that occur within the study area, thereby allowing for more specific classification. Numerous rind fragments in the Cutler Blake collection at the Illinois State Museum were simply labeled "Cucurbitaceae," but were recognizable as bottle gourd based on their epidermis (surface color of dark purplish-gray to reddish brown as well as rind thickness exceeding 3 mm (Smith 1997b: 353). There were a number of unlabeled items that were immediately recognizeable as known plant parts, such as *aquiche* (*Guazuma ulmifolia*) and *Thevetia* sp. fruits. Finally, there are several items that were found to be altogether misidentified. One is a sharply pointed fragment that was labeled in the collection as Amarylidaceae (or Agavaceae). Presumably this specimen was originally thought to be the distal spine of the agave leaf, but microscopic inspection revealed it to actually be a wooden implement that had been sharpened to a fine point. In addition to these minor reclassifications, I personally identified a number of tiny, previously unknown specimens in the ISM Cutler-Blake collection that were revealed only upon fine screening a small jar of sediment, as discussed below.

In some cases I use current nomenclature that differs fromwhat was accepted when the earlier analyses were carried out. With the increasing use of molecular data, plant systematics is a continuously evolving field and genera and families are constantly being shifted between and subsumed within one another, so for the present purposes I use the phylogeny and nomenclature outlined in Judd et al. (2002). At the INAH Departamento de Prehistoria, remains of the genus *Agave* are stored under the family "Amarylidaceae;" today agave is widely regarded to belong in the family Agavaceae; *Dasylirion* is stored in the collections under Liliaceae, though more current nomenclature classifies it within the family Ruscaceae. Other prior family designations have been renamed to fit the convention in which the family name must be based on the name of one of its genera. For instance, here the family name Arecaceae is used rather than Palmae. Four separate collections form the basis of this phase of the research.

Departamento de Prehistória, INAH Consejo, Mexico City (INAH). Much of the wild plant materials from the Ocampo caves, but certainly not all of them, are now located at the offices of the Departamento de Prehistória in Mexico City, where I examined them between September 15 and October 10, 2005. Besides the variety of non-domesticated plants, a few fragments of maize were also present in this collection. Approximately 680 items were examined, described, and tabulated.

Cutler-Blake Collection, Illinois State Museum, Springfield, IL (ISM). Squash and gourd remains from the Ocampo caves, originally analyzed and reported by Thomas Whitaker and Hugh Cutler (Whitaker et al. 1957), are now held in this collection in Springfield, Illinois. I examined these remains from May 8 to 10, and again from September 26 to October 3, 2006. I examined and collected information about approximately 3,600 specimens, including squash and gourd rind, peduncles, and a few seeds. Data for an addition 261 seeds came from a detailed inventory compiled by Bruce Smith following his study of the Cutler-Blake Ocampo materials (Smith 1997b, 1997c, 1997d). I also encountered several random items such as agave quids, small mammal bones, and paleofecal samples. Finally, additional plant materials were revealed by fine screening of a jar of sediment and plant matter labeled "Veg. Material" that was found in the collection.

This 150 ml soil sample came from Romero's cave, Unit S25, Level 4a (catalog number 247/57), near the central back (south) wall of the cave. MacNeish assigns this provenience to Occupation 10, during the Mesa de Guaje phase. The sample offered a unique opportunity for fresh (albeit limited) insight into human/plant interactions at one point in prehistory, as it represented the potential to reveal plant parts too small to be recovered through the traditional excavation methods used by MacNeish and his colleagues (MacNeish 1958:8).[7] With the permission of the ISM, I thoroughly analyzed the sample under magnification at the Paleoethnobotany Laboratory at Washington University in St. Louis in October and November, 2006, and identified numerous plant specimens among the sediments.

Harvard Herbarium, Boston, MA (HH). In the 1950s and 1960s Paul Mangelsdorf and Walton Galinat analyzed and reported more than 12,000 specimens of maize and closely related taxa, primarily from Romero's cave (Mangelsdorf et al. 1967). I examined the specimens in this collection in early May 2008, and tabulated some 1,197 items. Unfortunately I have no explanation for the discrepancy between the number of Mangelsdorf and colleagues reported remains and the number of specimens I found in the collections. The HH also contains the Valenzuela's cave maize materials, but much of these are still in what seem to be the original collection paper bags, and have not been sorted or analyzed in any way. Thus only a few of the Valenzuela's cave maize materials can be included in this discussion.

Smithsonian Institution, Washington, D.C. (SI). The Ocampo legume remains, once analyzed by Dr. Lawrence Kaplan, are now housed at the Smithsonian Institution. According to the resultant landmark report (Kaplan and MacNeish 1960:Table 2), a total of 845 bean specimens were originally studied by Kaplan. I did not need to re-examine

7 The primary data source concerning small-seeded taxa in the Ocampo caves is paleofeces, in which Callen (1967b, 1968, 1970) observed chile pepper (*Capsicum*), prickly pear (*Opuntia*), setaria (originally identified as *Panicum*), and amaranth (*Amaranthus*).

this collection for the present study, as Dr. Kaplan included with the curated remains a detailed inventory, complete with descriptions and provenience information for each item (Kaplan, n.d.). For the purpose of this dissertation, Dr. Bruce Smith of the Smithsonian Institution National Museum of Natural History supplied me with this inventory, and the data contained therein is used here with the permission of Dr. Kaplan. The inventory contains approximately 1,100 individual specimens; among the legume (both wild and domesticated) remains are listed some fragments of agave, grass culms, and several maize, goosefoot, and amaranth fragments.

Sources of Bias in the Plant Collections

The museum assemblages are potentially biased in several ways. First, the excavators screened sediments through ¼-inch mesh (MacNeish 1958:8), so the collections are prejudiced towards larger items. While the one soil sample from a Mesa de Guaje level in Romero's cave provides more refined data set from an isolated location, the limitations of this small sample regarding overall subsistence are obvious.

Secondly, it is unclear exactly what was ultimately saved from the excavations. In the last chapter the absence of a particular plant taxon from the published literature for a particular time phase does not necessarily indicate its absence in the cave deposits, as the descriptions only reflect what the authors chose to include. Likewise, the absence of taxa in the curated plant collections does not directly translate to their absence in the deposits, as it is presently unclear exactly what was retained during the excavations due to the sheer bulk of vegetal matter preserved and encountered. Some plant remains were undoubtedly left in the field following removal, because the unpublished excavation descriptions note levels of abundance in vegetal remains in various occupation layers that are far beyond the contents of curated collections. For example, concerning Zone D, Occupation 13 in Romero's cave, the excavation notes indicate that field crews counted and classified some 7,709 vegetal remains, but that "*This probably represents about two thirds of all that occur*" (MacNeish 1954b:59, emphasis added). I interpret this statement to mean that much vegetal material was not collected, counted, or classified, much less curated. Particularly sparse are the wild remains at the INAH offices in Mexico, while the domesticate collections contain more materials and are seemingly more complete (yet another source of bias against wild plants, although some non-domesticated specimens are included in the legume and cucurbit collections). Unfortunately the incomplete nature of the plant collections precludes quantitative analysis of relative frequencies of different plants against one another or within levels, although some qualitative observations may be made, as the collections do give insights into the use of several plant species that are never mentioned in the published accounts.

Another source of bias is the fact that not all specimens in the collections retained sufficient provenience information; many are no longer labeled with the original catalog numbers, preventing assignment to specific contexts. Finally, Smith (1997b) has demonstrated that some disturbance has occurred in the cave deposits, so it is possible that items attributed to individual occupation zones do not actually date to the cultural phases MacNeish assigned to these layers.

There are several other valuable sources of information concerning plant use and plant-related subsistence in the Ocampo caves not included in this study that should be mentioned, and these represent opportunities for future study. It was beyond the scope of this dissertation to analyze the manufacturing techniques of the few fragments of basketry and cordage held in the INAH collections; these were examined primarily to determine the types of raw plant materials used in their construction, and here they are only broadly classified by artifact type. Callen (1968, 1970) admits that the majority of the paleofecal specimens recovered from the caves remain unanalyzed; unfortunately, the current location of both the analyzed and unanalyzed specimen is unknown[8], so they were not examined in the present study. Finally, at the time of this study the location of the human remains recovered from the Ocampo caves was unknown, so these were not examined, though they would also be an excellent source for subsistence data.

Maps showing the horizontal extent of the cultural zones in Romero's and Valenzuela's caves are found in Appendix 1. The following discussion of the cultural deposits and their corresponding plant remains in Romero's, Valenzuela's, and Ojo de Agua caves is organized in order from the oldest occupations (deepest in the excavations) to the most recent. The descriptive information presented here in the text and in the figures in Appendix 1 regarding these zones is extracted from both unpublished field notes (Kelley 1954a; MacNeish 1954b, 1954c) and Smith's (1997b:Tables 1 and 6) summary. As in the published literature discussed in Chapter Six, there is often a lack of standardized names for specific plants mentioned in the field notes, so I have selected common names that will remain consistent throughout this chapter (except when direct quotes of the field notes are used). Refer to Table 6.1 in the previous chapter for names used in the field notes corresponding to the plants named here. The plants and their various parts found in the curated collections are listed in Table 7.2.

Romero's Cave

Excavators identified 16 occupation floors within Romero's cave, corresponding to eight cultural phases: Occupation 1a, Infiernillo; Occupations 1 through 4, Ocampo; Occupations 5 through 8, Guerra; Occupations 9 and 10, Mesa de Guaje; Occupations 11

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8 When asked about the location of the Ocampo cave paleofeces examined by Callen, Vaughn Bryant (Texas A&M University, College Station) informed me that these samples were supposedly returned to Mexico decades ago; officials at INAH are unaware of their location.

Table 7.2. Curated Plant Materials by Cultural Phase (asterisks [*] under Mesa de Guaje indicated items identified by the author in the sediment sample curated at ISM).

Taxon and part	San Antonio (500-200 B.P.)	San Lorenzo (1100-500 B.P.)	Palmillas (1900-1100 B.P.)	Mesa de Guaje (3600-3000 B.P.)	Guerra (4400-3600 B.P.)	Flacco (5200-4400 B.P.)	Ocampo (6000-5200 B.P.)	Infiernillo (9000-7600 B.P)	Unknown context	Total
Agavaceae (Amarylidaceae)										
Agavaceae	**13**	**10**		**1**	**1**					**25**
leaf	13	9		1	1					24
petate		1								1
***Agave* sp.**			**2**	**3**						**5**
leaf			2							2
quid (leaf)				*3						3
***Agave* sp.?**	**6**	**7**	**1**						**1**	**15**
leaf	6	4	1							11
quid (leaf)		3							1	4
***Yucca* sp.**	**2**	**4**								**6**
leaf	2	4								6
Agavaceae/Bromeliaceae										
Agavaceae / Bromeliaceae?	**1**									**1**
leaf base	1									1
Agavaceae?										
Agavaceae?					**1**				**1**	**2**
cloth									1	1
leaf					1					1
Amaranthaceae										
***Amaranthus* sp.**				**2**						**2**
seed				*2						2
Amaranthaceae/Chenopodiaceae										
***Amaranthus* sp./*Chenopodium* sp.**	**1**									**1**
stem	1									1
Apocynaceae										
***Thevetia* sp.?**									**1**	**1**
nut									1	1
Arecaceae (Palmae)										
Arecaceae	**14**	**12**	**3**		**2**					**31**
leaf	14	11	3		2					30
petate		1								1
***Brahea* sp.**						**2**				**2**
leaf						2				2
Asteraceae										
***Aster* sp.**				**2**						**2**
seed				*2						2
***Tithonia* sp.?**					**2**					**2**
stem					2					2
***Verbesinia* sp.**				**1**						**1**
seed				*1						1
Bombacaceae										
Ceiba pentandra	**7**	**17**							**4**	**28**
pod	5	12							4	21
seed	2	5								7
Bromeliaceae										
***Bromelia* sp.**		**3**								**3**
leaf		3								3
Bromeliaceae		**4**							**1**	**5**
leaf		4							1	5
Hechtia glomerata		**6**							**5**	**11**
leaf		6							5	11

Table 7.2, continued.

Taxon and part	San Antonio (500-200 B.P.)	San Lorenzo (1100-500 B.P.)	Palmillas (1900-1100 B.P.)	Mesa de Guaje (3600-3000 B.P.)	Guerra (4400-3600 B.P.)	Flacco (5200-4400 B.P.)	Ocampo (6000-5200 B.P.)	Infiernillo (9000-7600 B.P)	Unknown context	Total
***Tillandsia* sp.**			**1**	**66**					**1**	**68**
leaf			1							1
stem				*66						67
***Tillandsia* sp.?**	**1**								**2**	**3**
leaf	1								2	3
Cactaceae										
Cactaceae				**3**						**3**
seed				3						3
***Echinocactus* sp.**				**28**						**28**
seed				*28						28
***Opuntia* sp.?**					**1**					**1**
seed					1					1
Cucurbitaceae										
Cucurbita argyrosperma			**1**		**1**					**2**
peduncle			1		1					2
Cucurbita foetidissima	**2**	**2**	**13**				**9**			**26**
rind	2	2	13				9			26
***Cucurbita foetidissima*?**		**10**								**10**
rind		10								10
Cucurbita moschata	**3**	**19**	**8**	**4**	**1**					**35**
peduncle	3	4	2	3						12
rind		12	6	1	1					20
seed		3								3
Cucurbita pepo		**6**	**1**		**1**				**2**	**10**
rind		6	1		1					8
seed									2	2
***Cucurbita pepo* or *C. argyrosperma*?**			**1**	**1**						**2**
peduncle			1	1						2
***Cucurbita pepo* or *C. moschata*?**		**2**								**2**
peduncle		2								2
Cucurbita pepo* ssp. *pepo	**1**	**6**	**1**	**1**	**3**		**2**			**14**
peduncle	1	6	1	1	3		2			14
***Cucurbita pepo* ssp. *pepo*?**						**1**				**1**
peduncle						1				1
***Cucurbita pepo*?**						**1**				**1**
seed						1				1
***Cucurbita* sp.**	**11**	**2**	**2**	**241**	**9**	**5**	**25**		**35**	**330**
paleofeces/seeds				*>19						>19
peduncle		1					3			4
rind	10	1	1	14					34	60
seed	1		1	227	9	5	22		1	266
Cucurbitaceae	**208**	**334**	**90**	**150**	**236**	**125**	**263**		**17**	**1423**
peduncle	1	2	2		4		5		3	17
rind	178	304	82	33	111	74	177		13	972
seed	29	28	6	117	121	51	81		1	434
Lagenaria siceraria	**68**	**33**	**1**	**2**	**19**	**1**			**39**	**163**
peduncle	2	1			1					4
rind	66	32	1		18	1			39	157
seed				2						2
***Lagenaria siceraria*?**		**1**	**11**							**12**
rind		1	11							12
Cucurbitaceae?										
Cucurbitaceae					**1**					**1**

Table 7.2, continued.

Taxon and part	San Antonio (500-200 B.P.)	San Lorenzo (1100-500 B.P.)	Palmillas (1900-1100 B.P.)	Mesa de Guaje (3600-3000 B.P.)	Guerra (4400-3600 B.P.)	Flacco (5200-4400 B.P.)	Ocampo (6000-5200 B.P.)	Infiernillo (9000-7600 B.P)	Unknown context	Total
seed					1					1
Fabaceae										
***Acacia* sp.**	**1**	**1**								**2**
pod		1								1
seed	1									1
cf *Acacia* sp.			**1**	**1**						**2**
pod			1							1
thorn				*1						1
***Canavalia* sp. (*Maritima* sp.?)**		**1**								**1**
seed		1								1
***Canavalia* sp.**		**1**								**1**
seed		1								1
***Enterolobium* sp.**									**1**	**1**
pod									1	1
***Erythrina* sp.**	**2**		**16**							**18**
pod			15							15
seed	2		1							3
***Inga* sp.**		**1**							**14**	**15**
pod		1							14	15
Legume	**54**	**189**	**16**	**11**	**17**	**2**	**21**	**32**	**4**	**346**
inflorescence		1	1							2
pod	54	188	15	11	16	2	21	32	4	343
seed					1					1
Legume?					**2**					**2**
pod?					2					2
Leucaena edulis	**20**	**1**				**1**				**22**
pod	20	3				1			3	22
***Phaseolus coccineus*?**	**1**									**1**
pod	1									1
Phaseolus lunatus									**1**	**1**
seed									1	1
***Phaseolus lunatus*?**		**3**		**4**						**7**
pod		3		4						7
***Phaseolus* sp.?**					**2**					**2**
pod					2					2
Phaseolus vulgaris	**112**	**349**	**126**	**2**	**3**	**12**	**8**	**2**	**1**	**615**
inflorescence		2								2
pod	112	342	125	2	3	12	8	2	1	607
seed		5								5
(blank)			1							1
***Phaseolus vulgaris*?**		**1**	**30**	**6**		**5**				**42**
pod			30	6		5				41
seed		1								1
***Prosopis* sp.**	**1**						**2**			**3**
pod	1									1
seed							2			2
Fabaceae/Cucurbitaceae										
***Prosopis* sp.?/*Cucurbita* sp.?**				**1**						**1**
seed				1						1
Fabaceae?										
Fabaceae?	**1**									**1**
pod?	1									1
Fagaceae										

Table 7.2, continued.

Taxon and part	San Antonio (500-200 B.P.)	San Lorenzo (1100-500 B.P.)	Palmillas (1900-1100 B.P.)	Mesa de Guaje (3600-3000 B.P.)	Guerra (4400-3600 B.P.)	Flacco (5200-4400 B.P.)	Ocampo (6000-5200 B.P.)	Infiernillo (9000-7600 B.P)	Unknown context	Total
***Quercus* sp.**		**17**			**12**				**3**	**32**
leaf		1								1
nut		16			12				3	31
***Quercus* sp.?**					**1**					**1**
nutmeat?					1					1
Juglandaceae										
Juglandaceae	**1**	**2**								**3**
leaf		2								2
nutshell	1				*1					2
***Juglans* sp.**	**1**	**3**		**1**	**7**				**21**	**33**
nut		1			1					2
nutshell	1	2		1	6				21	31
Malvaceae										
Gossypium hirsutum			**9**							**9**
seed			9							9
Paleofeces										
paleofeces	**1**	**1**		**7**						**9**
paleofeces	1	1		7						9
Pinaceae										
***Pinus cembroides* Zucc.**	**1**									**1**
cone	1									1
***Pinus* sp.**				**6**		**1**				**7**
cone						1				1
needle				*6						6
Poaceae										
***Arundo* sp.?**	**5**	**1**	**3**							**9**
stalk	5	1	3							9
***Zea mays* ssp. *mays* (F1) x teosinte?**			**4**	**4**						**8**
rachis			3							3
stalk/leaf			1	4						5
Poaceae	**4**	**6**		**4**						**14**
culm	3	3								6
floret				*2						2
inflorescence		1								1
plant	1									1
seed head stem		1								1
spike				*2						2
stem		1								1
Setaria parviflora				**754**						**754**
seed				*754						754
***Tripsacum* sp.**									**2**	**2**
rachis									2	2
***Tripsacum* sp.?**		**1**								**1**
tassel		1								1
Tripsacum zapilotense									**1**	**1**
rachis									1	1
***Zea mays* ssp. ? (teosinte)**				**4**	**3**					**7**
kernel					1					1
stalk/leaf				4	2					6
Zea mays* ssp. *mays	**1987**	**993**	**1099**	**562**	**174**	**6**		**14**	**1424**	**6259**
cob (whole)	21	27	35	59	13				14	169
cob fragment	181	200	212	82	26				114	815

Table 7.2, continued.

Taxon and part	San Antonio (500-200 B.P.)	San Lorenzo (1100-500 B.P.)	Palmillas (1900-1100 B.P.)	Mesa de Guaje (3600-3000 B.P.)	Guerra (4400-3600 B.P.)	Flacco (5200-4400 B.P.)	Ocampo (6000-5200 B.P.)	Infiernillo (9000-7600 B.P)	Unknown context	Total
cob segment	507	527	620	356	89				191	2290
ear node/shank				1						1
husk	94	56	29	11	6	5		14	12	227
kernel	15	7	1		1				3	27
leaf	27	14	3	21	1					66
quid (leaf)	15	40	3	1	2					61
quid (stalk)	3			1					4	8
quid (tassel)		2	10							12
stalk	22	18	20	16	5	1			7	89
stalk/husk			1		1					2
stalk/leaf	4	3	2							9
tassel	1098	99	163	14	30				1079	2483
***Zea mays* ssp. *mays* ?**	**1**	**1**		**10**						**12**
kernel				10						10
stalk	1	1								2
Polypodiaceae										
***Adiantum* sp.**	**247**									**247**
leaf	186									186
stem	61									61
Polyporaceae										
Polyporaceae		**1**								**1**
fungus		1								1
Portulacaceae										
***Portulaca* sp.**				**47**						**47**
seed				*47						47
Rosaceae				**45**						
cf Rosaceae				*45						
Ruscaceae										
***Dasylirion* sp.**	**9**	**6**							**3**	**18**
leaf	7	6							3	16
leaf base	2									2
Rutaceae										
Esenbeckia berlandieri	**1**	**1**	**2**							**4**
pod	1	1	2							4
Solanaceae										
***Datura* sp.**				**8**						**8**
seed				*8						8
***Nicotiana* sp.**	**4**	**5**								**9**
leaf	4	5								9
Sterculiaceae										
Guazuma ulmifolia				**1**					**6**	**7**
fruit				1					6	7
Unidentifiable seed fragments				*23						
Total	**2791.5**	**2065**	**1442**	**1961**	**499**	**162**	**330**	**48**	**1592**	**10868**

and 12, Palmillas; Occupations13 and 14, San Lorenzo; and Occupations 15 and 16, San Antonio (MacNeish 1954b).

Romero's Cave, Zone O, Occupation 1a

Excavation Notes and Observations. The earliest occupation in Romero's cave, Occupation 1a, consists of Zone O, a thin layer of dark brown charcoal (3.3 m^3) that overlay a non-cultural layer of sand and gravel. The zone spanned approximately two 1.5 m^2 excavation units against the back wall of the cave (Figure A-1.1). MacNeish (1954b) attributes Zone O to Infiernillo times; he interprets it to reflect a summer occupation by a microband, based on the small extent and the presence of a single hearth. Besides plant food gathering, activities performed from the cave during this occupation included hunting and butchering, based on the presence of projectile points, a fragment of an atlatl main shaft, and 32 unidentifiable bones. Woven mats found in the deposit were perhaps used as beds.

Although MacNeish (1954b:11) states that pollen from this strata seems to indicate a slightly wetter climate than that of today, he acknowledges that general plant preservation here was poor (two factors that may be related). Regarding these plant materials, he writes:

> Their hunting diet … was supplemented somewhat by twenty wild plant specimens. Three of these wild specimens are from wild squash. Seeds from a feces may be from a very small variety of pumpkin, cucurbita pepo, which indicates a use of domesticated plants (MacNeish 1954b:13).

Artifactual data provided additional insights into plant collecting, as one humped scraping plane is suspected to have been used to pulp some of the wild vegetal materials.

Curated Plant Materials Attributed to Zone O, Occupation 1a. None of the curated plant remains considered for the present study could be directly attributed to Occupation 1a of Romero's cave.

Romero's Cave, Zone N, Occupation 1

Excavation Notes and Observations. Zone N (Occupation 1) was separated from Zone O by a non-cultural layer of "ash and cave dust" (Zone O_1). Zone N consisted of a thin (5 cm, 0.2 m^3) layer of charcoal and vegetal material, covering a relatively small space (approximately three contiguous excavation units) near the back wall of the cave (Figure A-1.2). Originally attributed to the Ocampo phase, it supposedly represents another microband occupation, possibly in the late spring and/or early summer (based on the presence of squash seeds). Projectile points and side scrapers and animal bones indicate that hunting and butchering (and possibly the processing of hides) were activities associated with this occupation, and there was limited evidence of plant collecting.

According to the notes this strata also only produced about 20 plant specimens (MacNeish 1954b:15), though these were interpreted to indicate that wild plants provided the greater bulk of the diet:

> There was one capsule of tripsicum grass and a pod of wild phaseolus cocconineus [*sic.*], that is runner beans. The mortar, the scraping planes and the saw-like chopper were probably implements used in preparing this wild food stuff for meals. The one squash stem seems to indicate that, while these peoples were basically food-gatherers, they did use domesticated plants in much the same manner as they used wild plants (MacNeish 1954b:15).

Some cordage and textile fragments are also noted.

Curated Plant Materials Attributed to Zone N, Occupation 1. None of the 20 plant specimens mentioned in the field notes as present in Occupation 1 of Romero's cave could be relocated among the curated materials.

Romero's Cave, Zone M, Occupation 2

Excavation Notes and Observations. Overlying Zone N was a non-cultural layer of ash and dust (Zone N_1), upon which was discovered Zone M (Occupation 2), a very thin (2.5 cm, 0.2 m^3) layer of vegetal material. Zone M spanned about 8 units across the block excavation at the back wall of the cave (Figure A-1.3). Also attributed to the Ocampo phase, it was interpreted to reflect a brief microband occupation of the cave. About "one fifth" of the refuse came from two pits (MacNeish 1954b:16). One was a small roasting pit filled with fire-cracked rock and charcoal, while the other was slightly larger and may have been used for storage of plant materials.

Besides plant collecting, this occupation seems to be associated with multiple activities. A fragment of deer skin, a bone from a skunk, a bird bone, 34 split bones, projectile points, and various other stone tools could be linked to hunting and butchering. The deer skin fragment, scrapers, and some wooden implements are evidence for some hide preparation. Finally, a partially completed wooden atlatl foreshaft indicates that the manufacture of hunting tools was an additional activity.

MacNeish (1954b:17) notes about 130 plant specimens from Zone M. The larger of the two pits mentioned above was "crammed with leaves of Huapillas [guapilla: *Bromelia pinguin* or *Hechtia glomerata*]" (MacNeish 1954b:16). A single cactus flower contributed to the interpretation of this zone as a late spring occupation. Also found among the remains were "… tripsicum grass and runner beans, as well as remains of a gourd represented by ten rind fragments, a pepper remain, and a number of seeds of squash, as well as two pods of common beans of the yellow-seeded variety" (MacNeish

1954b:17). Based on AMS dating such an early presence of common beans in Ocampo is no longer accepted (Kaplan and Lynch 1999). A "saw-like chopper" and "flat and humped scraping planes" were likely used to process the plants recognized in Zone M.

Curated Plant Materials Attributed to Zone M, Occupation 2. Although in the field notes MacNeish mentions some 130 plant specimens as present in the Occupation 2 deposits in Romero's cave, based on the field catalog only 39 specimens in the curated collections could be traced to this zone. These included multiple thin rind fragments from an unidentified cucurbit (n=28) and unidentified legume pod fragments (n=11).

Romero's Cave, Zone L, Occupation 4

Excavation Notes and Observations. A non-cultural layer (Zone M_1) of brown gray soil separated Zone M from the next more recent cultural level, Zone L (Occupation 4). Zone L consisted of a 5 to 10 cm (1.6 m^3) layer of brown vegetal material spanning a larger horizontal space than the previous zone (12 units) at the back of the cave (Figure A-1.4). Also attributed to Ocampo times, Zone L was interpreted to reflect spring-fall occupation by "… perhaps a family or two, in other words, something somewhat between a micro-band and a macro-band, but still more of the micro size than of the larger size" (MacNeish 1954b:19). Two pits originating in Zone L were discovered; one was a likely roasting pit filled with fire-cracked rock, while the other seems to have been a shallow storage pit filled with "quite a bit of wild plant material" (MacNeish 1954b:19).

Again, MacNeish found evidence that multiple activities were performed by the occupants that produced Zone L. Evidence for hunting includes about 80 fragments of animal bone, a fragment of deer skin, and projectile points (including three Tortugas-type spear points wrapped in a leaf at the back of the cave, two of which were attached to atlatl foreshafts and one was attached to a lance shaft). The deer hide fragment and various scrapers are indicative of skin preparation. Chipped stone debitage and an antler hammer show that the manufacture of stone tools was an activity during this occupation, and other artifacts demonstrate that wood working was done as well. Perishable items indicate the processing of fibers and leaves into cordage, baskets, nets, and mats. Finally, plant food collection and some agriculture were major activities during the occupants' stay.

The notes report that some 408 plant remains were found in Zone L. The interpretation of a spring to fall occupation is based on the remains of flowers and nuts, "… as well as peppers, corn, bean, and so forth…" (MacNeish 1954b:19). As was made clear in the last chapter, maize is not formally recognized at this early stage in the analysis presented in Mangelsdorf et al. (1967). Here, however, is mentioned the presence of "corn silk with the pollen still adhering" in feces, though no cobs were found. MacNeish (1954b:20) speculates that the occupants may have been chewing some form of wild maize while green, and spitting the remains outside the cave, resulting in the presence of silk and pollen in the feces. Chili pepper seeds are also noted in the feces. MacNeish interprets the remains in Zone L to indicate that "limited incipient agriculture" was definitely taking place by this time: "There are fragments of gourd rind, a squash stem, and in the feces there were definite evidences of bean tissue and bean pod, probably indicating that the beans were eaten green (MacNeish 1954b:20). Besides the domesticated remains were also found "some grains of tripsicum as well as some of panicum" (MacNeish 1954b:20). Artifacts such nets and baskets could have been used to transport these plants to the cave, the "sawed chopper" and "scraping plane" could have been used to process them.

Curated Plant Materials Attributed to Zone L, Occupation 4. Rather than 408 specimens as reported in the field notes, only some 217 plant remains found in the curated collections could be traced specifically to Occupation 4 using the field catalog. These included peduncles representing pepo squash, as well as a peduncle, rind fragments, and seeds of unidentified squash. Legume remains include two pod fragments from an unidentified legume, two seeds representing mesquite, and four pod fragments identified as common bean. Other materials in the collections were assigned to "Occupation 3" (Zone M_1), but this layer was later deemed to be non-cultural (Smith 1997b:354), and the materials therein were interpreted to have been introduced from Occupation 4 above. The intrusive materials included peduncles and rind of unidentified cucurbits, some wood fragments, and some legume pod fragments identified as common bean.

Romero's Cave, Zone K, Occupation 5

Excavation Notes and Observations. Zone K (Occupation 5) overlay Zone L. It consisted of a thin (0.6 m^3) layer of gray ash with some vegetal material; it was exposed in nine units and spanned much of the back portion of the cave (Figure A-1.5). MacNeish attributes Zone K to the Guerra phase (the phase between Ocampo and Guerra, Flacco, was not observed among the occupations in Romero's cave), and interprets it to represent a short occupation by a microband.

Though no animal bone was present, projectile points, scrapers, atlatl foreshafts and main shafts, and rabbit sticks indicate that hunting was one activity performed during this occupation. There is also some evidence for weaving and the preparation of cordage. Plant remains indicate both wild plant collection and cultivation of domesticates.

MacNeish (1954b:24) notes that wild plant remains were relatively rare in Zone K, though143 specimens were recovered. These included some seeds and rinds of a wild squash. Choppers, scraping planes, nets and baskets may have been used in the gathering and processing of wild plants. There is also noted a "wide variety of agricultural remains:" "Here we have not only squash seeds, rinds and stems, but also an actual corn leaf and a gourd container" (MacNeish 1954b:24). Cordage, a loop net bag, and a split-stitch basket are also mentioned.

Curated Plant Materials Attributed to Zone K, Occupation 5. The 143 plant specimens mentioned in the field notes as present in this zone were not fully accounted for. Rather, only 88 fragments in the collections were directly traceable to Occupation 5, including rind fragments and a peduncle representing bottle gourd; a pepo squash peduncle; and about 80 rind fragments and two seeds of unidentified cucurbits. One more seed is likely a cucurbit as well, but as it is highly degraded this identification is uncertain.

Romero's Cave, Zone J, Occupation 6

Excavation Notes and Observations. Zone J (Occupation 6) overlay Zone K. This zone reflects a significant departure over previous occupations, as it covers a very large space across the entire block excavation (Figure A-1.6). It consists of a thin (10.3 m^3) layer of red-brown vegetal material that has been interpreted as a single season occupation by a macroband during Guerra times. Extending down from this layer were found three hearths and a grass lined pit (possibly a bed).

The primary activities during Occupation 6 were hunting, plant collection, and cultivation, though there is also very limited evidence for the preparation of cordage (in the form of two fragments of hard-fiber yarn). About 50 animal bone fragments, an atlatl main shaft and foreshaft, scrapers, and projectile points are indicative of hunting and processing of the kill.

The excavation notes report 242 plant specimens from Zone J, though it is unlikely that this number reflects all of the grass remains found in the bed mentioned above. Wild plant remains mentioned include wild runner beans, wild squash, amaranth, and gama grass. A "muller" and a "saw-like chopper" may have been used to process wild plant materials for consumption. Domesticated plants noted included four maize cobs, gourds, beans, and seeds from both pepo and butternut squash (MacNeish 1954b:26). MacNeish suspects that a long pointed stick with a pounded end may well have been used as a digging stick in maize cultivation.

Curated Plant Materials Attributed to Zone J, Occupation 6. Thirty-two plant specimens in the curated collections were traceable to Occupation 6 based on cross-checking associated labels with the Romero's cave field catalog. One leaf fragment representing an unknown type of palm was found in the INAH collections, as was a stem fragment that possibly represents *Tithonia*. One peduncle of cushaw squash was among the remains, as was a peduncle and a rind fragment identified as pepo squash. Additional peduncles, rind fragments, and a seed represent unidentified cucurbits. There were three pod fragments representing common bean. Maize remains from this zone include 13 cob fragments, one stalk fragment, and a piece of tassel.

Romero's Cave, Zone J_1, Occupation 7

Excavation Notes and Observations. Zone J_1 (Occupation 7) overlay Zone J. Occupying a small space (about eight units) near the back wall of the cave (Figure A-1.7), this very thin (1.84 m^3) layer of yellow-brown ash was interpreted as a Guerra phase, single season occupation by a "small group" (MacNeish 1954b:27), likely a microband. Projectile points, a disk scraper, and 52 animal bones indicate hunting an butchering during this occupation; the only other activity besides plant gathering and cultivation seems to have been the making of fiber string.

The notes indicate that 262 wild plant remains were found in this thin yellow-brown ash zone, but the specific plant types are not mentioned. A chopper and scraping plane could have been used in their preparation. Domesticated plants mentioned include gourds, pumpkins, corn cobs, and "definite evidence of the common kidney bean" (MacNeish 1954b:28). Cotton string is also mentioned as evidence for cultivation of this plant.

Curated Plant Materials Attributed to Zone J_1, Occupation 7. The museum collections contained some 224 specimens that seem to have originated in Occupation 7, based on their catalog numbers. One leaf fragment likely represents agave or yucca, or a similarly succulent, fibrous-leafed plant, and another fragment is from an unidentified type of palm. A single degraded seed may represent prickly pear. Cucurbit remains included a bottle gourd rind fragment, and another 12 rind fragments were from unidentified cucurbits. Also present were over 100 seeds of unidentified squash. A single peduncle was identified as pepo squash. A seed and a pod fragment represent unidentified legumes, and another fragmentary item may be part of another legume pod. Several nutshell fragments of both acorn and walnut were present, as was a relatively complete walnut. Stalk and leaf fragments and a kernel were identified as teosinte. Fifty-nine specimens of maize were in the collections, including cobs and cob fragments, husk fragments, a whole leaf, a stalk fragment, numerous tassels, and, interestingly, one quid resulting from the mastication of a maize leaf.

Romero's Cave, Zone I, Occupation 8

Excavation Notes and Observations . Excavators found Zone I (Occupation 8) overlying Zone J_1. This zone, which spanned a significant portion (eight units) of the back of the cave (Figure A-1.8), consisted of a thick (5.4 m^3) layer of vegetal material. Attributed to the Guerra phase, it was interpreted to reflect a seasonal occupation by a macroband of possibly three to six families. Within the stratum of Zone I were found three hearths and a burial pit containing the remains of a young adult male, a young adult female, and an infant. Besides the burial of these deceased individuals, the function of this occupation seems to have also involved some limited hunting/butchering/ hide working (17 bone fragments, projectile points, an atlatl main shaft, and discoidal and flake scrapers), and a great amount of textile weaving and basketry and cordage manufacture (abundant basketry items in the burial pit, string, and cloth). Of course, plant gathering and cultivation were major subsistence pursuits.

The notes mention some 360 fragments of wild plant material, including leaves of guapilla and prickly pear, and fragments of panic grass, gama grass, manioc, and amaranth (MacNeish 1954b:29). Choppers, baskets, and nets found in the refuse may have been tools used in the collection of these plants. The burial pit mentioned above was lined with palm leaves (likely Hesper palm), and a maize cob and gourd water bottle were placed near the heads of the individuals, alongside a number of basketry burial goods. The agricultural products noted include some bean, gourd, and pepo squash fragments, "some cotton," and a single possible teosinte seed.

Curated Plant Materials Attributed to Zone I, Occupation 8. About 180 plant specimens attributable to Occupation 8 are present in the curated collections. A single fibrous leaf fragment from an unknown plant in the agave family was curated, as were one acorn and a fragment of what may be acorn nutmeat. Cucurbit remains include bottle gourd rind fragments, one rind fragment labeled as butternut squash, and rind fragments and seeds of unidentified squash. Almost 20 legume pod fragments were inventoried from this occupation (Kaplan, n.d.), but these were not more specifically identified. The collections contained 100 maize fragments from this zone, most of which were cobs and cob fragments, but tassels, stalk fragments (one of which still retained a husk), one kernel, and a quid of chewed maize leaf.

Romero's Cave, Zone H, Occupation 9

Excavation Notes and Observations. Zone H (Occupation 9) overlay Zone I. Attributed to the Mesa de Guaje phase, this thin (2.2 m^3) layer of ash and charcoal covered a significant portion (10 or 11 units) of the back of the cave (Figure A-1.9). Much of the refuse in this layer appears to have been burned, and a single grass pit (a bed?) extended down from it (MacNeish 1954b:36). Zone H was interpreted to represent a brief visit by a microband during the summer or fall. Significantly, this zone contains the earliest ceramics found in Romero's cave. Projectile points, an atlatl fragments (atlatl, foreshaft, and main shaft), part of a spring trap, and 34 animal bones are evidence for hunting activities during this occupation. Weaving comprised a major activity, as indicated by cordage (tied in a variety of knots), twilled mats, and a cotton tumpline. A variety of ceramic vessel forms were present, including flat-bottomed bowls and storage and water jars; however, ceramic manufacture was not likely an activity that occurred in the cave. Finally, there is strong evidence for plant food gathering and cultivation in Romero's cave during Occupation 9.

In spite of the burned nature of Zone H, 465 wild plant specimens were noted. Among these were "… a few grains of panicum, a few seeds of wild squash, some opuntia leaves and agave quids" (MacNeish 1954b:37). Thick and thin choppers may have been used to process these materials. Cultivated plants noted include pepo squash and gourd, maize, and "some evidence of cotton." Evidence for the consumption of peppers and beans was noted from feces found in this layer.

Curated Plant Materials Attributed to Zone H, Occupation 9. I tabulated more than 200 specimens in the collections and inventories with catalog numbers that indicate an origin in Occupation 9. Most of these were cucurbit remains and maize fragments. Maize remains were particularly abundant, including husk fragments, leaves, tassels, two quids (one of leaf material and the other a chewed stalk), and almost 130 cobs and cob fragments. Single peduncles of pepo squash and butternut squash were present, as were numerous rind fragments and seeds of unidentified squash or other cucurbits. Bean remains consisted of three unidentified legume pod fragments.

Romero's Cave, Zone G, Occupation 10

Excavation Notes and Observations. Zone G (Occupation 10) overlay Zone H. Attributed to the Mesa de Guaje phase, it covered almost the entire block excavation, and was exposed in about 25 units (Figure A-1.10), and consisted of "solid mass of vegetal material in [the] back of [the] cave to [a] thin layer in front" (Smith 1997b:354, Table 1). Zone G was estimated to have a volume of approximately 15.4 m^3). Due to its thickness and horizontal extent, it was interpreted to reflect a multi-season occupation by a macroband of farmers. Several features had been excavated down from this layer at the time of occupation. One was a probable roasting pit full of fire-cracked rock and charcoal. There was also a grass lined storage pit containing a large number of corn cobs. Finally, there was a burial pit containing one individual.

Multiple activities were associated with this occupation. As mentioned above, these included roasting of food and burial of the dead. Partially completed wooden tools indicate that wood working was performed during this occupation, and an antler flaker and abundant debitage indicate that stone tool manufacture was an activity. Weaving seems to have been a major pursuit, due to the abundance of cordage, knotted yucca fibers, nets, cloth fragments, baskets, and mats (many associated with the burial). Though it does not seem to have been a major subsistence pursuit, hunting and butchering took place from the cave, as indicated by 16 bone fragments, an atlatl foreshaft and main shaft, and a fragment of a wooden trap. There were a few scrapers indicating that limited hide preparation took place in the cave. In contrast to hunting, plant gathering and cultivation appear to have been of primary importance.

Besides basketry and cordage grave goods, a number of plant materials were associated with the one burial in Zone G. The body had been placed in a grass-lined pit; it apparently wore a "skirt" comprised of a mass of roots that may have been originally tied about the waist, and two gourd water bottles had been placed near the head in a net bag. Palm leaves and prickly pear pads had been placed on top of the body, which had been laid to rest upright in a flexed position, and the refuse that was used to fill in the shaft contained corn cobs.

Other plant materials were noted in the general floor refuse around this burial, including wild plants such as panic grass, amaranth, agave, and prickly pear. Manioc remains led MacNeish (1954b:39) to conclude that the Zone G occupation took place in a period characterized by a wet climate. Supposedly cultivated plants noted here include "long red- and yellow-seeded beans" (MacNeish 1954b:40), maize (many cobs were in the grass-lined storage pit, "a single seed of sunflower," gourds, pepo squash, warty squash (seeds, rinds, stems), as well as some grains of teosinte and a string made of cotton fiber. MacNeish (1954b:41) also notes here the first appearance of manos and metates, likely associated with cultivated products.

Curated Plant Materials Attributed to Zone G, Occupation 10. The museum collections contained abundant plant materials (over 2,000 fragments) that could be traced to Occupation 10, but this number is so high due to the sheer magnitude of tiny remains that came from a 150 ml jar of sediment (catalog number 247/57) collected from this zone and recently fine-screened at the Washington University Paleoethnobotany Laboratory. According to the field catalog (MacNeish 1954d), the sample came from Unit S25, Level 4a, near the central back (south) wall of Romero's cave. The miniscule remains it contained were therefore previously unknown to MacNeish and other analysts; the identifications, counts, and weights of these items are presented in Table 7.3.

Besides these tiny remains in the ISM soil sample, the general collections contained a succulent, fibrous leaf fragment from an unidentified Agavaceae, and one *aquiche* fruit. Maize remains were plentiful, and included husks, leaves, stalk fragments, tassels, an ear node (or shank), and almost 400 cobs and cob fragments. Ten fragmentary remains may represent maize kernels. There were several stalk and leaf fragments that were previously identified by Mangelsdorf and Galinat as teosinte, as well as a few that these analysts interpreted to represent maize-teosinte hybrids. Cucurbit remains

Table 7.3. Contents of a Fine-Screened Sediment Sample, Mesa de Guaje Phase, Romero's Cave Occupation 10 (Zone G, Unit S25, Level 4a, Cat. # 247/57). Sorted and Identified by the Author.

Identification	Part	Condition	Count	Weight (g)	Comment
Plant Parts					
cf Acacia sp.	thorn	complete	1	< 0.01	
Agave sp.?	quid	complete	3	1.15	squash seed fragments
Amaranthus sp.	seed	complete	2	< 0.01	
Aster sp.	seed	complete	2	< 0.01	
Cucurbita sp.	seed	complete	19	0.79	cf C. foetidissima
	seed	fragment	127	< 0.01	small
Datura sp.	seed	complete	8	0.12	
Echinocactus sp.	seed	complete	28	< 0.01	
Juglandaceae	nutshell	fragment	1	0.03	
Pinus sp.	needle	fragment	6	0.01	
Poaceae	floret	fragment	2	< 0.01	
	spike	fragment	2	< 0.01	
Portulaca sp.	seed	complete	47	< 0.01	
cf Rosaceae?	seed	fragment	45	< 0.01	
Setaria sp.	seed	complete	54	< 0.01	
	seed	fragment	700	< 0.01	
Tilandsia sp.	stem	fragment	66	0.1	
Verbesina sp.	seed	complete	1	< 0.01	
unidentifiable	seed	fragment	23	0.07	
unknown taxa	leaf (fibrous)	fragment	74	0.55	
	leaf	fragment	15	0.06	
	twig	fragment	12	0.06	
	wood charcoal	fragment	19	0.29	
Other					
insect parts	various parts	fragment	132	0.4	
paleofeces	fecal matter	fragment	n/a	20.37	fragmentary, too many to count
snail	shell	fragment	7	0.02	

numbered over 300, and included two bottle gourd seeds, two peduncles and one rind fragment previously identified as butternut squash, and copious rind fragments and seeds of unidentified cucurbits. A single peduncle may represent either pepo or cushaw squash. One fragmentary seed could represent either a squash species or mesquite. The legume inventory for Occupation 10 included pods identified by Kaplan as common bean, possible lima bean, and unidentified legumes.

Most material documented from this zone came from the jar of sediment collected from a single unit near the back of the cave that therefore constitutes only a small sample of the entire occupation; however, the material was particularly productive. The sample contained three small quids of agave leaf fiber and abundant Spanish moss stem fragments. Miniscule fragments of fecal matter were present throughout the sediment, though there were six larger fragments, one of which had masticated squash seeds. Over 100 squash seeds and seed fragments occurred in this small jar of sediment. I also tabulated some 750 fragmentary seeds of foxtail millet; many of these were obviously masticated, and cemented together among the fecal matter. Interestingly, one of these was much larger than the others, consistent with observations by earlier analysts that led to the belief that this grass had been the object of intentional selection in Ocampo (Austin 2006; Callen 1967a, 1967b); this will be discussed in greater detail later in this chapter.   Other grass fragments included several tiny florets and spikes. Over 100 mysterious items that resemble seed coats or thin nutshell fragments were recovered; though their identification is unknown, they may represent shells of pine nuts collected from the mesa top above the caves (six small pine needle fragments were also recovered from the sample). A single fragment of nutshell was identified as walnut.

Small seeds recovered included amaranth, aster, verbesina, cacti (*Echinocactus* and an unidentified type), and purselane. *Echinocactus* and purselane were relatively abundant. Although their tiny size presents the possibility that many of these small seeds arrived in the cave due to natural seed rain caused by wind action, some of these identified types are well-documented ethnographically and archaeologically as being economically important. It is also important to point out that small seeds and nuts are often collected and deposited in caves by non-human residents, though the specimens I observed showed no signs of rodent gnawing.

The field catalog makes no mention of a sediment sample associated with this provenience, but there is an entry for "50± Squash seeds" (MacNeish 1954d:29). I believe that excavators likely scooped up these numerous squash seeds at once for collection, inadvertently recovering the additional material that I analyzed and report here. Although the contents of this soil sample represent a single very small provenience, the abundance of material it contained hints at what the original excavators may have missed in the numerous occupation zones in the Ocampo caves.

Romero's Cave, Zone F, Occupation 11

Excavation Notes and Observations. Zone F (Occupation 11) was attributed to the next phase, Palmillas (the cultural phase defined between Mesa de Guaje and Palmillas, La Florida, was only recognized on surveyed sites and not in the cave excavations). Horizontally it spanned the entire excavation (Figure A-1.11), and consisted of a thick (13.5 m^3) layer of brown vegetal material. A number of features were excavated down from this level during the period of occupation. There were two fire pits, one of which contained a large number of burned corn cobs. A storage pit contained a large amount of vegetal material; in the bottom of this pit an alligator bag containing some teosinte seeds was apparently discovered. Five burial pits were found in this zone, each apparently established at slightly different times, indicating that Zone F likely doesn't represent a single occupation but several. MacNeish (1954b:45) presents the following interpretation of Zone F: "I have a feeling that this so-called Occupation 11 represents a series of brief intermittent occupations and ceremonies by small groups over a relatively long period, and that the real homes of the occupants were in the ruins on the mesa above the cave."

Several activities took place in Romero's cave over the course of the deposition of Zone F. Evidence that hunters used the cave is in the form of skin fragments, 116 bones, projectile points (representing both arrows and atlatl darts), and actual fragments of arrow and atlatl foreshafts and mainshafts. Atlatl remains are more abundant than arrow remains, so it seems that at this point in time the former remained more important than the latter. There is also abundant evidence for weaving, wood working, and stone tool manufacture. So it seems that the cave offered village residents a cool place to perform these activities. Stone axes or "celts" also occurred, these likely associated with clearing brush on nearby hill sides for the placement of cultivated fields. Finally, as indicated above, the villagers at this time used the cave for interment of the dead. Storage of plant food items was also practiced in the cave.

In spite of the periodic nature of the Zone F occupation and the likelihood that the true habitation sites were elsewhere, the excavation notes indicate that some 3,264 plant remains were recovered from these levels. Most of these were apparently guapillas, prickly pear, and agave, though there were also wild squash seeds, amaranth, panic grass, gama grass, manioc, "… as well as many other eatable wild plants" (MacNeish 1954b:47). Mortars, pestles, baskets, and net bags may have been used in their transport and processing. Yucca fiber was a primary raw material in the manufacture of cordage and textiles, apparently an important activity during this occupation.

Cultivated plants noted include gourds and cushaw, butternut, and pepo squash. Over 2,000 corn cobs are noted from this layer, as well as a number of teosinte grains. Black, yellow, and red-seeded varieties of beans were apparently "fairly numerous" (MacNeish 1954b:48), but a couple pods of what might be lima beans are mentioned as well. Fragments of chili peppers and sunflowers are also noted. Fragments of tobacco were found, as were pipes and cigarettes (possibly of cane?).

Interestingly, here MacNeish (1954b:48) notes the presence of cotton seeds in both the floor debris and in the feces from this level; he suggests that they may have eaten the cotton seeds for their oil content. This is the first mention I have been able to locate anywhere in print of cotton in the caves in the form of anything other than cordage or textiles, adding support to the interpretation that prehistoric populations in this region actually farmed this domesticate themselves rather than only importing finished products or raw materials.

Curated Plant Materials Attributed to Zone F, Occupation 11. More than 1,100 specimens in the curated collections were documented as originating from Occupation 11, although MacNeish (1954b) states in the field report that some 3,264 plant remains were recovered from these levels. Leaf fragments representing agave and unidentified palm were present, as were a couple of jopoy (*Esenbeckia berlandieri*) pods. Two stalk fragments of what may be carrizo were documented, but as the cane that is so abundant in the area today is a historic introduction, these may be intrusive or misidentified. Cucurbit remains were abundant, and included bottle gourd, buffalo gourd, and pepo squash rind; butternut, pepo, and cushaw squash peduncles; and seeds, rind fragments, and one peduncle of unidentified cucurbits. Maize remains were the most numerous documented for this occupation. Almost 700 cobs and cob fragments were found in the HH collections. Other remains included husk, leaf, and stalk fragments, abundant tassels, and chewed quids of tassels and leaf material. Kaplan's legume inventory lists pods of common bean, acacia, and coral bean, as well as a legume inflorescence. Also included in this inventory are nine cotton seeds, in agreement with statements made in the field report.

