

### 3

#### THE SETTING OF EARLY AGRICULTURE IN SOUTHERN CHIHUAHUA

---

*A. C. MacWilliams, Robert J. Hard, John R. Roney,  
Karen R. Adams, and William L. Merrill*

The history and details of how agriculture spread and became entrenched over vast areas are difficult to elucidate. In this chapter, physiographic, environmental, and recently acquired archaeological information from southern Chihuahua is used to contextualize the arrival of maize agriculture in the region sometime between ca. 4000 and 1500 B.C. The purpose of doing so is to better understand settlement patterns and other aspects of adaptation in the region during the interval when agriculture arrived and to build a foundation for further research.

Southern Chihuahua presents unique opportunities for investigating early agriculture because its intermediate geographic location may provide data relevant to the spread of agriculture from central Mexico into northwestern Mexico and the southwestern United States. Much of the landscape remains intact, including many locations that are reasonable prospects for evidence of early agriculture. The varied landscape provides many settings that can be sampled to understand where early agriculture may have been adopted. Although some problems exist, the general visibility of preceramic sites is good.

In the southwestern United States, the Early Agricultural period is defined as the preceramic interval during which agriculture was introduced and widely accepted.

# ARCHAEOLOGY WITHOUT BORDERS

Contact, Commerce, and Change in the  
U.S. Southwest and Northwestern Mexico

edited by

Laurie D. Webster and Maxine E. McBrinn

with

Mexican editor Eduardo Gamboa Carrera  
INAH CENTRE, CHIHUAHUA

UNIVERSITY PRESS OF COLORADO

 **CONACULTA** • **INAH**   
CHIHUAHUA

© 2008 by the University Press of Colorado

Published by the University Press of Colorado  
5589 Arapahoe Avenue, Suite 206C  
Boulder, Colorado 80303

All rights reserved  
Printed in the United States of America



The University Press of Colorado is a proud member of  
the Association of American University Presses.

The University Press of Colorado is a cooperative publishing enterprise supported, in part, by  
Adams State College, Colorado State University, Fort Lewis College, Mesa State College, Metro-  
politan State College of Denver, University of Colorado, University of Northern Colorado, and  
Western State College of Colorado.



The paper used in this publication meets the minimum requirements of the American  
National Standard for Information Sciences—Permanence of Paper for Printed Library Materials.  
ANSI Z39.48-1992

Library of Congress Cataloging-in-Publication Data

Archaeology without borders : contact, commerce, and change in the U.S. Southwest and  
northwestern Mexico / edited by Laurie D. Webster and Maxine E. McBrinn ; with Mexican  
editor, Eduardo Gamboa Carrera.

p. cm. /

Includes bibliographical references and index.

ISBN 978-0-87081-889-9 (hardcover : alk. paper) 1. Indians of North America—Commerce—  
Southwest, New. 2. Indians of Mexico—Commerce—Mexico, North. 3. Indians of North  
America—Southwest, New—Migrations. 4. Indians of Mexico—Mexico, North—Migrations. 5.  
Indians of North America—Southwest, New—History. 6. Indians of Mexico—Mexico, North—  
History. I. Webster, Laurie D., 1952– II. McBrinn, Maxine E.

E78.S7.A73 2008

979.004'97—dc22

2007039389

Design by Daniel Pratt

17 16 15 14 13 12 11 10 09 08 2007 9 8 7 6 5 4 3 2 1

Support for the translation of papers in part three was provided by INAH.

## CONTENTS

### List of Figures ix

1. Creating an Archaeology without Borders 1  
*Maxine E. McBrinn and Laurie D. Webster*

## PART I: EARLY AGRICULTURAL ADAPTATIONS IN THE U.S. SOUTHWEST AND NORTHWESTERN MEXICO

2. The Transition to Agriculture in the Desert  
Borderlands: An Introduction 25  
*Gayle J. Fritz*
3. The Setting of Early Agriculture in Southern Chihuahua 35  
*A. C. MacWilliams, Robert J. Hard, John R. Roney,  
Karen R. Adams, and William L. Merrill*
4. Modeling the Early Agricultural Frontier in the Desert Borderlands 55  
*Jonathan B. Mabry and William E. Doolittle*
5. Early Agriculture on the Southeastern Periphery of  
the Colorado Plateau: Diversity in Tactics 71  
*Bradley J. Vierra*
6. A Method for Anticipating Patterns in Archaeological Sequences: Projecting  
the Duration of the Transition to Agriculture in Mexico—A Test Case 89  
*Amber L. Johnson*

This interval is proving to be complex, varied, and dynamic. In reviving this term from dormancy, Bruce Huckell (1995:16) is explicit about the Early Agricultural period defining preceramic agriculturalists. He suggests that the Early Agricultural period began around 1500–1200 B.C. and lasted until A.D. 200, equivalent to the dates of the Late Archaic period. Rapidly accumulating data from the Tucson Basin suggest modifications to this scheme may be needed. Currently, the widespread use of ceramics is initially placed at A.D. 150 (Gregory 2001:253; Gregory and Diehl 2002:204; Mabry 1998:18), although their appearance occurred several centuries earlier (Heidke 1999). Pottery and figurine fragments appear to be associated with two 2000 B.C. direct dates on maize from the Tucson Basin (Jonathan Mabry, personal communication, 2003). Edgar Huber (2005) demonstrates that maize arrived on the Colorado Plateau by 2100 B.C., during the late Middle Archaic period. The dynamic qualities of research on this period make establishment of strict definitions difficult. Extrapolating the term and concept of the Early Agricultural period to southern Chihuahua will likely show that this term refers to a time-transgressive process as Early Agricultural sites are discovered. If agriculture is not demonstrated to be present, Huckell (1995) recommends retaining the term "Late Archaic period." For these reasons, in discussing southern Chihuahua archaeology, we will continue to refer to the Middle and Late Archaic periods as purely chronological units and use the Early Agricultural period to refer to the general period during which farming was adopted in northwestern Mexico and the southwestern United States.

The earliest directly dated maize, which comes from Oaxaca, dates to 4300 cal B.C., but molecular evidence suggests maize was first domesticated along the Río Balsas of Michoacán and Guerrero somewhat earlier (Piperno and Flannery 2001:2102). More controversial pollen, phytolith, and starch grain evidence from the tropical lowlands on the Gulf Coast of Tabasco, the Panamanian tropical forest, and northern South America suggests an even earlier initial date for maize, ca. 5500–3000 B.C. (e.g., Piperno and Flannery 2001:2103; Pope et al. 2001:1373). The earliest cluster of redundant maize dates in the intensively studied southwestern United States, where agriculture ultimately underpinned mid-level societies, is 2100 B.C. (Huber 2005). This leaves a broad window of 2,000 years (ca. 4000–2000 B.C.) during which maize agriculture can reasonably be expected to have arrived in and passed through southern Chihuahua and minimally another 2,000 years (ca. 2000 B.C.–A.D. 1) comparable to the Early Agricultural period of the southwestern United States.

The general idea of an Early Agricultural period includes two important conditions: the introduction of agriculture into southern Chihuahua and the entrenchment of agriculture. The introduction of agriculture, by whatever means, is defined as the time when people first had access to domesticated seeds, such as maize, and some information regarding how to produce a harvest. During this introductory period, referred to as "incipient agriculture" by Bruce Smith (1997), agriculture was maintained at a modest level. At this level, in the southwestern United States and

presumably in northwestern Mexico, no agriculture-driven major changes occurred in settlement or population, and farming efforts contributed a relatively minor portion of the diet (e.g., Minnis 1992). Incipient agriculture may, however, have been important in reducing risks or enhancing access to nondomesticated resources (Wills 1988). Entrenched agriculture is the condition at which settlement, seasonal movement, social organization, and material culture changed to accommodate agriculture to the extent that they were ill suited to hunter-gatherer adaptations.

In southern Chihuahua, we should expect to find two general classes of early agricultural sites: those that reflect the introduction of agriculture and are not immediately distinguishable from pre-agricultural sites and those that exhibit evidence of entrenched agriculture. Among some groups in southern Chihuahua, rapid agricultural entrenchment should be most apparent through increased proximity to optimal farmland such as fluvial terraces, more substantial habitation sites, and more task camps as people become seasonally tethered to their farmlands. Particularly in marginal settings but near optimal farmland as well, agricultural sites of any age may reflect the incipient or introductory strategy. The underlying conditions that bring about either strategy are likely far more complex than simply potential farming productivity (e.g., Binford 2001; Hard and Roney 2005).

## SOUTHERN CHIHUAHUA

Southern Chihuahua divides into three general zones based on physiography, modern environment, and vegetation (Figures 3.1 and 3.2). From east to west, these are the low Basin and Range country, the higher Basin and Range country, and the Sierra Madre Occidental. The Chihuahuan Desert of southeastern Chihuahua ranges from 1,400–1,700 m in elevation, excluding mountain ranges. Mean annual precipitation in Chihuahua, which primarily comes from summer monsoons, increases toward the south and west. Southeastern Chihuahua receives only about 300–350 mm modern mean annual precipitation, and mean June high temperatures normally exceed 26°C. The only perennial water other than isolated springs is in saline lakes such as Laguna de Palomas. Vegetation is desert scrub often dominated by mesquite. Even today, this part of Chihuahua is sparsely inhabited. Artifacts of many ages are widespread (González Arratia 1992; Marrs 1949), and small roasting pits are abundant in some areas, but no known evidence indicates that residents ever departed from hunter-gatherer subsistence in this region.

The higher-elevation Basin and Range Province of central southern Chihuahua, located roughly between the Pan American Highway or nearby Río Florida and the Río Balleza, is considerably more hospitable. Valley elevations are 1,600–1,800 m, whereas mountain peaks often reach 2,000 m. The valleys of perennial rivers such as the Río San Pedro, Río Conchos, and many tributaries contain wide floodplains and well-defined fluvial terraces. Modern mean annual precipitation is in the range of 400–450 mm per year, and average temperatures are several degrees lower than in southeastern Chihuahua. The area is mapped as Plains and Semidesert

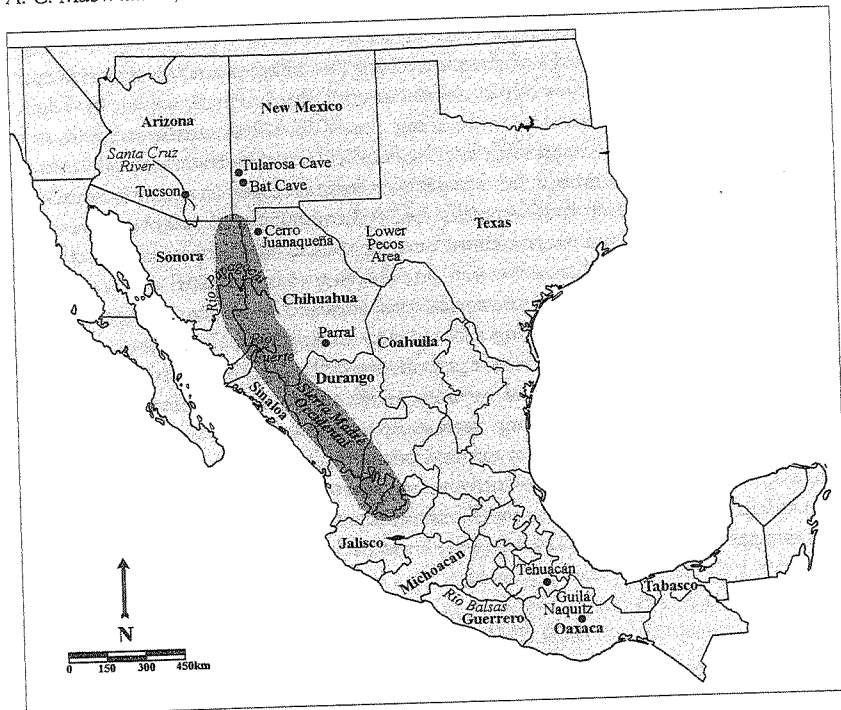


Figure 3.1. Map of Mexico and the southwestern United States.

Grassland (Brown and Lowe 1980) and is now a mix of Chihuahuan desert scrub and grasslands. Dry farming is practiced in better locations, and irrigation farming is widespread.

The Sierra Madre Occidental of southern Chihuahua (referred to hereafter as the Sierra Tarahumara) is somewhat higher in elevation, and the topography and climate are appreciably different from the higher Basin and Range Province. Elevations range from 1,800–2,800 m, and mean annual rainfall is 600–850 mm. The landscape is predominantly rhyolite plateau dissected by deep canyons (*barrancas*). Mesas are also common landforms. There are perennial rivers, such as the Rio Urique, and many perennial tributary streams. The Sierra Tarahumara is largely mapped as Madrean Evergreen Woodland and Petran Montane Conifer Forest biotic communities (Brown and Lowe 1980) and is prevalently pine and oak forest. In the *barrancas*, semi-tropical vegetation offers many alternative resources to the forest and woodlands. Arable plots are generally located on narrow river floodplains, such as the Rio Urique, and more frequently on medium-size and small side drainages. The Tarahumara use dry farming techniques with animal and chemical fertilizers to farm small upland valley bottoms. There are a few small seep fields that also require