Romero's Cave, Zone E, Occupation 12

Excavation Notes and Observations. Zone E (Occupation 12) spanned a much smaller area; it was exposed in only six units in the central portion of the cave (Figure A-1.12). Attributed to the Palmillas phase, it consisted of a thin (1.1 m^3) layer of dark ash and charcoal. It was separated from the earlier Zone F by a thin layer of white ash and dust (Zone F_1). MacNeish interpreted it to reflect a short summer occupation by a macroband, possibly during corn harvesting time. Two features were excavated down from this level by the occupants. One pit was apparently a large hearth with fire-cracked rock, charcoal, and some unburned vegetal material. The other was a grass-lined pit filled with vegetal remains; MacNeish (1954b:56) interprets this to have originally been a bed.

Although this occupation was apparently temporary and plant collecting and cultivation were of great importance, other activities are attributed to the Zone F deposits. Numerous fragments of fiber string may indicate production, but these may have been produced elsewhere. Hunting and butchering activities are indicated by the present of over 100 bones some atlatl projectile points, scrapers, and a cane knife.

According to the notes wild plant remains numbered 1,436, and included agave, prickly pear, and wild squash (MacNeish 1954b:56). Cultivated remains were equally numerous. Over 1,000 maize cobs came from this layer (many of which were recovered from the grass lined pit mentioned above). There were also remains of pepo and butternut squash, and pods and seeds of four varieties of beans. A possible tobacco leaf may be associated with cane cigarettes and some clay pipes. A piece of cotton string is indicative of use of this domesticate, if not its actual local cultivation.

Curated Plant Materials Attributed to Zone E, Occupation 12. About 300 specimens in the comparative collections were traceable to Occupation 12, rather than the thousands mentioned in the excavation report. A *Tilandsia* leaf and a fragment of what appears to be cane stalk constitute the wild plant materials. Rind fragments and a single peduncle were labeled as butternut squash, and over 20 rind fragments and a single seed represent unidentified cucurbits. Pods of common bean were abundant. Almost 200 specimens of maize were also documented, most of which were cobs or cob fragments; also present were numerous tassels, a stalk fragment, two husks, and a leaf.

Romero's Cave, Zone D, Occupation 13

Excavation Notes and Observations. Horizontally, Zone D (Occupation 13) spanned the entire excavation (Figure A-1.13); it consisted of a thick (2.5-10 cm, 16.7 m^3) vegetal layer. Attributed to the San Lorenzo phase, MacNeish interpreted it as a spring-summer occupation by a microband. A number of features were discovered that were associated with this occupation. Three areas of fire-cracked rocks and noticeable burning may be hearths. Two well defined pits were lined with grass, possibly to provide sleeping areas, while two others had apparent woven sleeping mats. Two other pits were apparently for storage: one was filled entirely with corn cobs and the other with different vegetal materials (MacNeish 1954b:58).

Other activities were apparently significant during this occupation besides gathering and cultivation of plants. There is substantial evidence for hunting, such as over 140 bones (including deer, peccary, and one buffalo), various scrapers, numerous atlatl projectile points, and fragments of atlatl foreshafts and a few possible main shafts. Abundant mats, string, and cloth fragments indicate that weaving was an important industry.

The notes indicate that excavators counted and classified some 7,709 vegetal remains, but that "*This probably represents about two thirds of all that occur*" (MacNeish 1954b:59, emphasis added). I interpret this statement to mean that much vegetal material was not collected, counted, or classified, much less curated in museum collections; this indicates that any quantification of the existing museum materials would be inaccurate. Among those counted are prickly pear, other unspecified cacti, agave, guapillas, amaranth, wild squash, and runner beans. Scraper planes and saw-like choppers were probably used in the collection and preparation of these materials. Gourds, pepo, butternut, and cushaw squash, lima beans, teosinte, three kinds of beans, several variety of maize, and teosinte are listed as evidence for cultivation. Cotton was observed but very rare. Though no tobacco leaves were found, pipes and cigarettes are indirect evidence for its use.

Curated Plant Materials Attributed to Zone D, Occupation 13. Curated materials from Occupation 13 were abundant, but not close to the 7,700 specimens mentioned in the excavation report. Agavaceae remains included two leaf fragments and a leaf quid, possibly from agave, a yucca leaf fragment, and a small fragment of a mat (*petate*) woven from yucca-like leaves. There was also another small petate fragment of unknown leaf material. Several fragments of palm leaves were present, as well as several fragments of sotol leaf. Ten ceiba pods were present among the materials from this zone, as were several fragments of guapilla leaves and a jopoy pod. Walnut remains included one nut and two fragments of nutshell, and there was an oak leaf and several stalk fragments of what is likely cane. Grass remains included a stem fragment, a seed head stem, an inflorescence, and two culms.

Cucurbit remains were comprised of a bottle gourd peduncle; seeds, rind fragments, and a peduncle identified by Bruce Smith as butternut squash; a pepo squash peduncle; and a peduncle that may be either pepo or butternut squash. Abundant rind fragments and two seeds of unidentified cucurbits were also tabulated. Legume remains documented in Kaplan's inventory (Kaplan, n.d.) consisted of inflorescences, numerous pods, and possibly one seed of common bean; pod fragments of guaje, a jack bean seed;

an inflorescence and abundant pod fragments of unidentified legumes, and two pod fragments of what may be lima bean. Maize remains traceable to Occupation 13 were numerous, and included husk fragments, kernels, leaves, stalk fragments, tassels, and almost 500 cobs and cob fragments. There were abundant quids of leaf material, and two quids of chewed tassels.

Romero's Cave, Zone C, Occupation 14

Excavation Notes and Observations. A non-cultural layer separated Zone D from Zone C (Occupation 14). This zone was exposed in much of the excavated area (22 units) (Figure A-1.14), though it did not extend all the way to the back of the cave. It is described as a thick (7.2 m^3) vegetal layer, interpreted to be the result of a seasonal occupation by another San Lorenzo phase macroband. The occupants excavated several pits into this layer, including a roasting pit or hearth filled with fire-cracked rock or charcoal, two possible beds consisting of grass lined pits, a grass lined pit with a mat that is another likely bed, and another large pit that was filled with grass (though the latter may have been the result of looters' activity (MacNeish 1954b:62).

Once again this occupation represents multiple activities beyond plant extraction and use. An antler flaker and abundant debitage are indicative of chipped stone tool manufacture. Leather shoe fragments, a piece of jaguar skin, a bone awl, and numerous scrapers show that processing of hides and production of leather items took place here. A spoke shave, a pointed stick, and "various whittled objects" demonstrate wood working. Some hunting took place from the cave, evidence of which included over 120 bones (including deer, jaguar, rat, and bird), deer and jaguar skin fragments, both atlatl and arrow points (the latter being more numerous), as well as numerous arrow foreshafts and main shafts. Once again, perishable production is indicated by some mats, basketry, nets, and cordage.

In this case all wild plant remains were counted, revealing 7,274 specimens from Zone C. Among these are fragments of wild runner beans, wild squash, amaranth, cacti, agave, and guapillas. Supposedly cultivated plants are equally abundant. Gourds, pepo and butternut squash are still present, as are four varieties of common beans, though lima beans are now absent. Maize cobs remain abundant. A few fragments of chili peppers are noted as well as cotton string. Tobacco leaves are absent, but again pipes and cane cigarettes in the layer may be indicative of its use (MacNeish 1954b:63).

Curated Plant Materials Attributed to Zone C, Occupation 14. Almost 600 specimens in the collections could be attributed to Occupation 14, representing both wild and domesticated species. Agavaceae remains included two yucca leaf fragments and several leaf fragments of unspecified species, though these likely represent agave. Two quids of agave fiber were present as well. Other leaf fragments were of unidentified palm leaf, but these are probably hesper palm, the most abundant taxon in the vicinity of the cave. A small fragment of a petate woven from palm leaves was in the INAH collections. Two pods and five seeds of ceiba were also present in this collection, as were three bromelia leaf fragments and two more from an unidentified bromeliad. A single fragment of sotol leaf indicates use of this plant for either food, or fiber, or both. An unidentified fungus was found among the collections, attached to a small fragment of wood. It is likely that this arrived in the cave inadvertently while the Occupation 14 inhabitants were collecting firewood. A single leaf labeled "Solanaceae" was found among the INAH materials; visual examination indicates that it may represent a wild tobacco (*N. glauca*) that grows in the vicinity (Claudia González Romo, personal communication 2006), but this is uncertain. Sixteen acorns indicate use as food at this time; close examination revealed no sign of rodent gnawing, supporting the interpretation that they are present due to human activity.[9]

The legume inventory contained abundant pods and several seeds identified as that Kaplan identified as common bean, and numerous pod fragments of unidentified legumes. A single pod was classified as guaje, while another may represent lima bean. Cucurbit remains were abundant as well, comprised of a few rind fragments labeled as buffalo gourd; a possible bottle gourd rind fragment; rind and a peduncle of butternut squash; rind and several peduncles of pepo squash; and numerous rind fragments and a peduncle of unspecified cucurbits. Maize remains included husks, two leaves, a few tassels, several chewed leaf quids, and almost 200 cobs and cob fragments.

Romero's Cave, Zone B, Occupation 15

Excavation Notes and Observations. Zone B (Occupation 15) was attributed to the subsequent San Antonio phase. It spanned an area of eight units against the back wall of the cave (Figure A-1.15), and consisted of a thin (0.6 m^3) layer of vegetal material. It was interpreted to reflect a short episode of occupation by a microband, possibly during the summer. Though there were several patches of charcoal throughout this layer that may have been hearths, this is uncertain. There was, however, a grass lined pit with a mat in it that likely was once a bed.

Zone B represents activities additional to gathering and cultivation. Some

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9 Among the materials in the INAH there is also a large (approximately 60 x 60 cm), fragmentary piece of cloth manufactured out of what appears to be agave fiber, associated with a label that reads "Romero's cave? Possibly 1400 A.D." The exterior surface exhibits geometric designs rendered in blue pigment; fragments of finished edge suggest that the original piece was circular, and finely braided agave fiber strings are exposed in the degraded portions of the fabric as concentric circles within the weave. Though its provenience is questionable, if it is indeed from Romero's cave and the suggested date is accurate, the fragment may date very late during the San Lorenzo phase, possibly from Occupation 14.

evidence for hunting occurred in the form of 25 bone fragments (including a deer bone flaker), and a piece of deer skin. Arrow points were more numerous than atlatl points (though both occurred), and numerous foreshafts and main shafts were found. The deer skin, partial leather sandals, thongs, scrapers, and antler piercers are indicative of leather working. Once again, mats, cloth, and string were produced.

The notes indicate that 2,842 wild plant remains were uncovered in Zone B. Many of these were stems and leaves of guapillas, though a few agave and cacti fragments and chewed quids of other wild plants were found. Some wild squash seeds were also present. Saw-like choppers were likely used in the collection of various wild plants. Cultivated plants are less frequent than in previous occupations, and include two varieties of beans, some tobacco leaves, pepo and butternut squash, and numerous maize cobs. Gourd fragments remain abundant, and a few strings of cotton were noted (MacNeish 1954b:64).

Curated Plant Materials Attributed to Zone B, Occupation 15. More than 1,300 items in the collections were traced to Occupation 15. Leaf fragments likely representing agave were documented, along with leaf fragments of some kind of palm and several sotol leaf fragments. A single ceiba pod indicates use likely for food. A stalk fragment that resembles cane was present. Over 30 cucurbit rind fragments were present in the Cutler-Blake collection; two of these were labeled as buffalo gourd, while the others were unspecified. Inventoried Fabaceae remains include common bean pods, a possible runner bean pod, three pods identified as guaje, and several unidentified legumes. Maize remains include husks, leaf fragments, stalk fragments, over 1,000 tassels (estimated, in large masses), two chewed leaf quids, and over 200 cobs and cob fragments.

Romero's Cave, Zone A, Occupation 16

Excavation Notes and Observations. Immediately above Zone B was a non-cultural layer of dust, above which Zone A (Occupation 16) spanned the entire excavation (Figure A-1.16). Attributed to the San Antonio phase, Zone A is the uppermost prehistoric occupation layer uncovered within Romero's cave. This zone is described as a thick (16.2 m^3) stratum with abundant plant remains, and was interpreted to reflect a spring-summer occupation by a macroband. Features associated with this occupation zone include one grass lined pit, three fire pits, and one burial.

Although plant use was more important, there is also evidence for hunting, in the form of over 250 bone fragments (including deer, peccary, rats, and birds), and projectile points, main shafts, and foreshafts of both atlatl and arrow. Hide working was apparently important by the presence of scrapers, bone awls, skin fragments of deer and jaguar, a leather bag, a belt, and shoe fragments. Again, string, cloth fragments, and mats demonstrate the importance of weaving.

Some 9,361 wild plant specimens were counted, but a great many more were not (MacNeish 1954b:67). Cactus, yucca, and wild squash fragments were among these. Choppers and flat and humped scraping planes may have been associated with the preparation of wild plant materials. Agriculture continued to be important, as indicated by abundant maize cobs, two kinds of beans, chili peppers, butternut and pepo squash, and gourds. Artifacts associated with agricultural products included metates and manos, and cane cigarettes and elbow pipes indicate that tobacco was likely smoked.

Curated Plant Materials Attributed to Zone A, Occupation 16. More than 700 specimens in the collections were attributed to Occupation 16. About ten fibrous leaf fragments represent members of the Agavaceae family, including two previously identified (probably by C. Earle Smith) as yucca and three that are likely agave. An equal amount was of an unidentified palm, and one other is likely *Tilandsia*. Sotol occurred as leaf fragments and a single leaf base. Parts of all these plants are edible, but the leaves are also a primary source for fibers, so both uses are likely. Kaplan's (n.d.) inventory lists a stem fragment representing either amaranth or chenopodium from this zone. Juglandaceae nutshell fragments (likely walnut) were present, as was a jopoy pod.

Almost 100 cucurbit remains were present in the Cutler Blake collection, including peduncles of bottle gourd and butternut, pepo, and an unidentified squash; rind fragments of bottle gourd and unidentified cucurbits; and four seeds of unknown squash. Legume remains consisted of an acacia seed and pods of common bean, guaje, and unidentified legumes. Over 400 maize remains from this occupation are curated at the HH, most of which are cobs or cob fragments (n=359). Other parts include husks, leaves, stalk fragments, and tassels, as well as several chewed leaf quids. Other grass remains include an unidentified culm and a fragment of what appears to be cane stem.

Miscellaneous Curated Items from Romero's Cave

Some 330 specimens in the collections were labeled as coming from Romero's cave, but more precise provenience information was not available, precluding assignment to a specific occupation layer. These include ceiba pods and leaf fragments of several bromeliad types, some cucurbit rinds and peduncles, abundant maize remains, some gama grass, and sotol leaf fragments. Also possibly originating in Romero's cave but with even less certainty is a single agave-like leaf fragment, and a large textile fragment tentatively assigned to this cave (described in Footnote 4 above).

Valenzuela's Cave

Excavators recognized eight occupation zones within Valenzuela's cave, spanning five cultural phases in MacNeish's sequence: Occupations 1 through 3, Infiernillo;

Occupations 4 and 5, Ocampo; Occupation 6, Flacco; Occupation 7, San Lorenzo; and Occupation 8, San Antonio (Kelley 1954a; Smith 1997b).

Valenzuela's Cave, Zone J, Occupation 1

Excavation Notes and Observations. The deepest cultural layer encountered in Valenzuela's cave, Zone J (Occupation 1), is attributed to the Infiernillo phase. This zone consisted of a layer of gravel encountered in three excavation units in the eastern chamber of the cave (Figure A-1.17). It is interpreted as a temporary occupation by a small group, likely a microband (Kelley 1954a; Smith 1997b:367). Though the evidence is relatively limited, it appears that hunting was more important than gathering during this occupation. Projectile points, 86 bones, scrapers, and bone awls demonstrate hunting and butchering behaviors.

Zone J contained 22 fragments of identifiable vegetal material, including 18 runner bean pod fragments. Articles associated with food gathering and processing include pebble smoothers, two flat scraping planes, four thin saw-like choppers, and flat pebble choppers.

Curated Plant Materials Attributed to Zone J, Occupation 1. Almost 30 curated specimens could be traced to Occupation 1 of Valenzuela's cave, including 14 legume pods (likely runner bean, according to Kaplan [n.d.]). Although 14 maize husks in the collections retained catalog numbers associated with these levels, these are almost certainly mislabeled or the remains themselves are intrusive, as maize was not present in Ocampo during the Infiernillo times to which this occupation is attributed.

Valenzuela's Cave, Zone I, Occupation 2

Excavation Notes and Observations. Overlaying Zone J was Zone I (Occupation 2), a thin (4.1 m^3) reddish layer of vegetal material encountered in eight excavation units in the eastern chamber of Valenzuela's cave (Figure A-1.18). Also attributed to the Infiernillo phase, it appears to represent a short occupation by a macroband. A number of features were associated with it, including a hearth, a shallow depression with a mat in it, and a pit full of vegetal material; in several locations were fragments of mats with grass that were probably beds.

Besides plant gathering and cultivation, there was also evidence for hunting, weaving, and wood working during Occupation 2 of Valenzuela's cave. Apparently the most numerous non-subsistence items consisted of spun and woven materials such as mats, baskets, bags, and strings. There is also evidence of wood working: "The wooden atlatl fragment, the wooden fire tongs, and the number of whittled sticks seem to hint that one of their activities during their occupation in the cave was wood carving and the chipped stone gouge may have been one of the tools of their trade" (Kelley 1954a:81). Also, there were over 220 bone fragments (including deer and skunk), atlatl projectile points and a foreshaft fragment, a bone awl and various scrapers, which were taken as evidence for some hunting, butchering, and hide preparation.

Excavators tabulated 185 wild plant remains from Zone I, including six wild squash seeds and some fragments of wild runner beans. Implements connected with wild plant collecting included basketry fragments, humped and flat scraping planes, "scraper-graver-like objects," disc choppers, pebble choppers, slab choppers, and a fragment of a digging stick. Some remains were attributed to domesticated plants: in the feces and/or refuse were discovered chili peppers, and pepo squash seeds and rind fragments.

Curated Plant Materials Attributed to Zone I, Occupation 2. No plant remains in the curated collections could be traced with certainty to Occupation 2 of Valenzuela's cave.

Valenzuela's Cave, Zone H, Occupation 3

Excavation Notes and Observations. Zone H (Occupation 3) was encountered above Zone I. It consisted of a 5 to 10 cm thick (3.3 m^3) layer of yellowish ash encountered in 11 excavation units in the eastern chamber (Figure A-1.19). It is interpreted to have been a seasonal (possible summer) occupation by an Infiernillo phase microband. Although no discernible features were discovered in this layer, much of the zone appeared to be burned, and it was partially disturbed by excavations by peoples in the much later Occupation 7 or 8.

Some activities during Occupation 3 included weaving and hunting. There were 149 unidentified bones, plus some of bison, skunk, and deer. There were also a few artifacts associated with the hunt and the processing of hides, such as a projectile point fragment and various scrapers. Evidence for weaving was limited, and consisted of some cordage, baskets, and mats. There was also indications of plant gathering and cultivation.

Excavators tabulated some 620 wild plant remains, many of which were either agave or prickly pear, along with some gama grass materials. A digging stick, flake and saw-like choppers, scraping planes, and baskets are implements likely associated with plant collecting. Fragments of pepo squash and gourd are considered evidence of cultivation, but the field notes do not further specify the taxon of the latter.

Curated Plant Materials Attributed to Zone H, Occupation 3. Only 20 plant specimens in the collections were attributable to this occupation, all of which are legumes. These include only two pods that Kaplan designated as common bean; the others are all unidentified legumes.

Valenzuela's Cave, Zone G, Occupation 4

Excavation Notes and Observations. Zone G (Occupation 4) overlay Zone H. Estimated to be about 1.4 m^3, it consisted of patches of vegetal material encountered in six excavation units in the eastern chamber (Figure A-1.20). Based on plant materials found in these patches, it is interpreted to represent a late spring - early summer microband occupation during the Ocampo phase. As was the case with Zone H, this layer was greatly disturbed by excavations originating in Occupation 7 or 8. One pit full of vegetal material extended down from Zone G.

As in previous occupations, hunting, hide processing, and weaving were carried out in addition to plant gathering and cultivation at this time. Atlatl points, 52 bones, and one scraper were the only indications of the first two practices. However, according to Kelley, "… their greatest activity during this brief occupation was in weaving." Evidence for this is in the form of mat fragments and abundant cordage.

Some 483 wild plant materials were counted from Zone G, consisting mostly of guapillas, agave, and prickly pear, yet also including 16 runner bean pods. Artifacts associated with plant collecting included saw-like choppers and humped and flat scraping planes. This Ocampo phase layer contained the earliest "considerable evidence of agriculture" (Kelley 1954a:86), in the form of 23 pepo squash rinds, 13 gourd rinds, and the seeds of both in the feces; "There are also seeds and pods of domesticated beans, both the yellow-seeded variety as well as the long red-brown variety" (Kelley 1954a:86). Some knotted yucca strands were found.

Curated Plant Materials Attributed to Zone G, Occupation 4. All six curated plant specimens from this zone were legume pods, one of which Kaplan (n.d.) speculates may be common bean.

Valenzuela's Cave, Zone E [10] *, Occupation 5*

Excavation Notes and Observations. Zone E (Occupation 5) is described as an extensive layer of vegetal material, 5 to 7.5 cm thick (2.2 m^3), exposed in nine units in the eastern chamber (Figure A-1.21). Attributed to the Ocampo phase, it is interpreted to reflect a seasonal occupation by a macroband. Excavated down from this layer were two pits filled with vegetal material, one of which had associated mats. There were also a number of burned patches with some fire-cracked rock which may have been hearth areas.

Whittled wood pieces indicate wood working during this occupation. Almost 50 bones were recovered; additional evidence for hunting and hide working was in the form of an atlatl point and foreshaft and numerous scrapers. However, the "dominant activity" was weaving; there was abundant cordage, bags, mats, and baskets in Zone E.

Some 805 vegetal remains were counted in Zone E, including pollen identified as panic grass, and ten runner bean pods. Artifacts interpreted to have been used in plant collecting included various bags, disc and saw-like choppers, humped and flat scraping planes, and "scraper gravers." Kelley (1954a:89) notes that the feces in this zone

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10 Zone F consisted of small patches of ash and dust; Kelley (1954a:87) lists this zone as non-cultural, but MacNeish (in Kaplan and MacNeish 1960) later re-classified it as a cultural zone and designated it Occupation 5, resulting in a different numbering system for all those occupations following Occupation 4 (Smith 1997b:367): Kelley's Occupation 5 is designated Occupation 6 in Kaplan and MacNeish (1960), 6 is 7, 7 is 8, and 8 is 9. For the sake of consistency with the excavation notes, here I consider Zone F non-cultural and choose to follow Kelley's original numerical scheme for the subsequent cultural zones.

contained "… considerable evidence of peppers, some bean remains that probably are domesticated, a small amount of wild plant material, mainly pods of wild runner beans, and some animal tissue." Otherwise evidence for cultivation was relatively limited in the form of a few squash and gourd specimens. Knotted yucca fibers were found among the evidence for weaving activities.

Curated Plant Materials Attributed to Zone E, Occupation 5. Almost 70 specimens in the collections were traceable to Occupation 5, almost all of which were cucurbits. These included rind and rind fragments labeled as buffalo gourd and seeds from unidentified squash. The few remaining items were pods from unidentified legumes and one pod that Kaplan identified as common bean.

Valenzuela's Cave, Zone C, Occupation 6

Excavation Notes and Observations. While Zone D was interpreted to be non-cultural, the overlying Zone C (Occupation 6) is a thin layer of vegetal material of only 0.6 m^3. It was revealed in nine excavation units in the eastern chamber of the cave (Figure A-1.22), though the layer itself appeared badly damaged by pitting in subsequent occupations. Zone C is believed to reflect a microband occupation of less than one season during the Flacco phase.

Although subsistence is seemingly much more devoted to plants, about 200 animal bones, four projectile points, an atlatl main shaft and foreshaft, a cane knife and a piece of a spring trap all indicate that hunters also occupied the cave at this time. Scrapers and antler piercers are taken as evidence of hide preparation. Once again, weaving is very important. Indications of this include cordage, nets, baskets, mats, and yucca strands.

Wild plant remains were abundant, with some 3,100 specimens counted, including amaranth, gama and panic grass, and wild squash and beans. Baskets, a humped back scraper and a saw-like chopper likely were used in the collection of such wild plants. Noted domesticates include yellow-seeded common beans, chili peppers, gourds, squash, and a few maize cobs. Beans and bean pods were found in the feces (though it is uncertain if these were wild or domesticated), as were maize, chili peppers, and panic grass.

Curated Plant Materials Attributed to Zone C, Occupation 6. About 160 specimens in the collections were associated with labels indicating origins in Occupation 6. These included a hesper palm leaf fragment, a pine cone, and an unidentified seed. Cucurbit materials consisted of bottle gourd rind, a seed and a peduncle possibly representing pepo squash, and abundant seeds and rind fragments of an unidentified squash. Pods of common bean, guaje, and unidentified legumes were inventoried. Finally, several husks and a stalk fragment from maize plants were documented.

Valenzuela's Cave, Zone B, Occupation 7

Excavation Notes and Observations. Zone B (Occupation 7) was exposed in 31 units in the eastern chamber of Valenzuela's cave and one unit in the eastern chamber (Figure A-1.23). It is described as a thick (24.3 m^3) layer of gray ash with occasional vegetal layers (Smith 1997b:367). Attributed to the San Lorenzo phase, this extensive zone is interpreted to reflect macroband use, either multiple occupations or a single occupation of more than one season. Considerable pitting was attributed to this occupation, disturbing both the deposits of Occupation 7 itself as well as those of earlier occupations, bringing up earlier materials. A burial wrapped in two brightly colored twilled mats was discovered in a deep pit in the western chamber.

Once again, Valenzuela's cave was the site of numerous activities during Occupation 7, the above-mentioned burial being one of them. Debitage and an antler flaker indicate the production or maintenance of chipped stone tools occurred. Again there is abundant evidence for weaving and cordage production. Evidence for hunting is considerable, consisting of over 1,100 bone fragments, including buffalo, deer, gopher, opossum, mouse, and birds. Artifactual evidence includes abundant projectile points, main shafts of both arrows and darts, bow fragments, and part of a spring trap. Needles, awls and scrapers are taken as evidence of hide processing and preparation.

Over 2,000 plant specimens were noted in Zone B, mostly consisting of "desert type plants" such as guapilla, prickly pear, and agave (Kelley 1954a:95). Wild squash (presumably buffalo gourd) and runner beans were also present. Gourds, pepo and butternut squash, chili pepper seeds, maize, lima beans, at least two varieties of common beans, and cotton seeds represent agricultural products. Perhaps indicative of tobacco use are some cane cigarettes. Fiber, string, and yarn of cotton and yucca are noted.

Curated Plant Materials Attributed to Zone B, Occupation 7. About 350 plant remains in the collections apparently originated in Occupation 7, most of which were cucurbits and maize. Among the cucurbits were found rind fragments representing bottle gourd and unidentified squash, peduncles of butternut squash and pepo squash, and seeds of butternut and unidentified squash. Maize remains included abundant tassels and husks, a few stalk fragments, a kernel, and almost 90 cobs and cob fragments. Kaplan's (n.d.) inventory lists common bean pods, an acacia pod, a jack bean seed, and several unidentified legume pods among the bean remains.

Valenzuela's Cave, Zone A, Occupation 8

Excavation Notes and Observations. Zone A (Occupation 8) was documented on the surface of four units in the western chamber and 24 units in the eastern chamber (Figure A-1.24). It consisted of a brownish, five to 15 cm thick (16.2 m^3) vegetal stratum on the surface of the cave at the time of excavation. It is interpreted to reflect a macroband occupation for at least one season during the San Antonio phase, the final prehistoric phase in the region leading into the contact period. A number of features are associated with this occupation: "There are three pits that have been dug down from and a number of areas that had mats in them on top of grass; they probably were beds" (Kelley 1954a:97).

Additional activities typical of previous occupations are represented in Occupation 8. "Celts" or stone axes, gouges, a wooden flute, and unfinished fire tongs, arrow and atlatl shafts are evidence for wood working. Weaving is again an important practice, with cotton cloth fragments, mats, and "a large twilled palm leaf basket-like implement." Evidence for hunting includes about 130 bone fragments, multiple atlatl point types and a few arrow point types, an arrow shaft, and trap fragments.

Wild plant materials in Zone A numbered some 1,360 specimens: "Many of these are runner beans, but again they are a great deal outnumbered by desert plants such as yucca, agave, and huapillas" (Kelley 1954a:98). Clay and ground stone pestles, pebble manos, humped and flat scraping planes, and saw-like choppers were likely used in the collection and preparation of wild plant foods. Evidence of agriculture is abundant in Zone A in the form of red-brown common bean pods, chili peppers, cushaw and pepo squash seeds, and numerous maize cobs. Cane cigarettes indicate likely use of tobacco, and a large amount of cotton cordage was discovered, along with some cotton cloth.

Curated Plant Materials Attributed to Zone A, Occupation 8. Some 760 curated specimens were attributable to Occupation 8. Some fibrous leaf fragments apparently represent members of the agave family; one leaf base may either be agave or guapilla, and another leaf base of sotol was present. Several pods and seeds of the ceiba tree were found. A cone of Mexican pinyon and a fragment of cane stalk were among the collections. Interestingly, almost 300 tiny leaves and a stem fragment of maidenhair fern were present at INAH. A fragment of unidentified epidermal tissue was listed in Kaplan's (n.d.) inventory of legume remains. Actual legume materials included pods of common bean, mesquite, and unidentified legumes, and a seed of coral bean.

Over 160 cucurbit remains from this occupation were among the Cutler-Blake materials, including rind fragments from bottle gourd and unidentified squash, and numerous seeds of unidentified squash. Maize remains consist of numerous husks, kernels, leaves, stalk fragments, and tassels, and about 140 cobs and cob fragments. Masticated quids of maize leaf and stalk material were documented among the HH materials.

Miscellaneous Curated Items from Valenzuela's Cave

Some 1,150 specimens in the collections were labeled as coming from Valenzuela's cave, but more precise provenience information was not available. However, this large number is inflated by the abundance of tassels, which occurred as a large mass. Other maize remains include 100 maize cobs and cob fragments, husks, and stalk fragments. Only two rind fragments were present among these materials, one of bottle gourd, another of an unidentified cucurbit. Legume remains consisted of pods of *Enterolobium* and *Inga* (two types with woody pods), common bean, guaje, an unidentified legume, and a single lima bean seed. Some *Tillandsia*, an unidentified seed, a sotol leaf fragment, and about 20 walnut shell fragments comprise the remainder of these materials.

Ojo de Agua Cave

Excavators recognized 12 occupations in the Ojo de Agua cave deposits, representing four cultural phases: Occupation 1, Infiernillo; Occupations 2 through 7, Flacco; Occupations 8 through 10, Palmillas; and Occupations 11 and 12, San Lorenzo (MacNeish 1954c).

Ojo de Agua Cave, Zone L, Occupation 1

Excavation Notes and Observations. The lower-most layer in Ojo de Agua cave is Zone L, with which Occupation 1 is associated. It is described as a 2.5 to 5 cm thick (estimated 7.5 m^3) charcoal strata that covered a large part of the north trench and extended into unexcavated portions to the south and west. Attributed to the Infiernillo phase, it is believed to represent a stay by a large macroband, and bird bones in the deposit indicate the visit was during the dry winter season. There are several indications of the activities that took place in the cave during this occupation. Some debitage is evidence for the maintenance or even production of chipped stone tools. It seems that hunting, butchering, and hide preparation were of primary concern, based on split bones (probably of white-tailed deer) and two deer teeth, projectile points, scrapers, and choppers. Almost 200 snail shells indicate that these small animals were likely gathered as a food resource.

MacNeish (1954c:111) writes: "Though our artifact complex and our bone material seem to point to a group who was basically hunting … this is not too secure evidence, and it may very well be that they did considerable food gathering, like other components of these peoples." Indirect evidence for plant use is in the form of humped and flat scraper planes and various choppers that may have been related to plant gathering or processing. However, no vegetal material was noted in this zone, and this may be indicative of an almost purely hunting function of this visit to Ojo de Agua.

Curated Plant Materials Attributed to Zone L, Occupation 1. No curated materials were documented as representing Occupation 1.

Ojo de Agua Cave, Zone K, Occupation 2

Excavation Notes and Observations. Overlying Zone L is Zone K (Occupation 2), consisting of a 30 cm thick layer of gray ash. Though attributed to the Flacco phase, excavators were unable to speculate about the size of the group that was responsible for this layer nor the duration of their stay. Likewise, there is very little information regarding subsistence, but I feel that it is safe to speculate that the primary purpose of this visit was based in hunting, due to the presence of projectile points and scrapers. On the other hand, two boulder mortars in this zone would indicate some degree of plant processing, although direct evidence is lacking.

Curated Plant Materials Attributed to Zone K, Occupation 2. No curated materials were documented as representing Occupation 2.

Ojo de Agua Cave, Zone J, Occupation 3

Excavation Notes and Observations. The characteristics of Zone J (Occupation 3) are not discussed in details in the notes, but it is described as thin and covering the entire excavation. Attributed to the Flacco phase, MacNeishy (1954c:116) interprets this zone thus: "It was relatively thin and on the basis of its wide extent, I would judge, if there were not a series of small repetitive occupations that a macroband occupied Floor 3 for a fairly short time period.” So the size of the group responsible for Zone J is unclear, as is the duration of occupation.

However, there is some limited evidence for their subsistence activities. Hunting and butchering were important, as indicated by scrapers, 59 split bones and one deer bone, and projectile points. Abundant snail shells demonstrate that these small animals were gathered for consumption.

No vegetal matter is reported from Zone J, but indirect evidence for plant gathering and processing activities is in the form of artifacts such as scraping planes, saw-like choppers, and one boulder mortar. Thus, although evidence is inconclusive, it appears that Occupation 3 represents both hunting and gathering.

Curated Plant Materials Attributed to Zone J, Occupation 3. No curated materials were documented as representing Occupation 3.

Ojo de Agua Cave, Zone I, Occupation 4

Excavation Notes and Observations. Zone I (Occupation 4) is described as a layer of white ash with two charcoal patches; there is also a large fire pit extending down from this level. The charcoal patches seemingly represent the actual occupation, but again the size of the group responsible is unclear: if the two patches of charcoal “…represent occupations, then it might be that we have two contemporaneous microbands living together, in other word, a macroband” (MacNeish 1954c:118). On the other hand, if the occupations temporally differed slightly, they each would represent a microband. Either way, the occupation appears to be relatively short.

Some split bones, projectile points, and discoidal, end, and side scrapers indicate that the occupation at least partially served as a hunting base camp. Also, numerous snails were gathered during this visit. Two flat scraping planes and saw-like choppers are indirect evidence for plant gathering and processing.

Curated Plant Materials Attributed to Zone I, Occupation 4. A single fragment of Hesper palm leaf comprised the entirety of the curated assemblage from Occupation 4 of Ojo de Agua cave.

Ojo de Agua Cave, Zone H, Occupation 5

Excavation Notes and Observations. Zone H (Occupation 5) is once again attributed to the Flacco phase. It is simply described as a thin layer of white ash. The dimensions and faunal contents of the floor facilitated MacNeish's (1954c:121) interpretation of Occupation 5: "The floors themselves were relatively thin, seeming to represent a short occupation while the area covered from our estimates as well as the fowl leg bones would seem to indicate we might be dealing with a dry season macroband or a number of repetitive dry season occupations by microbands."

Once again, hunting was a primary activity in Ojo de Agua. There were numerous projectile points; choppers indicate butchering of the kill, and scrapers and a bone awl suggest processing of the hides. A few flakes suggest some degree of chipped stone tool maintenance. It seems that Occupation 5 conformed with earlier occupations in this cave, indicating that Ojo de Agua functioned primarily as a dry season camp, possibly for logistically organized task groups whose primary concern was hunting: "Again our Flacco dry season occupations seem to have [been] doing roughly the same thing in occupation after occupation in Ojo de Agua cave but again their activities supplement the wet season activities seen in Romero and Valenzuela caves that saw the use of some domesticated plants like corn, gourds, and pumpkins" (MacNeish 1954c:121). Some scraping planes may indicate some plant food processing, but it appears this was not the primary function of the site at this time.

Curated Plant Materials Attributed to Zone H, Occupation 5. No curated materials were documented as representing Occupation 5.

Ojo de Agua Cave, Zone G, Occupation 6

Excavation Notes and Observations. Zone G is described as a thick layer of brownish ash. Occupation 6, found within Zone G, was recognized as a thin charcoal floor found mostly in the southern trench; it is attributed to the Flacco phase. The dimensions of the floor indicates use by either a microband or a "task group" (MacNeish 1954c:123), and a bird leg bone suggests the visit occurred during the dry winter season.

Projectile points and bird, deer, and unidentified bones indicate that this group was comprised of hunters; choppers and scrapers were likely used in butchering the prey and preparing the hides. According to MacNeish's (1954c:123) interpretation, "As always with these dry season microband Flacco occupations down near the spring a major activity was hunting of animals who were forced to exploit this water source." A few flakes indicate stone tool maintenance. There is no direct evidence for plant use, but a scraper plane and a boulder mortar indicate that such activities did take place.

Curated Plant Materials Attributed to Zone G, Occupation 6. No curated materials were documented as representing Occupation 6.

Ojo de Agua Cave, Zone F, Occupation 7

Excavation Notes and Observations. Zone F is yet another layer attributed to the Flacco phase. It is described as a very thick layer of brownish ash, but Occupation 7 within it was very patchy, leading MacNeish (1954c:124) to propose that the whole zone may have taken centuries to accumulate and had actually been little occupied during that time. It seems to represent more of the same: dry season hunting use with some degree of plant and snail collection. Only one bone was noted, but there were numerous projectile points. Choppers of various sizes may either indicate butchering and/or plant food collection and processing. No direct evidence for plant use was noted, but the choppers may have been used for this, and a single mortar indicates some plant processing.

Curated Plant Materials Attributed to Zone F, Occupation 7. No curated materials were documented as representing Occupation 7.

Ojo de Agua Cave, Zone E, Occupation 8

Excavation Notes and Observations. Occupation 8 was identified as two patches of charcoal floor within Zone E, a layer of brown ash. The floors are attributed to the Palmillas phase based on the types of ceramics present. Again snail shells and bird bones suggest a dry winter season occupation, most likely by a hunting group. The snails were gathered for food. For the first time, several fragments of cordage are noted. A few flakes indicate that stone tool maintenance took place during this occupation, and 12 bones, 18 projectile points, and scrapers are evidence for hunting and hide working activities. Evidence from open sites and from Romero's and Valenzuela's caves indicates that people of the Palmillas phase were villagers highly reliant on agricultural produce. It seems that these villagers occasionally visited Ojo de Agua cave as hunting parties; they likely brought along surplus corn to eat while there, which they process on ground stone tools that they left in the cave. Though no plant subsistence remains were noted, manos, metates, a pestle and a muller indicate that the Occupation 8 visitors did some plant food (likely cultivated) processing in Ojo de Agua.

Curated Plant Materials Attributed to Zone E, Occupation 8. No curated materials were documented as representing Occupation 8.

Ojo de Agua Cave, Zone D, Occupation 9

Excavation Notes and Observations. Zone D was a thick charcoal zone with rotting vegetation that contained Occupation 9. A large (1 m diameter) roasting pit was discovered on the north edge of the southern trench. Attributed to the Palmillas phase, the occupation represents a visit by either one macroband or several visits by microbands.

Occupation 9 is very similar to Occupation 8. The roasting pit and charcoal stained ceramics suggest that cooking was one of the activities. Several fragments of cordage were found, and it appears that some chipped stone maintenance occurred. Again, hunting is apparently the primary activity, as indicated by projectile points (both atlatl and arrow) and 11 bones. Choppers and scrapers are indicative of butchering and hide preparation. Some ground stone items indicate some plant food processing. Therefore, Occupation 9 conforms to the interpretation offered for the previous zone, in that Palmillas phase hunters from nearby villages used Ojo de Agua as a task camp for the purpose of taking fowl and other animals that came to the spring for water. While there, they may have done some limited plant food processing. Manos and metates in this layer demonstrate some plant use during Occupation 9.

Curated Plant Materials Attributed to Zone D, Occupation 9. No curated materials were documented as representing Occupation 9.

Ojo de Agua Cave, Zone C, Occupation 10

Excavation Notes and Observations. Zone C (Occupation 10) is described as a 15 to 30 cm thick layer of white ash fill, full of artifacts and vegetal material. The plant remains and a lack of corn cobs suggest a dry winter season occupation during the Palmillas phase. This floor, which contained a roasting pit, covered much of the excavation, but it could not be established whether a macroband(s), microband(s), or task force groups were responsible for its deposition. However, the latter interpretation is highly likely. Atlatl and arrow points, 28 bones, scrapers, and a bone awl indicate that hunting and animal processing were major activities. For the first time, we have abundant direct evidence for plant collecting activities during this occupation.

This is the only context for which relatively detailed information is given in the notes for plant parts recovered. Texas ebony (*Pithecellobium* sp.) pods (n=132) are among the most abundant. Other plant remains included legume cotyledons (n=69); pepo squash rind (n=29); agave (unspecified parts, n=249); foxtail millet seeds (n=50); prickly pear pads (n=108); chestnut dioon (*Dioon edule*) leaf bases (n=89), bracts (n=20), and seeds (n=9); a snake-cotton (*Froelichia* sp.) leaf base (n=1); caesalpinia (*Caesalpinia* sp.) seeds (n=7); lonchocarpus (*Lonchocarpus* sp.) bases (n=4); sabal palm (*Sabal* sp., but more likely hesper palm [*Brahea berlandierii*]) bases (n=2); bromelia (*Bromelia* sp.) (unspecified parts, n=16); and guapilla (*Hechtia* sp.) (unspecified parts, n=18) (MacNeish 1954c:131). The notes also indicate the presence of a maize stalk fragment. Manos and metates would have been used to process the plant foods.

Curated Plant Materials Attributed to Zone C, Occupation 10. Approximately 20 curated materials were associated with Occupation 10 of Ojo de Agua cave. Only one rind fragment of unidentified cucurbit was found; the remaining materials consisted of maize cobs and cob fragments.

Ojo de Agua Cave, Zone B, Occupation 11

Excavation Notes and Observations. Zone B (Occupation 11) was a 3-10 cm thick charcoal floor attributed to the San Lorenzo phase. Again, bird bones point to a dry winter season visit, but it is difficult to determine the length of the occupation nor the size of the group. There was substantial evidence of hunting activities, including projectile points (both atlatl and arrow, but dominated by the latter) and 14 bones. Choppers and scrapers are evidence for butchering and skin working. Some flakes indicate chipped stone tool maintenance. Perishables include cordage, yucca fibers, and cotton cloth fragments. Three yucca leaves and eight prickly pear pads comprise the plant assemblage of this occupation. Unlike previous occupations, no ground stone tools were discovered in Zone B.

Curated Plant Materials Attributed to Zone B, Occupation 11. Almost 40 curated plant specimens could be traced to Occupation 11. These included a single *Inga* pod, some rind fragments and a peduncle of unidentified squash, a bottle gourd rind fragment, and several maize tassels and cobs and cob fragments.

Ojo de Agua Cave, Zone A, Occupation 12

Excavation Notes and Observations. The top 15 cm thick humic layer on the surface of the cave comprises Zone A, the final prehistoric occupation in Ojo de Agua cave (Occupation 12, San Lorenzo phase). Numerous arrow points and deer bone indicate hunting activities, while scrapers are evidence for hide preparation. Preparation or maintenance of chipped stone tools is indicated by some debitage in the zone. Otherwise, evidence for other activities is limited. The only plant material noted is one overhand knot on a yucca leaf, though a single mano hints at vegetal preparation.

Curated Plant Materials Attributed to Zone A, Occupation 12. Almost 20 remains were discovered among the Ojo de Agua plant specimens that could be traced back to Occupation 12. These included a few leaf fragments from an unidentified palm, a sotol leaf fragment, several unidentified cucurbit rind fragments, and two maize cob fragments.

Miscellaneous Curated Items from Ojo de Agua Cave

Very few specimens were labeled as originating in Ojo de Agua cave without more precise provenience information. These include some unidentified cucurbit rind fragments, and two *aquiche* (*Guazuma ulmifolia*) fruits. In addition, three maize cob fragments in the collections *may* have come from Ojo de Agua, but this is uncertain.

In summarizing the varying functions of Romero's, Valenzuela's, and Ojo de Agua caves to humans over the millennia, MacNeish (1954c:138) writes: "Thus the occupations of Ojo de Agua finish very much like they started some 9,000 years earlier with dry season visits of people who came to the cave to hunt animals that visited the spring and contrast with the wet season visits in nearby Valenzuela and Romero caves, where more occupations occurred by people doing a wider variety of things."

Discussion

Several insights emerge from this inspection of the curated plant collections and unpublished documentation of the Ocampo cave excavations. First, MacNeish's descriptions of the deposits and associated artifacts as well as the plant remains from them point to difference in use *among* the caves. As was stated in the introduction to this dissertation, not only were cave occupations a single aspect of a larger pattern that also included open-air campsites and villages, different cave sites often played varying roles in the subsistence strategy. For example, it is clear from the curated plant remains, the artifact assemblages, and occupation deposits described in the field notes that Romero's and Valenzuela's caves served a wide range of purposes to the visitors, even villagers of later time periods, particularly during the wetter times of the year (spring, summer, and early fall); on the other hand, Ojo de Agua cave, just a few kilometers downstream, appears to have played a different role in the overall strategy. Data available from this site (but not published elsewhere) indicate that occupations in Ojo de Agua occurred for the most part in the dry winter months, and centered on the hunting of migratory waterfowl and other game attracted to the spring below the cave.

The plant collections themselves offer additional important insights, the most striking of which is the range of non-domesticated plants utilized. Although it was emphasized in most of the published sources that a wide variety of wild plants were used, these sources often do not specify what they were. While the collections are by no means complete, their contents hint at a very rich foraging-farming economy that lasted even beyond the establishment of settled villages. Many of these plants were readily available in the immediate vicinity, but some had to be obtained over greater distances indicating that even the villagers of later time periods ranged far and wide to obtain wild resources.

For example, in the curated collections I encountered pods and seeds of a species of ceiba tree, assigned to San Lorenzo and San Antonio phase contexts (Figure 7.1). Published sources do not mention the presence and use of such products in the Ocampo caves. Pods, roots, and floss of a related species (*C. parviflora*) were found in Coxcatlán, Purrón, San Marcos, and El Riego caves in the Tehuacán valley, dating as early as the El Riego phase (8500 – 7000 B.P.); in one site the floss had apparently been used to enclose a paste of ground seeds (Smith 1967:244). Today rural populations in Tamaulipas use this tree for various purposes, including construction (wood), fiber (floss from within the pods), and food (roots, flowers, and leaves), and oil from the seeds is useful for cooking

Figure 7.1. ***Ceiba pentandra*** **pods from Romero's cave, Occupation 13 (San Lorenzo phase).**

Figure 7.2. ***Enterolobium*** **sp. pod from Valenzuela's cave Occupation 6 (Flacco phase).**

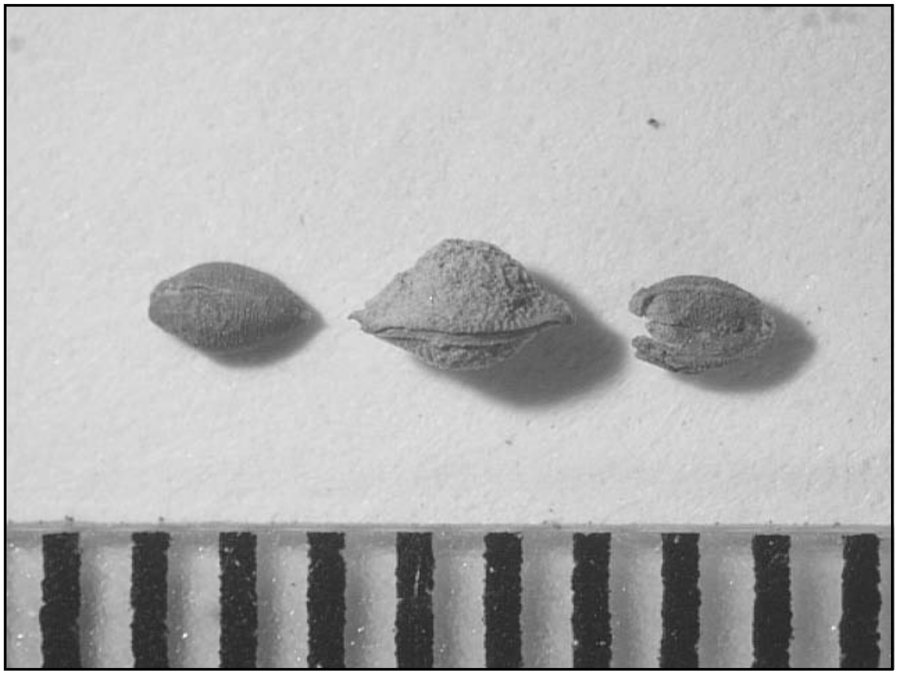

Figure 7.3. Foxtail millet caryopses, Romero's cave, Occupation 10, Mesa de Guaje phase. The specimen in the center is atypically large.

Figure 7.4. Masticated maize leaves (quids), Romero's cave, Occupation 13, San Lorenzo phase.

and for soap (Hernández Sandoval et al. 1991). Present-day residents of the Tehuacán valley consume ceiba seeds either raw or boiled (Smith 1967:244).

The ceiba species (*C. pentandra*) represented in the Ocampo cave collections has a wide distribution in Mexico on the Gulf Coast from Tamaulipas to the Yucatán peninsula (Puig 1991:171). Although Hernández Sandoval et al. (1991:19) state that the tree occupies lowland tropical forest (a vegetation zone that occurs in the study area; see Figure 4.5) it is not found in the immediate vicinity of the caves; it is more likely to be encountered in the humid lowlands south of Ocampo (Claudia Gonzalez Romo, personal communication 2006). In town there are several large ceiba trees surrounding the plaza, but these were planted in historic times.