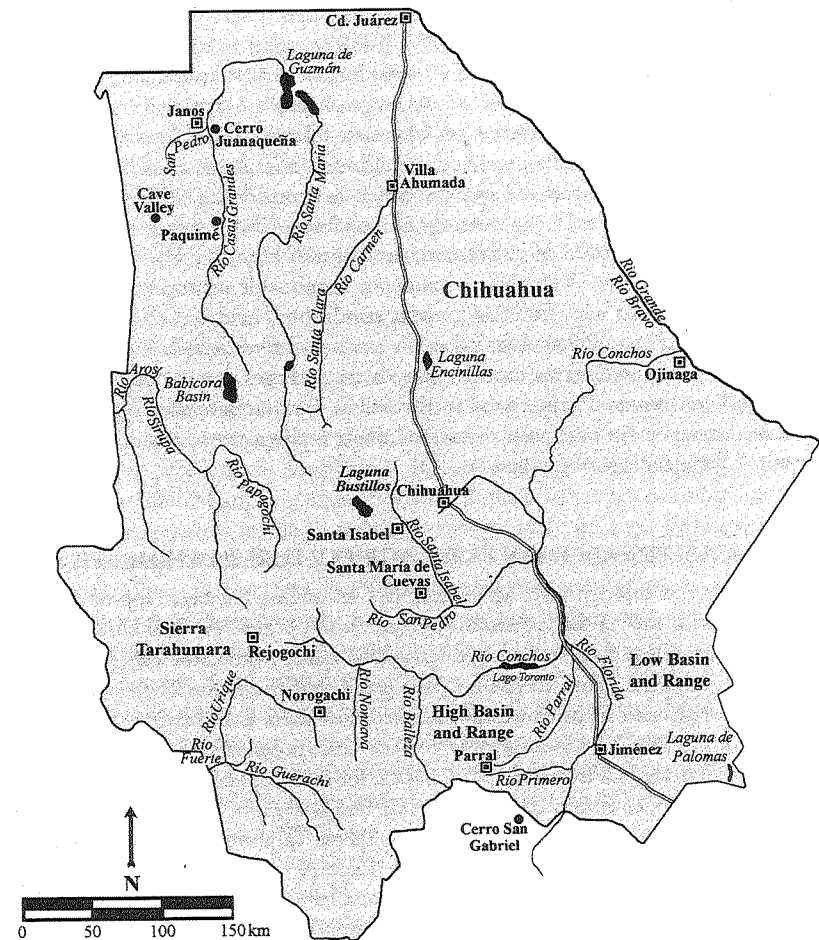


Figure 3.2. Map of Chihuahua.

fertilizing, limited slash-and-burn bean farming, and some plowing on steep slopes (Bennett and Zingg 1935; Hard and Merrill 1992).

Which physiographic and climatic parameters are judged to be ideal for early agriculture depends on what is believed about the earliest strains of maize and the diverse habitats containing them. Guila Naquitz, in Oaxaca, is about 1,900 m in elevation and has modern average precipitation of 600 mm annually. In contrast, the Rio Balsas watershed, at 1,000–1,500 m elevation, is far warmer and wetter, receiving 1,200–1,600 mm of annual precipitation (Piperno and Flannery 2001:2101). By

circa 5,500 years ago, maize was present in the Tehuacán Valley, with a climate more similar to that of Oaxaca (Long et al. 1989:1037). In other words, maize was viable in disparate settings at least 1,500–2,000 years before its first known appearance in the southwestern United States or northwestern Mexico. Restricted corridors for the spread of agriculture was once a popular view (Haury 1962; Lister 1958), but it now seems more plausible that early maize had wide tolerances, allowing radiation across an array of environmental settings, much as Bruce Benz (1999:29) suggests.

That being the case, many settings in southern Chihuahua are reasonable for the successful practice of subsistence agriculture. However, the Chihuahuan Desert of southeastern Chihuahua remains an improbable setting for subsistence agriculture under any semblance of present conditions. In the central portion of southern Chihuahua, archaeology takes on a much different feel. It is becoming clear that there are widespread sites of many forms and ages that include more than hunter-gatherer bands. Farther west in the Sierra Tarahumara, where subsistence agriculture remains the backbone of survival, there is also a previously unrecognized diversity of archaeological remains.

#### PREVIOUS RESEARCH ON EARLY AGRICULTURE IN CHIHUAHUA

Traditionally, the topic of early agriculture in Chihuahua has been approached in terms of what it means for the southwestern United States. As Paul Mangelsdorf (1958:98) framed the issue, referring to excavated maize from Cave Valley in northwestern Chihuahua, "This, in itself, is not proof that the maize of the American Southwest originated in northwestern Mexico, but there is a strong presumption that this is the case." Encouragement for the once-popular view that the Sierra Madre Occidental of Chihuahua was a conduit for maize agriculture has come from two principal sources within Chihuahua. The first is work by Robert Zingg (1940), who excavated three caves (in two sites) in the Sierra Tarahumara of southern Chihuahua during 1931 (Figure 3.2). At Zingg's "Cave A," located 2 km northeast of Norogachi, the lowest excavation levels contained lithics without ceramics. He did not report maize from these lower levels. This did not deter Zingg (1939:212) from concluding that a local sequence began with "Rio Fuerte Basketmaker" cave inhabitants who farmed maize but lacked beans and pottery.

Robert Lister (1958) excavated in Swallow Cave and four other Cave Valley sites at an elevation of about 2,000 m in the Sierra Madre Occidental of northwestern Chihuahua. In the lower strata of Swallow Cave, Lister found only a few lithics and three maize cobs in strata about 1 m below the ceramic-bearing levels. In the absence of radiocarbon dates, the age of these lower deposits remains uncertain. Charles Di Peso and colleagues (1974) estimated the age of the lower levels at Swallow Cave dug by Lister to be about 2500 B.C. Lister's work provides qualified evidence that maize agriculture extended into the Sierra Madre Occidental fairly early, fostering the idea that the Sierra Madre Occidental was a corridor through which agriculture spread north. This view is complemented by the upland settings

of Bat Cave and Tularosa Cave, among the first early agricultural sites discovered in the southwestern United States (Haury 1962).

In the vastness of Chihuahua's Basin and Range country east of the Sierra, archaeologists have typically focused on much later Ceramic-period sites to the exclusion of practically all else. Information about early agriculture did not reemerge until the 1990s with work at Cerro Juanaqueña and related sites near Janos (Hard and Roney 1998, 2004; Roney and Hard 2004). These thirteen *cerros de trincheras* (hills with constructed terraces) are located mostly in the Río Casas Grandes watershed, with a few in the Río Santa María Valley of Chihuahua. These optimal settings for agriculture have perennial rivers and broad floodplains with elevations of about 1,400–1,600 m. The hill sites are located along the river floodplains in a region mapped as Semidesert Grassland (Brown and Lowe 1980), now suffering from overgrazing and historic shrub invasion. Over four field seasons, four of these sites were partially excavated, with most work directed at Cerro Juanaqueña. This 150-m-high hill is by far the largest of the northwest Chihuahua *cerros de trincheras*, containing about 550 terraces constructed of stone and sediment. Over 300 projectile points from this site are almost entirely Late Archaic forms. Close to 650 complete and broken, deeply worn basin metates were recorded at Cerro Juanaqueña. In a region renowned for its pottery, there are only a few sherds from the surface of this preceramic site, a pattern that also holds for the other *cerros de trincheras*.

Radiocarbon dates from the four *trincheras* sites suggest two episodes of occupation: the first, and by far the largest, at about 1250 B.C., and the second around 200 B.C. These are sizable sites that must have accommodated dozens or, in the case of Cerro Juanaqueña, a couple of hundred people (Roney and Hard 2002). The presence of substantial quantities of maize and probable domesticated amaranth and the largely sedentary nature of a settlement of this scale leave no doubt about a major role for entrenched agriculture during these early times (Hard and Roney 1998, 2004; Hard et al. 1999; Roney and Hard 2002). Construction of these *cerros de trincheras* by agriculturalists is linked to increased conflict among groups by 3,200 years ago (Roney and Hard 2002). Dependence on entrenched maize agriculture likely required protecting harvests and land. Results from Cerro Juanaqueña contradict the long-standing view that maize was invariably only a minor component of what were essentially forager economies throughout the region until the end of the Early Agricultural period. To what extent it is coincidental or consequential that this same area is the central setting of a major mid-level society (Casas Grandes or Paquimé) more than two millennia later remains open to discussion.

#### CURRENT RESEARCH IN SOUTHERN CHIHUAHUA

Since 2002, we have been recording and testing sites in the Basin and Range Province and the Sierra Tarahumara of southern Chihuahua for the purpose of identifying Early Agricultural sites and, more broadly, acquiring information that contextualizes early agriculture in southern Chihuahua. In regard to the latter purpose, we

have located sites with late Middle Archaic- and Late Archaic-period remains in several settings. In the Basin and Range Province these settings are fluvial terraces, rockshelters and caves, *bajadas*, and *cerros de trincheras*. Work to date has focused on two distinct groups of Basin and Range sites: those constructed with D-shaped terraces, and *cerros de trincheras*.

### D-Shaped Terrace Sites

A phenomenon first noted by Richard Brooks (1971:169) in the Basin and Range country of southern Chihuahua is the widespread presence of rockshelter sites with built-up terraces behind D-shaped walls, which he referred to as "platform shelter sites." He did not suggest an age for these sites but commented that they were comparable to sites seen in the Chalchihuites area of Durango. We recorded three of these sites in the Parral area and a fourth near Santa Isabel (Figure 3.3). These sites share several distinct traits. The terraces generally follow cliff bases for 20 to 25 m, defining the straight side of an uppercase D, and arc outward about 10 to 15 m from the cliffs. The sites are invariably within 1.5 km of fluvial terraces suitable for agriculture. Surface assemblages at three of the sites include a mixture of Archaic to recent materials, whereas the fourth site, Sitio Pienso (A47-05), shows abundant surface lithics and little else.

We tested three of the terrace sites. At Cueva de los Indios (C75-01) near Santa Isabel, terrace deposits extended to 2.3 m below the surface, although the terrace surface is overlain by roughly 15 cm of overburden. This multicomponent site has a wide range of materials. The oldest are a basalt Plainview lance base and, from 20 cm deeper in the excavation, a radiocarbon date of  $9120 \pm 50$  (8440–8250 cal B.C., Beta-185635) from charcoal.<sup>1</sup> At least half of the almost fifty whole and broken projectile points recovered from this site closely or fully resemble late Middle Archaic and Late Archaic forms. Bifacial reduction is heavily represented in the abundant flaked stone. More recent materials, which are concentrated in upper levels, include arrow points, plain ware, one Mimbres Black-on-white sherd, and closer to the surface some green-glaze pottery. The faunal assemblage is remarkable both for its quantity of over 300 individual specimens (NISP) and because 80 percent of the identified elements found throughout the deposit are tortoise and turtle (Schmidt 2004). Maize samples found in the same excavation level as a late Middle Archaic Arenosa point and one plain ware sherd date to the early Ceramic period ( $1400 \pm 40$ , cal A.D. 600–680, Beta 182383;  $1310 \pm 40$ , cal A.D. 655–780, Beta 182384). The terrace deposits at this site are somewhat mixed as a result of both construction of the terrace and subsequent disturbance by rodents. The relative abundance of typed artifacts suggests that prevalent use of the site was during the late Middle Archaic and Late Archaic periods. In spite of this problem, C75-01 remains interesting because of the abundance of artifacts that coincide with the interval when maize spread north and its proximity to excellent terraces along the Rio Santa Isabel.

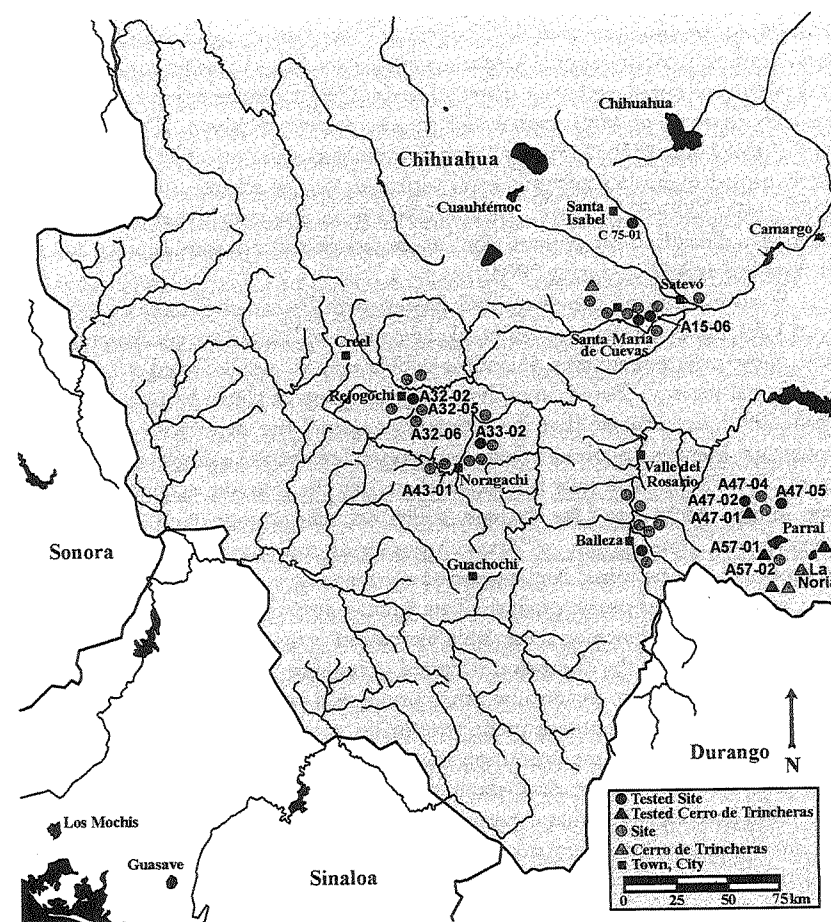


Figure 3.3. Map of southwestern Chihuahua, showing location of sites discussed in the text.

Site A47-02 consists of two D-shaped terraces and several smaller features beneath shallow overhangs in volcanic conglomerate cliffs northwest of Parral. A small test unit indicated terrace deposits were badly mixed, although the one projectile point found at this site is a Middle to Late Archaic Charcos point (Turner and Hester 1993:90). Nearby rockshelter A47-04 was not tested but also has a mixed surface assemblage that includes several late Middle Archaic to Late Archaic dart points.