The ceiba pods and seeds found in Romero's and Valenzuela's caves signify plant food procurement activities in the humid lowlands to the south during the latest prehistoric phases, probably during the dry season as this is when the trees flower and produce fruit. Travel between these habitats and the study area would be about 25 to 30 km on foot, but would have been facilitated by the Cañon Infiernillo which only intermittently contains water and functions as a natural corridor connecting the uplands of the study area and the northern extent of the Ocampo valley. During the San Lorenzo and San Antonio phases villages remained the typical settlement pattern although such sites were fewer in number and less elaborate than in previous time periods; caves were frequently used as campsites. Thus in these later phases it appears that the logistical mobility networks based in these villages were sufficiently extensive to bring in wild resources from humid zones at distances greater than 30 km. This indicates a substantial investment in non-domesticated plant gathering in spite of continued dependence on cultivated resources, as would be expected in a low-level food producing strategy.

Another plant not mentioned in any of the major published sources is the tree legume guaje (*Leucaena* sp.), which is documented in Lawrence Kaplan's inventory in

Occupation 6 (Flacco phase) in Valenzuela's cave and Occupations 13, 14, 15, and 16 (San Lorenzo through San Antonio phases) in Romero's cave (Kaplan, n.d.). Kaplan lists *L. edulis* among the remains in his inventory; however, Zárate (2000:485, 493), upon re-examining many archaeological guaje remains from Guilá Naquitz, the Tehuacán valley, and two specimens from Romero's cave, identified the latter as *L. pulverulenta*. This species is naturally distributed along the Sierra Madrea Oriental; Hernández Sandoval et al. (1991:26) list this species and one other (*L. leucocephalia*) as present in the lowland tropical forests such as those surrounding the Ocampo caves, where they are not cultivated but are presently used for their edible seeds. Members of this genus were brought under domestication in south and central Mexico (Zárate 2000), but there is nothing to indicate that the Ocampo remains represent anything but wild plants. Other wild tree legumes that were apparently important to the inhabitants include acacia (Mesa de Guaje, Palmillas, San Lorenzo, and San Antonio phases), mesquite (Ocampo and San Antonio phases), *Inga* (San Antonio phase), *Enterolobium* (Valenzuela's cave, unknown context, Figure 7.2), Texas ebony (Palmillas phase) and coral bean (Palmillas and San Antonio phases). It is clear that even the village occupants of later time periods continued to gather and utilize these locally-available foods, at least during visits to the caves.

Chestnut dioon is likewise not described among the wild plants in the Ocampo caves in published accounts, nor was it encountered among the physical remains in the curated collections; however, it is mentioned in the excavation notes as present in Occupation 10 (Palmillas) of Ojo de Agua cave (MacNeish 1954c). Remains reportedly included leaf bases, bracts, and seeds. This cycad is common in shallow soils in the oak forests on mountain slopes several kilometers to the west of the Ocampo caves. Seeds borne in its cones were apparently important food items in the Sierra de Tamaulipas, where they were abundant in cave deposits of the La Perra (n=372), Laguna (n=618), and Los Angeles (n=689) phases; La Perra and Laguna occupation zones also contained leaf bases and bracts (MacNeish 1958:148). Likewise, the seeds were apparently consumed (to a lesser degree) for several thousand years by the occupants of Coxcatlán and El Riego caves in the Tehuacán Valley (Smith 1967:235). Present-day residents of Tamaulipas toast and eat the seeds and recognize them for medicinal value (Hernández Sandoval et al. 1991:38); when cooked the seeds are high in starch (Smith 1967:235).

Published accounts, unpublished field notes, and several remains in the collections indicate that agave was an important resource for both fiber and food. Apparently the plant was eaten in great quantities throughout the sequence. According to Callen's (1970:238) analysis, agave remains were found in no less than 40 percent of the paleofecal specimens he examined per cultural phase from Infiernillo through Mesa de Guaje, and in 80 percent of the San Lorenzo phase paleofeces (no specimens were analyzed from Palmillas phase contexts). In addition, in the museum collections I encountered agave quids from Mesa de Guaje (Occupation 10) and San Lorenzo (Occupations 13 and 14) contexts in Romero's Cave; leaf fragments were found from numerous occupations in both Romero's and Valenzuela's cave. In the collections, fiber, leaf, fragments, and several cordage fragments of agave or closely related plants were attributed to Guerra, Mesa de Guaje, Palmillas, San Lorenzo, and San Antonio phase contexts.

There is presently no clear evidence that agave plants were cultivated in the area, even at the height of village life. This does not preclude the possibility for limited transplantation to bring a few plants into closer proximity of villages, but archaeological survey failed to reveal water manipulation feature complexes (e.g., rock mulch gardens) generally taken as evidence for intensive agave cultivation in other regions such as the Southwestern U.S. (Fish 2000). Agave plants (particularly *A. lophanta*) grow thick on the rocky slopes and canyon walls throughout the region, and thus would have been readily available without cultivation.

On survey we discovered some evidence for agave procurement and processing, indicating that collecting groups ventured into the canyons for this purpose. A small rockshelter on the northern end of the study area (Cav-7-05, discussed in the next chapter) contained on its surface six large retouched, tabular fragments of limestone ("tabular knives") that are interpreted as specialized tools for the extraction of the leaves and stems of agave and similar fibrous plants (e.g., yucca, guapilla, sotol). Also present on the surface were several ceramic sherds. If these artifacts are indeed associated, it seems that villagers of the ceramic period were sending out agave-collecting parties some distance from home communities, and shelters served as temporary resting places or campsites on such forays.

Another wild plant not mentioned in publication is guapilla (actually represented by species in two bromeliad genera). Due to its abundance in the vicinity, it was not surprising to find leaf fragments of guapilla among the collections. One species (*Bromelia penguin*) grows in great quantity alongside agave on canyon walls and rocky slopes in lowland tropical forests surrounding the caves, and the other (*Hechtia glomerata*) is a component of nearby mountain oak forests. These bromeliads are morphologically similar to agave, and are useful for the fibers in their leaves (for cordage and textiles); the stem and leaf bases provide a refreshing snack and juice for a beverage (though not likely an important food resource) (Hernández Sandoval et al. 1991:20). While the inhabitants of the Ocampo caves likely utilized these plants for the latter, it is more likely their primary purpose in the caves was fiber for cordage. For either function, guapillas were readily available in the vicinity year-round.

In addition to agave and guapilla, sotol, yucca, and Hesper palm were major fiber plants to the occupants of the Ocampo caves (though they all also have edible parts).

Yucca and Hesper palm are scattered throughout the local lowland tropical forest; sotol is less common but occurs along some rocky slopes. The range of the fiber remains of these plants span the entire process from fiber extraction to the manufacture of finished products. This suggests that the caves may have been preferred locations for such activities, as the cool, shady environment prevents the quick drying of the raw materials.

Though foxtail millet is emphasized in both published accounts and unpublished field notes, the only specimens encountered among the museum collections were within the jar of sediment and fecal matter collected from a Mesa de Guaje context in Romero's cave. Even for such a small sample the caryopses of this grass were abundant, supporting the notion that it was an important resource in prehistory (Austin 2006). Callen (1967b) observed abnormally large caryopses in the Ocampo paleofeces and interpreted this to indicate intentional selection for more productive plants. Unfortunately, he does not specify the caryopses dimensions that led to him to this conclusion, only that "… there were quite a number of grains definitely larger and fatter than normal" (Callen 1967b:535). Nor does he directly indicate exactly when the larger seeds appear and disappear, though MacNeish (1992:104-105) states that Callen observed the seeds increasing in size over the course of the Ocampo phase, then declining by the Guerra phase. Callen (1967b:536) does describe the rise and fall in general use as illustrated by ubiquity in paleofeces. The grass was present in 30 percent of the samples examined from Ocampo phase contexts and rose to 50 percent of the early Mesa de Guaje phase; by late Mesa de Guaje it diminishes to only 14.5 percent (Callen 1967b:536). Callen attributes this to the end of the EIA and increased use of maize. The general picture is one of initial use of and selection for larger seeds over the course of the Ocampo phase, increasing use over the next two phases (but with a decrease in seed size by the end of this period), then continued but diminished use in the subsequent Mesa de Guaje.

During my examination of the sediment sample mentioned above I identified 54 relatively complete foxtail millet seeds and an estimated 700 more fragmentary remains. Of the mostly complete seeds, one is substantially larger than all the others (Figure 7.3); while most of the caryopses range from 1.5 to 2.0 mm long, 1.0 to 1.1 mm wide, and 0.7 to 1.0 mm thick, this one is 2.6 mm long, 1.6 mm wide, and 1.5 mm thick. If the context of this large specimen is secure, its presence here does not fit the time frame outlined above, in that selection for larger seeded foxtail millet had supposedly ended before the Mesa de Guaje phase. I am more inclined to believe that it represents an anomalously large-seeded wild plant; according to Musil (1963:58) a seed this size is not well out of the natural range of the species identified in Ocampo (*S. parviflora* [formerly *S. geniculata*]: length: 2.5 mm, width: 1.25 mm). Also, as Austin (2006:152) notes the large seeds identified by Callen may in fact represent octaploid wild plants (possessing eight of each chromosome number for that species gene pool), a condition that can result in gigantism in the plant or its parts. The finding of a relatively large specimen in a context so long after selection for large seeds is believed to have stopped may support the interpretation that enlarged caryopses were not necessarily due to intentional human selection during the EIA (although vertical displacement within the deposits is also plausible).

In short, the cultivated status of the Ocampo foxtail millet has yet to be established. However, the high percentages of paleofeces containing its grains throughout the sequence (regardless of fluctuations between various phases) and the copious amounts found in a small Mesa de Guaje deposit during the present study indicate that this grass was continuously gathered by the people who repeatedly used the caves, even once village life had been established. *S. parviflora*, the species identified by Callen in paleofeces from the Ocampo caves, is a perennial weed that prefers disturbed areas (Austin 2006:152), and thus may have been easily collected in great quantities near human habitations and along waterways in the study area.

This sample of sediment and fecal matter provided a unique insight into Mesa de Guaje plant use, because fine screening revealed a number of plants with parts too small to be recovered using the original excavation methods. In addition to foxtail millet these included minute seeds of amaranth, purselane, *Echinocactus*, *Verbesina*, and *Aster*. Although these are small enough to have blown in as part of natural "seed rain," it is likely that at least the former three were economically valuable. However, these were found in the same sample with the hundreds of foxtail millet grains mention above, and the latter showed definite signs of mastication while the former did not, supporting the interpretation that they arrived by other means. This does not rule out the possibility that they were utilized by the inhabitants of the caves; Callen's analysis of the paleofeces demonstrates that amaranth was a food item; the seeds and greens of the weedy purselane has a long history of human use in Mexico and the U.S. Southwest; and the stem and fruit of a species of *Echinocactus platyacanthus* is valued as a food item in southern Tamaulipas today (Hernández Sandoval et al. 1991:20).

As discussed in the last chapter, all published accounts that declare cotton use in Ocampo either mention it only as being present and locally cultivated as early as the Guerra phase, or describe the archaeological manifestations as in the form of fiber, cordage, and textiles (Kaplan and MacNeish 1960; MacNeish 1958, 1971, 1992; Mangelsdorf et al. 1964). Therefore, these items might have been imported and the plants could have actually been grown elsewhere. Unpublished field notes indicate the presence of cotton products in occupation zones attributed to the Guerra through San Antonio phases. However, MacNeish (1954b:48) describes cotton seeds in both the floor detritus and in paleofeces from Occupation 11 (Palmillas phase) in Romero's Cave, suggesting that the seeds could have been eaten for their oil content. I did not encounter cotton remains in any form in the curated collections that I examined, but in Kaplan's (n.d.) inventory of legume materials I found reference to cotton seeds, also from Occupation 11. The documentation of cotton seeds in the deposits, rather than only finished cordage and textiles, supports published claims that prehistoric people in Ocampo actually farmed this domesticate themselves rather than only importing its products, at least as early as Palmillas times.

The varied maize remains at the HH indicate that entire plants were being brought into Romero's cave, rather than just cobs for the consumption of the grains. The materials offer some important insights into the hypothesis that maize was not only a grain crop, but was also used for the sugar content in its other parts. The collections contain more than 80 quids of maize tassels, stalks, and leaves, dating from the Guerra through San Antonio phases (Figure 7.4). Other maize parts that were unchewed included stalk fragments, leaves, husks, tassels; several leaves were tied into knots, presumably to be saved for later use.

Maize cobs and cob fragments are particularly abundant in Romero's cave from Guerra phase occupations onward. Although some maize remains from Valenzuela's cave were examined, it was unfortunately beyond the scope of the present project to examine the all of the maize materials from this site, as these are almost entirely unorganized in what appears to be the same bags they were placed in upon collection in the field. Therefore this discussion will focus on the Romero's cave materials. As stated in previous chapters, Smith (1997b) directly dated a small cob from Valenzuela's cave to about 4300 B.P. (Flacco phase). In Romero's cave, the earliest cobs I relocated were attributed to the Guerra phase (Occupations 6, 7, and 8; n=128); Occupation 6 only had 13 specimens, while Occupation 8 had 90. Thereafter, the numbers of cob fragments remain relatively high. The Mesa de Guaje occupations contained 497 specimens. It is not surprising that the highest recovery occurred from Palmillas phase contexts, during the apogee of settled farming life in the region; these occupations contained some 847 cobs and cob fragments. However, San Lorenzo (n=660) and San Antonio (n=568) phase contexts still contained abundant specimens. Of course we must be cautious when considering these numbers. Smith (1997b) has already demonstrated that some degree of disturbance has occurred in the caves, so the contexts of many of these specimens may be insecure. For example, based on the associated labels, 14 maize husks would be attributed to Occupation 1 in Valenzuela's cave; however, this occupation dates to the Infiernillo phase, so they should be regarded as either mislabeled or from a disturbed context. Also, as I have already stated, many plant remains were not retained during the excavations, but due to the research interests of the excavators, maize cobs would have been of primary importance to collect. Regardless, based on the collections it appears that maize was an important food item from relatively early on, even before the inhabitants of the region settled into villages during the Mesa de Guaje phase.

Conclusion

Several groundbreaking analyses emerged from the excavation of the Ocampo caves and the plant materials recovered therein. As these analyses emphasized specific classes of plant remains (that is, domesticates), some plants in other classes were never reported in publication. The present inspection of unpublished field notes and curated collections of the original plant materials has enhanced the known range of *non-domesticated* plants utilized over the long but sporadic history of occupation within the caves. Also, the field notes provide detailed descriptions and interpretations of the occupation zones themselves that go beyond the published accounts, which discuss use of the caves in terms of the very broad temporal periods in MacNeish's sequence. This permits a higher-resolution examination of use of the caves over time and therefore increases our capacity to view these occupations within the broader context of general land use.

To expand beyond this level, I performed an archaeological survey of the mountains, valleys, and canyons surrounding the caves. This was done in order to document a wider range of local site types and bring the existing data from the excavated caves into the larger framework of a prehistoric settlement system, and to gain further insight into how this possibly relates to plant utilization and the development of food production. The results of this survey are the topic of the next chapter.

CHAPTER 8: ARCHAEOLOGICAL SURVEY

Field survey was conducted in order to gain a broader perspective of other site types that were utilized by the occasional occupants of caves in the Ocampo region. In preparation for the fieldwork phase of this project, I performed two brief reconnaissance surveys near the Ocampo caves for two days in 2002 and again for four days in 2003. During these pilot studies we relocated and explored the previously excavated cave sites, verified the presence of uninvestigated cave and non-cave sites, and evaluated the logistics of additional field survey in the area. Field research could finally proceed with receipt of a National Science Foundation Doctoral Dissertation Improvement Grant (Award/Proposal # BCS-0507899) and a permit issued by INAH (Oficio Núm. C.A. 401-36/0152).

Archaeological Field Survey

The archaeological survey targeted a 13 x 8 km (10,400 ha) area, including the broad Huazacana river valley and adjacent hills and slopes surrounding San Lorenzo las Bayas to the west, and the Infiernillo and tributary canyons and adjacent ridges to the east (Figure 8.1). Full coverage survey was not feasible for the purposes of this dissertation, and even probabilistic sampling approaches were thwarted by field conditions in the study area. Personnel numbers were low (two to three people), the rugged landscape and heavy vegetation impeded mobility, and vegetation and thick leaf litter resulted in very low visibility. Ultimately I depended largely on local knowledge to locate archaeological sites by asking my guides to direct me to those already known by residents, resulting in the documentation of 14 open sites with architectural features and six cave sites. However, whenever possible we also explored various topographic settings in search of unknown sites, including narrow canyons, alluvial valleys, gentle slopes, and mountain

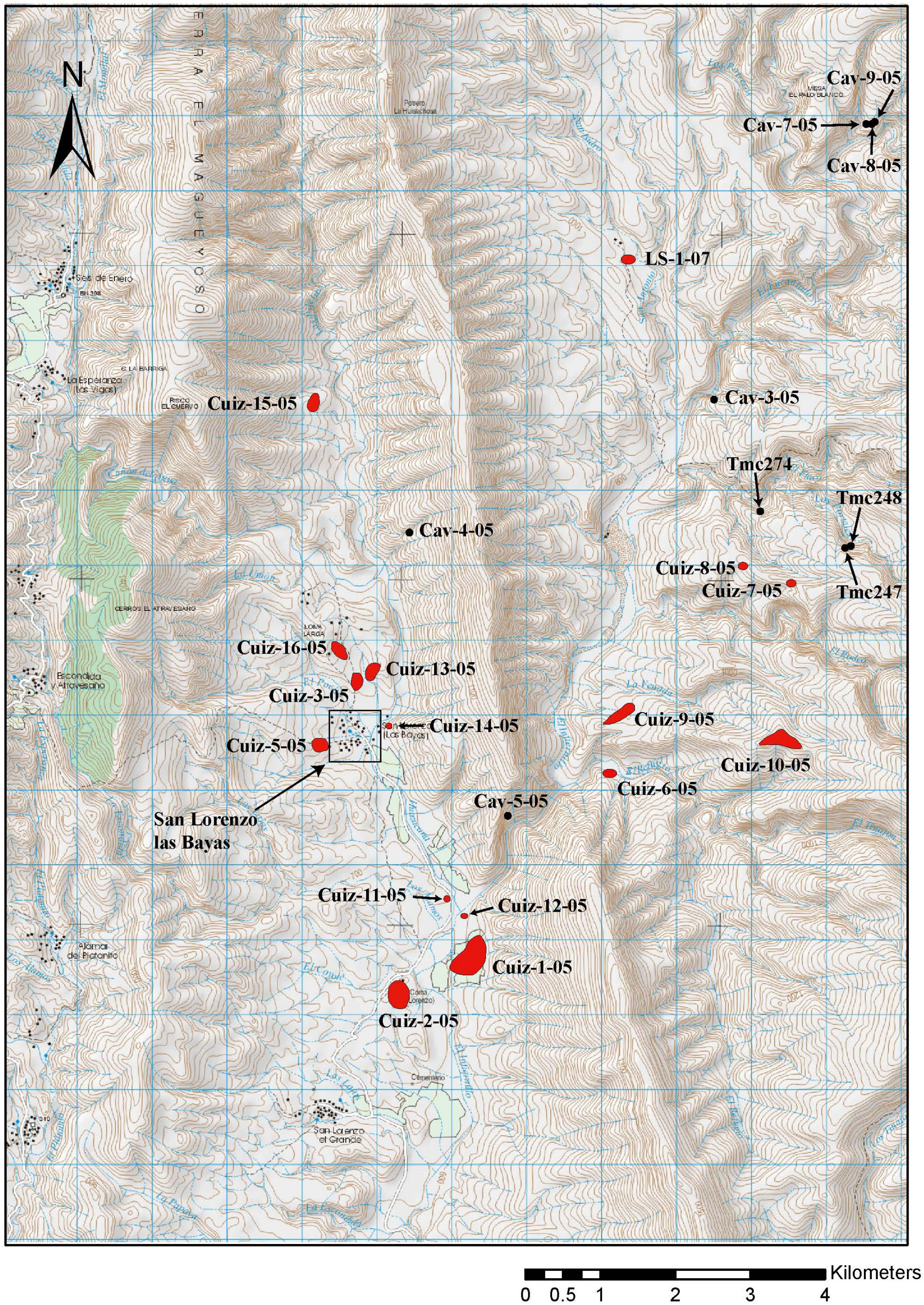

Figure 8.1. Map of study area, showing the Ocampo caves and sites documented during the survey.

summits. During such explorations and as well as transit between known sites one more prehistoric settlement and an open campsite were discovered that were previously unknown to current residents.

Time constraints precluded exploration and documentation of all archaeological sites known to local residents, as they are so abundant. Although the methods used did not result in a statistically representative sample of archaeological sites that can be used for comparative purposes, the types of sites documented, their locations on the landscape, and the types of artifacts found on them reveal insights into varied agricultural strategies, the nature of habitats and plants exploited, and plant processing methods. Another contribution of this fieldwork is the reporting and registration of the documented sites with INAH's *Registro Publico de Monumentos y Zonas Arqueológocos* ("Public Register of Archaeological Monuments and Zones"), thereby enhancing the formally recognized inventory of archaeological sites in the state of Tamaulipas and increasing the potential for future archaeological endeavors in the state.

Site Documentation

Site locations were recorded using a handheld Garmin Etrex GPS unit, and plotted on a topographic map (INEGI 2002). Sites were explored and mapped using a compass and 50 mm measuring tape, and documented through detailed notes and photographs. It was not always possible to map sites in their entirety, given heavy underbrush and the spatial enormity of some prehistoric settlements. Although many cave and open sites with significant potential for further investigation were identified during this survey, these by no means account for all of those in the vicinity. Several sites were visited but not recorded due to time constraints, and local residents tell of many more. Rock art is common in caves and on cliff faces; most panels consisting of red or black pictographs representing human figures, hand prints, animals, and geometric forms. In most cases, heavy vegetation and leaf litter prevented the discovery of ephemeral evidence for short term camp sites, activity areas, or perhaps pre-ceramic settlements out in the open. Much more survey remains to be done to thoroughly document the local range of site types.

Artifact Collection and Analysis. Artifacts were retained from the surface of documented sites. Diagnostic and unique specimens and ground stone were always collected upon encounter, and all observed artifacts were retained from sites with low artifact counts and/or general low surface visibility. On sites with high surface visibility and dense cultural materials, samples were obtained by collecting within 2 m diameter units on artifact concentrations. Efforts were made to balance the distribution of these units around various parts of the site, and the quantity of individual units varied depending upon site size and degree of visibility. The locations of all surface collections were plotted on the primary site map. Human remains, though present on three of the recorded sites, were left in place and their position mapped. Collected artifacts were washed, labeled, and bagged in San Lorenzo las Bayas, and artifact analyses took place at the INAH office in Ciudad Victoria, where the materials are presently curated.

Identity of ceramic artifact types was primarily used to infer relative dates of site occupation, but some vessel forms were considered to interpret particular kinds of plant processing activities. Ceramics were identified using published descriptions (Ekholm 1944; MacNeish 1958; Stresser-Peán 2000), comparative materials housed at INAH, Tamaulipas, and with the assistance and expertise of Gustavo Ramirez-Castilla. Only sherds larger than 2 cm were considered, as these are the most reliably identifiable. All diagnostic ceramics recovered during the survey were attributable to phases outlined for the Huasteca and the Sierra de Tamaulipas, rather than for the Ocampo sequence. In this chapter, site occupation phases based on these ceramic types are presented in the roughly contemporaneous phases of the Ocampo sequence; refer to Tables 5.1 and 8.1 for the corresponding Sierra de Tamaulipas and Huasteca phases.

Chipped and ground stone artifact types were identified using definitions outlined in Vierra (in press). Stone tool technological variation has been used to interpret mobility and labor organization within archaeological populations. For instance, high mobility limits the size and number of tools that can be carried, so relatively abundant formal tools (such as bifaces) or the debris of their manufacture is assumed to indicate mobile strategies, as such tools can be used as cores in the occasional absence of lithic raw materials. On the other hand, sedentary groups with ready access to local raw materials tend to use expedient core flaking technologies. Also, shifts in labor organization associated with sedentism and intensification of agriculture can lead to variation in chipped stone technology, as they emphasize the maintenance of facilities and activities associated with agriculture and sedentism (e.g., ceramics, storage facilities, agricultural features, habitations), and de-emphasize high investment in the manufacture of formal stone tools. Once again, a highly sedentary lifeway focused on agriculture will be reflected in the form of abundant expedient flake tools relative to formally curated tools (Vierra, in press). Thus lithic tool assemblages on a site can be informative of the subsistence and land-use patterns followed by the occupants, especially when considered alongside other material culture such as ground stone materials, presence of architecture, and ceramics. In addition, specialized tools can be used to interpret specific plant procurement and processing practices; for example, the presence of tabular knives on a site is indicative of the harvesting of agave, yucca, or similar fibrous-leaved species.

Material type and presence and type of cortex (the outer weathered surface of an unmodified stone) were recorded for all chipped stone remains, as such attributes are informative of the selection and origin of raw materials. During the survey, general observations were made of locally available materials, which primarily consisted of limestone (in varying degrees of silicification) and poor quality gray, black, and brown cherts. Based on the material types of artifacts collected on survey, most of the artifacts were manufactured using locally available materials. Cortex type was recorded as waterworn, tabular, or nodular. Waterworn cortex is the rounded surface created by water rolling and transport of a rock (e.g., river cobbles). Tabular or nodular cortex is the naturally weathered surface of a tablet- or nodule-shaped rock. Thus cortex type reflects the geologic context of the source material used to manufacture stone tools; for example, waterworn cortex on an artifact indicates that the raw material was collected from river gravels rather than the original source, which would rather be indicated by a nodular or tabular cortex.

All ground stone items were collected upon encounter. Most were fragmentary, precluding detailed analysis (e.g., measurements of grinding surface size), but the specimens were often complete enough for broader classifications, such as slab metate versus basin metate, one-hand mano versus two-hand mano, and so on. Such categories can be used to indirectly evaluate dependence on maize in contrast to wild small-seeded species, as grinding surface size is indicative of the size of the grains being processed (see Hard et al. 1996; Mauldin 1993). A prevalence of one-hand manos and basin metates is generally assumed to be associated with low dependence on agriculture, while larger (two-hand) manos and slab metates (with their larger grinding surface) are assumed to be associated with a higher investment in agriculture. Material types were documented for all ground stone artifacts, indicating use of raw volcanic materials that were typically not available in the immediate vicinity, yet could be collected or traded in from no great distance in the surrounding mountains.

Results

The fieldwork resulted in the discovery and documentation of 22 archaeological sites (Table 8.1, Figure 8.1) including six caves, one open-air lithic scatter, and 15 open sites with architectural features. The latter were found in a variety of topographic settings, including broad river valleys, hill slopes, and mountain summits, and range from isolated individual platform mounds to groups consisting of dozens or even over a hundred structures. It is often difficult to judge the actual extent of sites with architectural features, as historic farming practices have destroyed many features and heavy vegetation obscures eroded structures, but rough site dimensions were estimated from the distributions of mounds, artifacts, and architectural debris. In this discussion I distinguish between four "types" of sites with architectural features based on arbitrary size ranges: small hamlets (600-2,000 m^2, n = 3, which often consist of three or less structures); small villages (6,000-15,000 m^2, n = 4); medium villages (30,000-100,000 m^2, n = 7); and large villages (greater than 100,000 m^2, n = 1). Sites were named based on pre-existing local place-names.

The results of analyses of various artifact classes from these sites are presented in Appendix 2, and site maps can be viewed in Appendix 3. The following discussion of survey results is organized by estimated time period of site occupation. However, because seven sites lacked sufficiently diagnostic artifacts I begin with a brief description of sites of unknown age.

Unknown Age (Aceramic)

Three sites were located that had no ceramics or any other diagnostic artifacts, so their relative dates could not be established from surface observations (Table 8.1; Figure 8.2). All were cave occupations with either light lithic scatters on the surface or pictographs on the walls. In one the only indication of human use was a possible human

Table 8.1. Sites Documented During Survey, in Order by Phase of Occupation.

Site Number	Site Name	Site Type	Topographic Context	Vegetation Zone *	Elev. (masl)	Area (m2)	Est. Occupation (Sierra de Tamaulipas Sequence)	Corresponding Sierra Madre Phase
Cav-3-05	**Cueva del Flash**	Cave occup.	Canyon	LLTF	795	950	Unknown aceramic	**Unknown aceramic**
Cav-8-05	**Cueva de las Tijeras 2**	Cave occup.	Slope	LLTF	1,015	75	Unknown aceramic	**Unknown aceramic**
Cav-9-05	**Cueva de las Tijeras 3**	Cave/rock art	Slope	LLTF	1,096	300	Unknown aceramic	**Unknown aceramic**
Cuiz-12-05	**Cerca de Cañon de Infiernillo**	Sm. village	River valley	LLTF	680	15,000	Unknown ceramic	**Unknown ceramic**
Cav-7-05	**Cueva de las Tijeras 1**	Cave occup.	Slope	LLTF	1,010	100	Unknown ceramic	**Unknown ceramic**
Cuiz-6-05	**El Refugio**	Sm. village	Slope	OPF	730	6,000	Unknown ceramic	**Unknown ceramic**
Cuiz-7-05	**El Santuario**	Hamlet	Summit	LLTF	1,095	1,050	Unknown ceramic	**Unknown ceramic**
Cav-5-05	**Cueva Sin Sombreros**	Cave occup.	Canyon	LLTF	805	50	Laguna	**La Florida/Palmillas**
Cuiz-8-05	**El Matillal**	Sm. village	Summit	LLTF	1,075	6,450	Laguna	**La Florida/Palmillas**
Cuiz-11-05	**Los Basamentos**	Hamlet	River valley	LLTF	670	670	Laguna-Eslabones	**La Florida/Palmillas**
Cuiz-13-05	**La Termina de Loma Larga**	Sm. village	River valley	IP	790	37,500	Laguna-Eslabones	**La Florida/Palmillas**
Cuiz-16-05	**Loma Larga Manguera**	Sm. village	River valley	IP	820	15,000	Laguna-Eslabones	**La Florida/Palmillas**
Cuiz-2-05	**La Coma**	Med. village	River valley	LLTF	780	100,000	Laguna-Eslabones	**La Florida/Palmillas**
Cuiz-5-05	**El Basurero**	Med. village	River valley	IP	750	30,000	Laguna-Eslabones; Los Angeles	**La Florida/Palmillas**
Cuiz-15-05	**Las Piletas**	Med. village	Slope	OPF	915	90,000	Laguna-Eslabones	**La Florida/Palmillas**
Cuiz-9-05	**La Venada**	Med. village	Slope	LLTF/OPF	870	50,000	Laguna-Eslabones; Los Angeles	**La Florida/Palmillas**
Cuiz-10-05	**Los Razos**	Med. village	Summit	Oak forest	1,182	60,000	Laguna-Eslabones	**La Florida/Palmillas**
LS-1-07	**San Antonio Abajo**	Lithic scatter	Slope	LLTF	920	3,650	Eslabones	**Palmillas**
Cuiz-14-05	**Muchos Ebanos**	Hamlet	River valley	LLTF	735	1,750	Laguna-Eslabones; Los Angeles	**La Florida/Palmillas; San Antonio**
Cuiz-3-05	**Cuizios de Fermin**	Med. village	River valley	IP	740	76,000	Laguna-Eslabones; Los Angeles	**La Florida/Palmillas; San Antonio**
Cuiz-1-05	**Potrero de Bueyes**	Lg. village	River valley	LLTF/OPF	680	225,000	Laguna-Eslabones; Los Angeles	**La Florida/Palmillas; San Antonio**
Cav-4-05	**Cueva de la Calavera**	Cave occup.	Slope	LLTF	790	80	Los Angeles	**San Antonio**

* IP: Introduced Pasture; LLTF: Lowland Tropical Forest; OPF: Oak Pine Forest

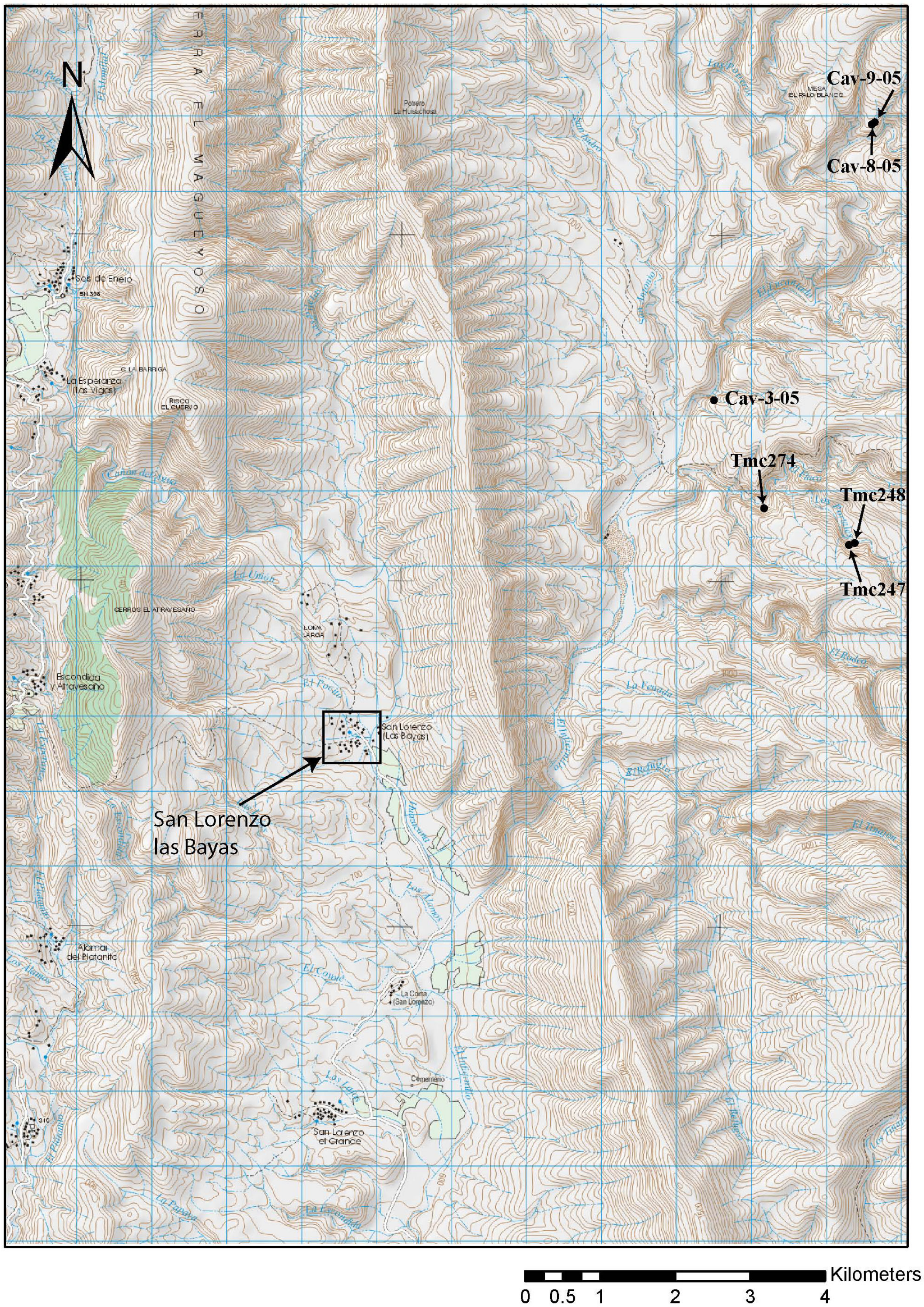

Figure 8.2. Aceramic sites of unknown age documented during the survey.

long bone on the surface. These could either represent use by preceramic groups or later visitations by villagers for purposes that did not require the use of ceramic vessels.

In the eastern face of the Cañon el Encantado, just north of where it intersects with Cañon San Antonio to form the Cañon el Infiernillo, is a large cave locals refer to as *Cueva del Flash* (Cav-3-05). The cave is approximately 20 m above the canyon floor, in the lowland tropical forest vegetation zone. Its entrance is about 15 m tall and 20 m wide, faces to the north, and the interior extends horizontally about 95 m into the mountainside. The dark zone is about 40 m in and the ceiling gradually pinches downward to the back wall of the cave. Romero and Valenzuela (1945:6) explored this site 1937 and designated it "Cueva No. 3."

There is a light scatter of lithic artifacts on the surface of this cave, all within 40 m of the entrance. The cave floor appears mostly undisturbed, except for eight shallow, tightly clustered eroded depressions below the drip line, exposing subsurface lithics. The lack of ceramics could indicate either a pre-ceramic visit or a later occupation for a purpose that did not require ceramic vessels. Production or maintenance of chipped stone tools was obviously an activity as debitage constituted almost the entire assemblage. Actual tools included a retouched flake and a large uniface; the latter seems to have functioned as a heavy chopping tool and may have been associated with wild plant procurement, as this type of tool is ideal for harvesting the leaves and stems of agave. These plants grow in abundance along the rocky walls of the Infiernillo, Encantado, and San Antonio canyons in close proximity to the site.

About six kilometers upstream from Cueva del Flash, high above the riverbed in the northern wall of the Cañon el Encantado, are three cave/rockshelter sites that my local guides call "Las Cuevas de las Tijeras." The sites are situated in lowland tropical forest, but oak forest is found less than a kilometer to the east. About 75 to 100 m of mountain side separates the caves from one another; Cuevas de las Tijeras 1 (Cav-7-05) and 2

(Cav-8-05) are at roughly the same elevation, while the third (Cav-9-05) is about 90 m higher. The former two are seemingly aceramic; the latter one will be discussed later in this chapter.

It is unclear if the cave I have designated *Cueva de las Tijeras 2* (Cav-8-05) is in fact an archaeological site due to an apparent lack of cultural materials. However, one long bone fragment, possibly human, was observed on the surface in a low, narrow tunnel that extends from the west side of the main chamber, so I have tentatively recorded it as a site. The cave is situated about 75 m east of Cueva de las Tijeras 1 and 75 m above the Cañon el Encantado riverbed. The 75 m^2 ground surface of the primary chamber is comprised of rich, brown, undisturbed and apparently deep sediments and large fragments of limestone roof fall. At the back of this chamber is a smaller second chamber of bare bedrock and roof fall; in its eastern wall is a third, uninhabitable cavity. The combined ground surface area of all chambers is about 350 m^2. Further investigation is required to verify if there are subsurface cultural materials.

About 100 m east of this cave is a large-mouthed rockshelter designated *Cueva de las Tijeras 3* (Cav-9-05). This shelter has a smaller back entrance, actually forming a short tunnel through the mountain top. It is located near the summit of a high east-to-west ridge on the southern edge of the Mesa el Palo Blanco, about 150 m above the Encantado riverbed. The shelter extends from the southern mountain face through the ridge and exits into a small meadow on the northern side. It is about 15 m wide and 20-25 m long, with a ground surface area of about 300 m^2. The ceiling is approximately 4 m high at the southern entrance and 2 m high in the north. Access is gained from the south by first climbing up a steep talus slope then over large boulders and roof fall; the ground surface slants upwards from south to north at a steep angle, and is strewn with large roof fall, shallow sediments, and leaf litter. The large southern mouth is highly visible from regions far to the south.

Artifacts are absent within this shelter, yet there are three pictograph panels on both walls near the southern entrance with hash marks, geometric designs, and stick figures in red and black pigment. The steeply-sloped floor in the shelter renders it uninhabitable, but given the high visibility of the shelter from great distances it is possible that the site held some ceremonial or symbolic significance.

Unknown Age (Ceramic Period, Post – ca. 3600 B.P.)

Four sites were documented in the study area that had either ceramic artifacts or architectural features, demonstrating that they were utilized following the end of the EIA (Table 8.1; Figure 8.3), although these lack sufficiently diagnostic materials to more specifically approximate the time period of their occupation.

The westernmost of the three Cuevas de las Tijeras is a small, shallow shelter about 70 m above the floor of the Cañon el Encantado, designated *Cueva de las Tijeras 1*(Cav-7-05). As mentioned above, the sites Cuevas de las Tijeras are situated in the lowland tropical forest vegetation zone, but oak forest is found less than a kilometer to the east-northeast. This shelter is about 12 m wide at the south-facing entrance and 11 m deep; the ground surface has an area of about 102 m^2. There is evidence of looting at the front of the shelter.

At only 1.5 m high at the mouth, this low shelter was likely inhospitable for extended occupation, but artifacts on the surface and in the looters' pit indicate temporary use. There were a few prehistoric ceramics, but these are non-diagnostic and inadequate to assign the occupation to a particular cultural phase. Debitage, a core, and a hammerstone are indications of chipped stone working. The remaining artifacts are evidence for plant procurement and preparation. A basin metate fragment suggests processing of plant foods, most likely small seeds, though it may also have been used for limited maize grinding. Interestingly six tabular knives were found on the surface of this

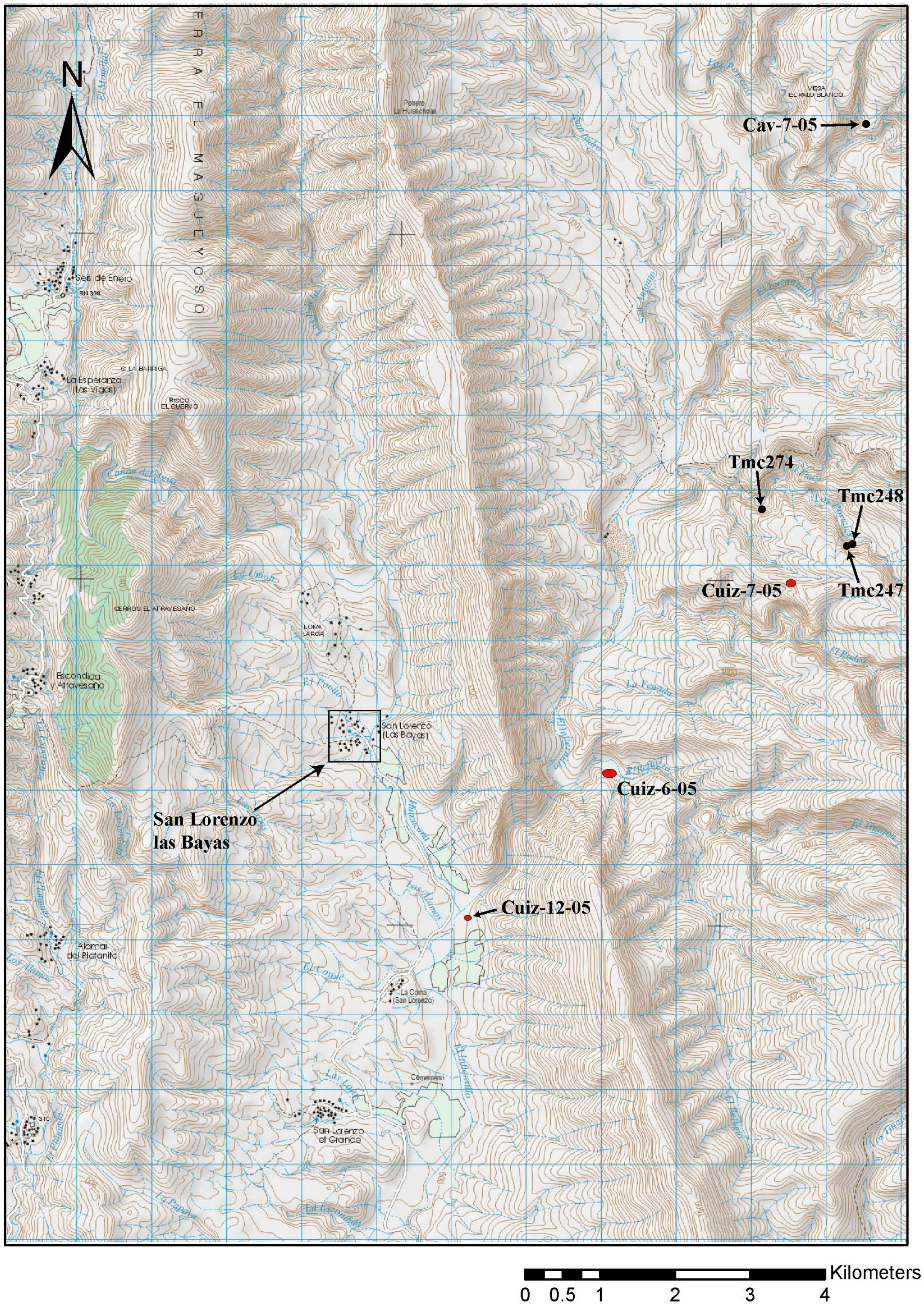

Figure 8.3. Ceramic sites of unknown age documented during the survey.

small shelter. These are on thin tabular pieces of stone, 7 to 18 cm in length, that likely flaked off naturally from exposed limestone; however, they are unifacially or bifacially retouched along one or more edge margins. They were probably used to harvest the leaves and stems of agave or similar plants; similar tools are found throughout the U.S. Southwest, where they are commonly known as "agave knives" (Parsons and Parsons 1990:301). The high number of such specialized tools in this small site suggests that this occupation was centered on such activities. Agave plants grow thick on the rocky slopes surrounding Cañon el Encantado. If the few ceramics are associated with these tools, the agave-collecting episode may have been conducted by a small logistical task group from some nearby village. Two human bones from the looter's pit indicate that the shelter was also used for interment of the dead.

Far downstream to the south, the small village of *Cerca de Cañon Infiernillo* (Cuiz-12-05) is situated in a river valley setting just south of the mouth of the Cañon de Infiernillo where it splits from the Río Huazacana. It is in lowland tropical forest, but oak forest presently lies less than a kilometer to the south. Based on visible architecture, the site appears to be at least 1.5 ha in size; two low, circular house platforms sit immediately on the eastern edge of the Infiernillo River, and three more structures lie atop a second terrace above and to the east of this first pair. A plaza-like level space is central to these five structures. A sixth feature, a limestone masonry wall, was constructed in a prominent position upon a 10 m tall hill, 75 m east of the main habitation cluster. Nearby archaeological sites include Los Basamentos, 300 m to the northwest, and Potrero de Bueyes, 400 m to the southwest. More house platforms may be present on the slopes above this site, and if this continuity extends southward to Potrero de Bueyes, these six structures may be only a small part of a very large village.

The Infiernillo River would have been a valuable resource to the inhabitants of Cerca de Cañon de Infiernillo. Wild plants could have easily been collected from the foothills immediately to the east of the site, which are now rich in chili peppers. The Infiernillo canyon would have allowed access to the canyon lands east of the adjacent mountain range for logistical hunting and collecting activities; the walls of this canyon are thick with agave and guapilla plants. As is the case for Potrero de Bueyes (and the modern occupants as well), the extensive alluvial terraces to the south would have provided land highly suitable for cultivation.

Surface visibility is very low due to heavy leaf litter, so survey revealed only two ceramic sherds. These superficially resemble the Huastecan type Zaquil Red (Ekholm 1944:355), but the porous paste is more characteristic of the Mountain culture (Gustavo Ramirez Castilla, personal communication 2006), so it is possible that they represent an imitation of a style introduced from the southeast. Ekholm (1944:356) states that the Zaquil Red type first appears at in Pánuco, Veracruz, during Period IV (see Table 5.1). MacNeish (1958:107) reports Zaquil Red first appearing in the Sierra de Tamaulipas during the La Salta phase, but its use in that region lasted at least into Los Angeles times. This extended period of use in other regions renders Zaquil Red unreliable as an indicator for dates of occupation at Cerca de Cañon de Infiernillo, which could range from the Palmillas through San Lorenzo phases by the local sequence.

To the east of Cerca de Cañon de Infiernillo is another small village site of unknown age that we have called *El Refugio* (Cuiz-6-05). El Refugio is situated along a north facing, 33 percent slope, approximately 30 m above the southern bank of the Río el Refugio. On the eastern slopes of the Sierra Duraznillo, it is within oak-pine forest, but immediately down slope to the north and east lowland tropical forest is found. Wild chili peppers, used as a condiment by modern as well as ancient populations, grow in abundance at the location. Presently, a productive spring is located 280 m to the northwest of the site in the otherwise dry riverbed at the entrance to the Cañon el Refugio.

Based on the distribution of features and rubble, the length of the El Refugio site spans possibly 250 m east to west and covers an area of about 0.6 ha. The northern and southern extent of the site is unclear due to heavy vegetation and leaf litter, but the very steep topography in these directions dictate that the original settlement was most likely long and narrow, perhaps only 40 m wide. While the settlement definitely dates to the ceramic period, heavy leaf litter and thick vegetation obscured all surface artifacts, precluding any assignment to specific time periods. The close proximity of the spring would have been attractive to the people who built and inhabited El Refugio; also, my guides pointed out that the moderate slopes on which the site is situated are considered ideal for the cultivation methods they themselves use today.

A small hamlet site of unknown age was located on a high summit not far from Romero's and Valenzuela's caves. The simple site called *El Santuario* (Cuiz-7-05) is located high up on the southern of two east-west trending ridges between the Cañon el Rodeo and the Cañon los Portales, within the lowland tropical forest vegetation zone. Not far beyond the site boundary to the south the ground surface steeply drops into the Cañon el Rodeo; to the north it drops into an unnamed ravine that runs northwest to where it joins the Cañon los Portales.

Based on the distribution of architectural features the site is estimated to be about 1,050 m^2. It consists of only three known structures, the most prominent of which is a highly visible masonry platform immediately south of a mule trail that runs west to east along the ridge top. The other two features are very low lying rings of limestone masonry blocks barely visible at the surface. Though definitely a ceramic period site based on the presence of architecture, no artifacts were recovered so it could not be assigned to a specific time period.

The larger settlement of El Matillal (Cuiz-8-05) (discussed below) is at a lower elevation on the same ridge 435 m to the west of El Santuario. Romero's and

Valenzuela's caves are a 1.2 km journey from the site; one may walk east along the ridge and then north to the edge of the Cañon los Portales, above their position in the southern wall of the canyon. It remains to be seen whether these sites are related, and scattered limestone slabs between El Matillal and El Santuario may indicate that these are in fact not two sites at all but parts of a very large site that ran continuously along the ridge top. Regardless, MacNeish's excavations in the caves revealed that ceramic period people, probably living in El Santuario or El Matillal or both, occasionally used the caves as campsites and for burial of the dead.

La Florida-Palmillas Phases (ca. 2400-1100 B.P.)

Fourteen sites found on survey had artifacts that are diagnostic of both the La Florida (2400-2000 B.P.) and Palmillas (1900-1100 B.P.) phases (Figure 8.4). By the available data, the period spanning both phases lasted some 1,300 years. Of course the presence of artifacts that represent both phases does not necessarily indicate that a particular site was occupied for the entire period; it is more likely that these sites represent multiple occupations at the same location during La Florida and Palmillas. Sites representing these phases include one cave occupation and villages of all sizes in all topographic settings.

Cueva Sin Sombreros (Cav-5-05) is a shallow shelter located about 2.5 km southeast of San Lorenzo las Bayas, approximately 1.5 km from where the Cañon el Infiernillo meets the Río Huazacana. At this point the Infiernillo runs northeast to southwest, and the cave is in the northwestern wall approximately 100 m above the riverbed; it is situated in lowland tropical forest, but on the upper slopes across the canyon oak-pine forest is found. A nearly vertical climb is required to reach the entrance. The vaulted ceiling peaks at about 8 m, and the chamber has a floor surface area of about

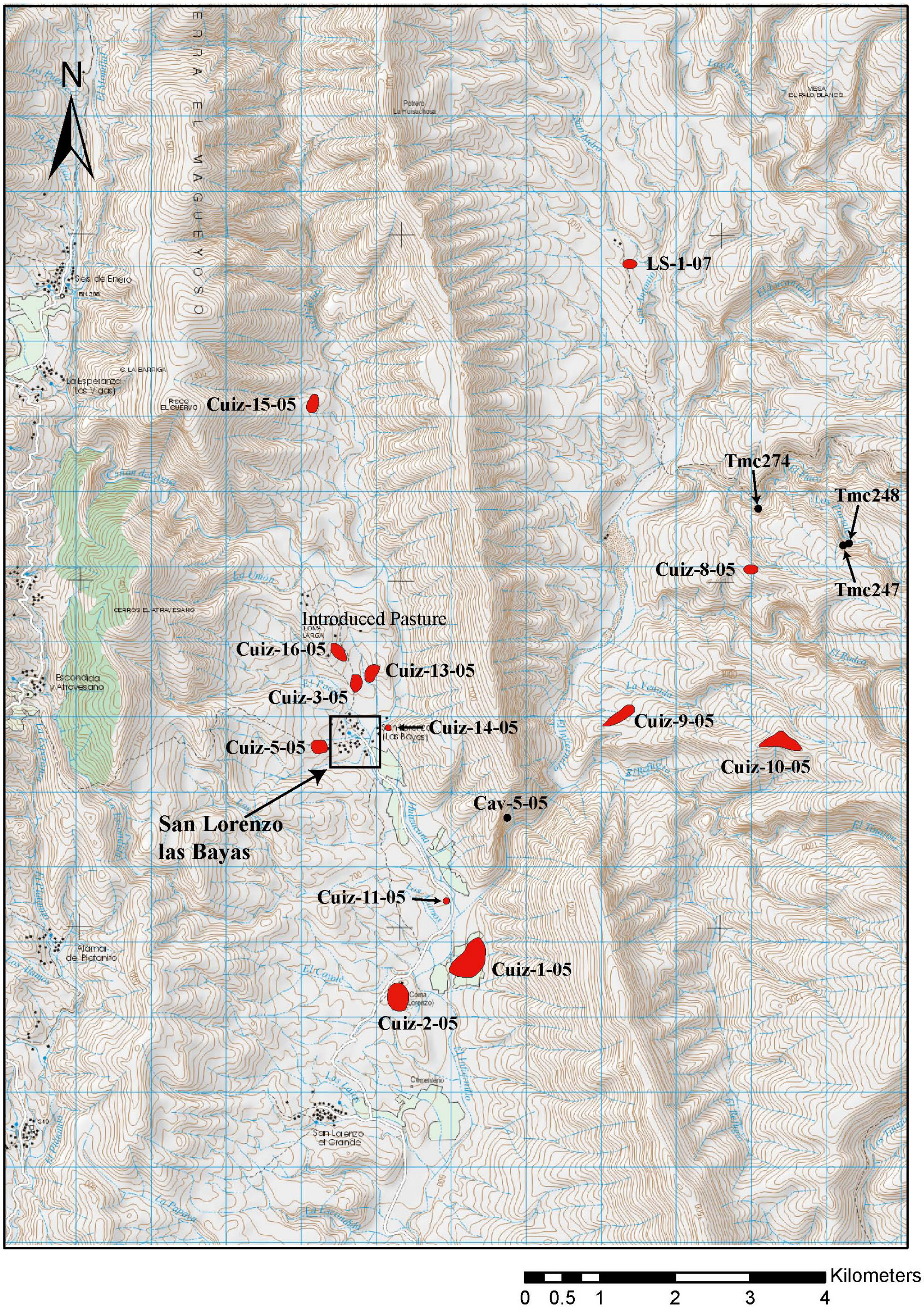

Figure 8.4. La Florida - Palmillas phase sites documented during the survey.

50 m^2, although the front one-third of this is under heavy roof fall. A small, shallow looter's pit has been excavated at the back wall.

Ceramic sherds include Eslabones Red and Finer Heavy Plain; as a whole they seemingly indicate an occupation from La Florida to early Palmillas times. Interestingly, in the central area of the floor lies a patch of what appears to be unprocessed fine clay, possibly used in ceramic production. Two highly polished river cobbles, one with visible battering, were found; MacNeish (1958:79) refers to similar artifacts as "pebble skin smoothers," and suggests that they may have been used to smooth the interior of hides once cleaned using a scraper. Debitage and several cores indicate stone tool production or maintenance; the only two tools recovered include a uniface and a retouched flake. This chipped stone assemblage is uninformative about subsistence activities, but it seems that all materials were locally available and that they were collected both from the river gravels and from primary sources in the vicinity.

Several plant specimens were also found, including a carbonized fragment of walnut or pecan (Juglandaceae) nutshell, and a fruit of seed representing thevetia (*T. tevetoides*). It is not likely that the latter is present due to human activity, as it has extensive rodent gnawing and is poisonous to humans (though some medicinal uses are known [Sandoval et al. 1991]). Several turtle bones, including the carapace, were also found. It is not possible that the animal arrived in the cave on its own due to the nearly vertical cliff face in which the cave is situated, but was probably brought in by human hands. Whether this occurred in prehistory is unclear.

All other sites of La Florida and Palmillas were open settlements with architecture, eight of which were found in river valley settings. *Los Basamentos* (Cuiz-11-05). Los Basamentos is a simple river valley settlement situated on the low slopes rising from the western bank of Río Huazacana. The site is in lowland tropical forest, but oak forest presently lies less than a kilometer to the south. Based on the distribution of architectural features the site area is about 672 m^2. Other nearby archaeological sites include Cerca de Cañon el Infiernillo 325 m to the southeast, and Potrero de Bueyes about 900 m due south.

Los Basamentos consists of at least two recognizable structures. Exposed on the surface of the road from the west is a semicircle of river cobbles that likely represents the foundation of a single circular house platform. On the eastern end of the site is a semicircular terrace-like platform situated on a northeastern-facing slope overlooking the Río Huazacana.

Surface artifacts are sparse. Four ceramic sherds represent Eslabones Red, Prisco Black, and Finer Heavy Plain Brushed, indicating occupation during the La Florida and Palmillas phases. A piece of black chert debitage and a fragment of mussel shell were also collected. Three narrow, eighteenth century irrigation channels (*acequias*) surround the prehistoric features on Los Basamentos. Also, there is a lime processing kiln northeast of the terrace platform near the edge of the river. A historic period ceramic is further evidence for this more recent occupation. The riverside road that runs through Los Basamentos provides direct access to a series of present-day *milpas* on river terraces north of the site. The proximity of such land would have been attractive to ancient farmers from this hamlet as well.

Muchos Ebanos (Cuiz-14-05) is a small hamlet (1,750 m^2) on a river terrace adjacent to the east edge of the Río Huazacana. It consists of the remains of four house platforms. The site is named for the many ebony (*Pithecellobium* sp.) trees growing on the slopes around the features. The seeds of these tree legumes are edible and the pods have been found archaeologically in Ojo de Agua cave, as indicated in the field notes (MacNeish:1954c); modern residents sometimes roast the beans in hot ashes.

Sherds include Eslabones Red, a possible Prisco Black, Zaquil Red, Heavy Plain, Finer Heavy Plain, and Huasteca Red on Buff; a sherd of Rio Verde Pulido indicates trade from the Rio Verde region on other side of the Sierra Madre to the west, during the period 1050-950 B.P. (Gustavo Ramirez, personal commumincation 2005). These ceramics indicate a La Florida and Palmillas occupation, though the presence of Huasteca Red on Buff trade sherds is indicative of a reoccupation later in prehistory, likely during the San Antonio phase. A single fragment from a ceramic *molcajete* suggests the grinding of chili peppers.

La Termina de Loma Larga (Cuiz-13-05) is a small village site situated along the slopes and summit on the southern end of a long hill, on the western bank of the Río Huazacana and about 0.5 km north of *ejido* San Lorenzo las Bayas. The site lies where lowland tropical forest presently intersects with introduced pasture.

The closest archaeological site is Cuizios de Fermin (Cuiz-3-05); as several house mounds currently attributed to this site lie less than 100 m west of the tentative boundary for Termina de Loma Larga, the two may actually represent a single, very large settlement. In spite of its spatial extent (an estimated 3.75 ha), only architectural features were documented on Termina de Loma Larga, including platform mounds on the lower slopes and low, narrow terraces along the upper slopes. Abundant cultural materials were noted, including Zaquil Red, Eslabones Red, Finer Heavy Plain, and unidentified plainware ceramics, indicating occupation during the La Florida and Palmillas phases. Lithic debitage and several stone tools (an obsidian blade fragment, a chert biface, and a projectile point base) were also found.

On the steep southern slopes of a long knoll is a small village called *Loma Larga Manguera* (Cuiz-16-05). The modern *ejido* is located about 700 m to the south of the site, and the nearby ancient villages of Cuizios de Fermin and Termina de Loma Larga are about 200 and 400 m to the southeast, respectively. Presently this site lies where oak-pine forest intersects with introduced pasture.

Architectural features, masonry rubble, and artifacts are scattered across an estimated 1.5 ha area on the hill slopes. Along the lower slopes of the site, highly eroded house mounds are visible only as circular stone alignments exposed on the surface. Structures become more prominent upslope to the west in the form of semi-circular, terrace-like platforms. The topography gets very steep to the north-northwest, and scattered rubble becomes the primary evidence for what were once platforms, although a low, 20 m long linear terrace wall follows the contour of the slope near the ridge top. Also, the ancient inhabitants appear to have constructed a circular masonry platform atop a tall natural promontory on the ridge crest; being the highest point on the site, it provides an unobstructed view of the valley to the south.

Ceramic sherds consist of Zaquil Red, Eslabones Red, Heavy Plain, and unidentified plainwares, indicating the La Florida and Palmillas phase occupation. Three obsidian blade fragments were the only recognizable formal chipped stone tools. The sole ground stone item observed was a fragment from a cylindrical, two-hand mano, indicating maize processing.

La Coma (Cuiz-2-05) is a medium-size settlement that covers about 10 ha. It is about 750 m west of Potrero de Bueyes (Cuiz-1-05), and is situated in a river valley setting but on hilltop adjacent to the western banks of the Río el Infiernillo. The residence of Fermin Puente Castillo is at the northern end of the site; a dirt road leading to this home from the south presently defines the western boundary, and the steep hill slopes descending to the Río el Infiernillo delineate the eastern periphery. Presently La Coma lies within lowland tropical forest, but oak forest is no great distance to the east and the south. The scrub brush vegetation on La Coma is dominated by acacia and prickly pear cactus. Some sparse grasses are present, but the predominantly bare ground surface allows heavy sheet wash erosion down slope to the east toward the Río el Infiernillo.

Clusters of house platforms and a scatter of cultural material extend over an elongated area oriented generally north to south. Evidence for at least 24 architectural features was noted, ranging from simple arcing alignments of stone exposed on the ground surface (the foundations of eroded house platforms), to circular platforms up to 2 m high. Fragments of burned daub are evidence for the perishable structures that once topped these platforms, and human remains were observed eroding out of on feature on the western edge of the site.

The ceramic assemblage consists of sherds of Eslabones Red, Zaquil Red, various plain wares, as well as a small foot or hand from a figurine. These artifacts point to a La Florida and Palmillas occupation. Ground stone items included part of a slab metate and a piece of a cylindrical two-hand mano; both presumably represent maize processing. Ceramic *molcajete* fragments are interpreted to indicate use of chili peppers. Chipped stone tools included multiple projectile points and bifaces. One of the latter is relatively large and is believed to have functioned specifically for the harvest of agave leaves, a more formalized version of the expedient tabular knives found on Cueva de las Tijeras 1. Abundant lithic debitage was also noted on La Coma; core flakes far outnumber biface flakes, suggesting that populations were relatively sedentary and agricultural activities sufficiently important to diminish investment in formalized tool-making.

The Río Huazacana emerges from a constricted canyon into a broader valley just north of San Lorenzo las Bayas. Here the eastern banks of the river rise steeply to the lower slopes of the Sierra Duraznillo, while the western banks give way to a series of low rolling hills interspersed with fertile, wide river terraces. A medium-sized village known as *Cuizios de Fermin* (Cuiz-3-05) spans the slopes of the hills at the north end of this broad valley, approximately 250 m north of the *ejido*. Due to the proximity of the modern community this site is presently found within introduced pasture, but it likely once consisted of lowland tropical forest.

This river valley settlement consists of the remains of at least 35 platforms, irregularly distributed over about 7.6 ha. The majority of known architectural features are tightly concentrated in a central area, but isolated structures were noted to the north, east, west, and northwest. A shallow drainage flows down slope south- and eastwards through the site to the Río Huazacana, separating several eastern platforms from the rest. The central cluster is dominated by two very large platform mounds, 4 to 5 m in height; these are in close proximity north and south of one another. They likely served some special purpose, perhaps as ceremonial locations or elite residences.

Surface artifact visibility is very high on Cuizios de Fermin. Most ceramics are types typical of the Mountain culture, but one Rio Verde Pulido points to trade with regions to the southwest, and Zaquil Red and Huasteca Black on White sherds indicate interactions with the Huastecs to the southeast. The ceramic assemblage indicates occupation during La Florida and Palmillas, but the Huasteca Black on White sherds are indicative of a brief reoccupation during San Antonio.

Formal lithic tools include bifaces, obsidian blades, and projectile points. Chipped stone debitage is abundant; as on other nearby large village sites, core flakes far outnumber biface flakes, suggesting that populations were relatively sedentary and agricultural activities sufficiently important to diminish investment in formalized tool-making. The only ground stone artifacts recovered were one fragment of a slab metate (probably for maize grinding), and one small pestle, likely used with ceramic *molcajetes* for pulverizing chili peppers.

El Basurero (Cuiz-5-05) is a medium-sized village on the southwestern outskirts of the *ejido*. At present it lies at the intersection of introduced pasture with lowland tropical forest. The site has at least 16 circular house platforms visible to varying degrees on the surface, and abundant limestone slabs strewn across the site suggest that many more existed in the past. One large mound, approximately 3 m tall and 15 m wide at the base, covers a circular masonry platform on the western end of the site. The unusual height of this feature suggests a unique function. Based on the extent of scattered artifacts and rubble, I estimate that El Basurero measures about 3 ha. It is presently the location of the communal trash dump; a pit for burning refuse is excavated on the western end of the site. Sherds protruding from the floor of this pit indicate that the cultural deposits exceed 40 cm deep.

El Basurero is situated on a hilltop providing a wide view of the Huazacana river to the east. The proximity of this small river would have been important in prehistoric times. Limited groundcover provides excellent visibility of surface artifacts. The ceramic assemblage points to a La Florida and Palmillas occupation. Consistent with other village sites of this period, core flakes are more abundant than biface flakes, fitting the pattern of a sedentary settlement. There is a single metate fragment, and this appears to be in slab form; while this is a small sample and not necessarily representative, it suggests that maize was a primary resource being processed, again conforming to similar sites.

Potrero de Bueyes (Cuiz-1-05) is a large river valley settlement located on the eastern banks of the Río el Infiernillo, 600 m south of where the Infiernillo bisects the Sierra el Duraznillo and joins the Río Huazacana. The smaller site of Cerca de Cañon de Infiernillo is about 300 m to the north; presently it is unclear whether this smaller settlement actually represents only a portion of Potrero de Bueyes. If so, Potrero de Bueyes is actually much larger than presently believed. Although historic land disturbance and heavy vegetation in some areas make it difficult to judge the actual extent of Potrero de Bueyes, the documentation of at least 120 platform structures and artificial terraces across 22.5 ha attests to its immense size. In terms of both surface area and number of known features Potrero de Bueyes is the largest site detected during this survey. It spans into both the oak forest and lowland tropical forest zones.

The Infiernillo river bed defines the western edge of Potrero de Bueyes, and about 16.5 ha of the site are on river terraces. The soil here is very rich and ideal for cultivation, which of course may have attracted the original inhabitants. My guide Fermin Puente Castillo presently maintains a *milpa* here, and about 40 percent of the site is now plowed on a yearly basis, so many former house platforms have been destroyed by recent farming and land clearing practices. Abundant limestone rubble to the northwest and several low-lying mounds in the central part of the site indicate the presence of more architecture in the past. Three high platforms are situated in the south central portion of the site, separated by what appears to be a central plaza. Several house platforms and masonry terraces, some constructed along the edges of natural river floodplain terraces, are discernable as far as 170 m west of this plaza group. Finally, the site's eastern boundary is defined by the western flanks of the Sierra el Duraznillo, where the inhabitants constructed numerous house platforms and terraces along the lower slopes.

Ceramics on Potrero de Bueyes are typical of the Mountain culture, although Huasteca Black on White sherds signify Huastec trade relations. The assemblage points to a primary occupation within the La Florida-Palmillas time frame, but the Huastec trade sherds are indicative of a later reoccupation during late San Antonio.

Chipped stone tools include dart points, bifaces, and discoid scrapers. The latter morphologically resemble "scraper planes" commonly found in Oaxaca, Tehuacán, and the U.S. Southwest; these are likely evidence for the removal of fleshy tissue from agave leaves in the extraction of fiber (see Parsons and Parsons 1990:301-305). Regarding debitage, core flakes far outnumber biface flakes; this is not surprising given the apparently sedentary nature of the site and the close proximity of the river bed, with its readily-accessible raw materials.

Fragmentary ground stone items are abundant. Both one-hand and two-hand manos indicate grinding of both maize and small seeds; further evidence for maize processing is in the form of several fragments representing slab metates. A fragmentary stone bowl might have originally functioned as a mortar for grinding seeds and herbs. A tiny stone pestle was probably used with ceramic *molcajetes* recovered on the site to pulverize chili peppers. A finely ground axe head, fashioned from tinguaite, is evidence that land clearing for habitations and agricultural land was taking place on and around the Potrero de Bueyes.

Clearly a wide range of activities took place at this large village. Mr. Puente Castillo discovered human remains on Potrero de Bueyes while digging postholes for a fence. Subsequent brush clearing revealed that these remains were interred in the center of a low house platform. Research elsewhere in southern Tamaulipas (Stresser-Péan 2000) and other findings during this survey at the La Coma site indicate that burial of the dead within platforms was a common cultural practice. However, as mentioned in the previous chapter, MacNeish's (1954b) discoveries in Occupation 11 of Romero's cave demonstrate that Palmillas phase villagers occasionally interred their dead in cave sites rather than the community itself.

It is not surprising that the largest village site documented was at this location, as fertile floodplain terraces would probably have been among the first settings in the region subject to the intensive agricultural practices necessary to sustain larger communities. Other things being equal, large communities and farmland on hill slopes and mountain tops would only follow after, as these settings are more difficult to clear and till. Valley settings may have also been attractive to earlier, low-level food producing groups, so investigations on late sites such as Potrero de Bueyes may reveal earlier, preceramic components.

Other sites dating to this time frame are not in open valley settings but rather on slopes and summits of mountains. *Las Piletas* (Cuiz-15-05) is a medium-sized settlement located about 4 km north of the *ejido*, on the eastward-facing slopes of the Cañon

Huazacana, approximately 80 m above the canyon floor. The surrounding vegetation is classified as oak-pine forest. Though its actual extent is not known, a rough estimate would be that it covers about 9 ha. Las Piletas is unique among the other settlements in that the usual house mounds were constructed around a shallow (floor area 35 m^2) rockshelter on the upper slopes at the northern end of the site. Several circular house mounds, semi-circular platforms, and terraces occupy the slopes north and east (down slope) of the shelter. Explorations to the south revealed numerous mounds, platforms, and terraces.

Artifact collections on Las Piletas were hindered by low surface visibility. Identifiable ceramic sherds represent Eslabones Red and Prisco Black, implicating occupation during the La Florida-Palmillas period (Laguna through Eslabones). Only a few pieces of lithic debitage were recovered; all were core flakes. A single-directional core and a gray chert projectile point were discovered as well. On survey, travel between the narrow river terraces closer to the *ejido* and Las Piletas took several hours. It is possible that the inhabitants of this settlement utilized these terraces for cultivation, but they may have also cleared nearby hill slopes for this purpose. The latter would be more likely the case if this site was occupied contemporaneous to the villages closer to those river terraces, such as Loma Larga, Loma Larga Manguera, and Cuizios de Fermin.

La Venada (Cuiz-9-05) is a medium-sized mountaintop village located on the western end of a vast east-west trending ridge separating two east-to-west flowing canyons, La Venada in the north and El Refugio in the south, just east of their junction with El Infiernillo canyon. The site is approximately 170 m higher in elevation than the Infiernillo riverbed, but there is also some degree of topographic variation within the site itself. The northeastern half of the site is characterized by oak forest, while the southwest half consists of lowland tropical forest. Known structures on La Venada appear to be distributed widely over about 5 ha, in an elongated pattern from southwest to northeast.

The village was established around a drainage that cuts through its central portions and eventually terminates in El Infiernillo canyon to the west. The southwestern end is atop a finger of the primary ridge, and the northeastern end is opposite the arroyo on the upper western ridge slopes that descend towards El Infiernillo canyon.

Surface visibility on La Venada is very low, but an artifact sample was obtained while clearing vegetal detritus away from house platforms. The few lithics encountered included debitage of compact limestone and black chert. Ceramic sherds here represent a variety of wares, including Eslabones Red, Heavy Plain, Finer Heavy Plain, and a possible Nogalar Black. Two sherds of Rio Verde Pulido indicate interactions with the Río Verde culture of San Luís Potosí and far southwestern Tamaulipas (Ramírez Castilla 2007). Huastec trade sherds are also present, including Prisco Black and Zaquil Red. The ceramic assemblage seems to indicate that the primary period of occupation during La Florida-Palmillas.

Some artifacts offer limited evidence for plant use. A ceramic *molcajete* fragment suggests that grinding of chili peppers occurred on La Venada, and a small ceramic zoomorphic effigy pipe was found. It is possible that future residue and pollen analysis of the bowl and the hole at the pipe stem attachment will reveal the identity of the substance that was smoked in this specimen, though tobacco is a likely candidate.

El Matillal (Cuiz-8-05) appears to be a small village (0.65 ha) situated on the southern of two east-west trending ridges between the Cañon el Rodeo and the Cañon los Portales, within the lowland tropical forest zone. The hamlet site El Santuario is on the same ridge at a higher elevation 435 m to the east. Though the ground surface on El Matillal is relatively level, shortly beyond the southern site boundary the topography slopes steeply downward into the Cañon el Rodeo; to the north the ground surface drops into a ravine that eventually joins the Cañon el Flacco 1.5 km to the northwest. Ojo de Agua cave is situated in the southern wall of the Cañon el Flacco just east of this junction. Romero's and Valenzuela's caves are a 1.64 km journey northeast of El Matillal, in the southern wall of the Cañon los Portales.

El Matillal consists of about 20 known architectural features, the most visible of which is the remains of circular platform that apparently was once approximately 12 m in diameter; the passage of pack animals along the trail has divided it into two distinct piles of limestone rubble. Other features now exist as rings and alignments of limestone masonry blocks on the surface. The largest feature on the site, an almost perfect circle of stones about 15 m wide, was found to have an old L-shaped excavation trench in its interior. In publication (e.g., MacNeish 1992:105), MacNeish mentions minor testing of open village sites in the Sierra Madre, but the locations of these sites are not disclosed. With the proximity of the excavated cave sites it is possible that the trench on El Matillal represents a part of this work. A site list found among the original field notes names two ruins (Tmr 274, 276) "down Cañon el Infiernillo from caves," visited December 1953-January 1954 (MacNeish 1954a). However, El Matillal's location relative to the investigated caves and to the Cañon el Infiernillo makes it questionable as to whether or not it is not one of these two sites.

Our search for features under the leaf litter also turned up artifacts among the house foundations, including ceramic sherds of Eslabones Red, Nogalar Black, and unidentified plainwares. Though the sample is small, these ceramics seem to indicate an occupation from La Florida to early Palmillas. Only three pieces of debitage were noted, including one core flake.

About 2 km east of La Venada on the summit of an east-west trending ridge south of La Venada canyon and north of El Refugio canyon is a medium-sized village designated *Los Razos* (Cuiz-10-05). Los Razos is 450 to 500 m above the El Refugio riverbed. The site is centered in oak forest vegetation but down slope to the north and south one finds lowland tropical forest. Hesper's palms and tall pine trees abound on the site, and a heavy layer of pine needles obscures many low lying architectural features and prevents an accurate assessment of their number. However, I estimate that Los Razos spans an area of about 6 ha based on the distribution of recognizable structures. The ground surface drops down sharply beyond the northern, western, and southern site boundaries, while the ridge rises to higher altitudes to the east.

A truncated mound on the eastern end of Los Razos had signs of looting, and from the backdirt of this trench a sample of artifacts was collected. These include debitage and ceramic sherds of Zaquil Red, Eslabones Red, Prisco Black, Heavy Plain, and Finer Heavy Plain, suggesting a La Florida-Palmillas occupation.

Interestingly, at least one pit approximately 3 m in diameter and 1.5 m deep was noted on the western side of Los Razos. Such features, known as "*tanques*," are common on village sites elsewhere high in the mountains of southern Tamaulipas (MacNeish 1947). It is assumed these were excavated as a means of catching and storing rainwater. This is not surprising given Los Razos' isolated location high above springs and other reliable water sources. The isolated setting also translates to greater distance from valley settings for farming (which was likely already populated by such large sites as Potrero de Bueyes and others), suggesting that the population at Los Razos was largely supported by slash and burn agriculture on nearby summits and hill slopes.

Palmillas Phase (ca. 1900-1100 B.P.)

Only one site detected on survey can be placed in the Palmillas phase alone, and this is simply from a lack of artifacts diagnostic of other time periods. The site is unique in that it appears to be the only open-air site found that seemingly lacks architecture and has very few ceramics. *San Antonio Abajo* (LS-1-07) is a light scatter of artifacts located on a southward-oriented finger ridge upslope from the western banks of the Río San Antonio near a small spring on the northern end of the study area. The ground surface slopes gently to the east-northeast into the arroyo, and soils are shallow with frequent bedrock exposures. This artifact scatter is found squarely in lowland tropical forest surroundings; there is some grass cover, but the vegetation is dominated by shrubs and trees. The remains of an historic period hacienda (San Antonio) are about 400 m northwest of the artifact scatter.

The scatter spans about 3,070 m^2, and about 145 m long east to west and 35 m wide north to south. Cultural remains are dominated by chipped stone materials, which number close to 50. Core flakes outnumber biface flakes, but the sample is too small to make confident interpretations. Two cores were also present. Formal tools include a notch, a biface, one retouched piece, and a single projectile point. The latter has been identified as the Palmillas type (Carlos Vanueth, personal communication 2009; MacNeish 1958: Figure 24); in southern Texas this type has been attributed to the Middle and Late Archaic periods (4000 B.C to A.D. 800), a very long time frame which in that region was clearly characterized by mobile hunter-gatherers (Turner and Hester 1993:167). However, regarding this type MacNeish (1958:67) notes that they only appear during Palmillas times in the Sierra Madre of Tamaulipas, suggesting that San Antonio Abajo may actually represent a camp comprised of a hunting group of villagers. On the other hand, there are also scattered limestone slabs on the site that may have once been construction materials; with the hacienda remains nearby, it is possible that historic cultivation practices may have destroyed some prehistoric house platforms, and that it actually represents a small hamlet rather than a camp. If this is true, the scarcity of ceramics is noteworthy; 11sherds were recovered from the surface of San Antonio Abajo during survey, but these were either too small or degraded to be identified to type.

San Antonio Phase (ca. 500-200 B.P.)

As mentioned above, several sites previously occupied during the La Florida-Palmillas phases were subject to later reoccupations dating to this time period (Figure 8.5). These include a river valley hamlet (Muchos Ebanos); a medium river valley village (Cuizios de Fermin); and a large river valley village (Potrero de Bueyes). In addition, a single cave site was seemingly occupied solely during the San Antonio phase, based on the surface artifact assemblage (though excavation may reveal other components).

Cueva de la Calavera (Cav-4-05) is a small cave 1.5 km northeast of the *ejido*. It is in the north-facing wall of a drainage that flows down the western slope of the Sierra Duraznillo about 100 m above the Las Piletas riverbed. The surrounding lowland tropical jungle vegetation is dense and includes small trees and low-lying shrubs. Several cacti are intermixed throughout, including night blooming cereus, or *jacubo* (*Acanthocereus pentagonus* (L.) Britton & Rose), and *organo* (*Stenocereus marginatus* DC. Berg & F. Buxb.).

The cave mouth is less than 3 m wide and 1.5 m high, but the ceiling rises slightly just inside and stays relatively consistent until it diminishes at the back wall (Figure 8.26). The 27 m deep shaft runs relatively straight south by southwest for its length, and the 81 m^2 floor is level. Two looter's pits are present near the cave entrance. There are abundant human bones scattered about the surface and in the looters' backdirt (hence the name of the cave). Ceramic types are typically non-diagnostic, but three bowl sherds of Huasteca Fine Paste Black-on-White (Ekholm 1944:411) indicate a late occupation of the site during the San Antonio phase.

Well preserved plant remains are present on the surface of the cave, including leaf fragments (likely Hesper's palm) and almost 100 maize cob fragments, possibly modern. The only chipped stone artifact is a small, flat limestone piece with a convex worked edge with two large flake scars; it appears to be an edge fragment from a large discoid scraper

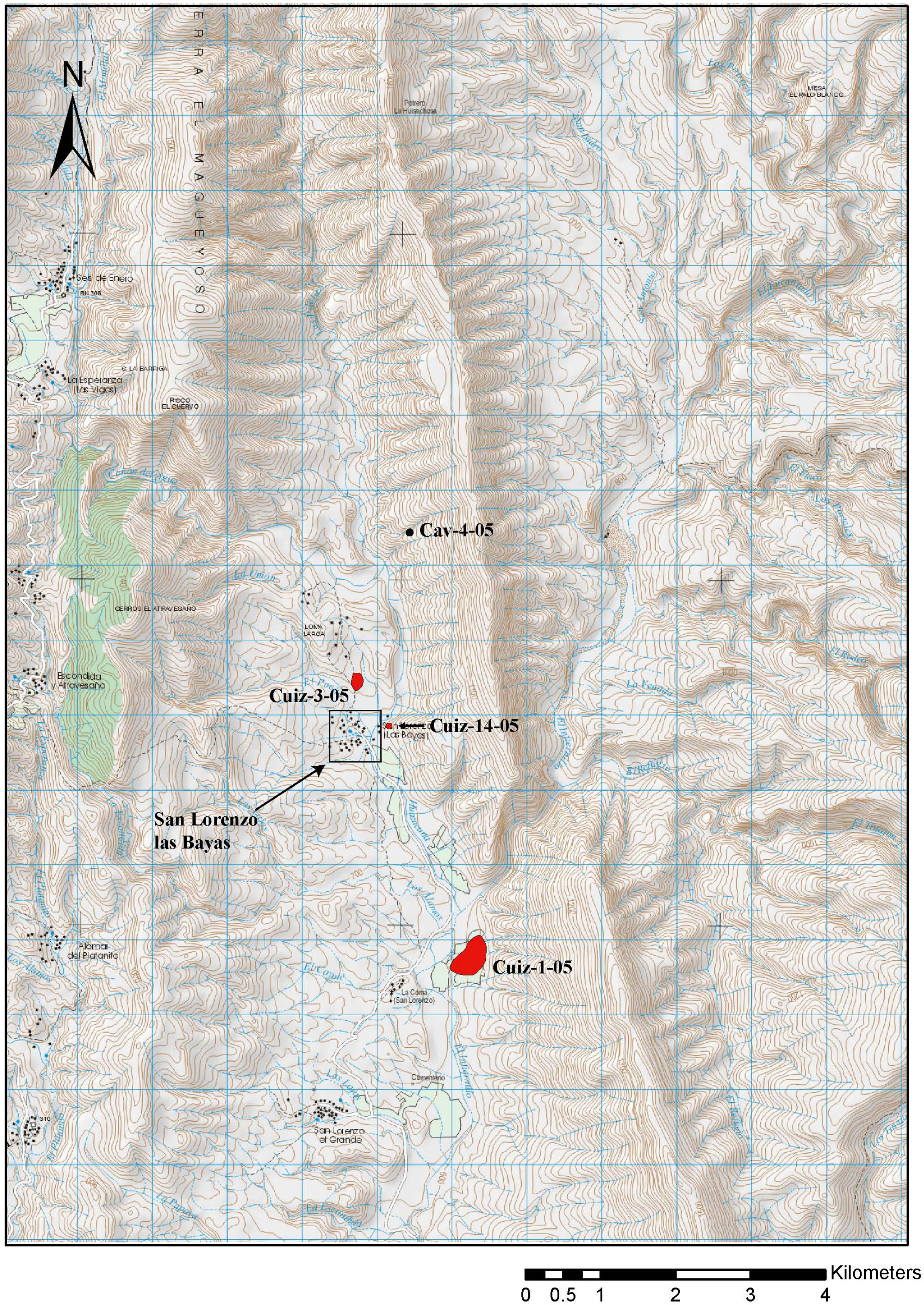

Figure 8.5. San Antonio phase sites documented during the survey.

like those used to remove fleshy material from the fibers in agave leaves (Parsons and Parsons 1990:301), suggesting that this was one activity in the occupation of Cueva de la Calavera. Finally, a fragment from a a large two-hand vesicular basalt mano indicates that maize grinding took place as well.

Discussion

Twenty-two archaeological sites were documented during this survey in the vicinity of the Ocampo caves, including six caves, one open-air lithic scatter, and 15 open sites with architectural features. Although this sample is too small to produce an in-depth analysis of settlement patterns in the study area, these sites and their distributions provide insights into general factors of land use and food production.

Three caves (one in a canyon wall, the other two on mountain slopes) did not have ceramic artifacts or other temporally diagnostic items; these could either represent occupations dating before ceramic times, or ceramic period visits that did not require the use of ceramic vessels. Unfortunately the survey produced insufficient information to illuminate settlement patterns of pre-village low-level food producers of the EIA.

Four sites were discovered that either had ceramic artifacts or architecture but the materials were not sufficiently diagnostic to more specifically estimate the date of occupation; these included a cave site (on a slope), one hamlet (on a summit), and two small villages (one on a slope and another in a river valley). Because the ceramic period as a whole in Ocampo lasted some 3,400 years, very little can be said regarding each site's place within a larger settlement pattern. However, the findings in Cueva de las Tijeras 1 support MacNeish's discoveries in Romero's, Valenzuela's, and Ojo de Agua caves, indicating that caves and shelters continued to be used even while villages were the primary habitation locations. These sites seem to have functioned occasionally as sheltered campsites used by individuals on various logistically organized resource extraction ventures (such as the collection of agave), or for burial of the dead. Also, small hamlets and villages were constructed in a variety of topographic settings, including river valleys, slopes, and mountain summits. Surrounding vegetation zones would yield wild plant resources, and in many cases other zones with additional plant species were no great distance away. Regardless of continued use of wild plants, farming was an important strategy for these villagers. River valley settings such as that of the village Cerca de Cañon de Infiernillo would be ideal for cultivated fields. However, such land is rare in the study area and probably would have become populated quickly, requiring expansion onto slopes and mountaintops. Inhabitants of settlements in more isolated locations such as these probably cleared tracts of land on nearby hill slopes for the cultivation of maize, beans, squash, and cotton.

Sites that are estimated to date to the La Florida-Palmillas phases were most frequently encountered (n=13); this is not surprising because populations were believed to be at their highest during this time frame. Unfortunately, it was not possible to further isolate the period of occupation based on artifact assemblages, and this period spans some 1,300 years, leaving open the possibility for multiple occupations. Any interpretation of settlement patterns will therefore be necessarily low-resolution. These La Florida-Palmillas phase sites include one cave site in a canyon wall, two river valley hamlets, three small villages (two in river valley settings, one on a mountain summit), six medium villages (three in a river valley, two on mountain slopes, and one on a summit), and a single very large village in a river valley.

Eight of the 13 La Florida-Palmillas sites were documented in a river valley setting; this is not to say that this location was necessarily occupied more than others, but is likely due to the fact that because modern residents live in this valley they know about more sites here, and the sample is biased towards these sites. In fact, settlements were also constructed on slopes and summits many hours' walk from the narrow Huazacana river valley during this period, some of them quite large (e.g., Los Razos), and local residents told me of many more such sites in remote locations in the mountains that could not be explored due to time constraints. Surely, the relatively level river valley was an ideal place to establish communities, as evidenced by the numerous ruins there. However, according to MacNeish (1971:578), populations reached their peak here during the Palmillas phase, and were likely on the rise during the previous La Florida phase. The Huazacana valley represents the greatest amount of broad, relatively flat land in the study area, but it is still relatively small compared to the vast amounts of mountain ranges. If the valley was the preferred place to live and farm it would have become populated quickly, and steeper slopes and summits would then have to be colonized.

Occupying rugged settings need not have posed a problem to the inhabitants of these villages, as they could clear and farm on slopes as modern populations do today. Present day farmers in the study area plant on hill slopes because these settings comprise most of the available land; in fact they say that cultivating such locations is advantageous, because the slopes get more moisture and are not as beaten down by the sun as level surfaces (Fermin Puente Castillo, personal communication 2009). The thin soils on slopes may seem ill-suited for cultivation, but my guides inform me that they can produce a satisfactory maize crop in as little as 10 cm of soil (Fermin Puente Castillo, personal communication 2009).

At the onset of this project I hypothesized that larger, agriculturally dependent settlements of the Palmillas phase would be concentrated in river valley settings; while findings on this survey do not contradict this, it is clear that this was not always the case. Although MacNeish (1958:139) states that large hilltop villages in southern Tamaulipas "... could have been easily defended," implying that this was an influential factor in their placement, I believe that it was more likely due to the scarcity of broad river valley settings and other level land as populations rose.

Only one open-air site was detected that did not have architectural features, and it had very few ceramics. The presence of a single Palmillas dart point on San Antonio Abajo suggests that this lithic scatter dates to Palmillas times, but the projectile point sequence in southern Tamaulipas is in need of refinement so this assignment should be considered tentative. If MacNeish's (1958:67) consideration of Palmillas type projectile points in this region is regarded as accurate, the site dates to the ceramic period village occupation. However, the function of San Antonio Abajo as a site is unclear. It could represent a logistically-organized hunting camp on which the production or maintenance of chipped stone tools also occurred, or the few seemingly out-of-place limestone slabs may indicate the former presence of house platforms and a habitation site that has since been destroyed by more recent land use.

One of the La Florida-Palmillas phase hamlets, a medium village, and the large village (all in river valley settings) had brief reoccupations in the San Antonio phase; this was most often determined by the presence of introduced Huasteca Black on White and Fine Paste Black on White sherds, which date to Period IV in the Huasteca, although one example of Huasteca Red on Buff was found on Muchos Ebanos (Period V) (see Table 5.1) (Ramírez-Castilla 2007). A single cave site on a mountain slope contained artifacts that only indicate occupation during this final prehistoric cultural phase.

Open-air settlements of the San Antonio phase were numerous but typically small hamlets or *ranchos* with several wattle and daub huts (MacNeish 1971:580). The limited information gained from this survey indicates that San Antonio phase settlements were at least occasionally established upon the ruins of much larger and more complex earlier sites. MacNeish does not describe in detail the settings preferred for San Antonio phase *ranchos*, but of the closely related and similar Los Angeles phase occupations in the Sierra de Tamaulipas he states that they were commonly found "… on the high terrace and valley bottoms, often near springs" (MacNeish 1958:163). The few open-air sites in the study area that had evidence for San Antonio phase occupation conform to these locations. With lower population densities and smaller habitations, river valley settings became more available than in previous time periods. Also, caves continued to be extensively occupied, so cave sites are not uncommon either in the San Antonio phase of Ocampo or the Los Angeles phase of the Sierra de Tamaulipas (MacNeish 1958:163, 1971:580). Therefore, it is not surprising to find Huasteca Fine Paste Black on White sherds in Cueva de la Calavera.

Some General Considerations about the Artifact Assemblage

Technological Organization, Plant Procurement, Processing, and Use

Analyzed chipped stone debitage samples were relatively small on surveyed sites. The highest numbers of such artifacts occurred on larger village sites with high surface visibility; these have evidence for stable habitations, high populations, a relatively high degree of investment in agriculture, and other aspects of sedentism. So it is not surprising that the lithic assemblages conform to expectations outlined in Vierra (in press) and discussed at the beginning of this chapter, in that there are higher proportions of core flakes relative to more refined biface flakes, and the raw materials are those that are readily available in the vicinity of the sites. This reflects that occupations were stable and other aspects of technology (such as those associated with food production) were more important than the manufacture of refined, curated tools for long distance travel into areas with less reliable stone sources.

At least one "agave knife" was found on a village site (La Coma, La Florida/Palmillas phases), and it is a formally flaked and shaped biface. On the other hand, more expedient versions of this type of tool (the "tabular knife") were recovered from Cueva de las Tijeras 1 (unknown age, though with associated ceramics) (Figure 8.6). The former indicates formal preparation for excursions from the village into the rocky

Figure 8.6. Tabular knife, Cueva de las Tijeras 1 (scale in centimeters).

canyons where agave plants can be collected, while the latter suggests a degree of forethought that the limestone in cave walls often fractures into tabular pieces that can be utilized expediently with little or no alteration. In addition, discoid scrapers, such as the one found on Potrero de Bueyes, may have been involved in agave processing (Figure 8.7). These artifacts resemble "scraper planes" or "turtleback scrapers" common on sites elsewhere in Mexico and in the American Southwest. Scraping experiments with these tools have demonstrated their utility in removing the cortical tissue and pulp from agave leaves in order to remove the fibers (Parsons and Parsons 1990:301).

Some ceramic artifacts also indicate that wild food plants remained an important if not staple component even at the height of village life. Ceramic *molcajetes*, likely for grinding up wild chili peppers that grow in abundance in the region, were found on Los Razos, Potrero de Bueyes, Los Basamentos, La Termina de Loma Larga, Muchos Ebanos,

Figure 8.7. Discoid scraper, Potrero de Bueyes (scale in centimeters).

Loma Larga Manguera, La Coma, Cuizios de Fermin, El Basurero, and La Venada; these are all hamlets and small to large villages that date to the La Florida - Palmillas phases. The artifacts are basically ceramic bowls with incised interiors that were used to pulverize the flesh of peppers using small, finely worked ground stone pestles, such as those found on Cuizios de Fermin and Potrero de Bueyes (Figures 8.8, 8.9). Identical tools are common in Mexican kitchens today. In addition, a zoomorphic pipe recovered from La Venada (Figure 8.10) and ceramic pipe stems observed on other sites attest to the presence of smoking traditions.

While wild plants were indeed used, the ground stone tool assemblage (although fragmentary) seems to indicate that villages were relatively dependent on agricultural produce; all metates from village sites (n=10) are in slab rather than basin form, reflecting grinding of larger grains such as maize. All of these came from Potrero de Bueyes, La Coma, El Basurero, and Cuizios de Fermin, sites that were primarily occupied during

Figure 8.8. Ceramic *molcajete* fragment, Potrero de Bueyes (scale in centimeters).

Figure 8.9. Ground stone pestle, Cuizios de Fermin (scale in centimeters.)

Figure 8.10. Zoomorphic pipe, La Venada (scale in centimeters).

the La Florida to Palmillas phases, when populations in the region are believed to be at their highest. The only basin metate fragment was found on the surface of a cave site (Cueva de las Tijeras 1), but the relative date of this occupation is unknown. There are ceramics on this site, however, and the metate might reflect an interesting special situation: if the occupation did occur when villages were the standard habitation type and it represents use of the cave by a task group away from home, the basin metate may signify a specialized diet of wild plants used by travelers while the usual diet in the village emphasized maize.

Manos, relatively proportionate between the two-handed (n=5) and one-handed (n=3) varieties, do little to clarify the issue. All but one were found on the village site of Potrero de Bueyes, while the other (a two-hand mano) is from Cueva de la Calavera, believed to have been occupied very late, during the San Antonio phase. Material types for ground stone items provide insight into mobility and cultural connections among prehistoric populations; however, they indicate either long distance trade networks or travel of local groups to obtain raw materials not available in the immediate vicinity for the manufacture of such tools.

Raw Material Sources, Availability, and Preference

Fine-grained limestone and chert resources are readily available in the study area both *in situ* among bedrock outcrops and in the form of river gravels found along stream bottoms in canyons. Observations of cortex type on artifacts seems to indicate that such materials were being collected from both sources. Although limestone would seemingly be inferior to chert for stone tool manufacture, local cherts tend to be of very low quality so artifacts of chipped limestone are quite frequent. The limestone common in the study area tends to be compact and relatively fine-grained and can be effectively flaked to produce a sharp edge and high quality tools. It is also not unusual to find individual artifacts composed of partially silicified limestone with elements that could be classified as both chert and limestone within the same piece.

The common occurrence of obsidian flake blades on ceramic period sites in the study area is consistent with observations made by Ekholm (1944:489) in the Huasteca, in that they seem to be limited to later time periods. However, the origin of the obsidian found in southern Tamaulipas is unclear. It is generally assumed that this material was imported through extensive trade networks with central Mexico (Gustavo Ramírez-Castilla, personal communication 2010) where the major Mesoamerican obsidian sources are concentrated (see Cobean et al. 1991), but this issue requires further research.

Raw materials suitable for ground stone artifacts are not as readily available as those types most often used for chipped stone artifacts. Ancient maritime sand deposits resulted in formations of sandstone at numerous locations in the Sierra Madre (Stresser-Péan 2000), but no outcrops have been observed within the study area boundaries. Natural basalt exposures also do not occur within the confines of the immediate study area, although indigenous populations would not have had to travel or trade very far to obtain this material as there are several potential sources in the Sierra Madre. There is a small extrusion in a valley just south of Gómez Farías about 20 km due east of the study area, and another at the north end of the Chamal Valley about 25 km to the southeast (Kellum 1930:85). Other potential sources include El Sombrero Mountain about 30 km distant to the east, the Huizachal Valley 44 km to the north, an isolated peak near Forlon station about 50 km east, and Llera de Canales 50 km northeast (Aranda-Gómez 2005; Barboza-Gudiño 1998, 2008; Kellum 1930). A basalt quarry near San Ignacio, outside of Llera, Tamaulipas, has debitage and fragmentary manos and metates scattered about its surface (Gustavo Ramírez-Castilla, personal communication 2009).

During this survey, a single axe head was obtained from Potrero de Bueyes that had been fashioned from tinguaite, another type of igneous rock. The closest confirmed source for this material is Cerro del Murcielago, some 115 km southeast of the study area in eastern San Luis Potosí (Alaniz-Alvarez and Nieto-Samaniego 2007:119). Other undocumented sources may exist closer to Ocampo.

Conclusion

This archaeological survey, though limited, revealed patterns that complement earlier investigations in the Ocampo caves and offer a starting point to place the cave occupations into a broader context. In the next chapter, I draw together this information gained on survey with other lines of evidence presented in previous chapters to enhance our perception of land use, human-plant interactions, and food production in the Ocampo region, and the role of the Ocampo caves in this greater system. Additional insights are provided by observations of present-day (yet traditional) farming practices in the study area and accounts of early encounters between indigenous populations and Spanish colonists.

CHAPTER 9: DISCUSSION

At the beginning of this dissertation, I outlined four questions that were to be the focus of this research. What non-domesticated plants contributed alongside cultigens to the local Ocampo economy? How are changes in prehistoric plant-related subsistence practices reflected in the distribution of various archaeological site types across the landscape over time? How do the brief, sporadic visitations in the previously investigated cave sites relate to the greater local subsistence-settlement pattern? What implications do these patterns have for understanding the long-term development of food production in this context? The lines of evidence outlined in the previous chapters contribute to more comprehensive understanding of prehistoric plant and landscape use in the vicinity of the Ocampo caves and help to address these questions. I have evaluated the few previously published accounts concerning the Ocampo cave findings against one another and knowledge gained in subsequent decades, and I have shown that unpublished field notes and curated collections have much to add to this growing picture. Finally, site distributions and surface artifact assemblages documented during my own survey of the area provide insights into prehistoric settlement and mobility patterns, land use, and human-plant interrelationships, particularly between 2,500 and 1,100 years ago. These findings will be summarized and drawn together in the present chapter. Other sources to be considered here include traditional farming practices used in the study area today and early historic encounters between indigenous groups and Spanish colonists.

The Arrival of Domesticated Plants in Ocampo

Domesticated plants probably filtered into the Ocampo region from the south, either through the Huastecan lowlands or directly from central Mexico, but not enough is known about the archaeological records of intervening regions at the appropriate time frames to verify which. As discussed in Chapter Two, they probably arrived through the delivery of seed stock among pre-existing hunter-gatherer or low-level food producing groups rather than through migrations of the farmers themselves. Those first to use domesticated plants in the Ocampo caves seem to have lived in low population densities, precluding the migration scenario offered by Bellwood (2005:165-168) which calls for large groups of farmers expanding into new regions as arable land became occupied. The available data indicates that the Ocampo situation remains consistent with the EIA scenario outlined by MacNeish (1964). A primary point of this framework concerns the source regions and subsequent spread of domesticated plants, that is, the major Mesoamerican crops originated in widely scattered areas and times, and arrived in the Ocampo caves individually over thousands of years (Table 3.1). I now consider more carefully how these plants may have been physically introduced into the study area.

Remoteness of the Caves and Routes of Cultigen Dispersal

Much of our past knowledge of prehistoric plant use in the Ocampo region has been limited to excavated data from only three small cave sites in close proximity to one another. To complicate matters further, the ancient occupations exposed in these caves are sometimes separated by thousands of years, so in the grand scheme of things the available information is very meager indeed. Another potentially restricting factor is the location of the sites themselves. Smith (1997b:378) very rightly points out: "Given the remote location and rugged terrain of the Ocampo caves, they should not be considered as representative of Tamaulipas or northeastern Mexico; crops may have arrived in less remote areas of Tamaulipas sometime before they first appeared in the Ocampo sequence." So, externally-introduced domesticated plants were likely delivered first to hunter-gatherers or low-level food producers in more accessible lowland areas before they reached those in the mountain forests.

While this is probably the case, the Ocampo caves are only deceptively secluded. The Cañon Infiernillo drains southward from near the caves and soon connects with the Río Santa Bárbara, which forms a very broad floodplain near Ocampo, 20 km to the south. This is one of a series of north-south oriented valleys nestled between localized small mountain ranges on the eastern slopes of the Sierra Madre Oriental in the region; the Ocampo valley opens onto the coastal plain of the Gulf of Mexico at Ciudad Valles, only 90 km to the south. The often dry Cañon Infiernillo forms a natural corridor between the uplands surrounding the Ocampo caves and these lowlands. At only 25 km foot travel distance into the mountains from the northern extent of the Ocampo valley, this passage would have greatly facilitated delivery of imports such as domesticated plants into the less accessible uplands by mobile people accustomed to traversing long distances on foot, particularly if there were preexisting exchange networks in place. As mentioned in Chapter Seven, the presence of ceiba pods in San Lorenzo and San Antonio contexts in the Ocampo caves demonstrates travel or trade between the mountains and the humid lowlands later in prehistory; there is no reason to assume that such wide ranging travel could not have occurred in the more distant past. Thus, while the findings in the caves should certainly not be viewed as representative of the region as a whole, there was not necessarily a major time lag between the arrival of domesticates in the more accessible lowlands and their appearance in the excavated cave sites.