Sitio Pienso (A47-05) is another D-shaped terrace site located in the same drainage. The generally recognized time interval for over one dozen projectile points from this site embraces the late Middle Archaic to Latest Archaic periods. A  $1 \times$



2 m excavation produced over 4,000 pieces of flaked stone, much of it from biface reduction, and not one sherd. A diverse faunal assemblage includes turtle, tortoise, jackrabbit, cottontail, and mule deer (Schmidt 2004). Cobble manos, a small grinding slab, charcoal, and fire-cracked rock are also present. A recent radiocarbon date of  $170 \pm 40$  (Beta 185632, four calibration intercepts span A.D. 1650–1950) is obviously intrusive and has nothing to do with the site age, whereas an older date of  $2770 \pm 40$  (1000–825 cal B.C., Beta 182382) is in line with the site assemblage. Neither radiocarbon sample was from maize, which was not found in our limited excavations at A47-05 during 2003.

By all indications, these four rockshelters with D-shaped terraces were heavily used habitation sites, with considerable labor invested in terrace construction and with substantial assemblages, including cobble manos, ample flaked stone debris, and faunal material. Based on replicative experiments at Cerro Juanaqueña (Hard et al. 1999), we estimate that these terraces required five person-days or more to construct. Metates are absent from excavations, except for a single grinding slab from Sitio Pienso. The only time span shared by the four site assemblages is the late Middle Archaic to Late Archaic, which we believe imprecisely dates terrace construction. Based largely on Texas chronologies and types, the projectile point assemblages suggest initial Archaic-period occupations no earlier than 2500–2000 B.C., with continued use through the Late Archaic period. None of these four sites provides direct evidence of preceramic agriculture from limited testing, but they remain pertinent to the discussion. If initial occupation of these sites predates the arrival of agriculture in the area, which is presently a possibility of unknown likelihood, they at least connote a predisposition to accept agriculture. According to W. H. Wills (1988:41), predisposition involves repetitive seasonal movement, limited geographic movement, and resource storage capacity. Suzanne and Paul Fish (1994:86) have suggested that experience with manipulation of wild plants may be an important pre-agricultural adaptation. The investment in terrace construction and the dense assemblages are more congruent with logistically organized settlement, as the rockshelters are far from typical forager camps (*sensu* Binford 1980). Such a strategy may imply plant intensification and decreased residential mobility (Binford 2001). Proximate locations to fluvial terraces may be related to the use of wild or domestic resources or both. In the case of the Parral area, the volcanoclastic cliffs contain abundant, high-quality chert cobbles that provide much of the chert in assemblages. The generalization that hunter-gatherers will move to the least portable resource and reach the others with task groups (Binford 1980; Wills 1988:43) may be applicable in this instance.

### Cerros de Trincheras

There are also *cerros de trincheras* in southern Chihuahua, and at least some of these hills have evidence, albeit limited, for early agriculture. Deric Nusbaum (1940) was the first to identify *cerros de trincheras* in southern Chihuahua and in

nearby northern Durango. Nine of these hill sites are now known from the central Basin and Range Province in southern Chihuahua. Gerry Raymond (2001; Raymond et al. 2003) tested three southern Chihuahua *cerros de trincheras* during 2000 in affiliation with the Cerro Juanaqueña project. We have since returned to one of these sites, Cerro Prieto de Santa Bárbara (A57-01), mapped another site, and both mapped and tested three additional *cerros de trincheras* sites in the region. One of Raymond's samples from Cerro Prieto de Santa Bárbara (Terrace 5, Level 7) produced a maize radiocarbon date of  $3410 \pm 40$  (1770–1620 cal B.C., Beta 174996), and another one from Cerro La Noria (Terrace 1, Level 4) produced a maize date of  $1950 \pm 50$  (50 cal B.C.–cal A.D. 140, Beta 174994) (Raymond et al. 2003). However, unlike *cerros de trincheras* in northwestern Chihuahua, those in the south have substantial Ceramic-period occupations. So far, we have been unable to isolate an earlier component on any of these terraced hills.

The southern *cerros de trincheras* each have from five to forty terrace walls made with stacked rocks and have closely arranged round rock outlines, presumably of structures, on top. These outlines are typically about 3 to 3.5 m in diameter. Several of these sites have saddles that are cleared of rocks and enclosed by stone walls, an arrangement not seen in northwestern Chihuahua. Assemblages from these hills are variable and include brown to buff plain ware with infrequent red ware. The only metate fragments seen are basin and slab varieties. On the hills with sizable samples of lithics, extensive bifacial reduction is evident. This is particularly true of Cerro las Flojeras (A47-01), located within direct sight of three of the D-shaped terrace sites. At four of the five sites tested in 2003, at least one dart point indistinguishable from known and well-defined Archaic dart points from Arizona, New Mexico, and Texas was found. In addition, more recent arrow points and ceramics were recovered. Eight radiocarbon dates from six of these sites, including two tested by Raymond, fall primarily into the interval A.D. 500–1000, which probably reflects the major period of occupation, given the ubiquity of ceramics in the test units. Whether probable Early Agricultural-period components of these hills are scaled-down variants of northwestern Chihuahua *cerros de trincheras* remains unclear but seems quite possible. Present evidence for this distills down to two early maize radiocarbon dates, projectile points, lithics not at all characteristic of the Ceramic period in the greater region, and the northwestern Chihuahua precedent.

Other Basin and Range sites of note include an extensive artifact scatter (A57-02) on the *bajada* beside Cerro Prieto de Santa Bárbara that has several late Middle Archaic dart points. Only two sherds were found in this sprawling site. The Los Pilaes site (A15-06) is on a fluvial terrace along the Río San Pedro and includes an aceramic buried component of unknown extent and age. In summary, sites or components that likely date to the window when agriculture arrived are widespread in the higher Basin and Range country of Chihuahua. These sites occur in diverse settings and in most instances imply some stabilization in settlement.



## The Sierra Tarahumara

Fieldwork in two areas of the Sierra Tarahumara also produced evidence of habitation during the later mid-Holocene. Limited survey along Arroyo Caliente near Rejogochi produced one site (A32-06) with a dart much like or the same as late Middle Archaic Gypsum/Almagre points (see Justice 2002) and another (A32-05) comparable to Late Archaic Shumla points (Turpin 1991:32–33). A third open site (A43-01), on a terrace of the Rio Urique near Norogachi, had one dart comparable to Chiricahua points. This is a widespread type also dated to the later Middle Archaic period in the southwestern United States. The ages of these points are extrapolated and not directly verified, and we lack excavation data from these three sites. Nonetheless, they are important for simply adding to very scarce evidence that the Sierra Tarahumara was inhabited coincident with an interval of rapidly spreading maize agriculture several thousand years ago.

Additional evidence has come from two cave sites tested during 2003. The first montane cave tested is in a moderately remote location near Rejogochi. Sowérare (translates as Swallow Place), or A32-02, is a rockshelter perched below the base of one cliff and above a lower cliff in the Rio Urique watershed. This small cave has been thoroughly plundered, but intact deep midden deposits remain in front of the cave. We dug a single 1 m unit in the midden to a depth of over 120 cm below the surface. Underneath spoil from the looted cave, the actual midden deposits contained dense lithics, rare ground stone, and charcoal. No maize was found, but two samples of wood charcoal yielded radiocarbon dates of  $2660 \pm 40$  (880–790 cal B.C., Beta 185630) and  $3500 \pm 40$  (1920–1725 cal B.C., Beta 182381). These samples are in stratigraphic order and are chronologically consistent with the midden assemblage and dart points from the site. Based on such a small excavation sample, it would be premature to rule out the presence of maize.

The second cave is located about 1 km west of Zingg's Cave A, near Norogachi, and was almost certainly recorded by Zingg. In this sizable cave site known as Ganóchi (Place of the Giant, A33-02; Figure 3.4), a single  $1 \times 1$  m excavation replicated the pattern seen at Swallow Cave, of lithics and maize below ceramics, in deep cave fill. The upper 80 cm contained abundant artifacts, including pottery, and bits of cord and basketry, with remnants of a mud and grass container (Figure 3.5). Lithics, although moderately scarce, continued to approximately 130 cm below the surface. Organic artifacts continued to bedrock at more than 200 cm below the surface. A maize sample from 180 cm below the surface produced a radiocarbon date of  $2280 \pm 40$  (400–350 cal B.C. and 310–210 cal B.C., Beta 185631).

At this point, it is reasonable to argue that people expanded into the Sierra Tarahumara no later than the late Middle Archaic period. Sites are widely distributed in both areas of the Sierra we have worked in and are in locations presently well suited to small-scale subsistence agriculture. In our limited work there is no indication of *cerros de trincheras* or the D-shaped terrace sites in the Sierra Tarahumara. Overall, sites in the mountains are small, even by the modest standards of southern Chihuahua.



Figure 3.4. View of site A33-02, facing southeast.

## CONCLUSIONS AND DISCUSSION

Our present results allow us to make several conclusions. There are many locations in diverse settings across southern Chihuahua west of the Rio Florida where subsistence agriculture is feasible. Southwestern Chihuahua was widely inhabited during the later mid-Holocene, by which time people were distributed over the entire landscape. In the Basin and Range country of central southern Chihuahua, there are indications of increased settlement stability on a modest scale from the late Middle Archaic period. Maize agriculture minimally dates to ca. 1600 B.C. in the upper Basin and Range region and to 300 B.C. in the Sierra Tarahumara.

A marked increase in visible archaeology is seen beginning with the late Middle Archaic period, ca. 2500–2000 B.C., based on extrapolation from well-dated sites in the United States. It is not clear if this increase precedes or coincides with the arrival of maize agriculture. Coincidence would mean the same people who made San José, Langtry, and Pedernales dart points were at least introduced to agriculture. There is no precedent for this farther north, although there need not be, particularly given the direction of agriculture's spread. Interestingly, Thomas Hester (1989:59) describes the "late phase" of the Middle Archaic period in Texas, where agriculture is not a factor, as "perhaps the most distinctive and dominant occupational period in the Lower Pecos in terms of the sheer amount of cultural refuse." No evidence points to mass departure from the Sierra Tarahumara at any time to populate the Basin and Range country. Growth of an indigenous population in an area favorable to hunter-gatherers is left as the strong possibility. The settlement

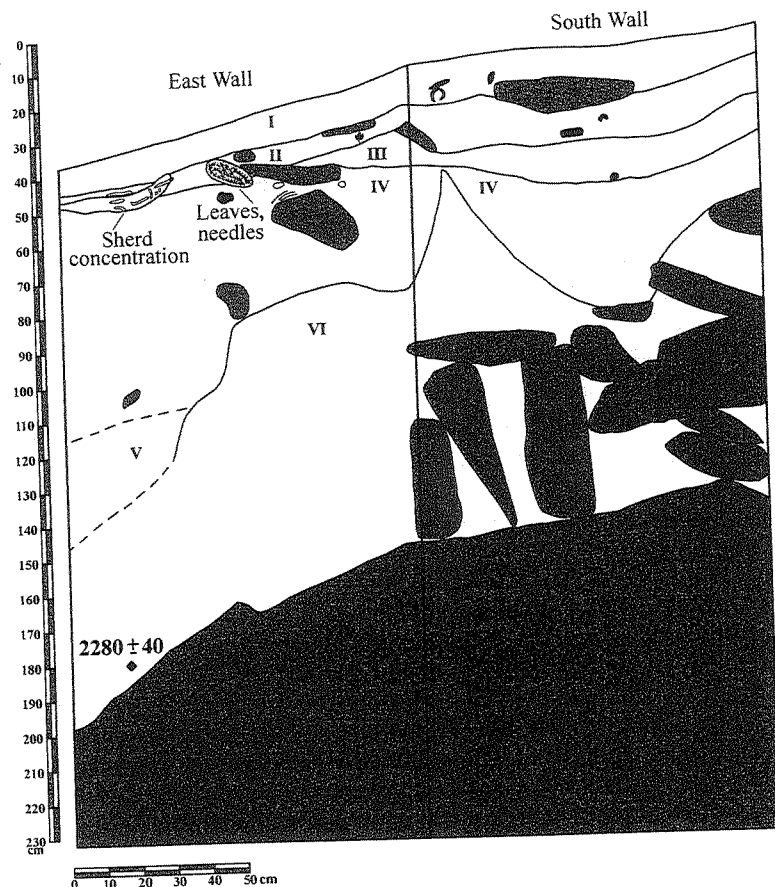


Figure 3.5. Excavation profile of site A33-02.

information briefly presented here might reveal the development of more conspicuous logistical hunter-gatherer sites created by populations fortuitously organized to receive maize agriculture (see Binford 1980; Fish and Fish 1994; Wills 1988:41).

Entrenched agriculture, as defined here, is implied for the southern *cerros de trincheras*. Although these are modest efforts in comparison with many larger *cerros de trincheras*, and as exclusively preceramic sites they may have been even smaller, the labor investment in building even a few terraces cannot be discounted. The D-shaped terrace sites also reveal a departure from forager settlement, although the presence of maize from preceramic contexts in these sites remains unproven.

The Sierra Tarahumara presents a similar picture of widespread remains from the late Middle Archaic period onward, but with an important difference. The few

sites known to have Archaic materials are relatively small. The deep deposits at both cave sites we tested probably reflect repeated, but not populous, occupation. Lister's (1958) work in the Sierra Madre Occidental left little to no doubt about early agriculture of some scale in the mountains. Results from the Ganóchi Cave substantiate this with a maize radiocarbon date exceeding 2,000 years—long before metal tools and goat dung fertilizer, presently so vital to Tarahumara agriculture, were available (Hard and Merrill 1992).

A final point to ponder is the relationship among the introduction of agriculture, entrenchment, and the long-term consequences of entrenchment. A well-known pattern in the history of the southwestern United States is the cycle of agricultural intensification, population increase, aggregation, and political complexity, although considerable disagreement exists on the underlying causal relationships (e.g., Boserup 1965; Cordell, Doyel, and Kintigh 1994; Leonard and Reed 1993; Stone and Downum 1999). Southwestern Chihuahua is an exception to this generalization. It has been long recognized that nothing resembling the dynamic mid-level regional polities of the southwestern United States or northern Chihuahua and nothing evoking Mesoamerican elaboration ever developed in southern Chihuahua. The possible emergence of *cerros de trincheras* during the Early Agricultural period, and their certain use between ca. A.D. 500–1000, suggest a foundation for a growing society, but evidently little came of it. Undated Ceramic-period sites of many forms are widespread. The apparent paradoxical absence of both agricultural intensification and significant aggregation in southwestern Chihuahua deserves more research because understanding why this cycle did not occur may provide insight into the underlying dynamics of growth and aggregation both to the north and south. It appears that entrenchment of agriculture occurred, but with only limited pressure toward aggregation and intensification of food production. Whether the structure of domestic and wild resources influenced this developmental trajectory remains to be examined. This issue and the other uncertainties recognized in this chapter await new research.