A second point of the EIA framework concerns shifts in settlement and group organization during this extended period. Available data still uphold that for several millennia the people who used the Ocampo caves lived in small, single-family groups (microbands) that residentially moved across the landscape yet occasionally accumulated into larger, multi-family groups (macrobands). The frequency and duration of these congregations increased over time until settled villages (dependent on farming) became the norm. However, concepts of the EIA are not mutually exclusive from Binford's

(1980) notions of foragers and collectors (see Chapter Two) in the Mesoamerican case in general and likely for Ocampo in particular. Small foraging microband camps, occasional multi-family macroband base camps, and various logistically-organized special purpose camps (characteristic of collectors) can be integrated into one larger yet flexible settlement pattern, as illustrated by Flannery (1986b:40-42) for the Oaxaca and Tehuacán pre-ceramic periods. Smith (2001a) offers concepts that complement the EIA framework across Mexico, including Ocampo. As domesticated plants sporadically filtered into the Ocampo region they were adopted into an economy of low-level food producers, in that for millennia they were a minor yet integral part of a diet that consisted mostly of gathered plant resources. This begs the question: how were plants that require some degree of human tending integrated into what were likely relatively mobile settlement systems? Some present-day cultivation practices in San Lorenzo las Bayas have implications for such issues (Hanselka 2010).

Present Day Casual Cultivation and Implications for Prehistory

Once the first domesticated plants began to be introduced into the study area, they were seemingly incorporated with little major disruption into pre-existing hunting and gathering economies, and by the available evidence it appears that some 3,000 years passed between the arrival of the earliest domesticates (bottle gourd and pepo squash) and the emergence of settled farming villages in the study area. Although most agricultural practices take place in the immediate vicinity of the present-day *ejido*, some local residents also utilize more distant canyons and mountain forests for cattle herding and for the exploitation of wild plants. As an added benefit, such expeditions also present opportunities for the casual, supplementary cultivation of domesticates. This may involve simple dispersal of seeds across unprepared yet fertile ground, or it may accompany small-scale, intentional landscape burning events.

In anticipation of future herding rounds, fires are occasionally set before the summer rains to clear small plots of land and encourage forage growth, often many kilometers away from the community. Clever individuals carry small quantities of squash and gourd seeds with them on these excursions, particularly bottle gourd and cushaw and butternut squash. Once the surrounding brush is reduced to ash and the ground cools, the seeds are manually depressed into the enriched earth. No more effort is applied to their tending. Months later, when small groups of cattle are escorted into the canyons to graze at these plots, mature fruits are available for collection and use back in the *ejido*. During the archaeological survey phase of the present project I directly witnessed several instances of such activities. In March 2005 we encountered a large burned patch of land about 4.5 km foot-travel distance from the *ejido* that had apparently been prepared as a future grazing plot. Upon discovering a ripe *Cucurbita moschata* squash fruit at this location (that had apparently been left behind by the persons who had prepared the plot), my guides split it open and proceeded to plant its seeds across the burned area, explaining that they would collect the fruits at some later date. In November 2005 on the river terraces below the archaeological site of Las Piletas, north of the *ejido* at a distance of some 4.5 km we encountered extensive mature bottle gourd vines with numerous fruits; these had apparently been planted by people from the community who would eventually collect them while in the area on other business. In November 2007, we stopped at a small cleared and burned plot of land on an alluvial terrace in the Cañon Infiernillo, about 7.5 km foot travel distance northeast of the nearest residence. The informally prepared patch contained more than a dozen large *C. moschata* fruits (Hanselka 2010).

Local residents obviously are not dependent upon these behaviors for their survival, but they are beneficial in that they result in knowledge of the location of squash and gourd fruits whenever they are wanted. Though the practitioners are farmers in the *ejido*, these observations demonstrate the casual, informal cultivation of domesticated plants *outside* the context of the primary means of subsistence, and they therefore have relevance for prehistoric low-level food production in the region. Once added to the repertoire, some domesticated plants may have been formally cultivated in plots positioned near longer-term camps, for instance on the mesa top about 30 m above the excavated cave sites. Based upon these observations, however, I suggest that early food production in southern Tamaulipas was a fluid adaptation in which formal/planned and informal/opportunistic strategies played integral roles. These were further integrated into sophisticated foraging strategies.

The behaviors demonstrated by present-day people present the possibility that such plants could be casually cultivated by individuals on forays some distance from the home base, at locations foreseen to be visited again in the future. This planting may have consisted of simple seed dispersal upon an unprepared ground surface, but controlled burning of vegetation has a very long history and serves a variety of human needs (Hammett 1997:200; Smith 2007a). Fire permitted aboriginal peoples to artificially construct a niche that benefited target plant species by enriching the soil with nutrients, eliminating competitors, and improving exposure to sunlight, and by altering the landscape in such a fashion, they were possibly consistently creating artificial niches for themselves in order to maintain their likely mobile lifestyle (see Smith 2007a, 2007b). These modern observations also show that cultivators need not have been consistently present to tend to these plots, but instead might only return after a few months to collect the resulting fruits.

This scenario holds several implications. Early during the EIA, settlement patterns were not necessarily tethered to crop fields, even over the growing season or at harvest time. As squashes and gourds are sufficiently resilient to be successful without constant tending, local low-level food producers could have maintained their routine annual hunting and gathering rounds while supplementing this lifestyle with some types of domesticated plants. Such a lack of constant attention would conform to the archaeological evidence that the resulting fruits were not initially dominant in the economy, but may have rather served to supplement other major prey items, as a buffer when wild crops were less productive, or simply as an indulgence when the mood struck. Thus some plants that were fully domesticated by the time they arrived in Ocampo could have been successfully incorporated into an otherwise hunter-gatherer lifestyle without major economic disruptions. If storage and the natural environment provided sufficient food resources throughout the year, an elaborate but fluid system integrating both residential and logistical mobility, hunting and gathering, storage, and the casual use of domesticated plants could have supported small populations for an extended period without a necessary escalation in food production.

While these observations demonstrate that squashes and gourds are hardy enough for "hands-off" cultivation, what about other domesticates? Based on available AMS radiocarbon dates, a period of some 2,000 years passed between the arrival of bottle gourd and pepo squash (6440 B.P. and 6310 B.P., respectively), and maize (4300 B.P.) in the Ocampo region. By existing data at least another 1,000 years passed until the emergence of farming villages. It is necessary to clarify how resilient maize is in the absence of tending in this particular setting, if one is to model mobility patterns at and after the arrival of this important cultigen. If maize requires more consistent care and protection than do squashes and gourds, it may have required a higher level of residential stability in order to be successfully incorporated into the local economy. To address this issue, in early 2010 we prepared five small plots at varying elevations west of the Ocampo caves; in July 2010, in at least 30 locations per plot we planted maize kernels that are traditionally used in the *ejido*. No other tending was provided, and by October 2010 my guides reported that many of these maize plants were over six feet tall, and many held cobs that were nearing maturity. These results are tentative at this writing so precise figures are not yet available, but the findings indicate that in the study area traditional maize used locally today is potentially compatible with a plant-and-leave casual cultivation strategy.

I hypothesize that special conditions must exist for maize plants to escape predation in the absence of human tending in a particular region, however. For instance, a particularly vulnerable stage in the maize plant's life cycle is early on, when the tender vegetative parts are most appetizing to animals (Karen Adams, personal communication 2008). In some regions, such as the deserts of the U.S. Southwest, this poses a problem because young green maize plants are highly visible on the ground. However, the present study area is thick with vegetation and there are many other plants for pests to eat; the lush green backdrop also may camouflage young maize plants long enough to survive the first vulnerable months. Although our experimental plots appear to have done well, plant-and-leave is still a risky strategy for maize here; in 2009 one of my guides planted a small maize *milpa* adjacent to his home, only to have birds decimate the crop even with the very close proximity of humans. Maize has been dated to the end of the Flacco phase in Valenzuela's cave (Table 1.2), and by MacNeish's findings, the subsequent Guerra phase is characterized in Romero's cave by short-term occupations of a single season or less (Occupations 5, 6, and 7) and one seasonal macroband occupation (MacNeish 1954b). To ensure maize crop success for the remainder of the EIA, it is likely that the plant was grown in close proximity to longer-term macroband encampments that were in place at least during the most vulnerable stages of the plants life cycle. Judging by the growing conditions observed in the region today, this may have been in the late summer and late fall.

The Rise of Farming Village Life in Ocampo

Bellwood (2005) suggests that although Mesoamerica may have been subject to various spatially and temporally scattered plant domestication events, true settled farming communities developed only in select areas and then subsequently spread across the region due to increasing population sizes, demand for cultivable land, and the ability of food-producing groups to absorb and/or displace foraging ones (Bellwood 2005:165-168).

By this scenario, although individual domesticated plant species may have filtered into the Ocampo region into the hands of local low-level food producers over millennia, settled farming lifeways were introduced by migrating farmers colonizing the region. One version of the origin of the Huastecs holds that these linguistic relatives of the Maya migrated northward from a homeland in southeastern Mexico (see Bellwood 2005:238). According to Stresser-Peán (2006:32), Huastec populations were established in northeastern Mexico sometime around 4,000 years ago, slightly before the beginning of the Mesa de Guaje phase in Ocampo, when village life first emerged in that region. This would seemingly lend support to a scenario in which large-scale expansions of farming groups from the south brought the concept and practice of village life into Ocampo. However, MacNeish (1958:168, 1971:578) interprets cultural remains in the mountains of southern Tamaulipas to show that the Mesa de Guaje phase evolved directly from the previous Guerra phase (4400-3600 cal. B.P.), and both MacNeish (1947:3) and Ramírez Castilla (2007) consider the villages of the mountains surrounding Ocampo to be a cultural development distinct from that of the Huastecs based on differences in ceramic styles and architecture. I agree with MacNeish and Ramírez Castilla and believe that the evidence more firmly supports an independent origin for settled farming village life in the Mountain Region.

However, such contacts with the Huastecs likely influenced the trajectory of agriculture among the inhabitants of the mountains during later time periods. Although the two cultures are sufficiently distinct to be classified as relatively independent developments there is evidence for significant interaction between them. Several mountain village sites documented during the present survey contained locally made ceramics, Huastec ceramic types, and locally made pottery that superficially resembles Huastec types (presumably copies). The Mountain Culture sites documented here lie within about 130 km northwest of major Huastec centers such as Pavón, located near Pánuco, Vera Cruz, on the Tamesí River (Ekholm 1944). However, there are much closer outlier Huastec posts, including the unexcavated site of La Alberca on the eastern outskirts of Ocampo a mere 20 km south of the study area. This small site has a series of square masonry platform mounds and is dominated by ceramic types dating to the final phases of the Huastec sequence. Given the previously discussed natural corridor between this site and the study area afforded by the Infiernillo Canyon, the exchange of goods and ideas between the Huastecs and the mountain inhabitants is not surprising. Numerous other Huastec outposts have been found around Ciudad Mante, about 50 km to the southwest of the study area, and near the town of Xicotencatl about 40 km over the mountain ranges to the east (Ramirez Castilla, personal communication, 2011).

A detailed account of Huastec subsistence cannot yet be formulated, as plant remains preserve poorly in the humid lowlands and intensive data recovery strategies (e.g., flotation) have yet to be utilized. It can be assumed that agriculture was a major part of the diet, though they likely also relied on a wide variety of anthropogenic vegetation zones from dooryard gardens to active management of rain forest resources (Alcorn 1981). While they are not as traceable as ceramic styles, foodstuffs such as domesticated plants likely formed part of the interaction sphere between the Huastecs and the inhabitants of the villages in the mountains. As mentioned above the ceiba pods found in San Lorenzo and San Antonio contexts in the Ocampo caves may indicate that such trade networks may also have included wild plant resources.

Site Distributions and Implications for Agricultural Practices

Two sources provide insights into more intensive farming practices and landscape use later in prehistory: distributions of village sites and the potential for the surrounding habitat for food production discussed in Chapter Eight, and present-day farming traditions followed in local communities. Although it was not a goal of the present research to conduct formal ethnoarchaeological interviews among the present-day populace, observations made in the field and informal questioning of my guides produced interesting insights into local farming ecology and the potential of this landscape for food production that have implications for prehistoric economies in this setting. Local environmental conditions set parameters that limit or enhance cultivation success, and present-day subsistence farmers are very familiar with these factors. Although the contexts are obviously not identical, local indigenous peoples met the day-to-day food quest under natural environmental conditions comparable to those my guides face today, and may have dealt with such concerns in similarly creative ways.

Present-day farmers plant mixed *milpas* of maize, beans, and squash, a common practice that likely extends far back into prehistory (Flannery 1986a:8-9; Zizumbo-Villareal and Colunga-GarcíaMarín 2010). Contrary to the informal dispersed cultivation described above, most formal planting is done on prepared slash-and-burned plots in and around the *ejido*. These fields are cleared between January and March, and the dried brush is burned between April and May (Fermin Puente Castillo, personal communication 2009). The size of the plot will vary, but in more heavily wooded areas the plot must be large enough to allow in sufficient sunlight. If the plot is cut too small, shade from surrounding trees will in effect shorten the day length and hinder growing crops.

Using mule-drawn plows, initial tilling takes place well before the arrival of the rainy season, and actual sowing is done as soon as the first rains arrive in May, though it can continue through the latter part of July. According to my guides, a successful crop on a minimally-prepared plot requires at least 20 cm of rain. Fields or sections can be cultivated for a year or two, but then the farmer must shift to a different section and allow the first to fallow. As a result, fewer and fewer individuals in the community are fulltime farmers today, because they do not hold title to enough land for the necessary year-to-year rotations.

The lower slopes along canyon margins may have been most attractive during the initial stages of cultivation, because the oak-pine forests at higher elevations would have been more difficult to clear. But on survey village sites were documented in a wide variety of settings, including limited river terrace space, hill slopes, and mountain summits. The range of diagnostic ceramic sherds on Potrero de Bueyes, for instance, indicates that this large valley settlement was occupied during the La Florida to Plamillas phases. On the other hand, the comparably large Los Razos site seems to have been occupied during this same time frame, but it is located on a mountain summit 500 m above the El Refugio canyon bed, 6.5 km east of Potrero de Bueyes as the crow flies. MacNeish (1958:139) seems to suggest that large hilltop villages ("ceremonial centres") were placed in such locations because they could have been "easily defended," but this pattern is more likely due to population packing and the simple fact that most available land is on hill slopes and mountain tops.

Where were the cultivated fields required to support large populations in big sites like Potrero de Bueyes and Los Razos? During the La Florida and Palmillas phases Potrero de Bueyes and its associated hamlets and villages would likely have had the entire San Lorenzo valley under cultivation. Presently this small amount of relatively level land is quickly put to use by farmers, necessitating the utilization of steeper surrounding hill slopes. I have in fact observed extensive maize fields in the region on slopes sometimes exceeding 45 degrees, and there is no reason to believe that similar practices did not take place in prehistory. An axe head was recovered from Potrero de Bueyes, indicating that forest clearance was a fact of daily village life.

Soils in this general region are relatively shallow, often less than 40 cm deep (Sosa et al., n.d.). Deeper soils accumulate on gentle lower slopes and in canyon and valley bottoms. Present-day farmers prefer these deeper soils, but can successfully produce maize crops in soils as little as 10 cm deep, so shallow soils on hill slopes are capable of successful cultivation. According to some farmers in the region today, cultivation of hill slopes may in fact provide an advantage over farming on level river terraces, as hill slopes receive more moisture than do flatter locations, and sloping surfaces are not as beaten down by the sun (Fermin Puente Castillo, personal communication 2009). However, gentler slopes are still preferable, because cultivation is accomplished by mule drawn plows, and the grade of the hill slopes that can be worked depends on the farmer's and animal's ability to work the plow. While the historic use of metal plows obviously facilitates tilling of the soil to a degree not possible with the simple digging sticks used by prehistoric cultivators, animal powered plows did not confine these early farmers to gentler slopes, effectively expanding the amount of land near settlements that could be cultivated.

Therefore, our survey findings suggest variable cultivation practices between villages. Nine village sites were located on or in very close proximity to the terraces around San Lorenzo las Bayas, but another six settlements were encountered in high, isolated locations, sometimes many hours walk from valley settings. Modern cultivators in the region, in addition to planting in river valleys, also clear vegetation from hillsides to make room for farm plots. The isolated locations of some very large sites, along with ground stone axe heads commonly found on village sites, suggest that some prehistoric populations practiced similar slash and burn cultivation on hilltops and hill slopes. This was likely done out of necessity as relatively level land is rare in the region and rising populations would have required more fields.

Another potential strategy for cultivating on a smaller scale in regions with very thin soils is demonstrated by adaptations of some contemporary Maya in the lowlands of the northern Yucatán Peninsula (Fedick et al. 2008). Being a lowland setting in a far more tropical environment, this situation is widely divergent from that found in the present study area. However, both circumstances are similar in that large parts of both regions are characterized by a very thin, patchy soil veneer overlying limestone bedrock outcrops. In the Yucatán Peninsula, homegardens have a very long history and continue to provide most of the diversity in Maya diet today. These Maya have adapted their homegardening strategies to be compatible with the very thin soil conditions through what Fedick et al. (2008) refer to as "container gardening," that is utilizing soils accumulated in natural bedrock depressions for the purpose of cultivating useful plants near their homes. I have often observed soil-filled cavities on bedrock exposures in the study area occupied by resilient plant life. There is no direct evidence that these were used here in the manner described for the Maya region either now or in the past; yet this ethnographic case presents the possibility that prehistoric Ocampo populations could have optimized plant cultivation similarly.

In addition to cultivating maize, beans, and squash in formally prepared fields on river terraces and hill slopes, it is likely that villagers tended some domesticates or even useful wild plant species in gardens adjacent to their habitations. Plants such as gourds or chili peppers are ideal for such habitats. Such gardens were probably an integral part of the village economy, as they were across prehistoric Mesoamerica (Killion 1992).

Village Plant Use, as Indicated by Surface Artifacts

Artifacts found on sites during the survey are informative of plant processing in open air settlements. Tiny wild chili peppers were likely ground up in ceramic *molcajetes*, bowls with incised textured interiors. Sherds from such artifacts were found on several sites, particularly during the La Florida – Palmillas phases, including Cuizios de Fermin (n=4), El Basurero (n=5), La Coma (n=3), La Termina de Loma Larga (n=2), La Venada (n=1), Loma Larga Manguera (n=4), Los Basamentos (n=1), Los Razos (n=4), Muchos Ebanos (n=1), and Potrero de Bueyes (n=3). Their frequency on these sites and others in the mountains of southern Tamaulipas (MacNeish 1958) seems to suggest that grinding of chili peppers was a common practice in these villages. Although identical tools are used for this purpose in Mexican kitchens today, it is possible to identify chili pepper starch grains archaeologically (Perry et al. 2007), and *molcajete* sherds from the study area should be tested for these to be absolutely certain. Local residents have found large groundstone pestles associated with bedrock mortars near extensive oak forests, possibly for the purpose of processing acorns (Fermin Puente Castillo, personal communication 2005). Pipe fragments were found on Potrero de Bueyes and La Venada, attesting to the existence of smoking traditions.

Also, in November 2007, we located a large (> 3,000 m^2), open lithic scatter, affirming that we should alter our perception of Ocampo pre-village populations simply as "cave dwellers" (Callen 1968). Campsites were potentially placed at any suitable tactical (more or less level) location on the landscape depending on need or convenience, particularly during the dry season when shelter is not always a necessity.

The Use of Caves

Although open-air camps and settlements certainly existed in the study area throughout the prehistoric sequence, the abundant caves in the region provided convenient places for shelter and for the pursuit of various activities, including hunting, harvesting wild plants, planting and harvesting domesticates, processing agave hearts in earth ovens, and constructing grass-lined pits for the temporary storage of food plants. It even appears that different cave sites may have been targeted for different purposes: for example during the EIA, Romero's and Valenzuela's caves were locations for various rainy season activities, especially plant collecting and cultivation, while Ojo de Agua cave seems to have been continuously used primarily as a hunting camp during the dry season, as will be discussed in detail below. Interestingly it seems that these patterns remained consistent even after the establishment of village life in the region. Romero's and Valenzuela's caves contained storage pits, burials, and evidence for large and small temporary camps dating to the ceramic period, possibly representing use by the inhabitants of El Matillal, El Santuario, or other small to moderately sized settlements nearby.

Plant Harvesting

Although northeastern Mexico and southern Texas have been subject to large- and small-scale climatic shifts since the end of the Pleistocene, multiple lines of evidence indicate that biological communities similar to those of today have remained somewhat consistent in the general region throughout the Holocene (Jones 1999; Presley 2003). Thus these shifts would not have drastically changed the kinds of plants and animals accessible to prehistoric populations, but rather would have influenced alterations in their frequency, availability, and spatial distribution, and possibly may have influenced opportunities to intensify on the use of introduced domesticated plants.

Observations made during survey also support a scenario characterized by the use of caves and shelters for short-term, task oriented campsites. Cueva de las Tijeras 1 is an eight-meter-deep rock shelter (about 40 m^2 floor area) on the northeastern end of the study area. On the surface of this small shelter were found six large bifacially- and unifacially- retouched tabular stone artifacts that compare well with the "agave knives" common on rock mulch agave cultivation fields in the Hohokam region of the southwestern U. S. (Suzanne Fish, personal communication 2006). Similar artifacts are distributed across the Mexican arid lands wherever agave is found (Taylor 1966); they are presumed to have been employed in the extraction of the fibrous leaves and possibly to assist in the removal of the edible hearts of agave and sotol. Because very few artifacts were observed otherwise, the surface component of Cueva de las Tijeras 1 is tentatively interpreted as the campsite of a logistically organized task group intent on harvesting the fibrous leaves of agave, yucca, sotol, and/or morphologically similar bromeliad species that grow so abundantly in the region. The very small floor space would not have been ideal for extended occupation, and the relative abundance of a specific tool type indicates a specialized purpose. Also, as discussed in Chapter Seven, inspection of curated plant collections revealed that domesticated plants were an integral part of the Ocampo economy as they arrived in the region, but they merely complemented a wide variety of locally available wild plants that were not previously specified in published accounts. Some curated specimens (e.g., *Ceiba pentandra*) indicate that even during later time periods, when local people lived in permanent habitations in villages, foraging activities drew them as far as 30 km away from their homes.

Fiber, Basketry, Cordage, and Textile Manufacture

Long rosters of basketry, cordage and other perishable artifacts mentioned in published accounts indicate that fiber and textile industries were a very important part of the Ocampo life way (e.g., MacNeish 1958, 1971). Further, unpublished field notes (Kelley 1954a; MacNeish 1954b) indicate that the manufacture of perishable items was an important activity throughout the prehistoric sequence. Materials at INAH include remnants representing all steps in cordage and textile manufacture, including raw leaf materials (from palm, sotol, agave, and *guapilla* bromeliads [Figure 9.1]); leaves with partially extracted fibers (Figure 9.2); fully extracted fibers (Figure 9.3); and braided string and rope (Figure 9.4) and fragments of mats (Figure 9.5). These observations suggest that caves may have been targeted as ideal locations for tasks related to spinning and weaving industries. Such settings are appropriate for working with plant leaves and fiber, because the cool, shady cave environment prevents raw materials and partially constructed basketry and textiles from prematurely drying, keeping them pliable during the manufacturing process (Horton 2010).

Food Storage

Excavations in Romero's cave revealed storage pits filled with both wild plant foods and domesticates (MacNeish 1954b). The cool dry settings in the cave would delay spoiling of harvested foods, though the favored use of these caves by rodents may have presented a problem with pests. Storage pits were found in contexts attributed to both the EIA and to periods when villages were occupied in the region. MacNeish (1954b:16) interprets a pit discovered in Occupation 2 (Ocampo phase) to have been for the storage of plant foods as it was "crammed with" *guapilla* leaves. A second Ocampo phase (Occupation 4) pit contained "… quite a lot of plant material" (MacNeish 1954b:19). A pit dug during Occupation 10, in the Mesa de Guaje phase, held a large number of maize cobs.

Another pit originated during Occupation 11 of the Palmillas phase, contained abundant plant material as well as teosinte seeds in an alligator bag (MacNeish 1954b:45). "Occupation" 11 seems to represent multiple short-term occupations by a number of small groups rather than a single habitation of the site (MacNeish 1954b:46; Smith 1997b:354). While a primary purpose of these visits appears to have been

Figure 9.1. ***Guapilla*** **(*Bromelia* sp.) leaf fragments, Romero's cave.**

Figure 9.2. Agave (*Agave* sp.) leaf fragment with partially extracted fibers, Romero's cave.

Figure 9.3. Fiber extracted from agave leaf, Romero's cave.

Figure 9.4. Twisted string of Agavaceae fiber, Romero's cave.

Figure 9.5. Basketry fragment, Romero's cave.

interment of the dead, as will be discussed below, food storage for nearby villages seems to have been a goal as well. Foods in this pit likely would have eventually been transported back to some neighboring settlement on the ridge top above the caves, possibly even El Santuario and El Matillal. Finally, during Occupation 13 in the San Lorenzo phase two pits were excavated in Romero's cave; one contained maize cobs while the other held miscellaneous vegetal material, indicating that the caves continued to serve this function later in prehistory.

Caves for Ceremonial Use and Burial of the Dead

Caves in the study area often contain abundant evidence for spiritual behavior and beliefs, even in those sites in which multiple other economic, domestic, and industrial activities took place. For centuries caves have figured heavily in Mesoamerican ritual life. As Evans (2004:34) put it, “The spiritual power that enlivened the mountains, rivers, and trees needed to be acknowledged and propitiated and the earth itself was perceived as a living being, its caves and springs were orifices to another world, the realm of beginnings and endings.” Springs, caves, and caverns represented passageways to the interior of the living earth, the orifices of the earth as a breathing entity. It appears that such associations may extend back into the earliest human occupations of Mesoamerica, and even last to the present day in some parts of Mexico (e.g., Markens and Baudouin 2007). Therefore, it is not surprising to find evidence for ritualistic art and interment of the dead in caves and rock shelters within the study area. MacNeish (1964:425) suggests that “A small bag with herbs, an awl, some flint knives, string, and polished pebbles from Romero’s Cave may be a medicine man’s kit…,” and may indicate the existence of shamanism during the EIA. He also recovered multiple burials (often with associated grave goods, indicating a belief in some form of afterlife) from his excavations in Romero’s and Valenzuela’s caves (MacNeish 1964:425); some of these are from contexts attributed to the EIA. In the later phases of the Mountain Culture sequence burials were often placed in the floors of house platforms on open village sites (Ramirez Castilla 2007), but even at the height of village life the deceased were buried in caves. During the present survey human bones were noted near looter’s pits in several cave sites, including Cueva de la Calavera and Cueva de las Tijeras 1.

It is clear from MacNeish’s excavations in the Ocampo caves as well as observations in less-investigated sites during this survey that caves were used as places to inter the deceased, both during and after the EIA. According to the field notes, MacNeish and his crew encountered as many as ten individuals buried in Romero’s and Valenzuela’s caves. The earliest of these was a single pit in Romero’s cave dating to Guerra times (Occupation 8) that contained the remains of an adult male and female and an infant.

The pit had been lined with palm leaves, and grave goods (including baskets, fiber bags, blankets, and a bottle gourd canteen) were placed with the bodies (MacNeish 1954b:35). This practice continued beyond the EIA; early villagers of the Mesa de Guaje phase buried an individual in Romero's cave during Occupation 10.

A single occupation zone (11) in Romero's cave held five burial pits dating to the Palmillas phase (all excavated at different times), indicated continuing use of caves for mortuary purposes even at the height of village life. MacNeish (1954b:46) believes that the deceased were brought into the cave rather than have perished while there. It is possible that they were residents of village sites found on the ridge top above the caves during the present survey, such as El Santuario and El Matillal. Interestingly, one of the interred individuals was missing the head and the body appears to have been pierced by arrows, possibly representing some form of ceremonial sacrifice (MacNeish 1954b:54).

The use of caves as burial places during the Palmillas phase is interesting and points to high variability in mortuary practices, as it was also common for these villagers to bury their dead both in open cemeteries and beneath house and temple floors within masonry platforms in settlements (Ramírez Castilla 2007; Stresser-Péan 2000; Valdovinos 2003). Two village sites discovered during this survey provided further evidence for the latter practice. On the La Coma site, we noted mandible and cranial fragments as well as phalanges (representing both an adult and a juvenile [Sandi R. Copeland, personal communication 2005]) eroding out of a narrow wash; further investigation revealed them to be in the center of a wide but low platform feature. On Potrero de Bueyes, Fermin Puente Castillo was installing a fence through his *milpa* and in a fence post hole encountered human bones representing the cranium and portions of the torso. He left the burial intact, and further brush clearing revealed the location to be in the center of a low-lying prehistoric house platform.

Caves continued to be used for this purpose after the decline of village life in the region. A buried individual was discovered in San Lorenzo phase contexts (Occupation 7) in Valenzuela's cave (Kelley 1954a:96), and another dating to the San Antonio phase (Occupation 16) was excavated in Romero's cave (MacNeish 1954b:66). Discoveries made during the present survey further support the use of caves for burials during the latter phase. The only diagnostic artifacts found on the surface in Cueva de la Calavera point to an late occupation during the San Antonio phase. Human remains, including a robust mandible fragment and a sacrum, apparently disturbed by looting activity, were found scattered about the surface in the front half of the cave.

Caves as Hunting Camps

It is clear from this discussion that occupations during all phases within Romero's and Valenzuela's caves spanned a wide range of activities. Although hunting was one activity consistently carried out from these sites, the amount of vegetal refuse encountered indicates that gathering and cultivation were of primary importance during their occupations. The abundant and well preserved plant matter in their deposits has drawn most scholarly attention to these two sites because of their potential to elucidate early agriculture in the region. However, this has resulted in something of an overemphasis on Romero's and Valenzuela's caves over other sites that lack such evidence, but that can illuminate other important aspects of the local human economy. According to the excavation notes, the Ojo de Agua cave deposits contained very few plant remains, and these were primarily non-domesticated. Likewise, the curated collections contained very few plant remains from Ojo de Agua, including some maize cob fragments and tassels, bottle gourd rind, *aquiche* fruits, Hesper palm leaves, sotol leaf fragments, and unidentified squash (rind and one peduncle); but the remainder of the Ojo de Agua plant materials were unidentified twigs and wood fragments. There were also very few plant processing tools.

On the other hand, animal bones were abundant in all levels, especially those of migratory waterfowl. These bones and the associated artifacts suggest that Ojo de Agua functioned primarily as a dry-season (winter) campsite for micro- and macroband hunting task groups intent on picking off fowl and other game attracted to the location for water accumulated in the spring and bedrock tinajas in the canyon bed below.

Flannery (1986b:41) and MacNeish et al. (1972) observed similar patterns among cave sites in the Oaxaca and Tehuacán valleys. Cueva Blanca is a small cave about 1.7 km northeast of Guilá Naquitz. Excavations here revealed what seem to have been brief microband occupations; some of these were contemporaneous with the preceramic, low-level food producing inhabitation of Guilá Naquitz, but one that was more oriented towards hunting. While grinding implements and other plant processing tools were rare in the Cueva Blanca deposits, projectile points and deer bones were numerous, indicating that the small groups that occasionally visited this cave clearly had a hunting focus. However:

> At this writing, we have not yet decided whether these Cueva Blanca occupations represent all-male deer-hunting camps indicative of "logistically organized hunting" in the San Bushman sense (or Binford's "collector" sense) or whether they are family microband camps with a strong hunting focus (Flannery 1986b:41).

It appears that Zones C-B represent a similar hunting microband occupation of Abejas cave in Tehuacán (MacNeish et al. 1972).

Other factors should be considered regarding the discrepancy between the vast amount of plant materials in Romero's and Valenzuela's caves versus the lack of such remains in Ojo de Agua cave, as this could be due to several factors. First, Ojo de Agua was not as heavily investigated as the other two sites, and unexcavated portions may yet contain more abundant plant materials than the investigated sections suggest. Secondly, although Ojo de Agua is only about 1.5 km downstream from the other two sites, Ojo de Agua is some 200 m lower in elevation and the habitat immediately surrounding the cave is significantly more humid; this possibly could have had an adverse effect on plant preservation in the site deposits. However, I believe it to be very likely that this pattern actually reflects human behavior and differentiation in site use, as it appears that Romero's and Valenzuela's caves primarily represent occupations with mixed activities (chipped stone tool manufacture, hide working, wood working, fiber/cordage/textile manufacture) in the spring, summer, and/or fall when plant foods were being gathered, cultivated, or harvested, resulting in their abundance in these sites. On the other hand, occupations in Ojo de Agua cave appear to have taken place during the dry (winter) season, due to the presence of bones representing migratory water fowl. In fact, bones of various animals are the primary subsistence remains found in Ojo de Agua cave, leading the excavators to conclude that this site was mainly used as a winter hunting site; the spring and enduring pool of water at the base of the canyon attracts waterfowl and other wildlife, making it an attractive hunting spot to hunters that found shelter in the cave above.

A recent observation I made in the study area has important implications for the prehistoric use of caves for winter hunting activities. One early January morning in 2010, I heard very loud squawking of numerous birds drifting down the Cañon Infiernillo from the direction of the Ocampo caves to the home of my guide Fermin Puente Castillo, some 7 km distant. He informed me that these birds are migratory waterfowl, and visit the region during the late fall and winter. He says that these birds were so abundant at these times in decades past that they devastated maize crops in Ocampo. In fact, the birds were so thick in the fields that local residents could take a heavy stick and hurl it over the flocks as they grazed, killing several of them upon taking flight. It is easy to see how they could become an important dietary item during dry winter months when most plant foods were unavailable. Their seasonal presence would have drawn human groups to locations attractive to the birds, such as the standing water in the riverbed beneath Ojo de Agua cave.

Although no direct correlation can be established between the two processes, the apparent cultural "decline" and corresponding decreases in agricultural dependence observed in the archaeological record during the final cultural phases (San Lorenzo and San Antonio) may be related to decreasing effective moisture and harsher conditions in northeastern Mexico following 1500 B.P. (see Chapter Four). The San Antonio phase in the Sierra Madre lasts beyond Spanish contact, which in the region now known as Tamaulipas occurred at approximately A.D. 1518; both published accounts and the contents of curated collections indicate that people of this phase continued to practice agriculture, although on a smaller scale than previously. However, early Spanish explorers downplayed the presence of farming groups in the Sierra Madre.

Variability in Plant Subsistence and Food Production at European Contact

When Don José Escandón y Helguera founded the village of Santa Bárbara in 1749 (later to be known as Ocampo in 1869), the Spanish colonists knew of such local indigenous groups as the Janambres, Pisones, Tancalguas, Olocnoques, and Siguillones (Olvera Guerrero and Muñiz Torres 1987:7; Saldivar 1943:14). These were considered "barbaric," nomadic groups that occasionally constructed simple huts but often occupied caves like their prehistoric forbears (Saldivar 1943:15).

The Sierra Madre groups that were encountered for the most part subsisted primarily on resources hunted and gathered from the mountain forests (Eguilaz 1965; Olvera Guerrero and Muñiz Torres 1987:7). However, there are no highly detailed accounts of their subsistence practices. Contrary to these indigenous groups of the Sierra Madre, peoples of the Sierra de Tamaulipas (Pasitas, Mariguanes, Simariguanes, Olives, Anacan, Mapucan, Yamacan) were documented as sedentary agriculturalists at contact (MacNeish 1958; Stresser-Péan 2000). According to MacNeish (1958:17) they cultivated maize, beans, squash, "sweet potatoes, potatoes," melons, gourds, and chili peppers. There is evidence for continuity between the latest prehistoric phases and contact period groups in the Sierra de Tamaulipas. MacNeish (1958:193-194) relates the archaeological Los Angeles phase remains to the material cultural complex of the Pasitas. These include Los Angeles phase remains associated with Spanish Colonial glazed sherds at Tmc 198; burned, cut, ground and scraped modern horse bones found in Los Angeles contexts at Tmc 81 and 82 (the Pasitas are documented to have hunted horses for food); and Los Angeles phase pictographs depicting horses, mounted horsemen, and cattle.

Such cultural continuity is less apparent in the Sierra Madre, where the San Antonio phase is archaeologically characterized by the (albeit diminished) presence of domesticated plants, while contact period groups were regarded as bellicose mobile foragers. Of the diet of the Sierra groups observed during the historic period, MacNeish (1958:17) writes that they consumed such foods as prickly pear pads and fruit, mesquite beans, and agave hearts. Gabriel Saldivar likens the historic Sierra diet to that of foraging groups of northern Tamaulipas and the Río Grande Valley between Tamaulipas and South Texas, of which he discusses in some detail (Saldivar 1943:12-13, 15). These peoples caught fish in their rivers and lakes; hunted deer, cottontail, and jackrabbit; stalked turkeys, chachalacas (*Ortalis* spp.), pheasants (Phasianidae) and other birds; and collected seeds and fruits of mesquite, Texas ebony, "*anacahuita*," or Mexican olive (*Cordia boissieri*), *zapote* (any of a number of soft, fleshy tree fruits), coma (*Bumelia* spp.), "*granjeno*," or spiny hackberry (*Celtis llida*) and many others. In the winter when nothing else was available they consumed roasted agave hearts, while in the summer prickly pear stems, flowers and tunas were storable staple foods (Saldivar 1943:13).

Foster (1997:15) describes the general diet of northeastern Mexican groups as follows:

> In the winter, they ate the heart and fleshy leaves of the lechuguilla [*Agave lechuguilla*] and the roots of other unidentified plants. In the spring they ate wild fruit and cooked the green tunas of the prickly pear, which they also dried for future use…. [T]he mesquite bean ripened soon after the tunas dropped (a sequence that continues during the autumn). Mesquite beans were a part of the diet from the time the beans started to ripen until they dried, at which time they were ground with wooden mortars into a coarse meal or finely ground flour and stored in reed bags.

Foster based these descriptions on the observations of Captain Alonso de León, who in the late seventeenth century wrote of his travels between 1579 and 1650 in Nuevo León (which at the time included all of northeastern Mexico north of the Huasteca and most of southern Texas). De León noted that the indigenous groups there were non-agricultural, while those of the Huasteca (southeast of the study area) were cultivators of maize, beans, squash, and cotton (Foster 1997:8). However, as will be discussed below, this does not preclude the likelihood that the northern groups were aware of domesticated plants and even used them on occasion.

There appears to have been some degree of specialization among the hunter-gatherer groups of northern Tamaulipas and southern Texas, depending on locally available resources. For example, the Payaya, whose territory lay southwest of San Antonio, Texas, gathered pecans in great quantities while camped along rivers where the trees were abundant (Campbell 1975:17-19). While some nuts were shelled and eaten immediately, others were left in the shell and stored in underground pits for use the following year. This was likely due to inconsistencies in yearly harvests because of the timing of frosts.

Although these portrayals of the northern groups' economies are likely not far removed from those of the Sierra Madre, the mountains offered a suite of other resources in addition to the cacti and leguminous tree foods favored by groups in the north. But how do we reconcile the disjuncture between the archaeological and ethnohistoric records in the Ocampo region? The apparent lack of food production mentioned in historic documents is likely an exaggeration, and on one hand might be at least partially due to biased observations of early explorers in the Ocampo region who may have intentionally downplayed cultivation among these seemingly otherwise "barbarians." Alternatively they may have actually failed to directly witness the diminished use of domesticated crops among some local peoples, possibly due to their preoccupation with more hostile mobile hunting and gathering groups.

Food-producing communities likely persisted beyond Spanish contact in the isolated mountain valleys around Ocampo. As a matter of fact, Hernán Cortéz encountered such a group of Pisones in the valley in which the present-day town of Ocampo is located (Stresser-Peán 2002:608). The sedentary populations around Ocampo were so small and scattered that they went largely unnoticed by the Spanish, especially with the presence of other, more volatile groups challenging the newcomers at every turn. Many groups that were doing well in farming villages may have quickly fallen apart due to Old World diseases that spread well in advance of the newcomers (probably before any of the victims even saw a European in person), direct conflicts with or enslavement by Spanish colonists, and warfare among various indigenous tribes (possibly brought on by the cultural upheaval caused by European contact). All of these factors may have contributed to the diminishment of sedentary, food producing populations in the Ocampo region within the ethnohistoric record (Stresser-Peán 2002:608). In fact, the local mobile hunter-gatherers that quickly accepted sedentary life in the missions may have done so because this lifestyle was a relatively recent memory.

Another explanation, one that is not mutually exclusive from these, pertains to shifting environmental conditions on the northeastern periphery of Mesoamerica. Roberto Weitlaner (1948) spent several weeks conducting linguistic studies among peasant *campesinos*, likely descended from the Pisones, around Naolá, Tamaulipas, 30 km west of the study area. These people were maize farmers at the time of the study, but in dry years they quickly "reverted" to obtaining the majority of their sustenance from local mountain woodlands in the form of honey from wild bee hives, acorns, pine nuts, dates from a small palm (*Brahea dulcis*), diverse other fruits (particularly cactus), and flowers of yucca and ponytail palm (*Beaucarnea* spp.). Their primary source of monetary income became the sale of fiber extracted from the leaves of wild lechuguilla agave. As discussed in Chapter Four, in recent centuries northeastern Mexico has experienced varied yet increasingly drier conditions overall, so it is possible that pre-contact and contact period farmers in the Ocampo region responded in a similar manner: when annual rainfall was inadequate to support their cultivated crops they sought non-cultivated sustenance (Stresser-Peán 2000:610), thereby increasing the likelihood that local food production would be left undocumented by early Spanish explorers. This scenario illustrates the flexibility and adaptability of mixed foraging-farming systems, a hallmark of a low-level food producing economy.

Limited Use of Cultigens Beyond the Northeastern Periphery of Mesoamerica

Such variability is further demonstrated when one examines the vast landscape of hunter-gatherers to the north, between the study area and the far eastern portions of present-day Texas. This region is for the most part characterized (both prehistorically and historically) by mobile groups that subsisted on hunted and gathered resources

(Taylor 1966, 1972). Shiner (1976) suggests that as farming in the northern regions can potentially be succussful, these populations intentionally avoided such influences from the south, possibly to maintain their own ethnic identity: "The inhabitants of southeastern Nuevo León and west-central Tamaulipas seem to have gone out of their way to appear poor, unsettled, and savage" (Shiner 1976:502). However, there is some limited ethnohistoric evidence for minor use of domesticated plants in these northern regions, particularly maize. The expedition of Francisco Garay encountered evidence for maize cultivation near the Gulf Coast just south of the Río San Fernando (northern Tamaulipas) in 1523 (Mártir de Anglería 1944:573, cited in Salinas 1990:118). Also, in 1535 Cabeza de Vaca encountered two women carrying loads of ground maize near Cerralvo, in what is now Nuevo León about 50 km south of the modern border with Texas (Cabeza de Vaca 1542:49a, cited in Salinas 1990:118). This latter example is less reliable, as de Vaca never actually mentions seeing maize growing in these northern regions and it is questionable whether he was capable of recognizing maize in ground form. Regardless, as Salinas (1990:118) notes, "… there is enough evidence to suggest that in the early sixteenth century some maize was being grown farther north in northeastern Mexico than in later times."

This anecdotal evidence has some archaeological support. For example, the Late Prehistoric antecedents of the Tonkawa (who occupied much of central Texas and had an economy centered on bison hunting) seemingly practiced some limited cultivation of maize, as small cobs have been discovered in sites such as Timmeron Rockshelter in Hays County south of Austin (Hester 1980:51). In addition, domesticated bottle gourds, presumably vessels, have been recovered from burial caves in the Laguna district of southwestern Coahuila (Taylor 1972:172). While bottle gourd vessels many have been imported into this region from the south, cultivation of these resilient plants is compatible with a mobile lifestyle, as discussed above; there is no reason to assume that they could not have been grown locally by hunter-gatherer groups (Hanselka 2010). As the groups in the study area on the northern periphery of Mesoamerica were not above returning to a foraging lifeway as necessary, some hunter-gatherers beyond the boundaries to the north were occasionally willing to use maize or other domesticates on a limited basis where ecological conditions permitted and it suited their needs. At the very least, this demonstrates that the northern groups were well aware of the existence of such plants.

CHAPTER 10: CONCLUDING REMARKS AND AVENUES FOR FUTURE RESEARCH

The present study places the Ocampo plant remains into a more comprehensive context than previously available through a reassessment of temporal variation in plant subsistence and the documentation of settlement trends within this system. These approaches have allowed me to refine conceptions of the prehistoric development of human-plant interactions and food production in southwestern Tamaulipas, thereby contributing to a growing appreciation of the regional diversity of such processes in general. In the process, this research has rendered a widely scattered and incompletely published set of archaeobotanical data more available to the general archaeological community, and opened up numerous doors of future inquiry. Due to the paucity of previous archaeological research in the study area relative to other parts of Mexico, an exhaustive list of potential future projects would be endless, but I will present several possibilities here.

This project succeeded in documenting 22 previously unknown sites. However, I was made aware of numerous others of which time constraints precluded closer study, and the potential exists for many more as yet unknown sites (particularly ephemeral open-air campsites that are likely invisible to the casual eye beneath heavy vegetation and leaf litter). Therefore extensive surveys are yet required. Local knowledge is an excellent resource for locating obtrusive open air sites with architecture as well as sheltered sites in caves, but this should be supplemented by more systematic strategies, perhaps incorporating sub-surface probes to mediate issues of low visibility. Continuing surveys are necessary to reveal the size, location, and relative permanence of various settlement types, particularly those dating to the post-cultigen-pre-ceramic period in the mountains of southern Tamaulipas.

Through my field survey I have identified six additional caves, 15 open village sites, and one open camp site that may be excavated in the future for a growing understanding of prehistoric cultures in this important region. It is possible that more obtrusive ceramic period valley settlements were established on top of earlier, more ephemeral villages or encampments, so investigations on such sites may reveal earlier aceramic components. It is essential that excavations employ site-appropriate programs for the recovery of paleoethnobotanical data, such as flotation (water separation) for open sites and fine screening dry sediment samples collected within shelters. Such fine-grained data collection methods will further enhance our awareness of prehistoric plant use in the region.

The present study represents initial steps to incorporate site distribution data into considerations of prehistoric subsistence strategies in Ocampo. An informative follow-up will be to conduct stable carbon and nitrogen isotope analyses of skeletons from in and around the study area, both those previously obtained by MacNeish from the caves and examples interred within house platforms on village sites documented in the present survey. As mentioned in Chapter One, such studies have greatly augmented survey and archaeobotanical data in clarifying the complexity of ancient subsistence practices elsewhere in Mexico (Farnsworth et al. 1985; Kennett et al. 2006).

Further study will clarify the function of artifacts believed to be related to plant harvest and processing. In agreement with MacNeish (1958:106), I hypothesize that *molcajetes* recovered from ten sites on this survey were used to pulverize chili peppers for use as a condiment. Perry et al. (2007) recently demonstrated that presence and processing of such fruits can be detected through starch grain analysis of artifacts. Such analyses should be used to confirm if this was indeed the function of incised bowls found within the study area. Also, large tabular stone knives similar to those found in Cav-7-05 are widespread throughout the arid regions of Mexico and the U. S. Southwest (Fish et al. 1992; Flannery et al. 1981:61;

Hole 1986:139; Nárez 1996:108; Parsons and Parsons 1990:300-303; Taylor 1966:69). These are commonly refered to as "agave knives" and are believed to have been used to harvest the fibrous leaves of agaves and similar plants. However, in many cases this function has not been verified.[11] Experimentally harvesting agave and *guapilla* with such tools, then subjecting them to use-wear analysis, may lay this issue to rest in the study area.

These are just a few examples of future avenues of research that will help further clarify prehistoric human-plant relationships in the Ocampo region. The landmark investigations undertaken in the study area by MacNeish almost 60 years ago lay the groundwork for understanding processes related to the adoption of plants domesticated elsewhere into a local hunter-gatherer economy, the development of low-level food production strategies, and the rise of settled farming villages, but this picture is far from complete. The Ocampo region still has abundant data relevant to these issues, and holds significant potential for future research.

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11 There are, however, some exceptions. The abundance of such tabular stone artifacts on Hohokam rock-pile fields in southern Arizona, probably locations of agave cultivation, strengthens the inference that they were used for leaf extraction (Fish et al. 1992). Also, Hole (1986:139) reports an unretouched chert flake from Guilá Naquitz, Oaxaca, with an agave fiber still clinging to its edge. Another flake tool dating to the Oaxaca Archaic exhibited a polished area along one edge margin ("sickle sheen") that is believed to have been caused by cutting the tough leaves of the agave plant (Flannery et al. 1981:61).