**Acknowledgments.** This work was supported by a grant from the Committee for Research and Exploration, National Geographic Society, and the National Science Foundation (0220292). We greatly appreciate the support of the Consejo de Arqueología, Instituto Nacional de Antropología e Historia (INAH), and Ing. Joaquín García-Barcelona González, president, as well as the assistance of Centro INAH Chihuahua and Antrop. Elsa Rodríguez García, director. Lic. Ranferi Juárez Silva deserves special recognition for his tireless help in the field and Arq. Rafael Cruz Antillón for his extensive logistical assistance. The people of the many communities we visited were always helpful, including those of Balleza, Norogachi, Parral Rejogochi, and Sta. Maria de las Cuevas. Cultural anthropologist Dr. Felice Wyndham took us to sites in the Rejogochi area, including Sowérare, and we greatly appreciate her interest and support.

## NOTES

1. All radiocarbon dates reported here are based on a half life of 5,568 years, are corrected for isotopic fractionation, and are calibrated [cal] at 2 sigma, as reported by Beta Analytic. If more than one calibration range is listed, all are given unless otherwise noted. All samples not identified as maize are wood charcoal.

## REFERENCES CITED

- Bennett, Wendell C., and Robert M. Zingg  
1935 *The Tarahumara: An Indian Tribe of Northern Mexico*. University of Chicago Press, Chicago.
- Benz, Bruce F.  
1999 On the Origin, Evolution, and Dispersal of Maize. In *Pacific Latin America in Prehistory: The Evolution of Archaic and Formative Cultures*, ed. Michael Blake, 25-38. Washington State University Press, Pullman.
- Binford, Lewis R.  
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4-20.  
2001 *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building Using Ethnographic and Environmental Data Sets*. University of California Press, Berkeley.
- Boserup, Ester  
1965 *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. G. Allen and Unwin, London.
- Brooks, Richard H.  
1971 *Lithic Traditions in Northwestern Mexico, Paleo-Indian to Chalchihuites*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Colorado, Boulder.
- Brown, David E., and Charles H. Lowe  
1980 *Biotic Communities of the Southwest*. USDA Forest Service General Technical Report RM-78 (map). Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
- Cordell, Linda S., David E. Doyel, and Keith W. Kintigh  
1994 Processes of Aggregation in the Prehistoric Southwest. In *Themes in Southwest Prehistory*, ed. George J. Gumerman, 109-134. School of American Research Press, Santa Fe.
- Di Peso, Charles C., John B. Rinaldo, and Gloria Fenner  
1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca*. 8 vols. Amerind Foundation Series 9. Amerind Foundation, Dragoon, Ariz., and Northland Press, Flagstaff, Ariz.
- Fish, Suzanne K., and Paul R. Fish  
1994 Prehistoric Desert Farmers of the Southwest. *Annual Review of Anthropology* 23: 83-108.
- González Arratia, Leticia  
1992 La Población Prehispánica Cazadora-Recolectora y el Desierto de Chihuahua. In *Historia General de Chihuahua: Geología, Geografía y Arqueología*, ed. Arturo Márquez-Alameda, 163-185. Universidad Autónoma de Ciudad Juárez, Ciudad Juárez.
- Gregory, David A.  
2001 An Evaluation of Early Agricultural Period Chronology in the Tucson Basin. In *Excavations in the Santa Cruz River Floodplain: The Early Agricultural Period Component at Los Pozos*, ed. David A. Gregory, 237-254. Anthropological Papers 21. Center for Desert Archaeology, Tucson.
- Gregory, David A., and Michael W. Diehl  
2002 Duration, Continuity, and Intensity of Occupation at a Late Cienega Phase Settlement in the Santa Cruz River Floodplain. In *Traditions, Transitions, and Technologies: Themes in Southwestern Archaeology*, ed. Sarah H. Schlanger, 200-223. University Press of Colorado, Boulder.
- Hard, Robert J., and William L. Merrill  
1992 Mobile Agriculturalists and the Emergence of Sedentism: Perspectives from Northern Mexico. *American Anthropologist* 94:601-620.
- Hard, Robert J., and John R. Roney  
1998 A Massive Terraced Village Complex in Chihuahua, Mexico, 3000 Years Before Present. *Science* 279(5337):1661-1664.  
2004 Late Archaic Period Hilltop Settlements in Northwestern Chihuahua, Mexico. In *Identity, Feasting, and the Archaeology of the Greater Southwest*, ed. Barbara Mills, 276-294. University Press of Colorado, Boulder.  
2005 The Transition to Farming on the Rio Casas Grandes and in the Southern Jornada Mogollon Region. In *The Late Archaic across the Borderlands: Foraging to Farming*, ed. Bradley J. Vierra, 141-186. University of Texas Press, Austin.
- Hard, Robert J., José E. Zapata, Bruce K. Moses, and John R. Roney  
1999 Terrace Construction in Northern Chihuahua, Mexico: 1150 B.C. and Modern Experiments. *Journal of Field Archaeology* 26:129-146.
- Haury, Emil W.  
1962 The Greater American Southwest. In *Courses toward Urban Life*, ed. Robert J. Braidwood and Gordon R. Willey, 106-131. Viking Fund Publications in Anthropology 32. Wenner-Gren Foundation for Anthropological Research, New York.
- Heidke, James M.  
1999 Cienega Phase Incipient Plainware from Southeastern Arizona. *Kiva* 64(3):311-338.
- Hester, Thomas R.  
1989 Chronological Framework for Lower Pecos Prehistory. *Bulletin of the Texas Archaeological Society* 59:53-64.
- Huber, Edgar K.  
2005 Early Maize at the Old Corn Site (LA 137258). In *Fence Lake Project, Archaeological Data Recovery in the New Mexico Transportation Corridor and First Five-Year Permit Area, Fence Lake Coal Mine Project, Catron County, New Mexico, Volume 4, Synthetic*