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Appendix 1: Maps Showing the Horizontal Extent of Occupation Zones in Romero's and Valenzuela's Caves

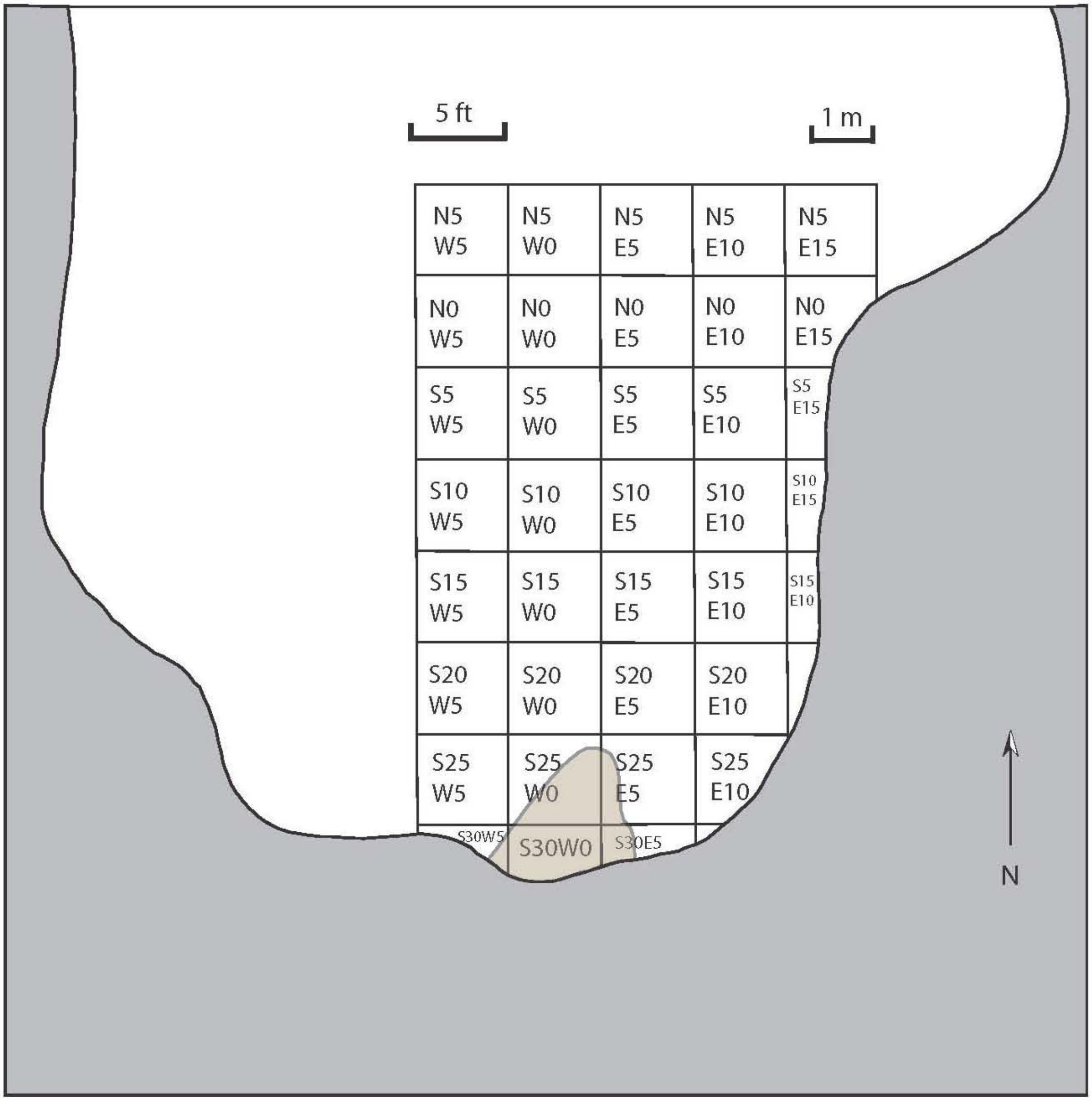


Figure A-1.1. Romero's Cave, Zone O, Occupation 1a.

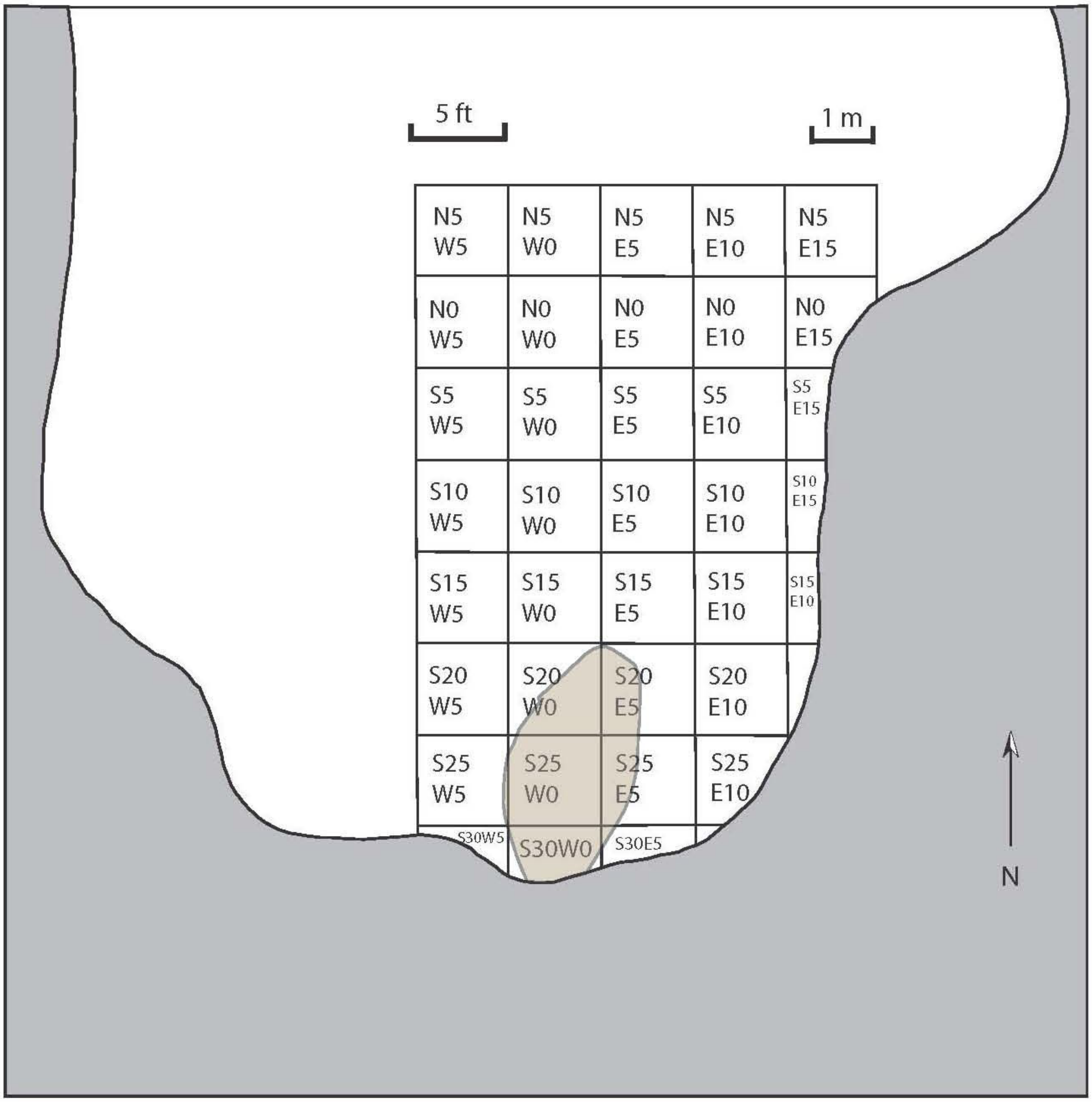


Figure A-1.2. Romero's Cave, Zone N, Occupation 1.

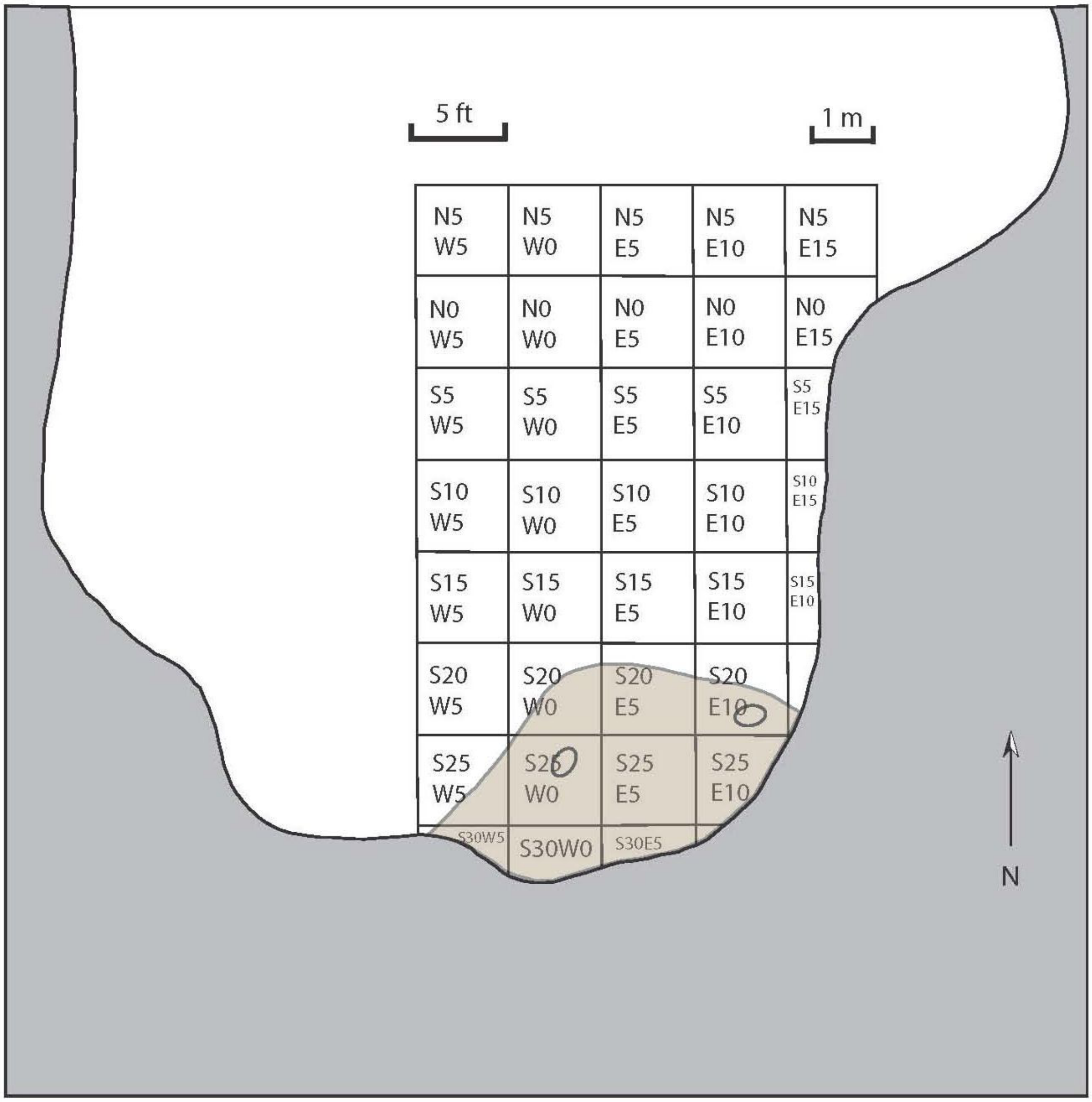


Figure A-1.3. Romero's Cave, Zone M, Occupation 2

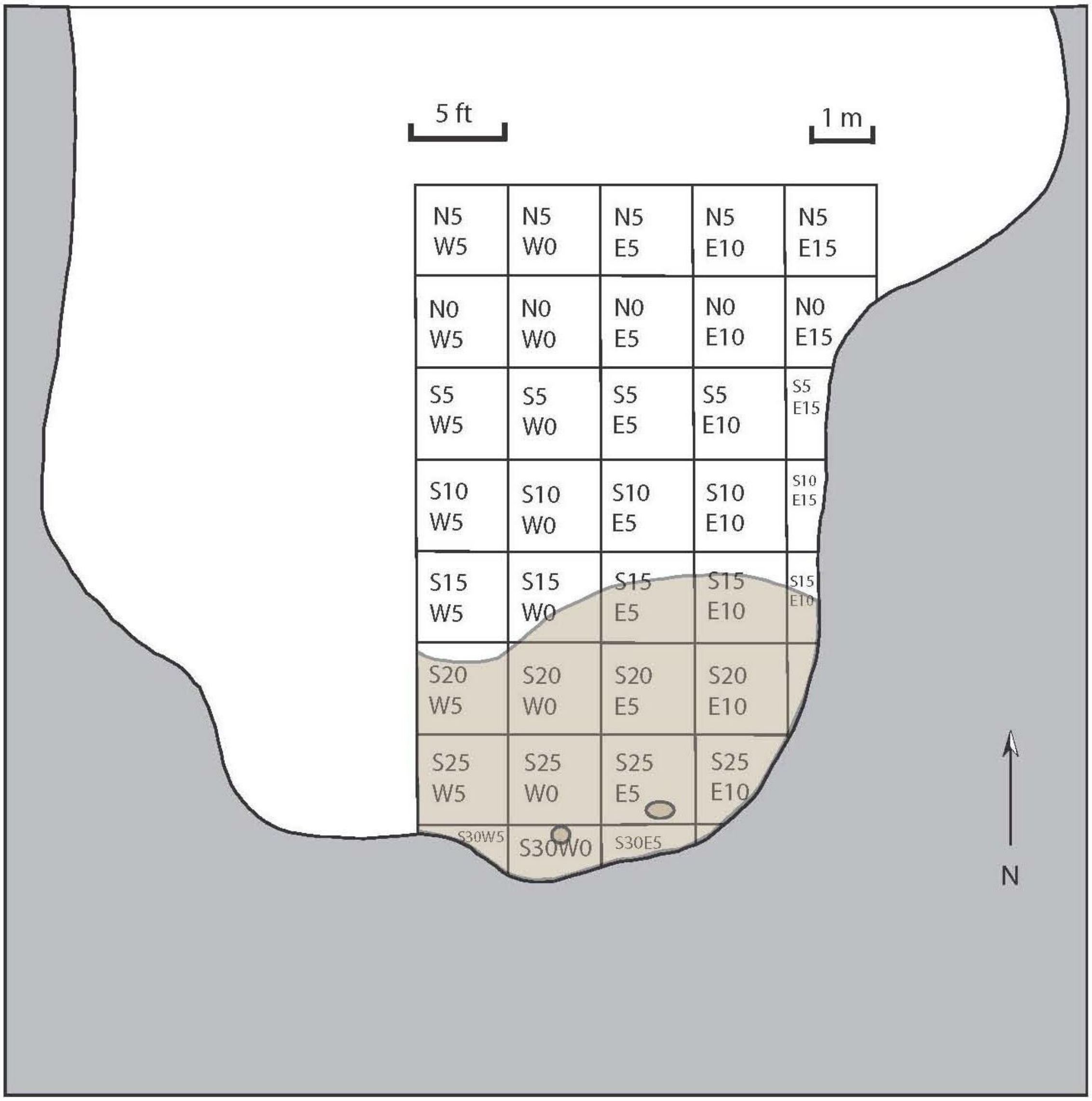


Figure A-1.4. Romero's Cave, Zone L, Occupation 4.

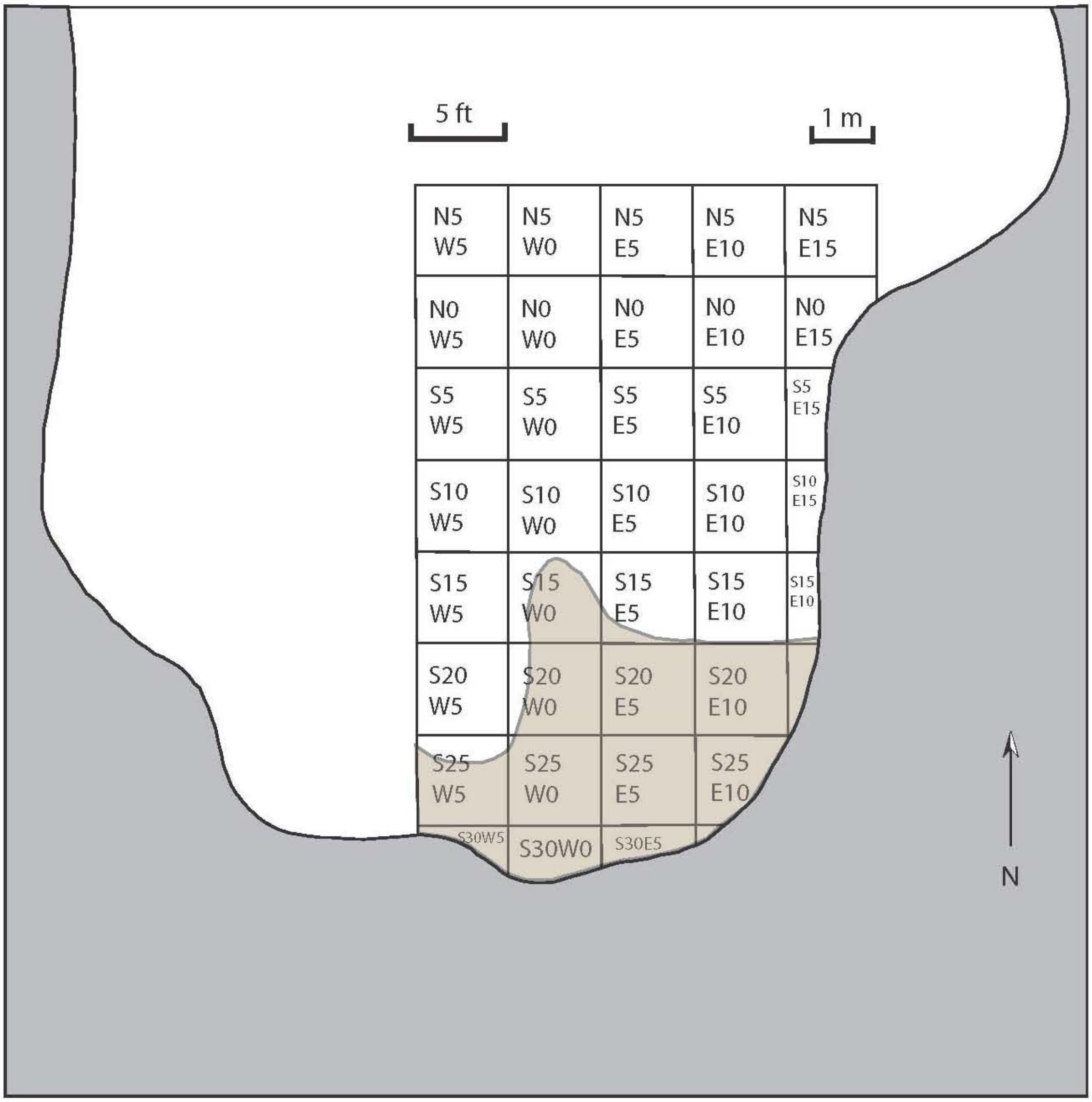


Figure A-1.5. Romero's Cave, Zone K, Occupation 5.

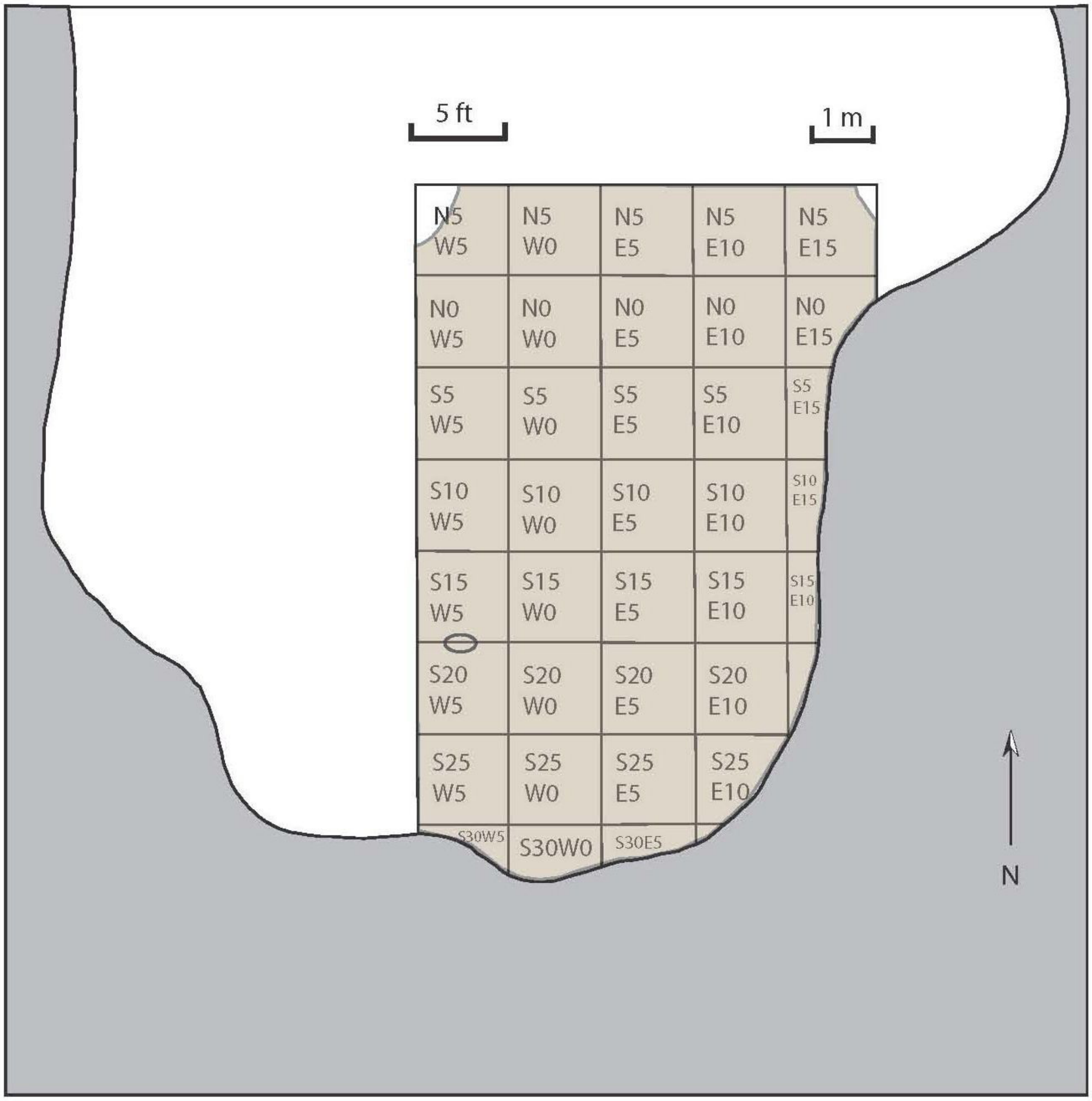


Figure A-1.6. Romero's Cave, Zone J, Occupation 6.

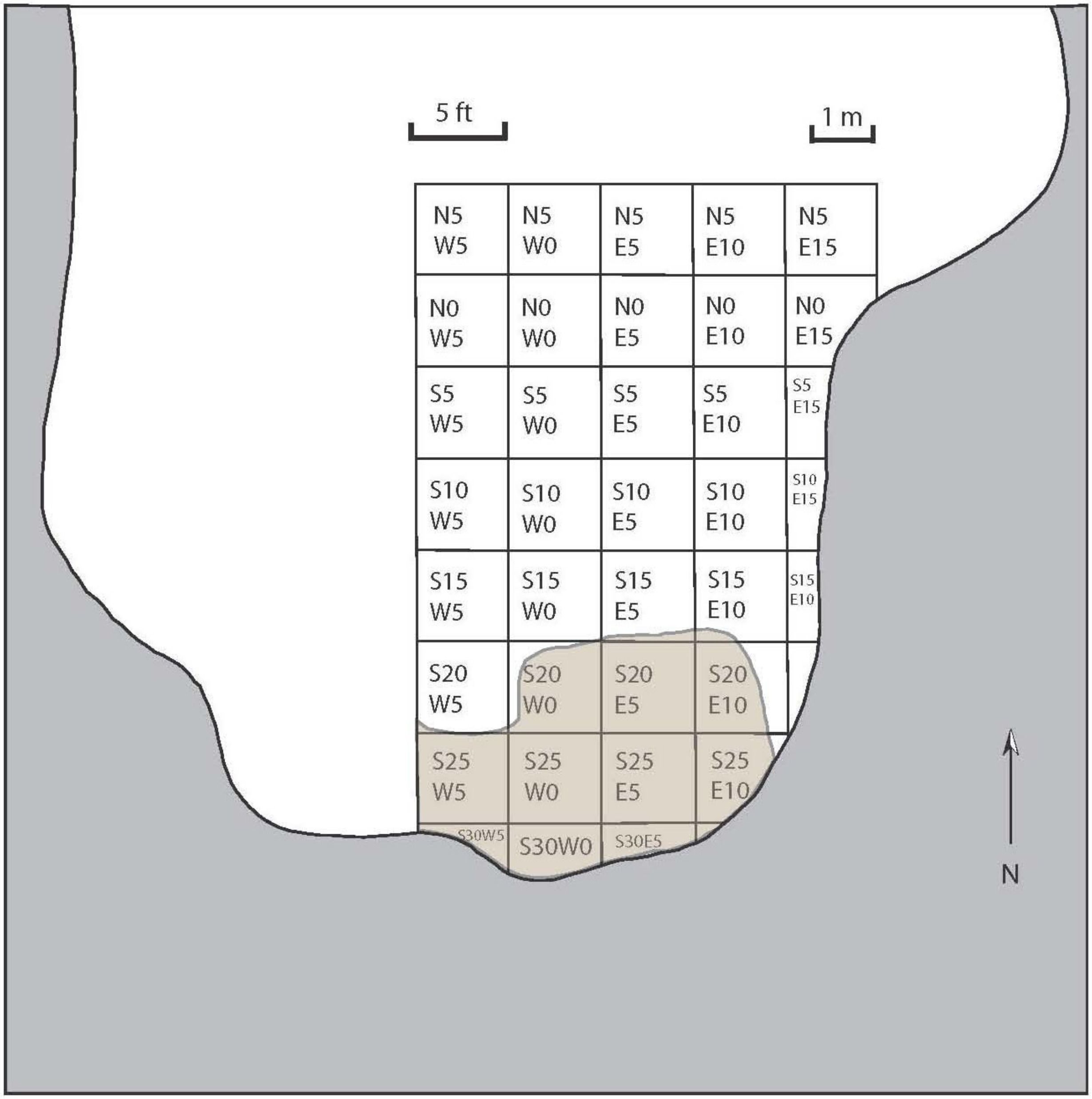


Figure A-1.7. Romero's Cave, Zone J_1, Occupation 7.

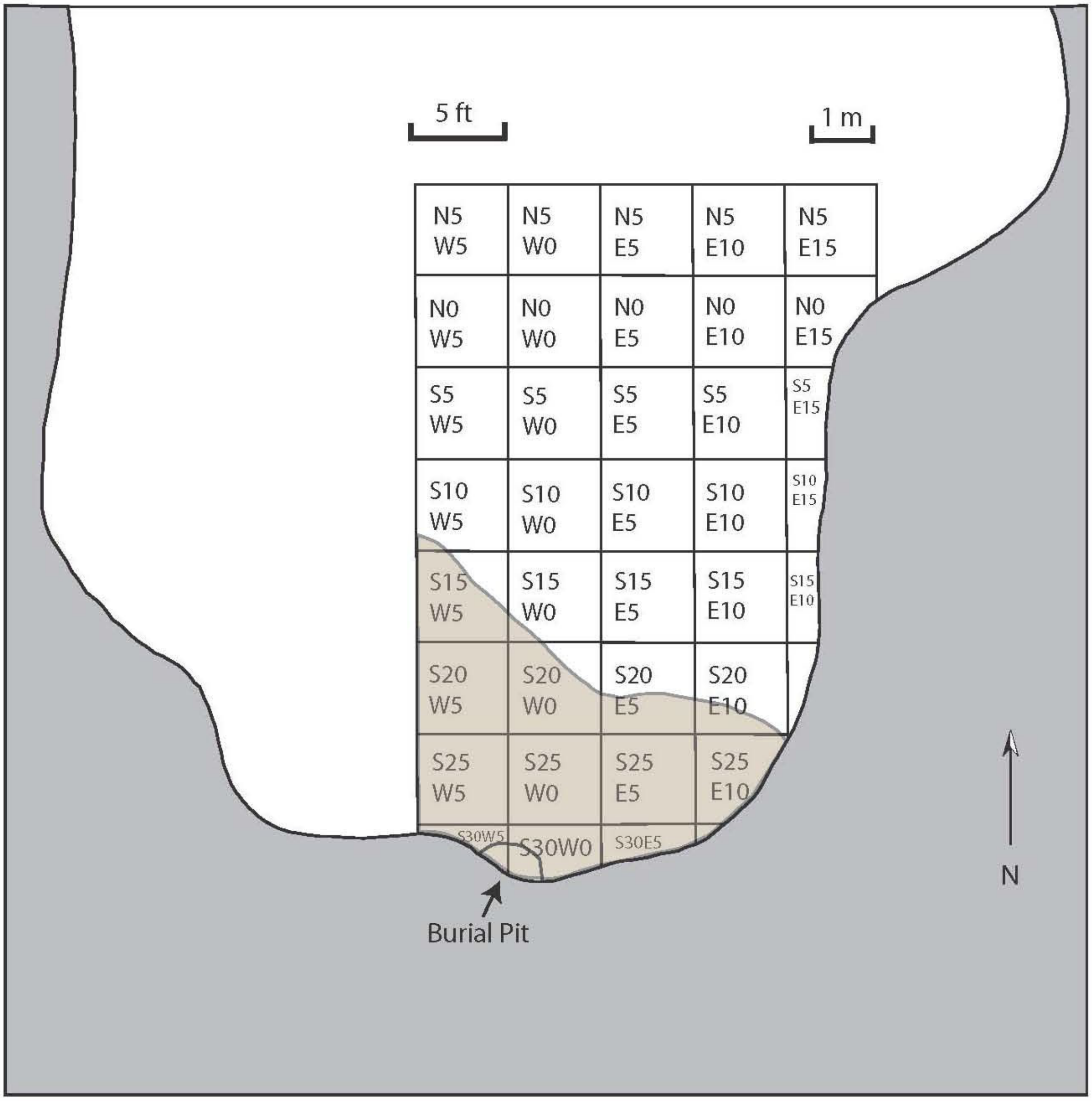


Figure A-1.8. Romero's Cave, Zone I, Occupation 8.

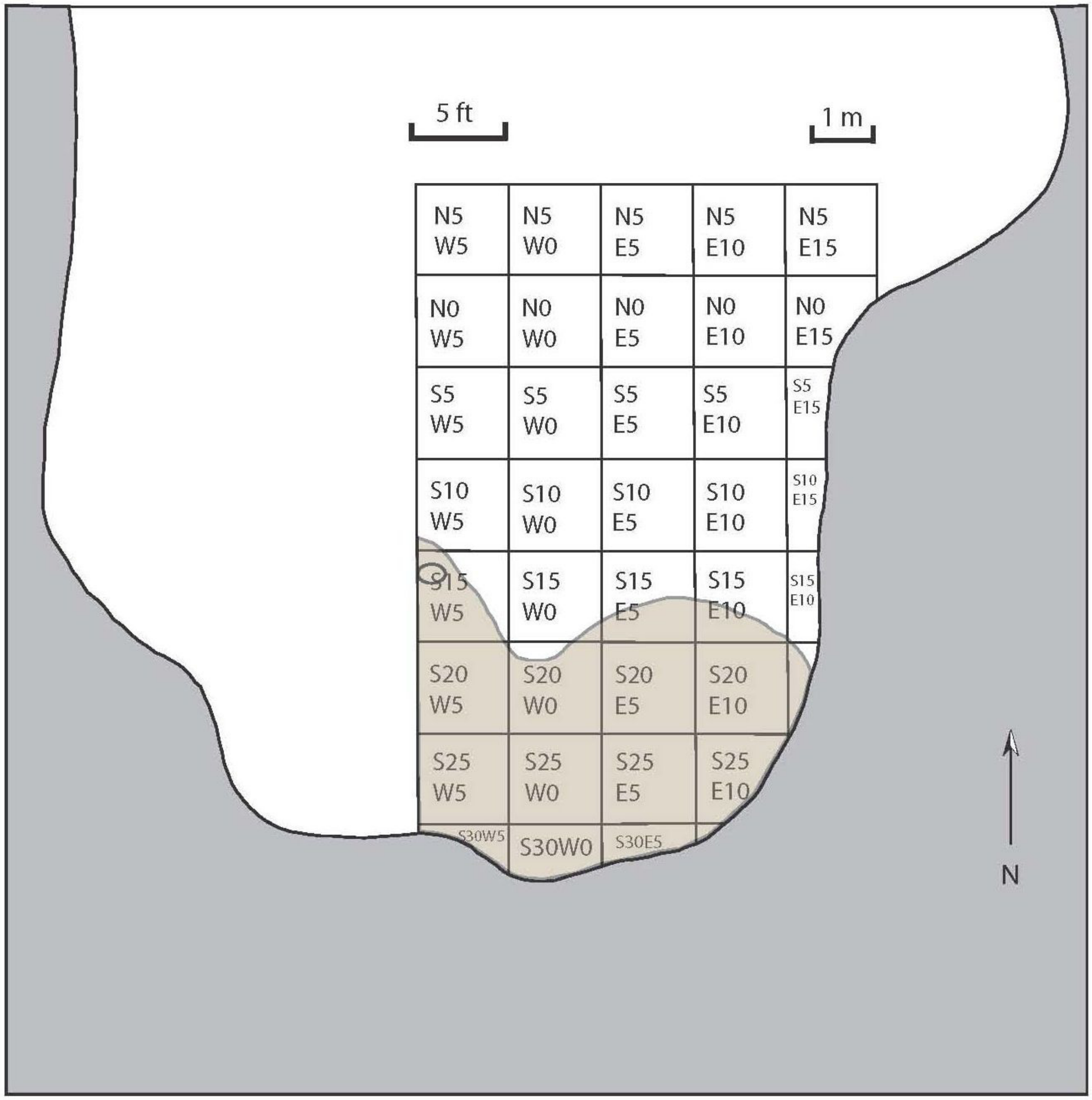


Figure A-1.9. Romero's Cave, Zone H, Occupation 9.

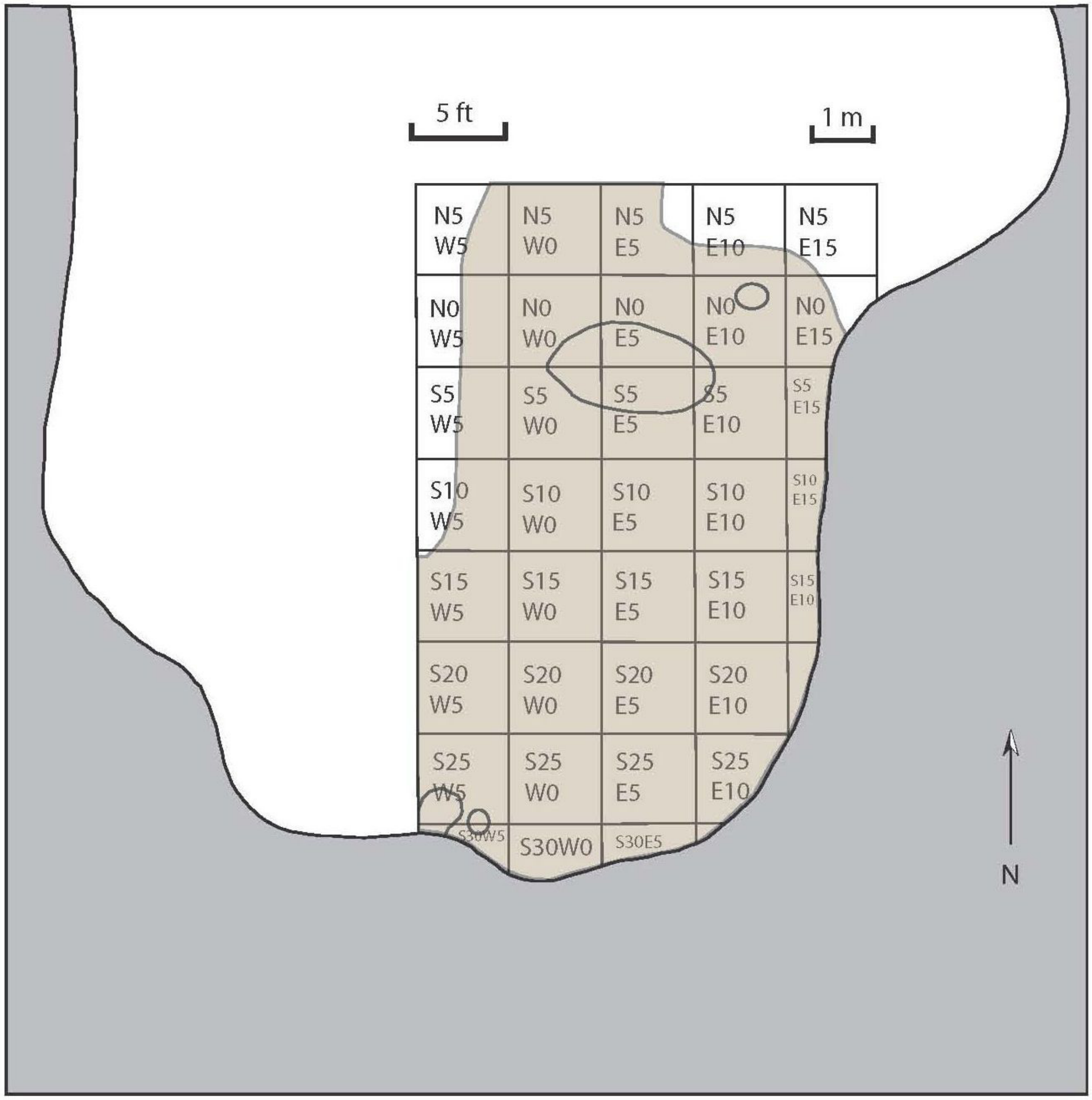


Figure A-1.10. Romero's Cave, Zone G, Occupation 10.

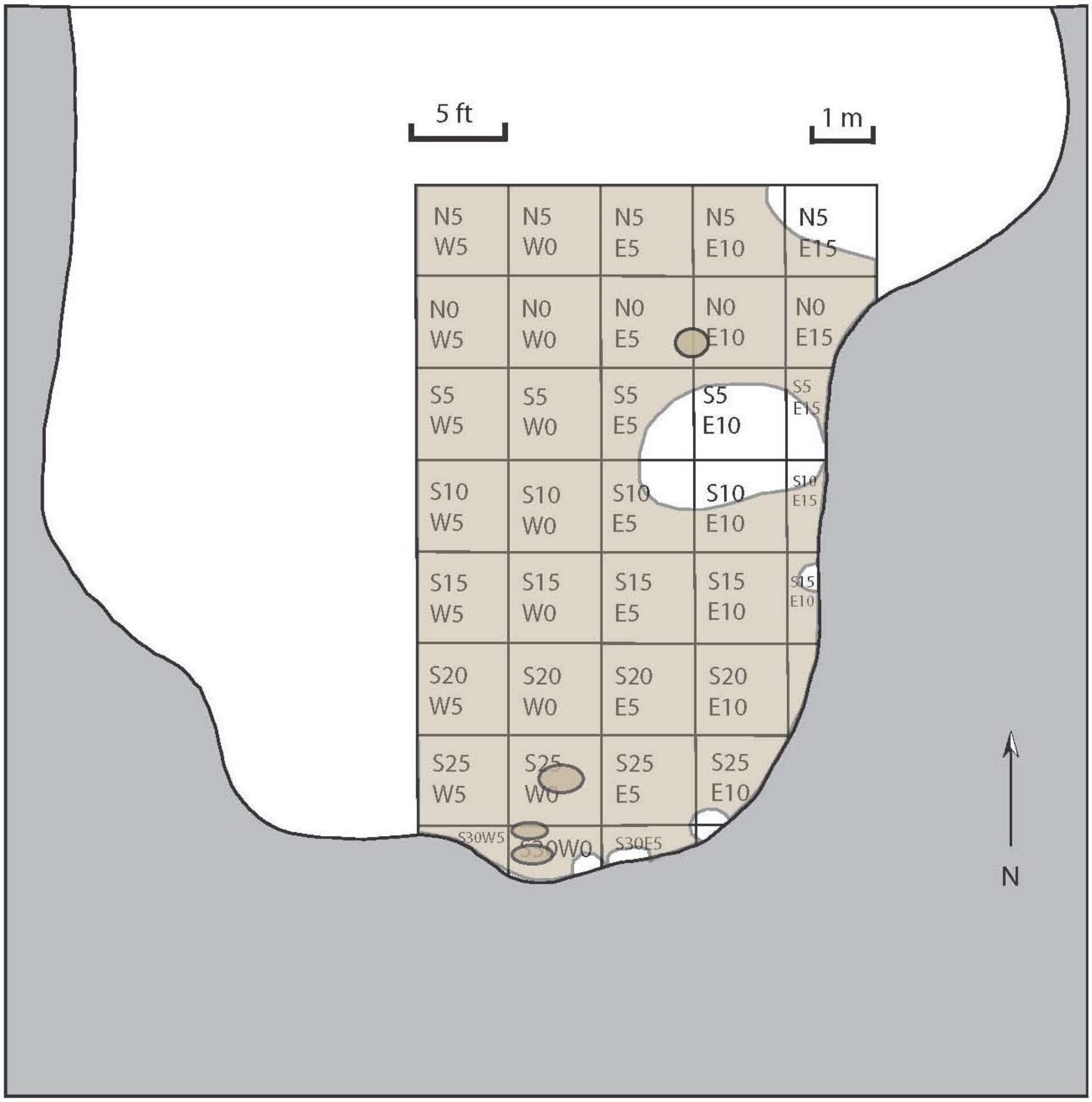


Figure A-1.11. Romero's Cave, Zone F, Occupation 11.

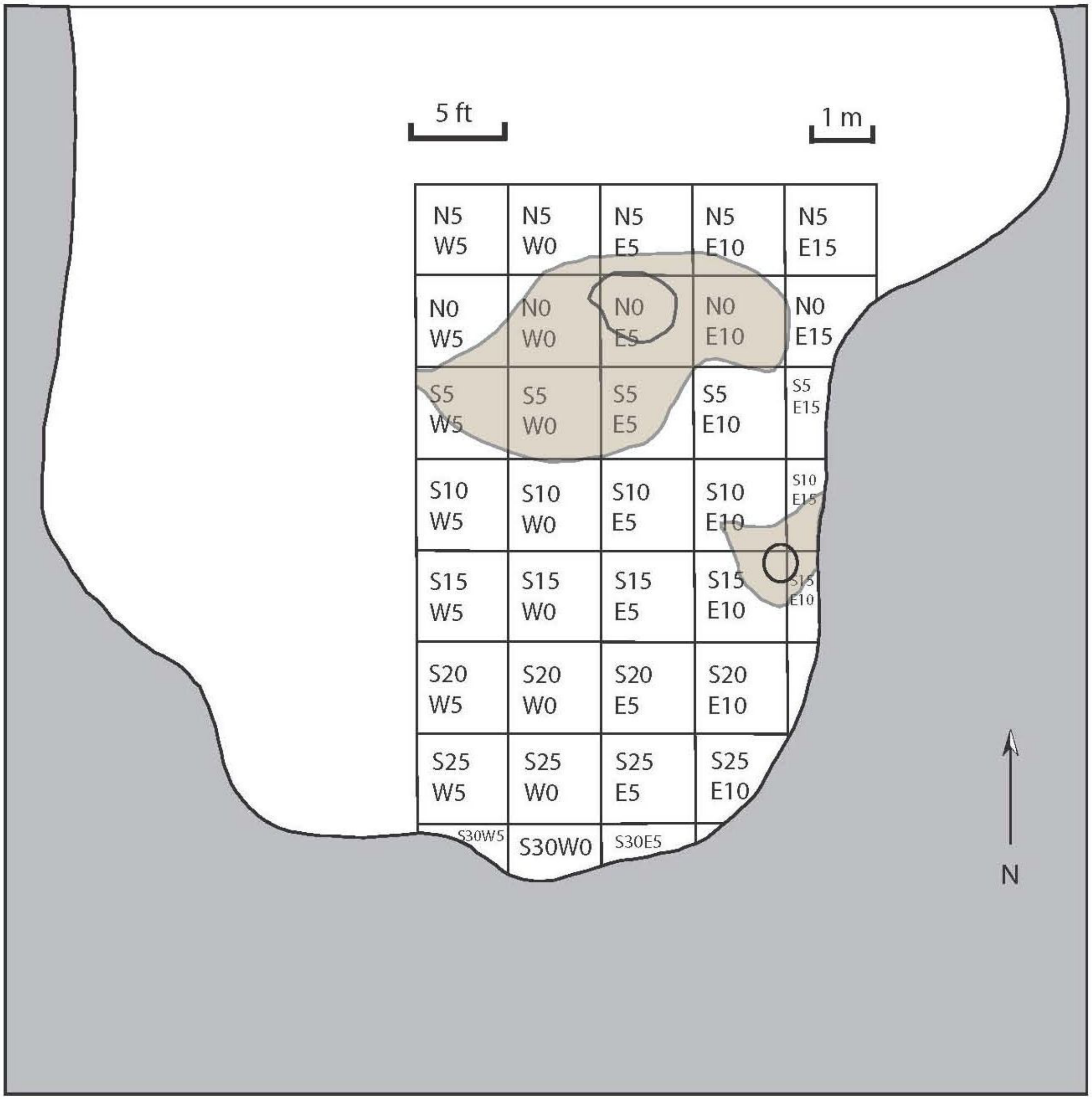


Figure A-1.12. Romero's Cave, Zone E, Occupation 12.

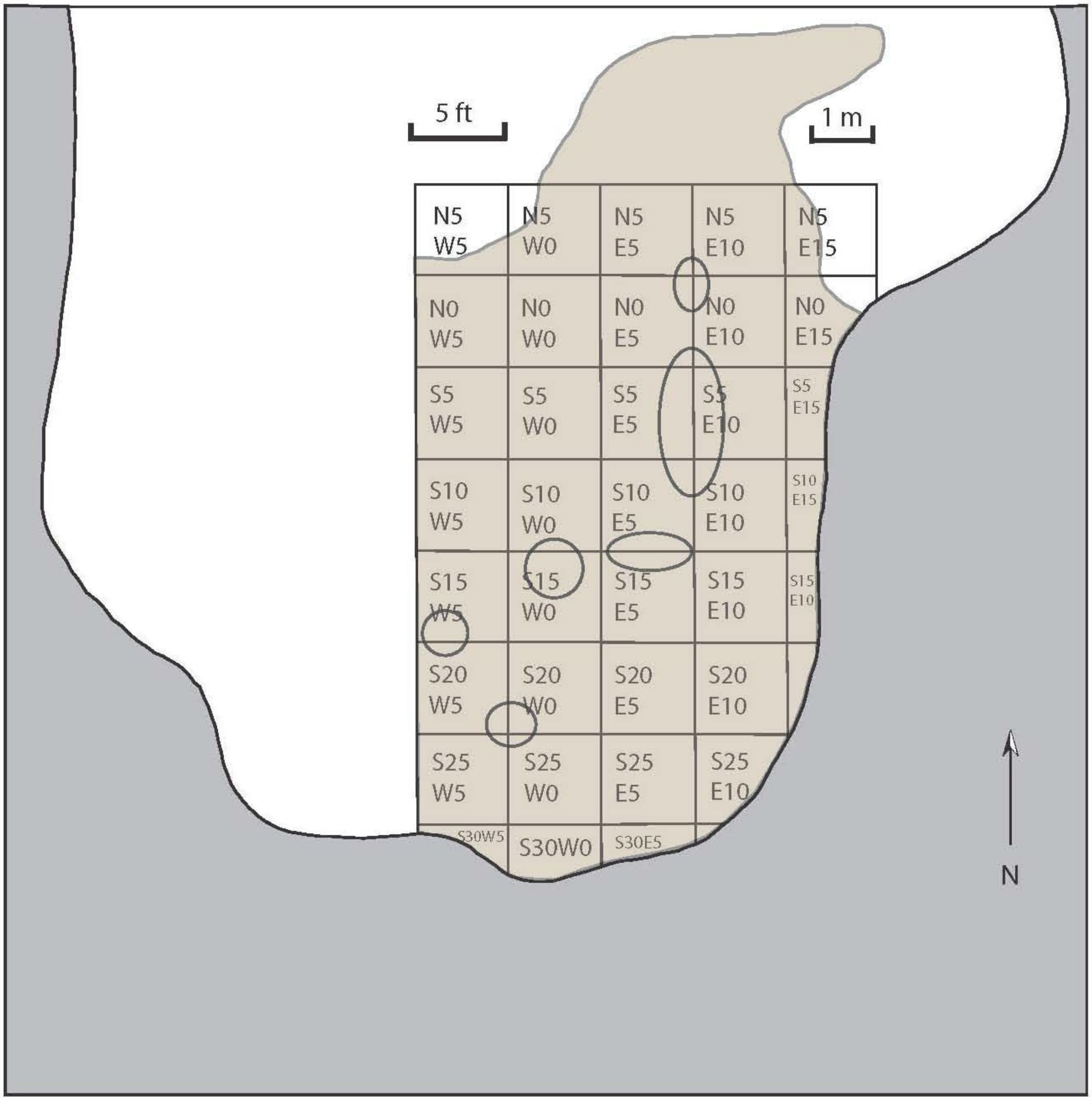


Figure A-1.13. Romero's Cave, Zone D, Occupation 13.

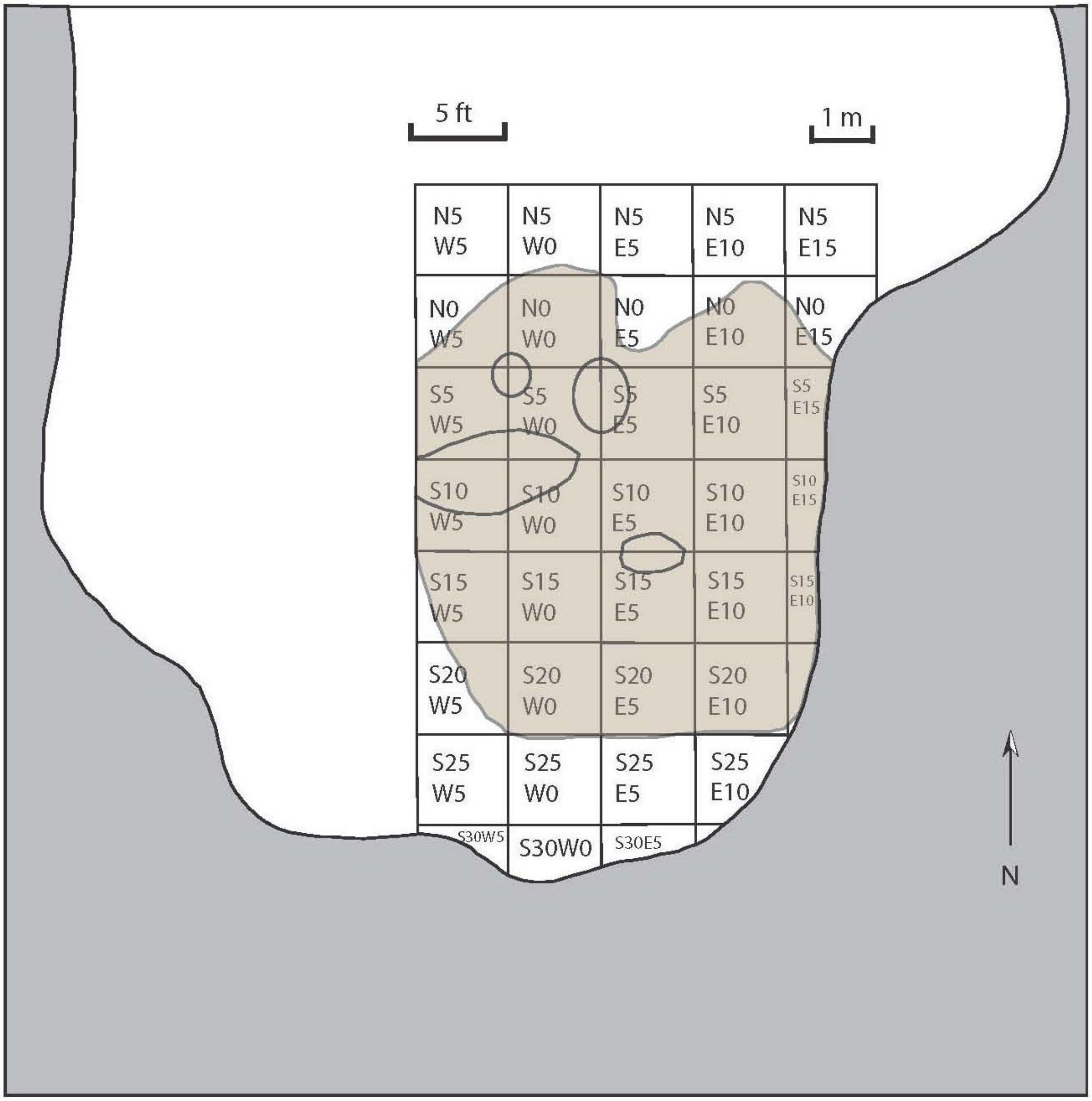


Figure A-1.14. Romero's Cave, Zone C, Occupation 14.

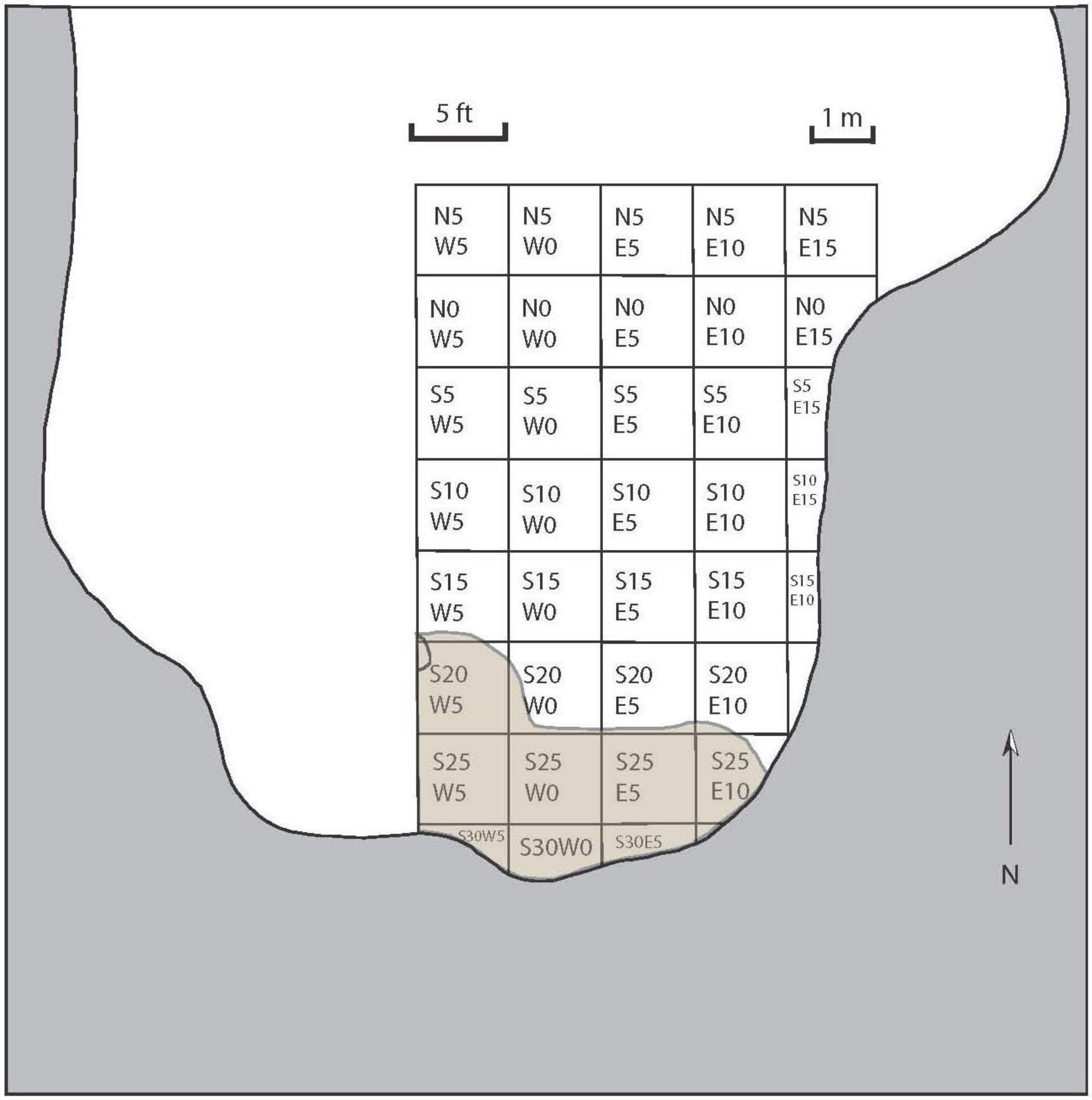


Figure A-1.15. Romero's Cave, Zone B, Occupation 15.

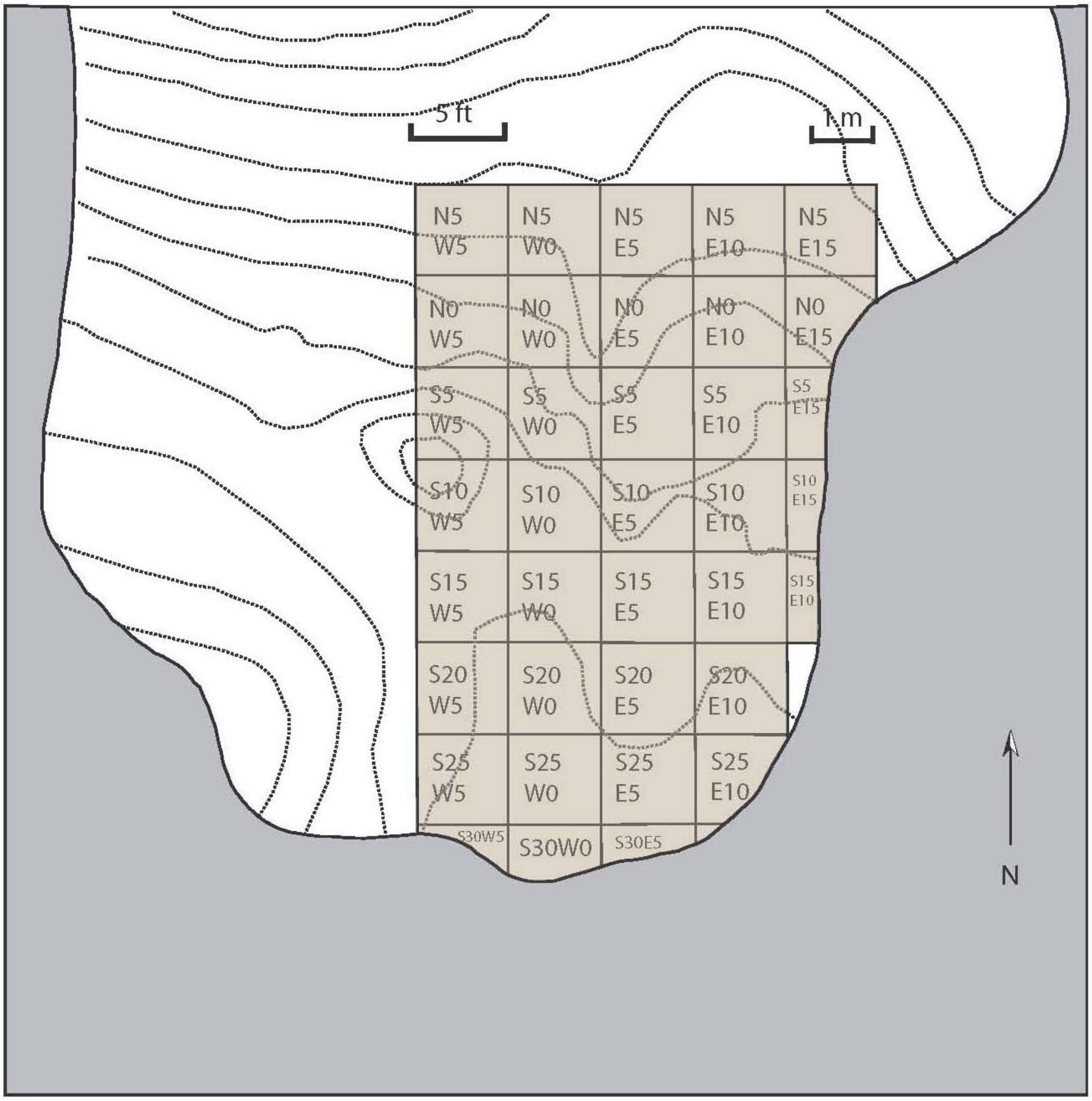


Figure A-1.16. Romero's Cave, Zone A, Occupation 16.

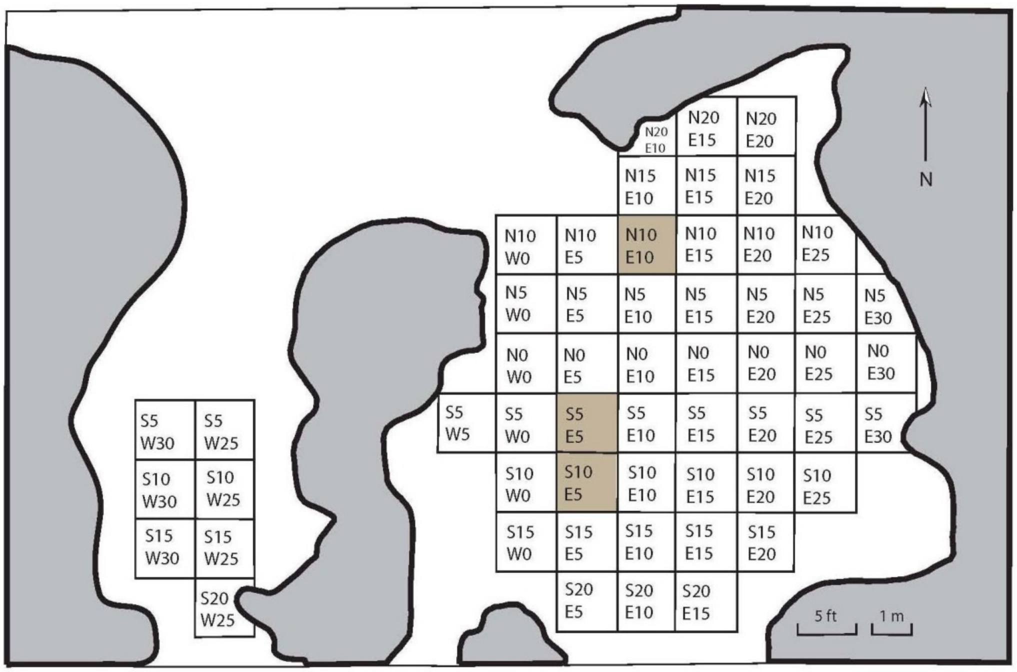


Figure A-1.17. Valenzuela's Cave, Zone J, Occupation 1.

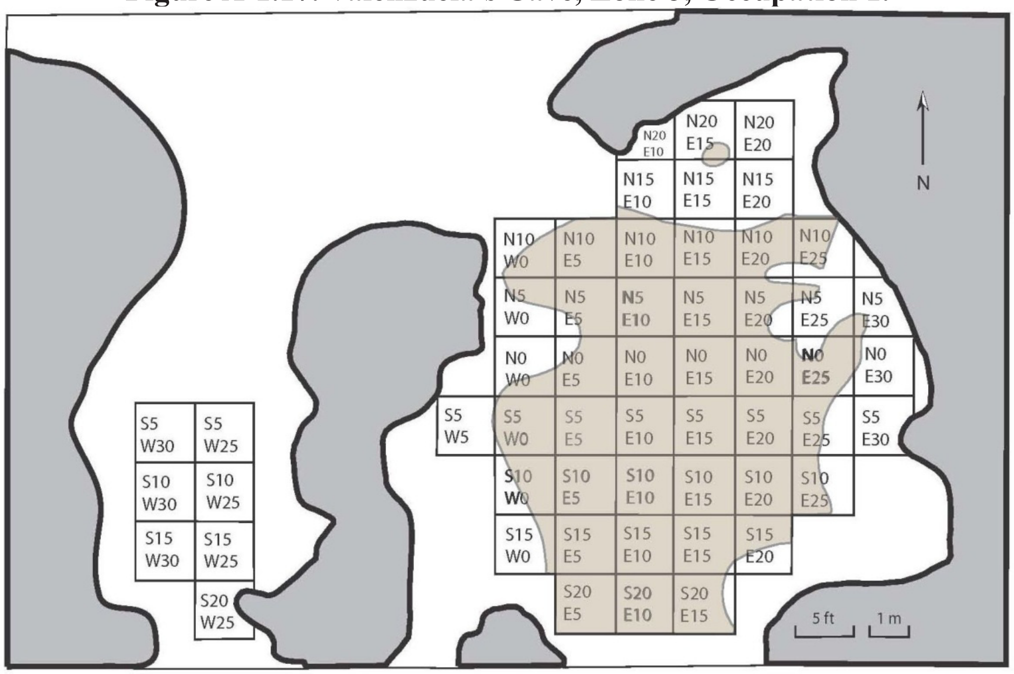


Figure A-1.18. Valenzuela's Cave, Zone I, Occupation 2.

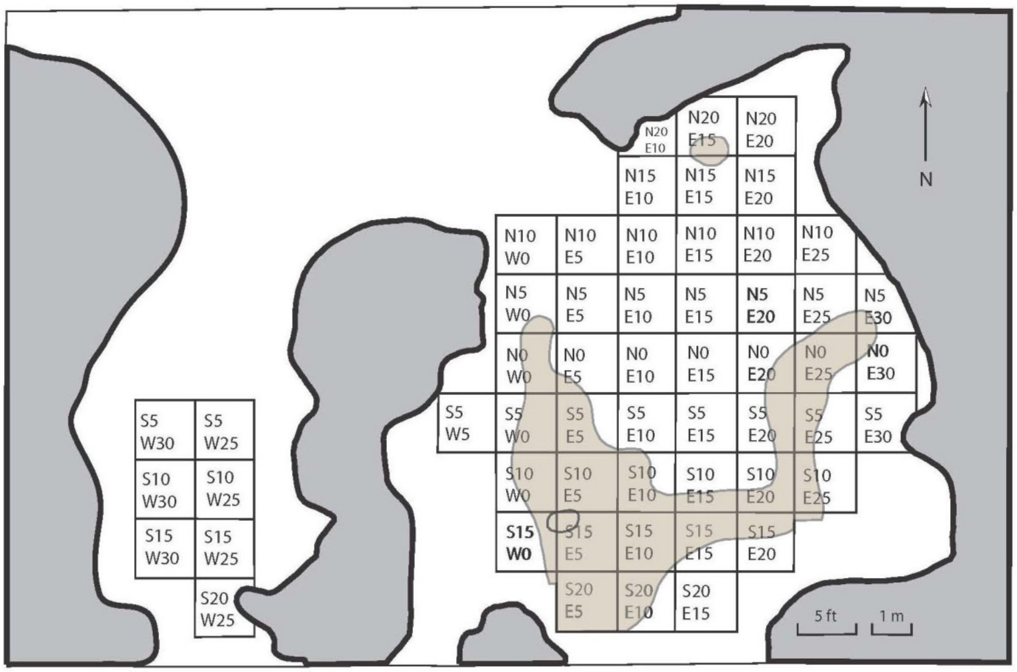


Figure A-1.19. Valenzuela's Cave, Zone H, Occupation 3.

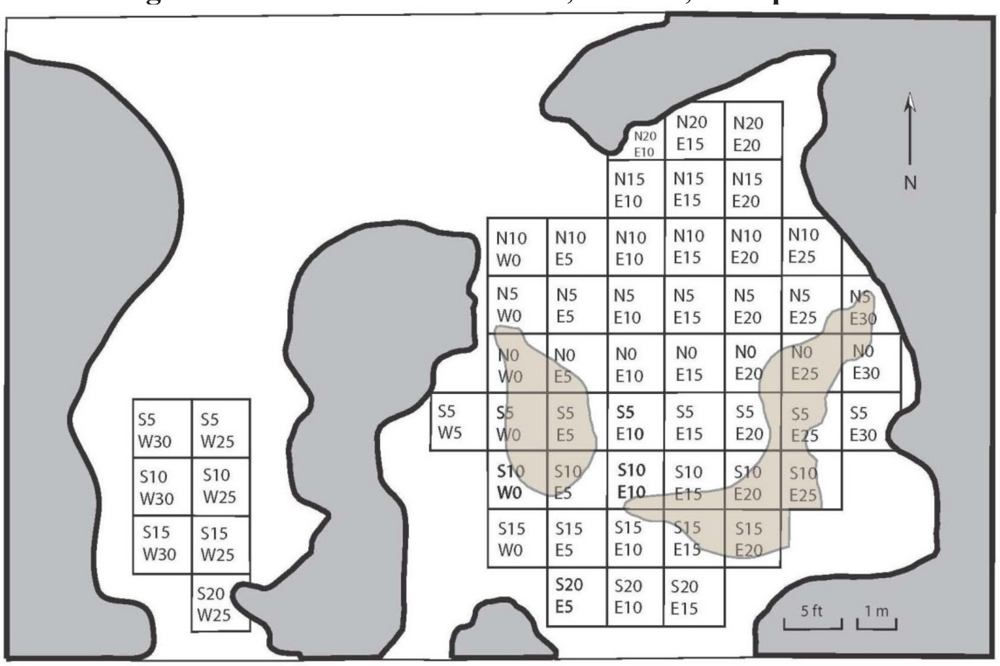


Figure A-1.20. Valenzuela's Cave, Zone G, Occupation 4.

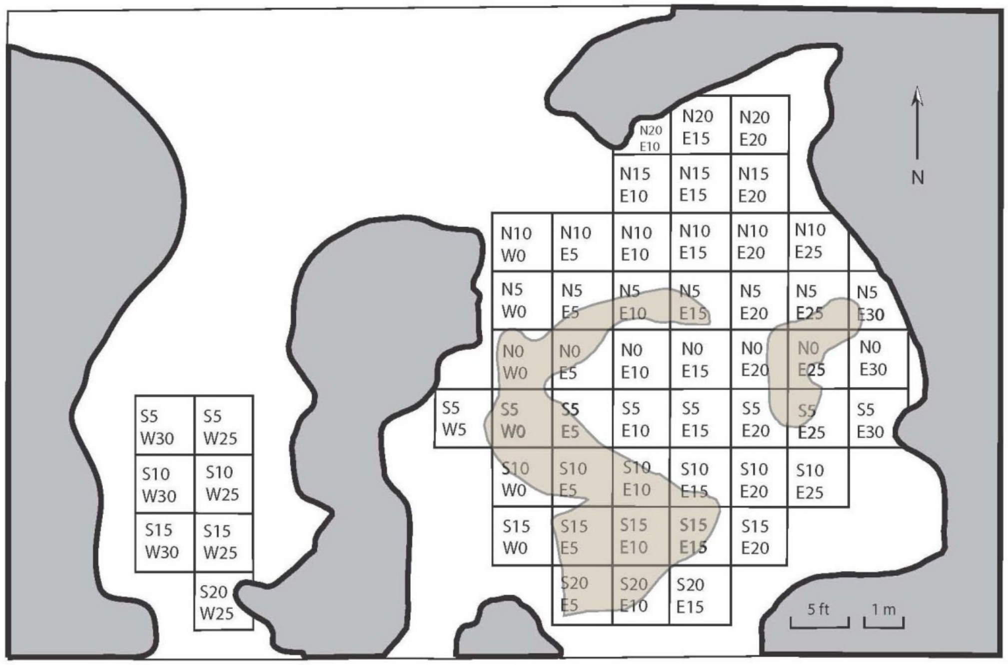


Figure A-1.21. Valenzuela's Cave, Zone E , Occupation 5.

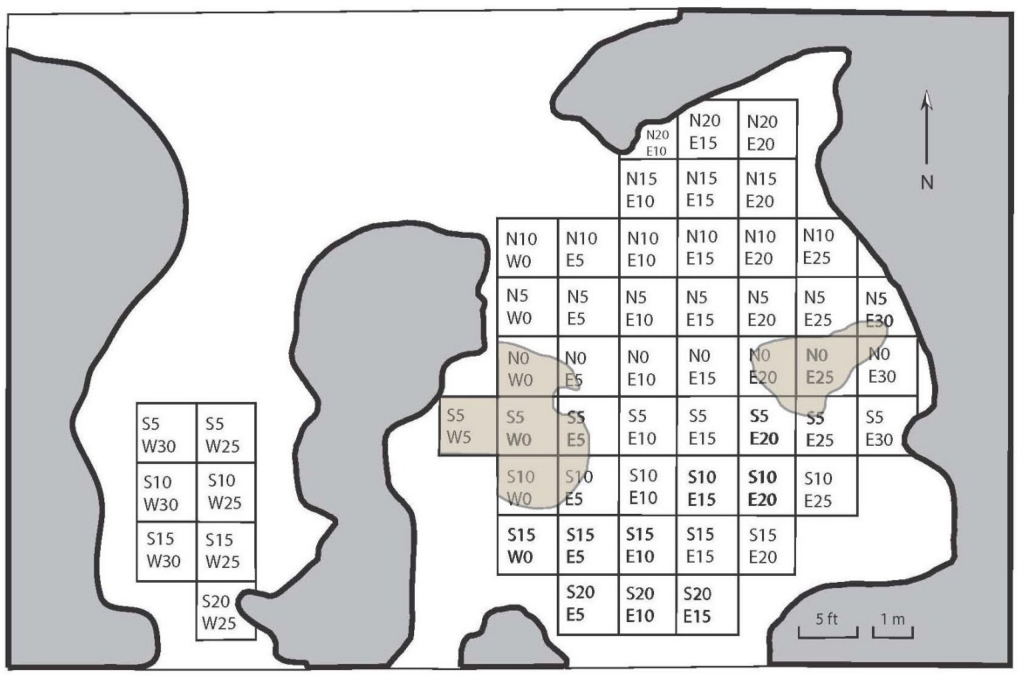


Figure A-1.22. Valenzuela's Cave, Zone C, Occupation 6.

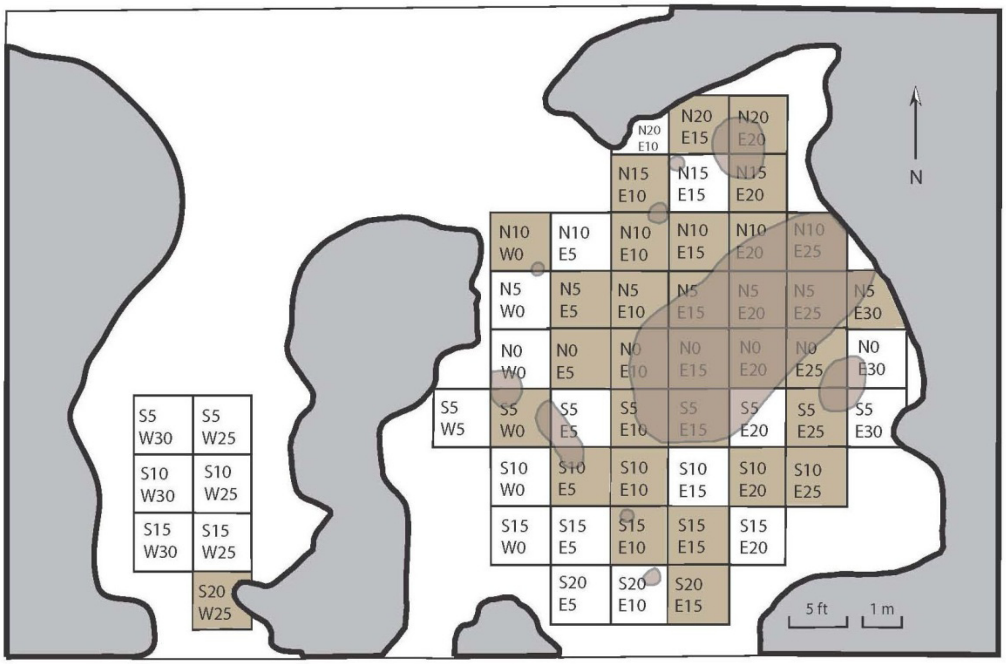


Figure A-1.23. Valenzuela's Cave, Zone B, Occupation 7.

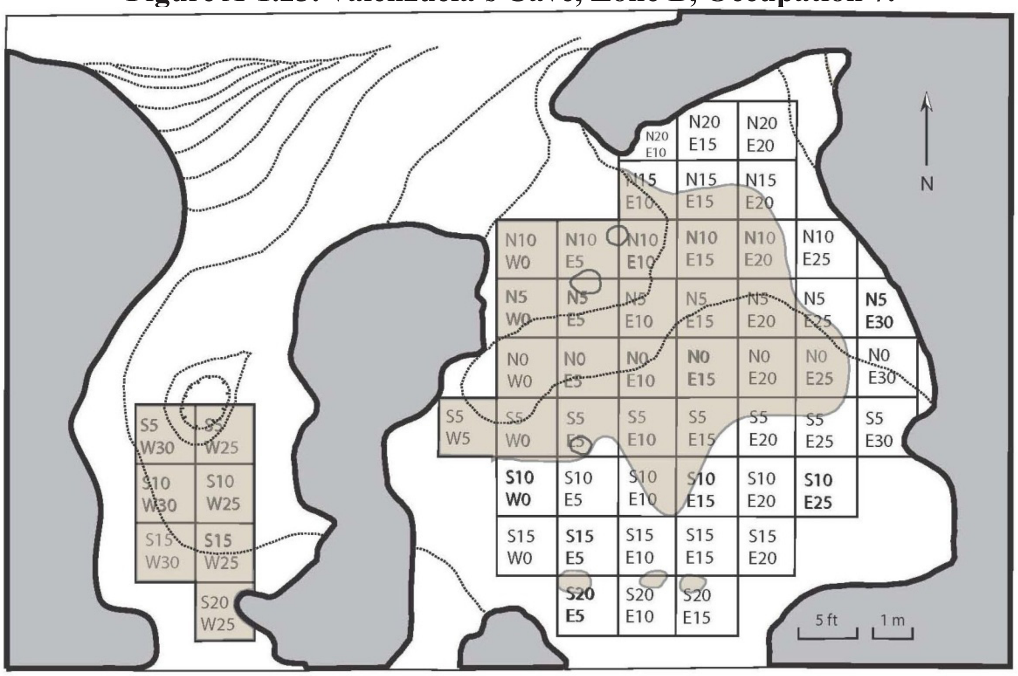


Figure A-1.24. Valenzuela's Cave, Zone A, Occupation 8

Appendix 2:

Artifacts Documented on Survey

Table A-2.1. Ceramic artifacts documented on survey.

Site:	<2cm	clay	Eslabones Red	figurine	Finer Heavy Plain	Heavy Plain	Heavy Plain Brushed	historic ceramic	Huasteca Black on White	Huasteca Fine Paste Black on White	Huasteca Red on Buff	Nogalar Black	pipe	porcelain	possible Chila White	possible Nogalar Black	possible Prisco Black	Prisco Black	Prisco Black copy	Rio Verde Pulido	Type B	Type C	Type D	undertermined plain ware	undetermined decorated	undetermined Huastec	unidentified decorated	unidentified plain ware	unidentified sherd	Zaquil Red	Total:
Cav-4-05					1	1				3													2		1				1		9
Cav-5-05			5		1																										6
Cav-7-05					2	3																									5
Cuiz-10-05	19		3		8	2												1			1									1	35
Cuiz-1-05	22	1	33	2	1	2	1		2	1			1		1									1		1	1		2	10	82
Cuiz-11-05			2		1			1										1													5
Cuiz-12-05																					2										2
Cuiz-13-05	28		10		1												2		1						1				27	10	80
Cuiz-14-05	3		1		8	2		4			1						1			2										1	23
Cuiz-15-05	2		2															1					1						1		7
Cuiz-16-05	44		19			1																							3	7	74
Cuiz-2-05	60		16	1		2								1											1				2	4	87
Cuiz-3-05	102		27		7	9	4		2							1	2		1	1									1	16	173
Cuiz-5-05	147		48			4											3									1			1	17	221
Cuiz-8-05	1		1									4									9							2			17
Cuiz-9-05	8		5		1	3		1					1			1		1		1	6	2			1			1		1	33
LS-1-07	3																												8		11
Total:	439	1	172	3	31	29	5	6	4	4	1	4	2	1	1	2	8	4	2	4	18	2	3	1	4	2	1	3	46	67	870

Table A-2.2. Debitage documented on survey.

Site:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
Cav-3-05	27	3	9	2		5	46
chert (black)	4	1					5
chert (gray)		1					1
limestone	7		2				9
limestone (silicified)	16	1	7	2		5	31
Cav-5-05	9	1	4				14
chert (black)	1						1
chert (pink)		1					1
limestone	4		1				5
limestone (silicified)	4		3				7
Cav-7-05	5		3		1		9
chert (black)	2						2
limestone			1		1		2
limestone (silicified)	3		2				5
Cuiz-10-05	9		9				18
chert (black)	1						1
limestone	8		9				17
Cuiz-1-05	14	2	25	8		10	59
chert (black)	3		1	1			5
chert (gray)	3	2		1		1	7
chert (tan)			1				1
limestone	7		23	3		8	41
limestone (green fine)	1						1
limestone (silicified)						1	1
obsidian				3			3
Cuiz-11-05	1						1
chert (black)	1						1
Cuiz-13-05	1		1			2	4
chert (gray)	1					1	2
limestone			1				1
obsidian						1	1
Cuiz-14-05	7		9				16
chert (gray)	2						2
limestone	5		9				14

Table A-2.2, continued.

Site:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
Cuiz-15-05			3				3
chert (gray)			1				1
limestone			2				2
Cuiz-16-05	12		4	1		2	19
chert (black)	1						1
chert (brown)	1						1
chert (gray)	2			1		1	4
chert (pink)						1	1
limestone	6		4				10
limestone (silicified)	2						2
Cuiz-2-05	23	1	34	2	1	10	71
chert (black)	2						2
chert (gray)	9	1	11	2		9	32
chert (mottled)	1						1
chert (pink)	1						1
chert (white/tan)			1				1
limestone	9		18		1	1	29
limestone (green coarse)			3				3
limestone (silicified)	1		1				2
Cuiz-3-05	18	2	19	17		6	62
chert			1				1
chert (black)	4		1			1	6
chert (gray)	4	2	4	9		2	21
chert (mottled)	1						1
chert (tan)			1				1
limestone	6		12	7		3	28
limestone (silicified)	2			1			3
obsidian	1						1
Cuiz-5-05	27	8	33	16		23	107
chert (black)			2			1	3
chert (gray)	10	3	8	10		9	40
chert (mottled)	4						4
chert (pink)	3	1	1			3	8
chert (tan)		1				1	2
limestone	9	2	20	4		7	42

Table A-2.2, continued.

Site:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
limestone (green fine)	1	1	2	1		1	6
limestone (silicified)						1	1
obsidian				1			1
Cuiz-8-05	2		1				3
chert (gray)	1						1
limestone	1		1				2
Cuiz-9-05	1		2				3
limestone	1		2				3
LS-1-07	6	3	11	1	1	13	35
chert (black)	5		2			5	12
chert (gray)	1	2	1	1		6	11
chert (white)		1	2			1	4
limestone			6		1	1	8
Total:	162	20	167	47	3	71	470

Table A-2.3. Debitage documented on survey, by cortex.

Site:	Material type:	Cortex:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
Cav-3-05	chert (black)	absent	4	1					5
	chert (gray)	absent		1					1
	limestone	absent	7		2				9
	limestone (silicified)	absent	16	1	7	2		5	31
Cav-3-05 Total			27	3	9	2		5	46
Cav-5-05	chert (black)	absent	1						1
	chert (pink)	absent		1					1
	limestone	absent	1						1
		nodular	2		1				3
		waterworn	1						1
	limestone (silicified)	absent	1		1				2
		waterworn	3		2				5
Cav-5-05 Total			9	1	4				14
Cav-7-05	chert (black)	absent	1						1
		nodular	1						1
	limestone	absent			1		1		2
	limestone (silicified)	absent	2						2
		waterworn	1		2				3
Cav-7-05 Total			5		3		1		9
Cuiz-1-05	chert (black)	absent	2		1	1			4
		nodular	1						1
	chert (gray)	absent	1	2		1			4
		nodular	2					1	3
	chert (tan)	nodular			1				1
	limestone	absent	5		9	1		8	23
		nodular	2		11	2			15
		undet.			1				1
		waterworn			2				2
	limestone (green fine)	absent	1						1
	limestone (silicified)	nodular						1	1
	obsidian	absent				3			3
Cuiz-1-05 Total			14	2	25	8		10	59
Cuiz-2-05	chert (black)	absent	1						1
		nodular	1						1
	chert (gray)	absent	7	1	4	2		9	23

Table A-2.3, continued.

Site:	Material type:	Cortex:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
		matrix	1						1
		nodular			5				5
		tabular			2				2
		undet.	1						1
	chert (mottled)	nodular	1						1
	chert (pink)	nodular	1						1
	chert (white/tan)	undet.			1				1
	limestone	absent	8		11		1	1	21
		nodular	1		7				8
	limestone (green coarse)	tabular			3				3
	limestone (silicified)	absent			1				1
		nodular	1						1
Cuiz-2-05 Total			23	1	34	2	1	10	71
Cuiz-3-05	chert	nodular			1				1
	chert (black)	absent	3					1	4
		tabular	1		1				2
	chert (gray)	absent	2	2	3	8		2	17
		nodular	2		1				3
		undet.				1			1
	chert (mottled)	absent	1						1
	chert (tan)	absent			1				1
	limestone	absent	6		10	7		3	26
		nodular			2				2
	limestone (silicified)	absent	1			1			2
		waterworn	1						1
	obsidian	absent	1						1
Cuiz-3-05 Total			18	2	19	17		6	62
Cuiz-5-05	chert (black)	absent			2			1	3
	chert (gray)	absent	5	3	7	10		9	34
		nodular	3		1				4
		tabular	1						1
		undet.	1						1
	chert (mottled)	absent	4						4
	chert (pink)	absent	3	1				2	6
		undet.			1			1	2
	chert (tan)	absent		1				1	2

Table A-2.3, continued.

Site:	Material type:	Cortex:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
	limestone	absent	5	2	10	4		4	25
		nodular	4		9			3	16
		waterworn			1				1
	limestone (green fine)	absent		1	2	1		1	5
		tabular	1						1
	limestone (silicified)	absent						1	1
	obsidian	absent				1			1
Cuiz-5-05 Total			27	8	33	16		23	107
Cuiz-8-05	chert (gray)	absent	1						1
	limestone	absent	1		1				2
Cuiz-8-05 Total			2		1				3
Cuiz-9-05	limestone	absent	1		2				3
Cuiz-9-05 Total			1		2				3
Cuiz-10-05	chert (black)	absent	1						1
	limestone	absent	8		9				17
Cuiz-10-05 Total			9		9				18
Cuiz-11-05	chert (black)	absent	1						1
Cuiz-11-05 Total			1						1
Cuiz-13-05	chert (gray)	absent	1					1	2
	limestone	absent			1				1
	obsidian	absent						1	1
Cuiz-13-05 Total			1		1			2	4
Cuiz-14-05	chert (gray)	nodular	1						1
		waterworn	1						1
	limestone	absent	4		8				12
		nodular	1		1				2
Cuiz-14-05 Total			7		9				16
Cuiz-15-05	chert (gray)	nodular			1				1
	limestone	nodular			2				2
Cuiz-15-05 Total					3				3
Cuiz-16-05	chert (black)	absent	1						1
	chert (brown)	absent	1						1
	chert (gray)	absent	1			1		1	3
		nodular	1						1
	chert (pink)	absent						1	1
	limestone	absent	6		4				10

Table A-2.3, continued.

Site:	Material type:	Cortex:	angular debris	biface flake	core flake	microdebitage	opposing core flake	undetermined flake fragment	Total:
	limestone (silicified)	absent	2						2
Cuiz-16-05 Total			12		4	1		2	19
LS-1-07	chert (black)	absent	4		2			5	11
		nodular	1						1
	chert (gray)	absent		2	1	1		5	9
		nodular	1					1	2
	chert (white)	absent			1			1	2
		nodular			1				1
		undet.		1					1
	limestone	absent			3			1	4
		nodular			3		1		4
LS-1-07 Total			6	3	11	1	1	13	35
Total:			162	20	167	47	3	71	470

Table A-2.4. Chipped stone tools documented on survey.

Site:	Material type	**biface**	**blade**	**cobble biface**	**discoid scraper**	**notch**	**projectile point**	**retouched piece**	**tabular knife**	**uniface**	**Total:**
Cav-3-05	limestone							1		1	2
Cav-3-05 Total								1		1	2
Cav-4-05	limestone				1						1
Cav-4-05 Total					1						1
Cav-5-05	limestone									1	1
	limestone (silicified)			1				1			2
Cav-5-05 Total				1				1		1	3
Cav-7-05	limestone								3		3
	limestone (silicified)								3		3
Cav-7-05 Total									6		6
Cuiz-1-05	chert (gray)	2									2
	limestone	1		1	1		1	1			5
Cuiz-1-05 Total		3		1	1		1	1			7
Cuiz-2-05	chert (gray)	5					3				8
	chert (white/tan)						2				2
	limestone	1									1
	obsidian		1								1
Cuiz-2-05 Total		6	1				5				12
Cuiz-3-05	chert (black)	1									1
	chert (gray)	1					3				4
	limestone	2									2
	limestone (silicified)			1							1
	obsidian		3					1			4
Cuiz-3-05 Total		4	3	1			3	1			12
Cuiz-5-05	chert (gray)						2				2
	chert (white/tan)						2				2
	limestone	1		1			1	1			4
	limestone (green fine)						1				1
	limestone (silicified)							1			1
	obsidian		1								1
Cuiz-5-05 Total		1	1	1			6	2			11
Cuiz-13-05	chert (black)						1				1
	chert (gray/brown)	1									1
	obsidian		1								1
Cuiz-13-05 Total		1	1				1				3
Cuiz-14-05	obsidian		1								1
Cuiz-14-05 Total			1								1
Cuiz-15-05	chert (gray)						1				1
Cuiz-15-05 Total							1				1
Cuiz-16-05	obsidian		3								3
Cuiz-16-05 Total			3								3
LS-1-07	chert (gray)					1	1				2
	chert (white)	1									1
	limestone					1		1			2
LS-1-07 Total		1				2	1	1			5
Total:		16	10	4	2	2	18	7	6	2	67

Table A-2.5. Cores documented on survey.

Site:	core (bidirectional)	core (bipolar)	core (multi-directional)	core (single-directional)	core fragment	hammerstone	tested material	Total:
Cav-5-05		1		2			1	4
chert (black)		1						1
limestone				2				2
limestone (silicified)							1	1
Cav-7-05				1		1		2
limestone				1		1		2
Cuiz-1-05			1	1				2
limestone			1	1				2
Cuiz-2-05				1	2	1		4
chert (gray)					2			2
limestone				1				1
limestone (silicified)						1		1
Cuiz-3-05			1	4				5
chert (gray)				2				2
limestone			1	2				3
Cuiz-5-05			1	1				2
chert (black)				1				1
chert (gray)			1					1
Cuiz-10-05			1					1
chert (black)			1					1
Cuiz-14-05							1	1
limestone							1	1
Cuiz-15-05				1				1
limestone (silicified)				1				1
LS-1-07	1			2				3
chert (gray)	1			1				2
limestone				1				1
Total:	1	1	4	13	2	2	2	25

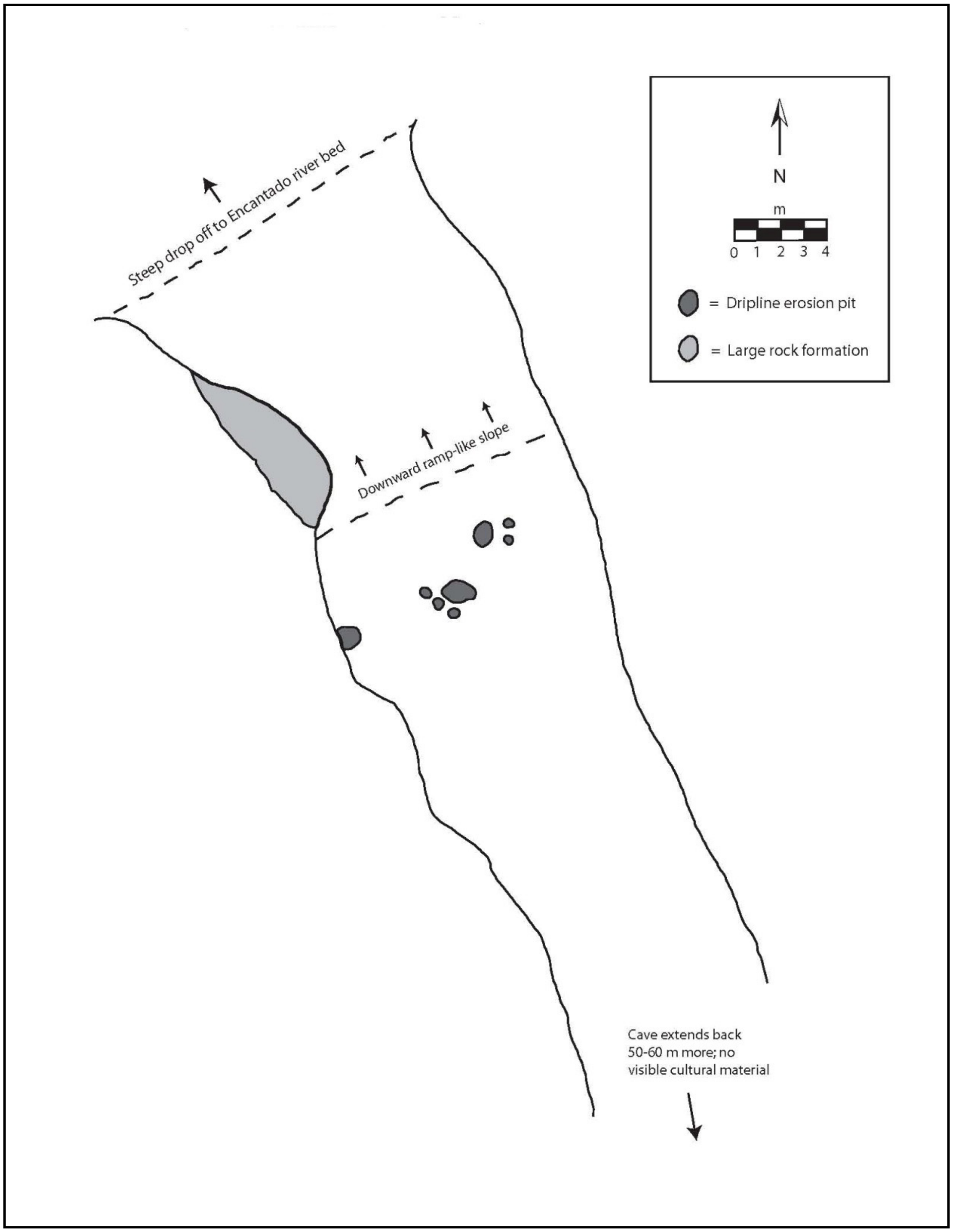
Table A-2.6. Ground stone items documented on survey.

Site:	axe head	bead	mano (one-hand)	mano (two-hand)	manuport	metate fragment (basin)	metate fragment (slab)	pestle	polished cobble	stone bowl	undetermined ground stone	undetermined mano fragment	Total:
Cav-4-05				1									1
basalt (vesicular)				1									1
Cav-5-05									3				3
limestone (silicified)									3				3
Cav-7-05						1							1
basalt (vesicular)						1							1
Cuiz-1-05	1	1	3	4	1		7	1		7		2	27
basalt				1									1
basalt (vesicular)				1	1								2
limestone		1											1
limestone (silicified)			1										1
sandstone			2	2			6	1		7		2	20
sandstone (pink)							1						1
tinguaite	1												1
Cuiz-2-05							1				1	1	3
basalt (vesicular)											1		1
sandstone							1					1	2
Cuiz-3-05							1	1					2
sandstone							1	1					2
Cuiz-5-05							1				1	3	5
basalt (fine-grain)												1	1
basalt (vesicular)											1		1
sandstone							1					2	3
Cuiz-16-05												1	1
limestone (silicified)												1	1
Total:	1	1	3	5	1	1	10	2	3	7	2	7	43

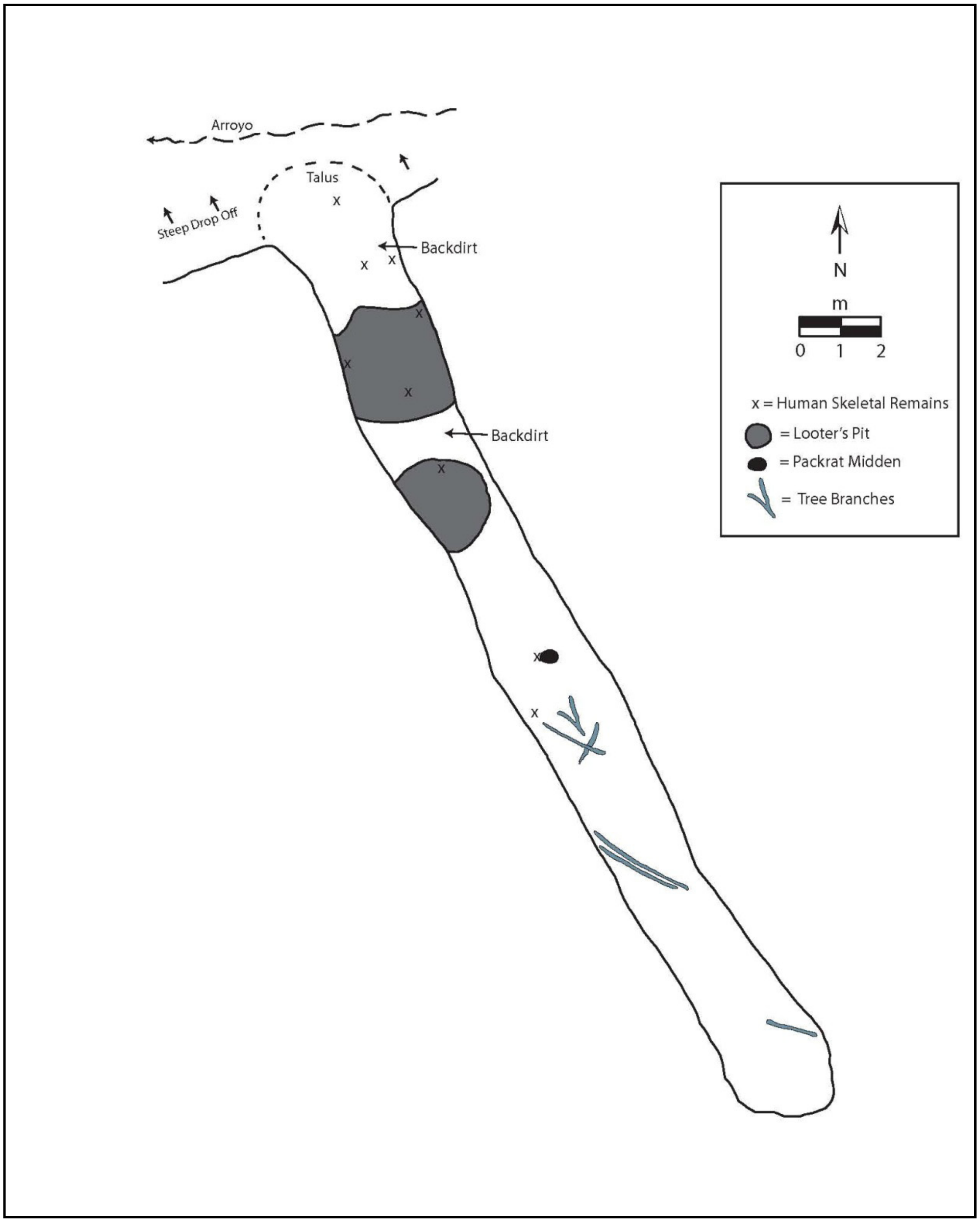
Table A-2.7. Miscellaneous materials documented on survey.