- A. C. MacWilliams, Robert J. Hard, John R. Roney, Karen R. Adams, and William L. Merrill  
*Studies and Summary*, ed. Edgar K. Huber and Carla R. Van West, 36.1-36.33. Statistical Research Technical Series 84, Tucson.
- Huckell, Bruce B.  
 1995 *Of Marshes and Maize: Preceramic Agricultural Settlements in the Cienega Valley, Southeastern Arizona*. Anthropological Papers 59. University of Arizona Press, Tucson.
- Justice, Noel D.  
 2002 *Stone Age Spear and Arrow Points of the Southwestern United States*. Indiana University Press, Bloomington.
- Leonard, Robert D., and Heidi E. Reed  
 1993 Population Aggregation in the Prehistoric American Southwest: A Selectionist Model. *American Antiquity* 58:648-661.
- Lister, Robert H.  
 1958 Archaeological Excavations in the Northern Sierra Madre Occidental, Chihuahua and Sonora, Mexico. In *Archaeological Excavations in the Northern Sierra Madre Occidental, Chihuahua and Sonora, Mexico*, ed. Robert H. Lister, 1-95. University of Colorado Studies, Series in Anthropology 7. University of Colorado Press, Boulder.
- Long, Austin, B. F. Benz, D. J. Donahue, A.J.T. Jull, and L. J. Toolin  
 1989 First Direct AMS Dates on Early Maize from Tehuacán, Mexico. *Radiocarbon* 31:1035-1040.
- Mabry, Jonathan B.  
 1998 Introduction. In *Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Analyses and Synthesis*, ed. Jonathan B. Mabry, 1-29. Anthropological Papers 19. Center for Desert Archaeology, Tucson.
- Mangelsdorf, Paul C.  
 1958 Archaeological Evidence on the Evolution of Maize in Northwestern Mexico. In *Archaeological Excavations in the Northern Sierra Madre Occidental, Chihuahua and Sonora, Mexico*, ed. Robert H. Lister, 96-119. University of Colorado Studies, Series in Anthropology 7. University of Colorado Press, Boulder.
- Marrs, Garland J.  
 1949 *Problems Arising from the Surface Occurrence of Archaeological Material in Southeastern Chihuahua, Mexico*. Unpublished master's thesis, Department of Anthropology, University of New Mexico, Albuquerque.
- Minnis, Paul E.  
 1992 Earliest Plant Cultivation in the Desert Borderlands of North America. In *The Origins of Agriculture: An International Perspective*, ed. C. Wesley Cowan and Patty Jo Watson, 121-141. Smithsonian Institution Press, Washington, D.C.
- Nusbaum, Deric  
 1940 Gila Pueblo Detail Sheet for GP U:13:2 (CHIH). Document on file, Arizona State Museum Archives, Tucson.
- Piperno, D. R., and K. V. Flannery  
 2001 The Earliest Archaeological Maize (*Zea mays* L.) from Highland Mexico: New Accelerator Mass Spectrometry Dates and Their Implications. *Proceedings of the National Academy of Science* 98:2101-2103.
- Pope, Kevin O., Mary E.D. Pohl, John G. Jones, David L. Lentz, Christopher von Nagy, Francisco J. Vega, and Irvy R. Quitmyer  
 2001 Origin and Environmental Setting of Ancient Agriculture in the Lowlands of Mesoamerica. *Science* 292:1370-1373.
- Raymond, Gerry R.  
 2001 La Investigación de Algunos Sitios al Sur de Chihuahua. In *Una Investigación Arqueológica de los Sitios Cerros con Trincheras del Arcaico Tardío en Chihuahua, México*, ed. Robert J. Hard, José E. Zapata, and John R. Roney, 37-44. Informe al Consejo de Arqueología, Instituto Nacional de Antropología e Historia. Center for Archaeological Research, University of Texas at San Antonio, Special Report 27-S, San Antonio.
- Raymond, Gerry R., John R. Roney, A. C. MacWilliams, Robert J. Hard, Karen R. Adams, and William L. Merrill  
 2003 Looking for Early Maize between the Southwest and Mesoamerica: A Field Report from Southwest Chihuahua, Mexico. Paper presented at the 68th Annual Meeting of the Society for American Archaeology, Milwaukee, Wis.
- Roney, John R., and Robert J. Hard  
 2002 Early Agriculture in Northwestern Chihuahua. In *Traditions, Transitions, and Technologies: Themes in Southwestern Archaeology*, ed. Sarah Schlanger, 163-180. University Press of Colorado, Boulder.
- 2004 A Review of Cerros de Trincheras in Northwestern Chihuahua. In *Surveying the Archaeology of Northwest Mexico*, ed. Gillian E. Newell and Emiliano Gallaga, 127-148. University of Utah Press, Salt Lake City.
- Schmidt, Kari M.  
 2004 Faunal Remains from Test Excavations at Early Agricultural Sites in Southern Chihuahua, Mexico. Manuscript on file, Center for Archaeological Research, University of Texas, San Antonio.
- Smith, Bruce D.  
 1997 Reconsidering the Ocampo Caves and the Era of Incipient Cultivation in Mesoamerica. *Latin American Antiquity* 8:342-383.
- Stone, Glenn D., and Christian E. Downum  
 1999 Non-Boserupian Ecology and Agricultural Risk: Ethnic Politics and Land Control in the Arid Southwest. *American Anthropologist* 101:113-128.
- Turner, Ellen Sue, and Thomas R. Hester  
 1993 *A Field Guide to Stone Artifacts of Texas Indians*. Gulf, Houston.
- Turpin, Solveig A.  
 1991 Time Out of Mind: The Radiocarbon Chronology of the Lower Pecos River Region. In *Papers on Lower Pecos Prehistory*, ed. Solveig A. Turpin, 1-49. Studies in Archeology 8. Texas Archeological Research Laboratory, University of Texas, Austin.
- Wills, W. H.  
 1988 *Early Prehistoric Agriculture in the American Southwest*. School of American Research Press, Santa Fe.

A. C. MacWilliams, Robert J. Hard, John R. Roney, Karen R. Adams, and William L. Merrill

Zingg, Robert M.

- 1939 *A Reconstruction of Uto-Aztecan History*. University of Denver Contributions to Ethnography II. G. E. Stechert, New York.
- 1940 *Report on Archaeology of Southern Chihuahua*. Contributions of the University of Denver, Center of Latin American Studies, Denver.

## 4

### MODELING THE EARLY AGRICULTURAL FRONTIER IN THE DESERT BORDERLANDS

---

*Jonathan B. Mabry and William E. Doolittle*

In 1998 excavations near Tucson in southern Arizona along the path of a highway construction project uncovered a series of canals dating between about 3,000 and 2,400 years ago (in uncalibrated radiocarbon years) (Mabry 2006b). This confirmed the earlier discovery of canals about as old at a nearby site in the same floodplain (Ezzo and Deaver 1998). Shortly thereafter, some Basketmaker II canals of almost the same age were found near Zuni Pueblo in northwestern New Mexico (Damp et al. 2000). This new and unexpected evidence for very early irrigated farming in both the southern and central parts of southwestern North America led Mabry to search the literature to find out if these canals were truly anomalous. A surprisingly wide variety of different types of farming can be identified or inferred for the Early Agricultural period, including most of those documented historically in southwestern North America (see Doolittle 2000).

This recognition of diversity, in turn, led Mabry (2005) to consider how recent approaches to the transition to agriculture in southwestern North America (including northwestern Mexico) tend to assume as the primary motivation either energy maximization (e.g., Barlow 2002; Diehl 1997) or risk minimization (e.g., Huckell 1990; Minnis 1992) and how these models calculate the labor, yield, and predictability of