Site:	bone	charcoal	clay	daub	maize cob fragment	mussell shell	nutshell (*Juglans* sp.)	nutshell (*Thevetia tevetoides*)	palm leaf fragment	Total:
Cav-4-05					90				7	97
Cav-5-05	6		10				2	1		19
Cuiz-10-05		3								3
Cuiz-11-05			13			1				14
Cuiz-16-05						8				8
Cuiz-2-05				3		11				14
Cuiz-3-05	1					2				3
Total:	7	3	23	3	90	22	2	1	7	158

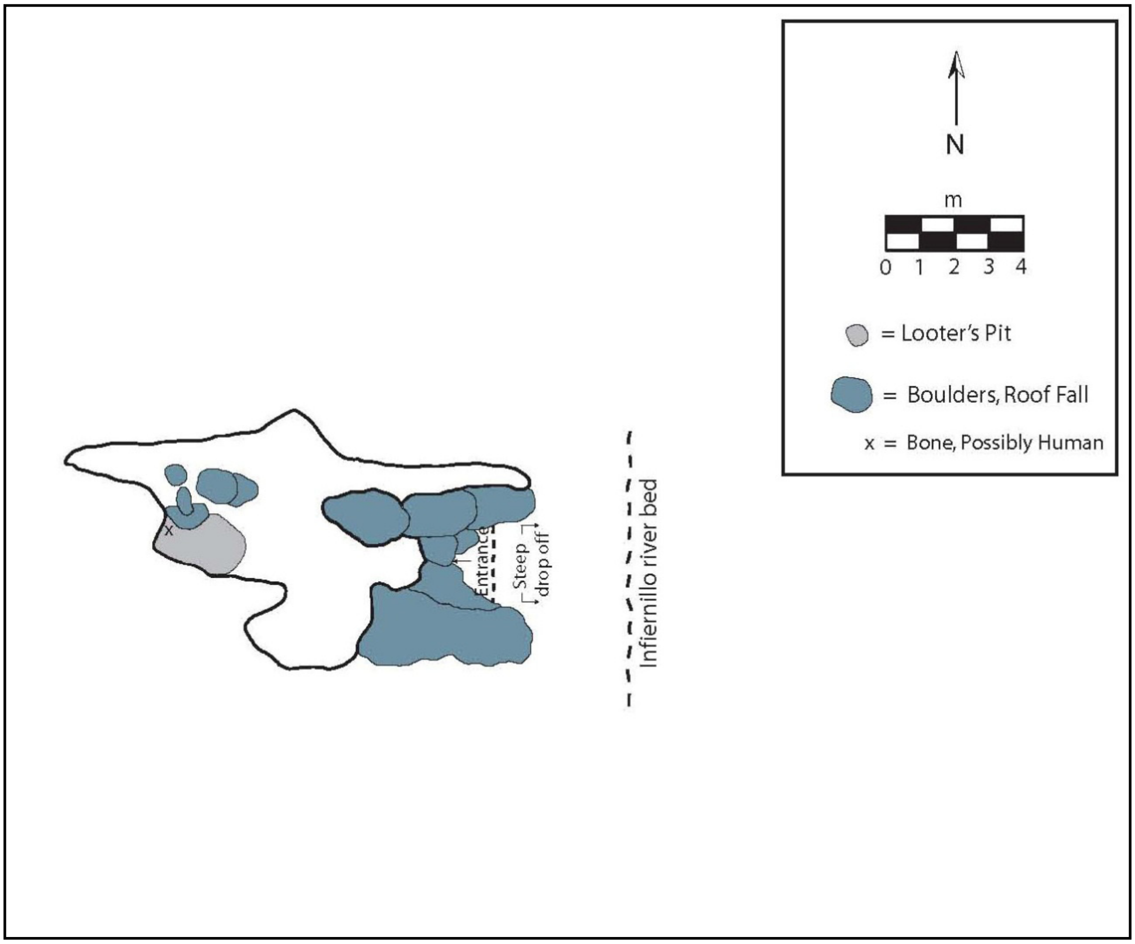
Appendix 3:
Maps of Sites Discovered on Survey (in order by site number)



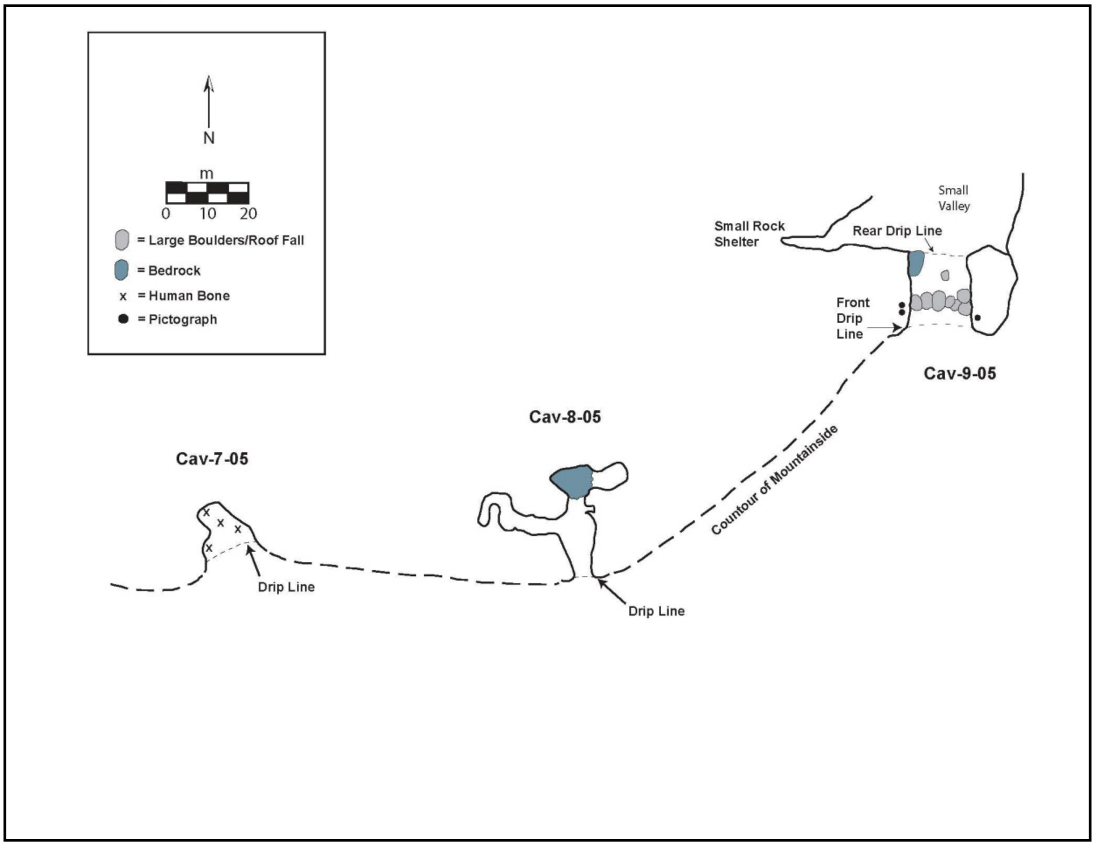
Cav-3-05, Cueva del Flash.



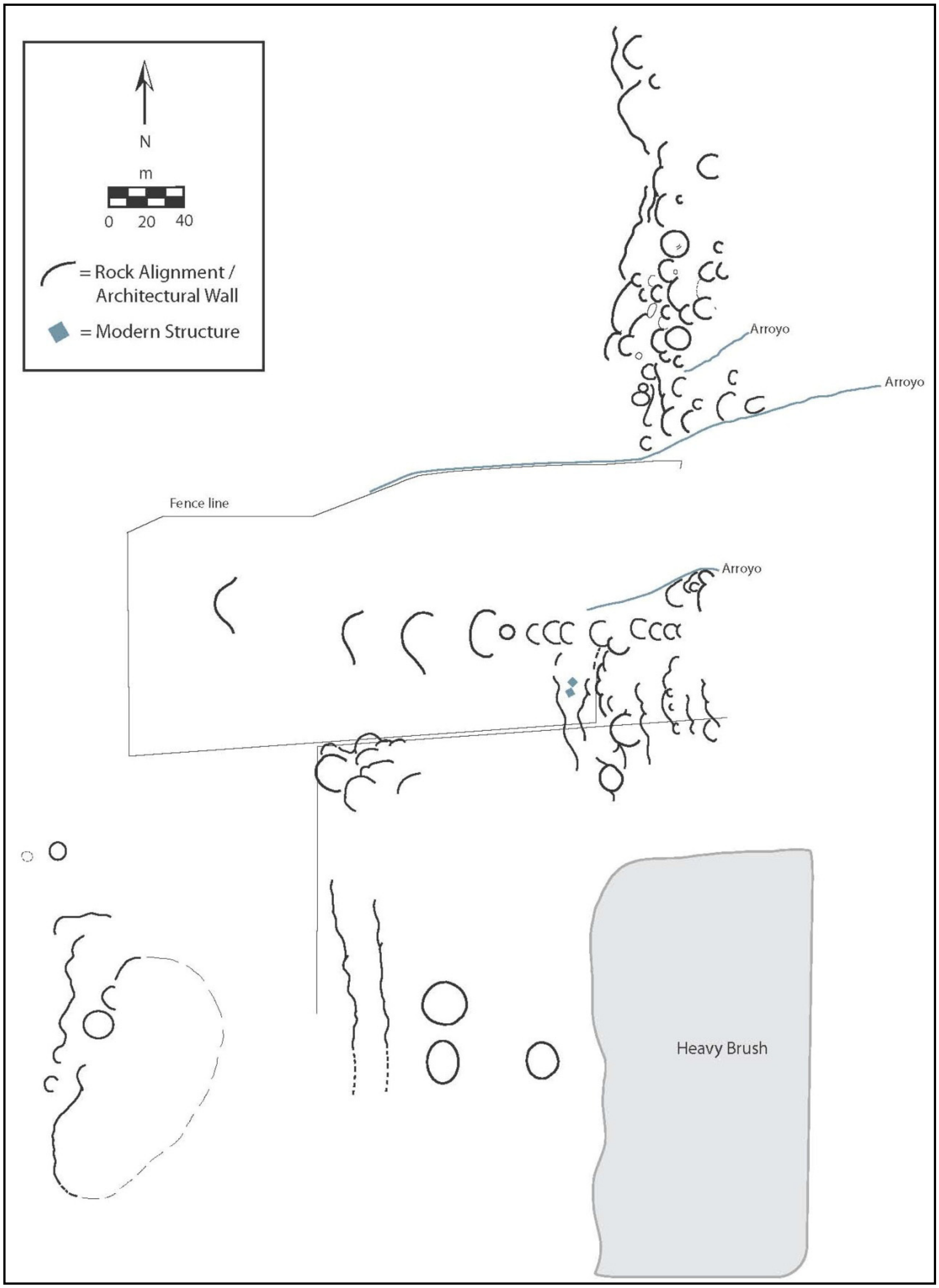
Cav-4-05, Cueva de la Calavera.



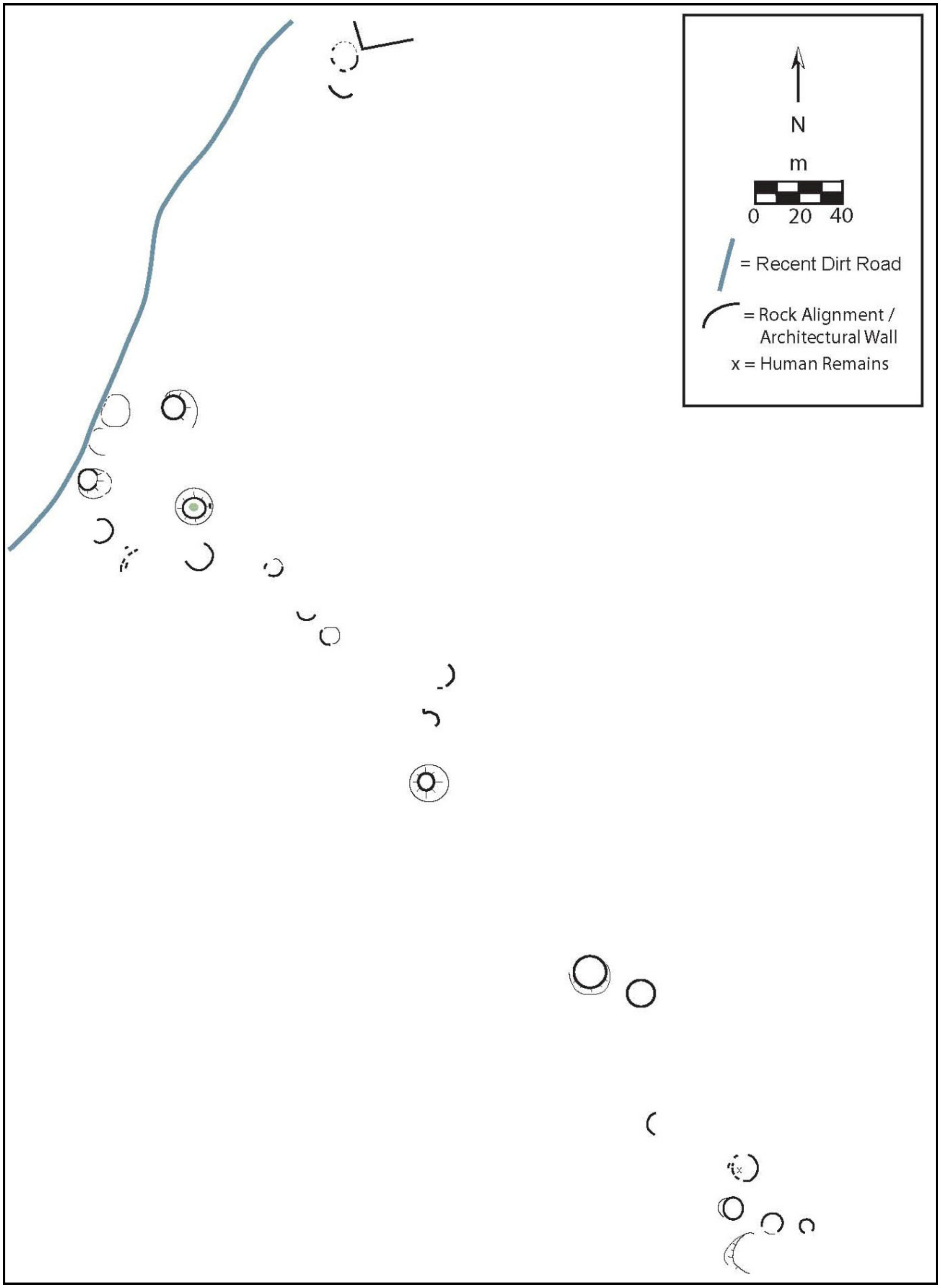
Cav-5-05, Cueva Sin Sombreros.



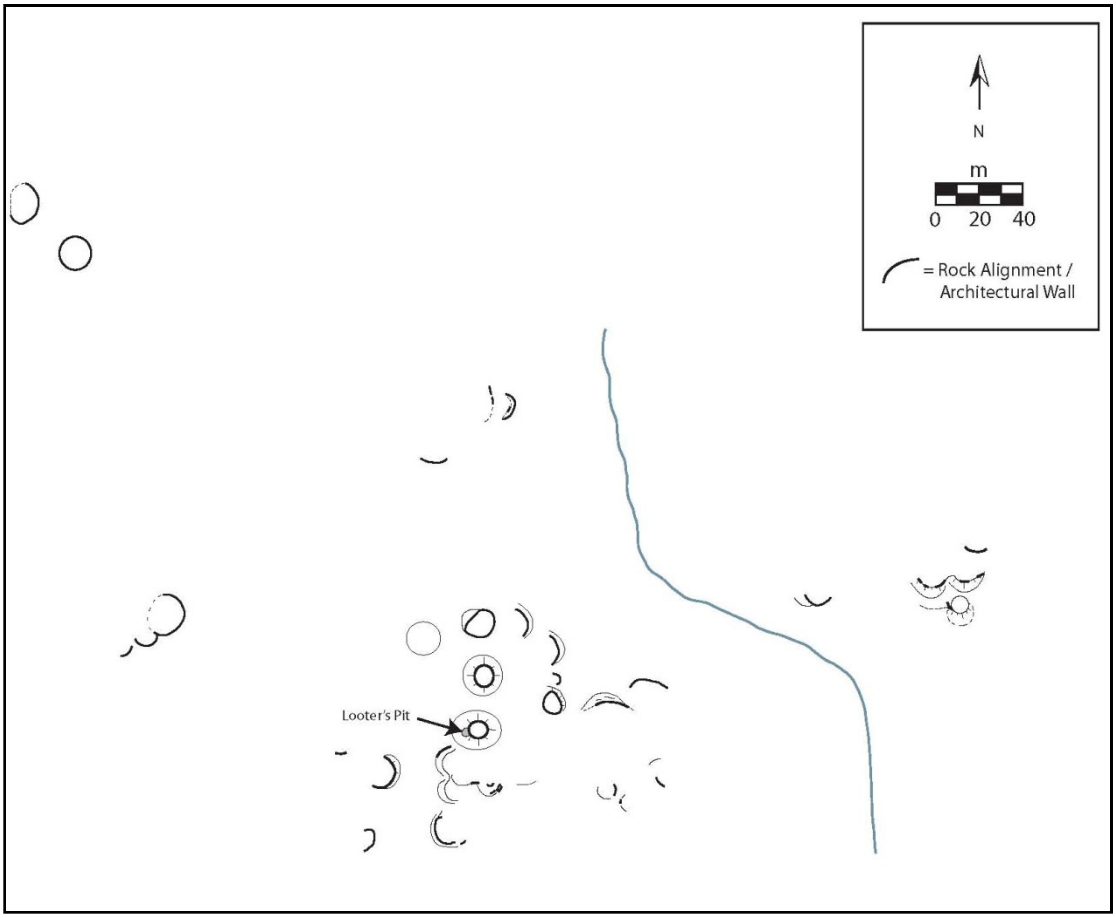
Cav-7-05, Cav-8-05, and Cav-9-05, Las Cuevas de Las Tijeras 1, 2, and 3.



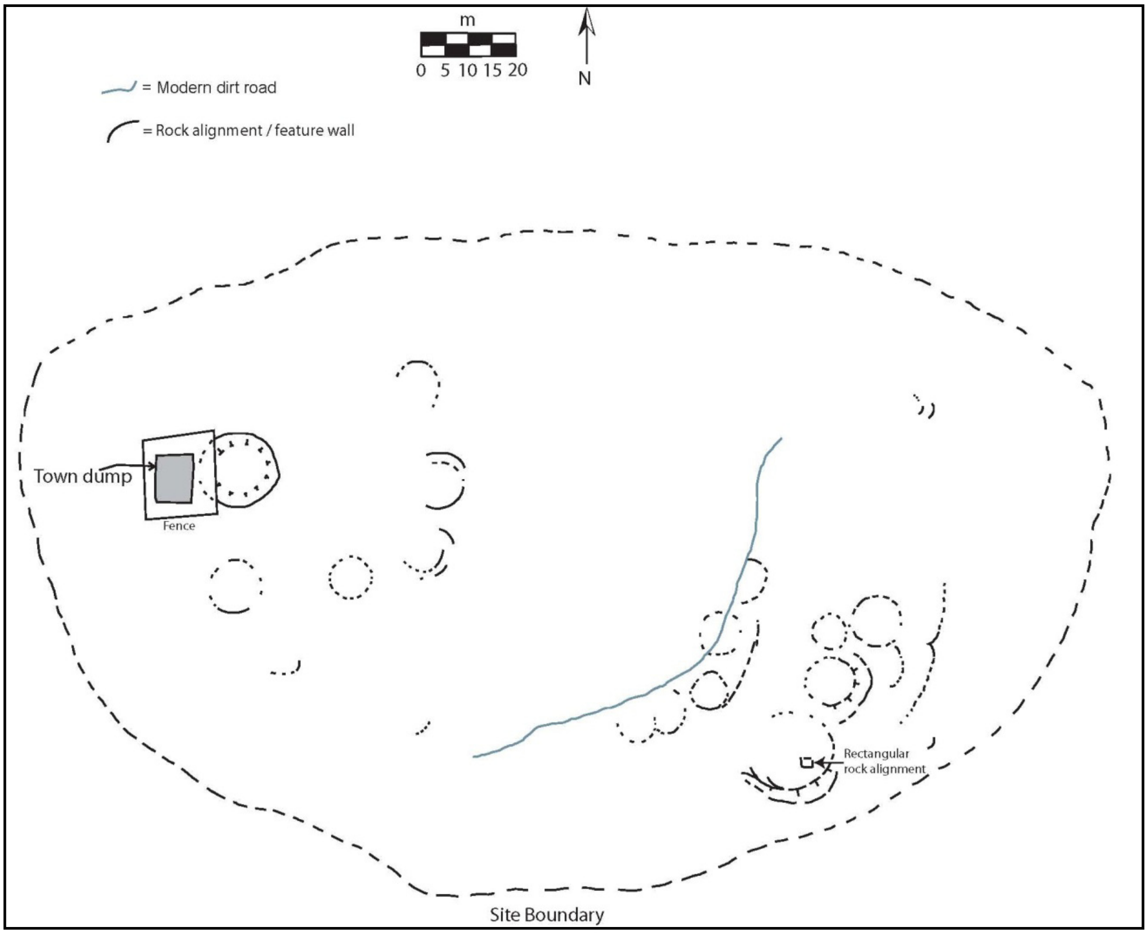
Cuiz-1-05, Potrero de Bueyes.



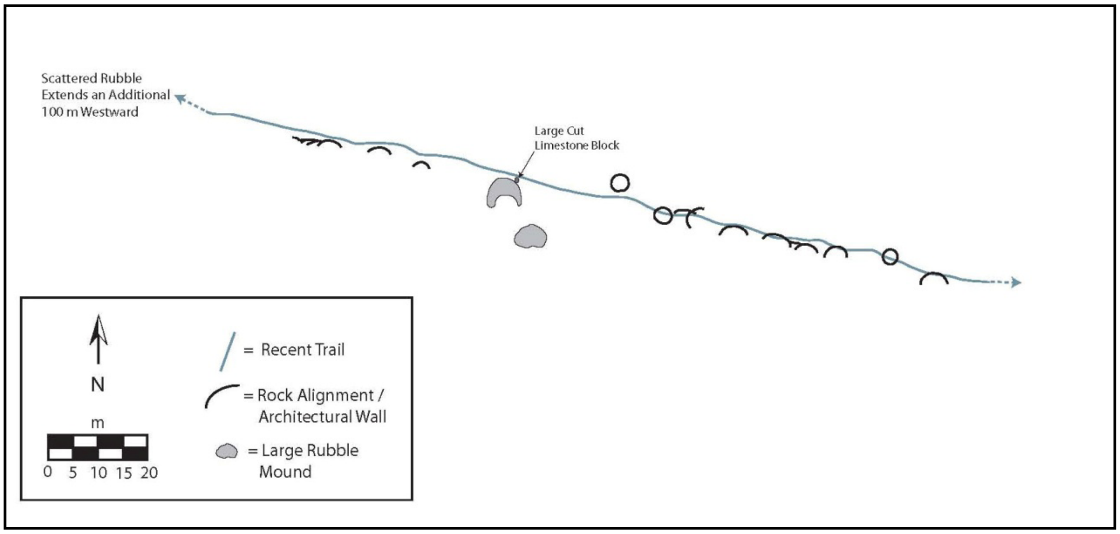
Cuiz-2-05, La Coma.



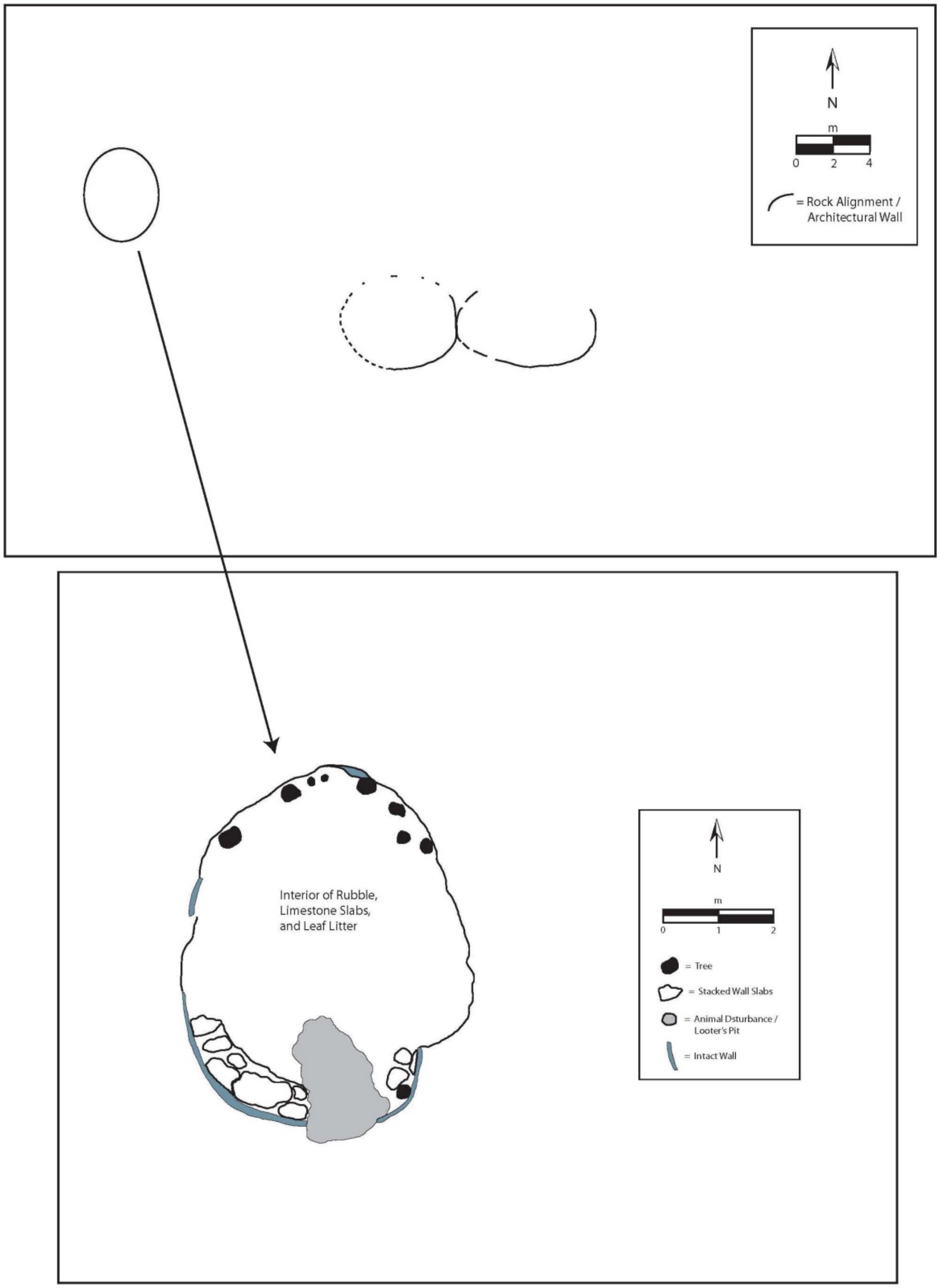
Cuiz-3-05, Cuizios de Fermin.



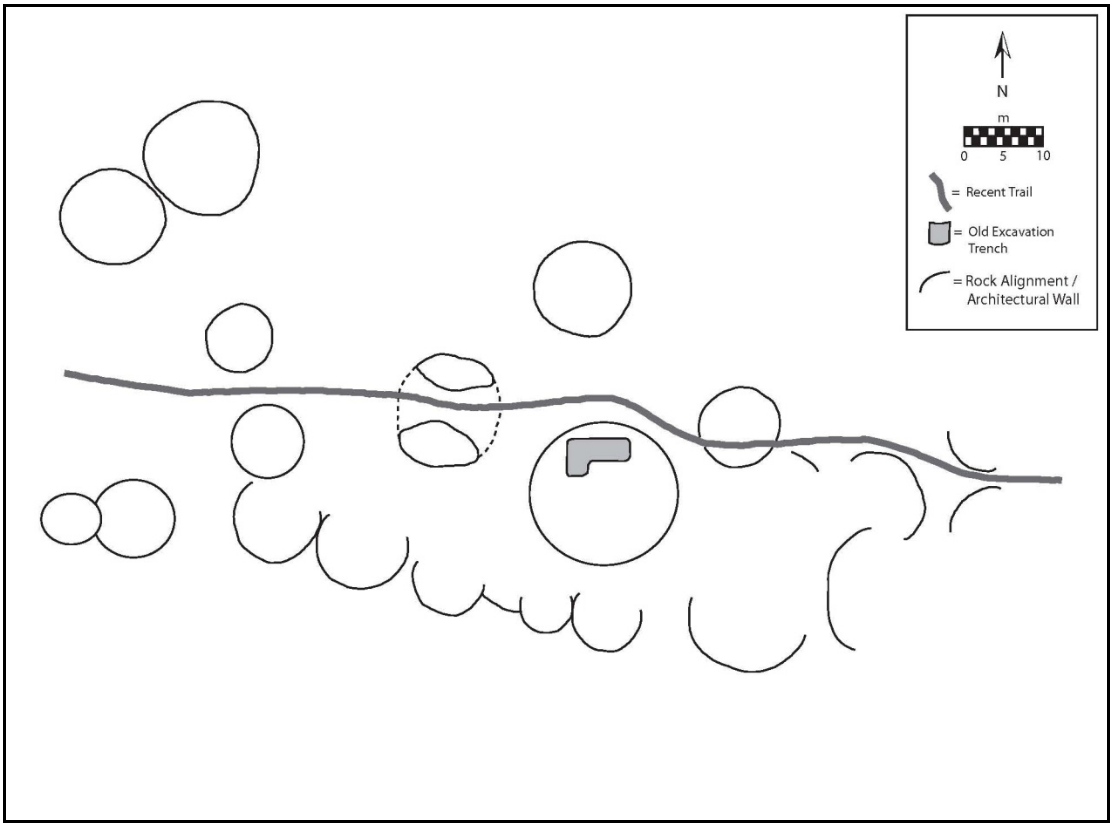
Cuiz-5-05, El Basurero.



Cuiz-6-05, El Refugio.

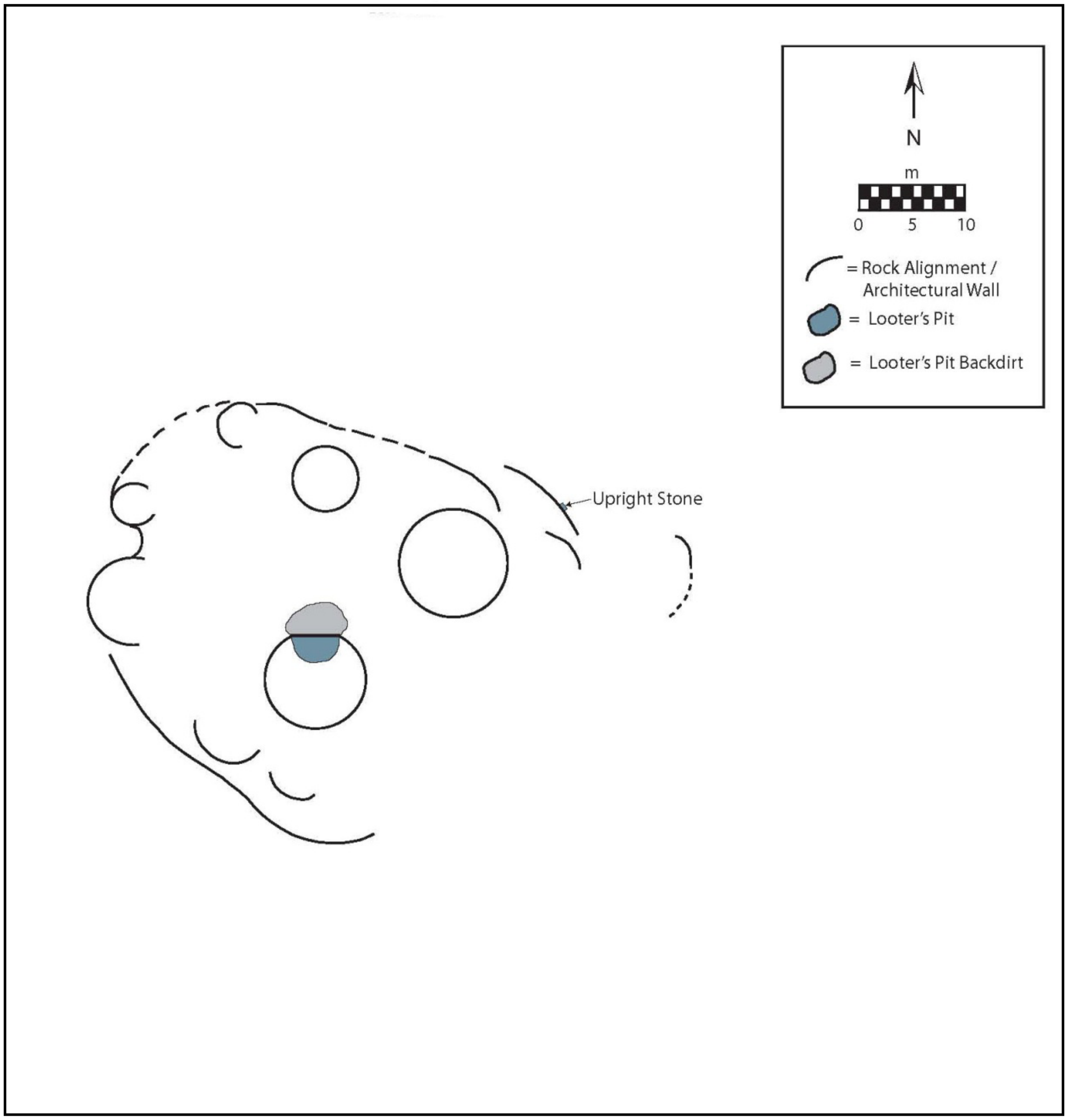


Cuiz-7-05, El Santuario.

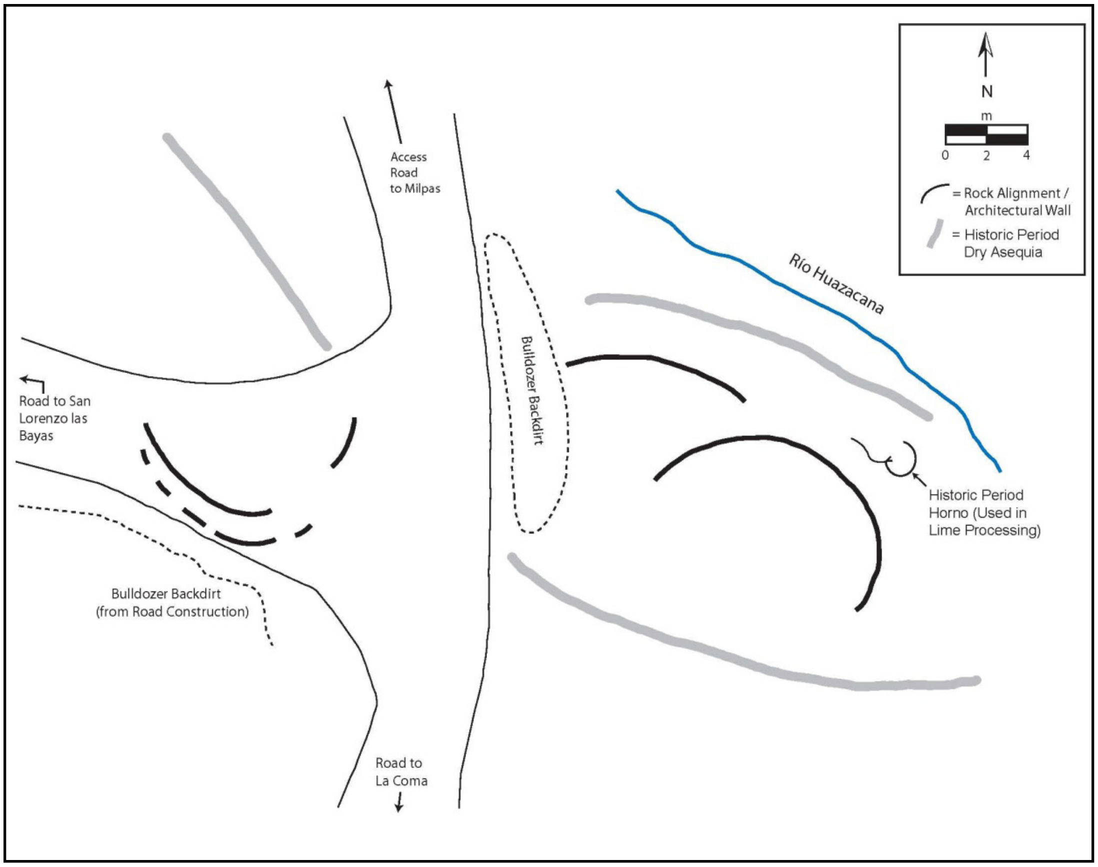


Cuiz-8-05, El Matillal.

Cuiz-9-05, La Venada.

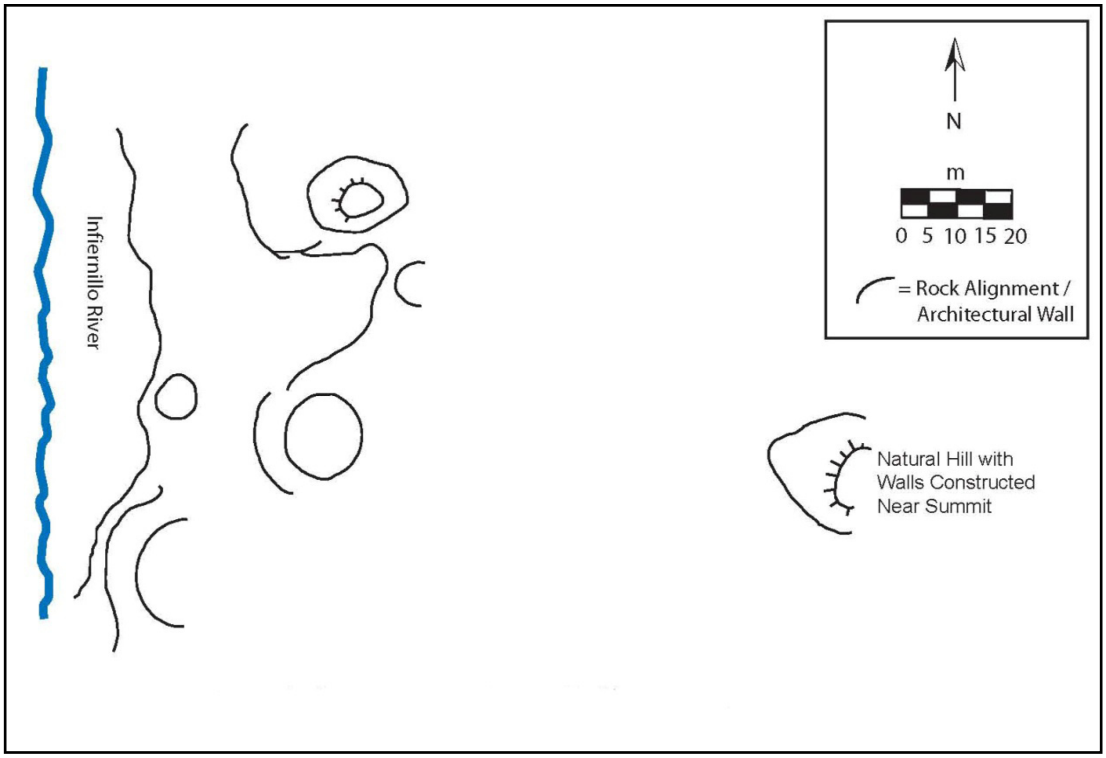


Cuiz-10-05, Los Razos detail, feature cluster on eastern end of site.

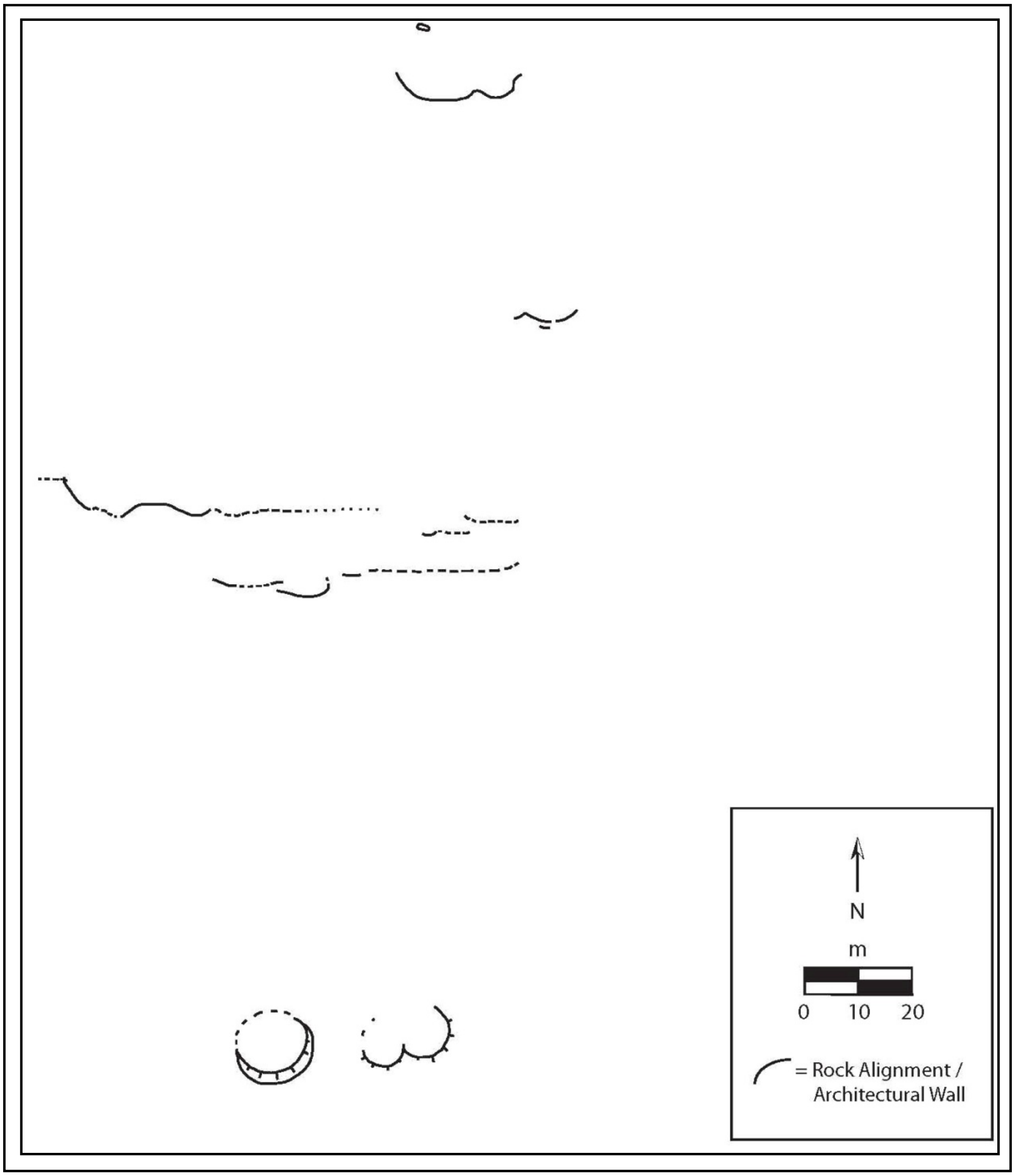


Cuiz-11-05, Los Basamentos.

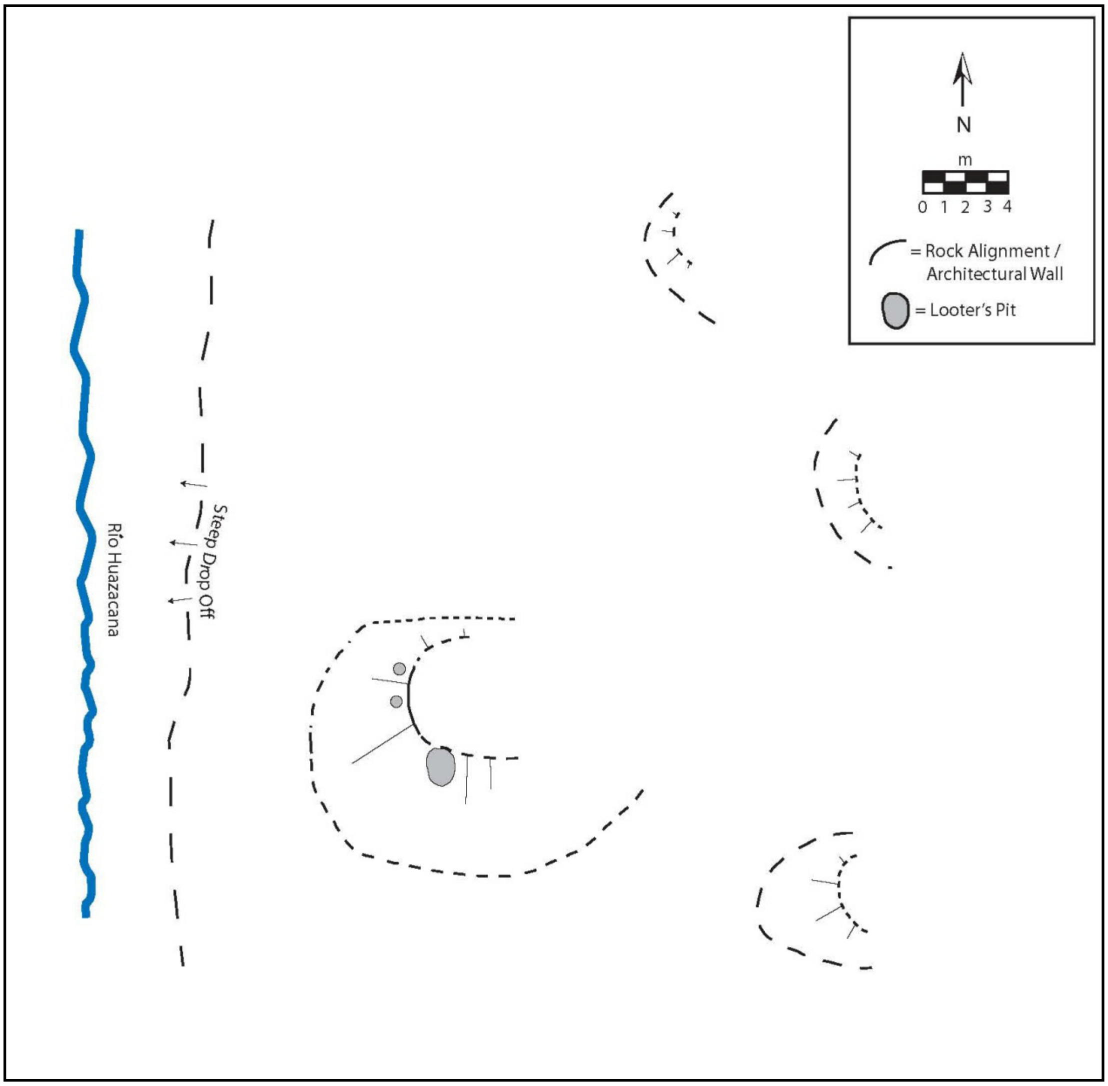
407



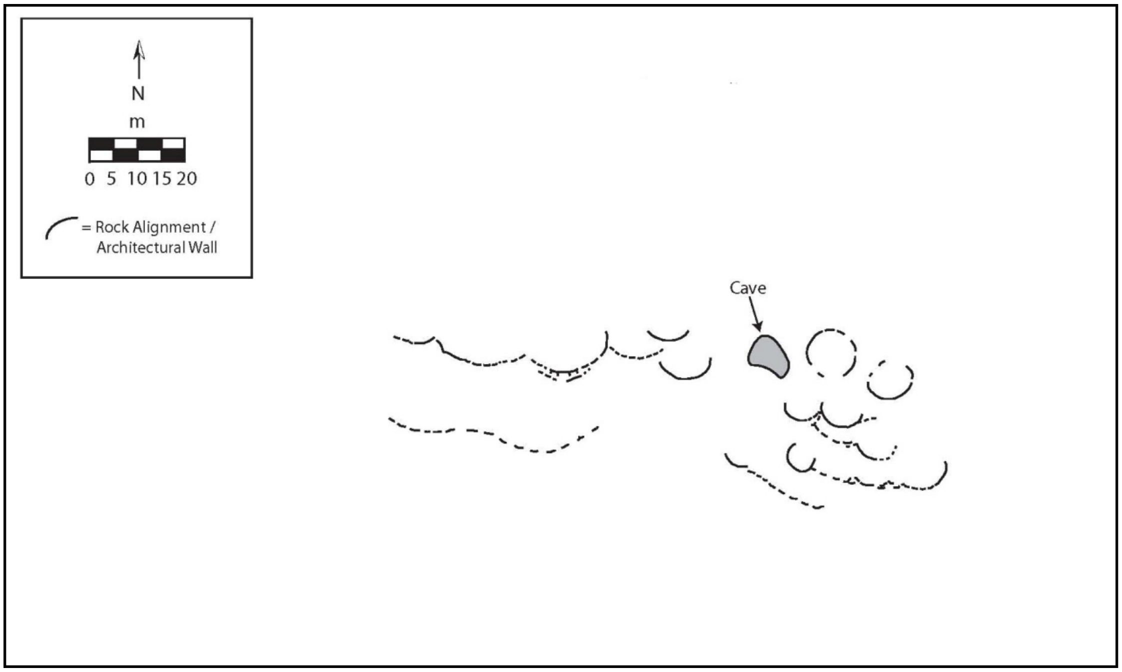
Cuiz-12-05, Cerca de Cañon Infiernillo.



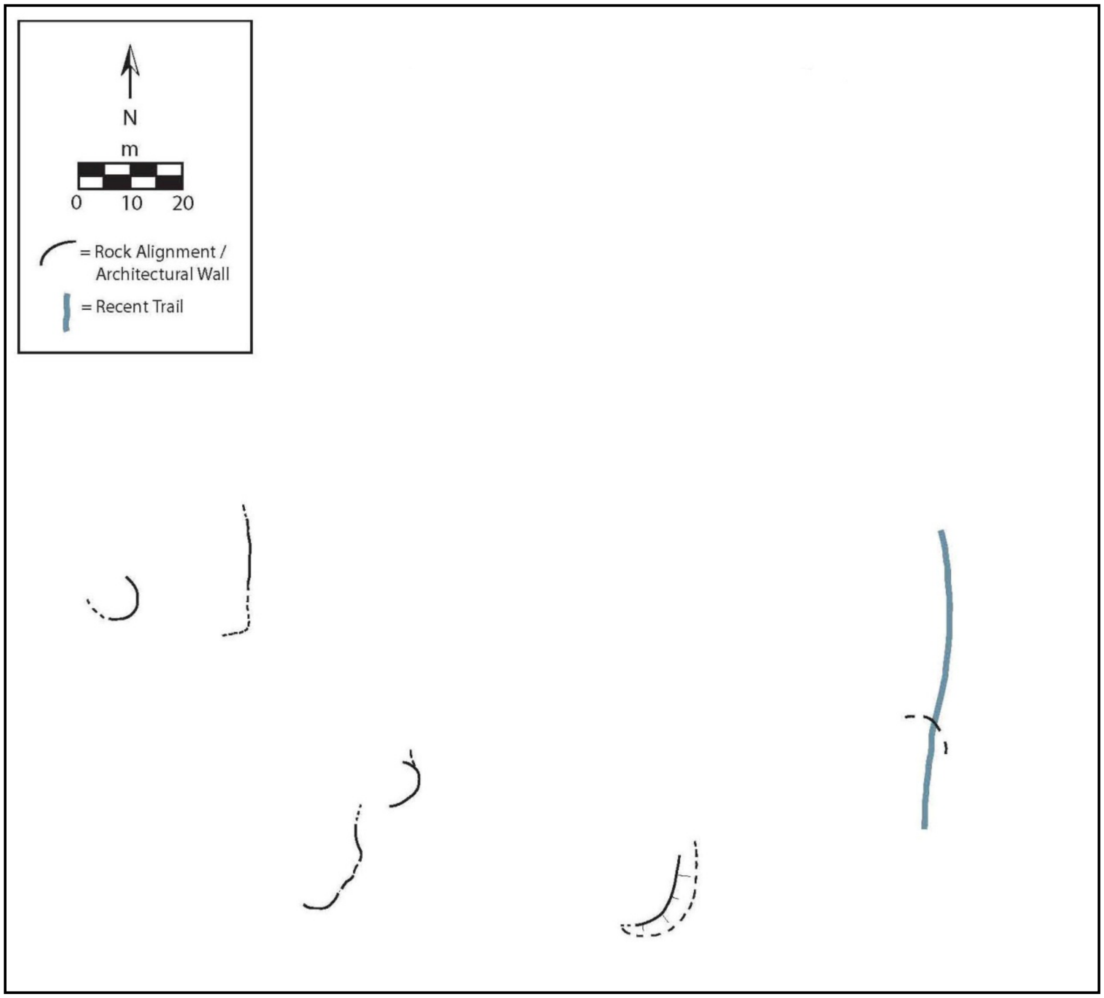
Cuiz-13-05, La Termina de Loma Larga.



Cuiz-14-05, Muchos Ébanos.



Cuiz-15-05, Las Piletas detail, northern end of site.



Cuiz-16-05, Loma Larga Manguera.