WAY DOWN SOUTH: A REVIEW OF EVIDENCE PERTAINING TO EARLY AGRICULTURE IN MEXICO AND BEYOND

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ABSTRACT

Our understanding of the origins, timing, and geographic distribution of early agriculture in the New World is changing rapidly due to application of AMS radiocarbon dating and increasingly sophisticated microbotanical techniques. In this chapter, we review recent literature on this subject, with particular emphasis on the eventual development of maize agriculture and its spread into the Southwestern United States and northeastern Mexico.

In the past several years, there have been important developments in understanding the origins and spread of agriculture in Mesoamerica and further south in Central and South America. These developments have been driven largely by new methods, and they provide a broader context for early agriculture in the southwestern United States. Here, some of the underlying methodological advances are briefly discussed, and some of these recent developments are then reviewed.

The first and most obvious development is AMS radiocarbon dating, which has made it possible to date cultigens directly. This capability has revised the chronology of many early cultigens, sometimes in surprising ways. A second development is the application of genetic research and molecular biology to the issue of early agriculture. These approaches have opened an entirely new window on the origin and development of agriculture. The third methodological development is actually a series of microbotanical techniques, which, when used in conjunction with one another, can result in convincing multiproxy records of early agriculture (Bryant 2007). These methods are pollen analysis, phytolith identification, and starch identification. In combination with AMS radiocarbon dating, these techniques have made it possible to trace early agriculture in settings where plant macrofossils (the traditional mainstay of studies of early agriculture) are not preserved.

It should be noted that the microbotanical evidence is still somewhat controversial (cf. Sluyter and Dominguez 2006; Staller and Thompson 2002). Objections fall into two general categories: taxonomy and context. Taxonomic issues revolve around the ability of analysts to identify species and to differentiate between domesticated and nondomesticated varieties of plants based on pollen, starch, and phytoliths. This problem is illustrated by the early use of the size of pollen grains to distinguish between maize and teosinte. Although this was initially thought to be a valid approach, further comparative studies showed that there can be considerable overlap between these different varieties of *Zea mays* (Hoist et al. 2007). Similar problems could exist with starch and phytoliths, although specialists seem to be addressing these difficulties in a systematic way (Hastorf 2009; Piperno 2006b). The use of phytolith assemblages rather than reliance on identification of individual specimens also increases confidence in this method.

Context is the other potential pitfall of microbotanical approaches. When direct dating of very small carbon samples first became possible, it was revealed that archeological associations were often not as secure as originally thought. There is now a very important body of literature that reassesses the chronology of cultigens all around the world based on direct AMS dating, rather than relying on dates from associated materials. This is a particular problem with materials as small as starch grains and phytoliths, which can migrate through soil. Fortunately, it is now sometimes possible to directly date concentrated samples of both pollen and phytoliths. Further, new techniques for recovering starch and phytoliths from the working surfaces of tools and from cooking residues increase confidence.

EARLY HORTICULTURE: 10,000 TO 6,000 B.C.

For many years, prehistorians believed that the story of agriculture in the New World began with corn. However, it is now apparent that small-scale horticulture was widespread in Mesoamerica long before the advent of maize (Figure 1; Table 1). This possibility first became apparent several years ago when Smith (1997, 2005) reported direct AMS radiocarbon dates on squash seeds from Guila Naquitz in Oaxaca, Mexico. Morphologically, the seeds were clearly from domesticated varieties of squash (*Cucurbita pepo*), and they yielded nine dates between 8000 and 6000 B.C.

More recently, Erickson and colleagues (2005) have argued that the bottle gourd (*Lagenaria siceraria*) was also widely cultivated in the New World at an equally early date, 8000-6000 B.C. Even more surprising is the possibility that this domesticated plant was introduced into the Americas by Paleoindian immigrants. The bottle gourd is not a food plant, but instead, is raised to provide durable, lightweight containers, musical instruments, and fishing floats. It is an Old World plant, native to Africa, but also widespread in Asia, where domesticated varieties have been documented in China and Japan in the 7000-6000 B.C. range.

There are no known wild populations of bottle gourd in the New World. However, direct AMS radiocarbon dating has now shown that this plant was cultivated in Florida, Mexico, Peru, and Ecuador between 8000 B.P. and 6000 B.P. Moreover, genetic studies show that the New World variety originated in Asia, rather than Africa. Potential mechanisms for its initial dispersal from Asia to the New World include both natural and cultural vectors, but the fact that it was so widespread as a cultigen prior to 6000 B.C. suggests to some that it was introduced by Paleoindian immigrants.

Piperno and Stothert (2003) have proposed coastal Ecuador as one location where squash may have been initially domesticated, sometime between 10,000 B.C. and 8000 B.C. Their argument is based on direct AMS radiocarbon dating of phytoliths specific to the fruit rinds of the genus *Cucurbita*. They distinguish wild from domesticated varieties based on relative size of the phytoliths, a distinction supported by studies of phytoliths from modern wild and domesticated populations of *Cucurbita*. They also report a clear relationship between larger phytoliths and larger fruit size. Based on this criterion, their earliest deposits included only the wild, non-domesticated varieties, but domesticated *Cucurbita* appears as early as 10,000 B.C. Phytoliths of bottle gourd and leren (*Calathea allouia*), a minor root crop, appear as early as 7300 B.C.

AMS dates on squash and bottle gourd macrofossils provide good evidence for early horticulture 8000-6000 B.C. The phytolith evidence, which suggests even earlier dates for squash and leren, is more controversial, but it is carefully developed, with evidence from multiple sites, careful attention to indicators of domestication, and well-described archeological contexts.

Maize also initially appeared during this interval. The earliest evidence of maize, consisting of both starch and phytoliths, is now dated at about 6700 B.C., in the Rio Balsas region of Mexico (Piperno et al. 2009), where genetic and molecular studies predicted it would be found (Matsuoka et al. 2002).

BEGINNINGS OF MAIZE AGRICULTURE: 6000 TO 4500 B.C.

A growing body of evidence indicates that by 5000 B.C., some form of cultivated maize was widespread in Central America and adjacent areas of northern South America and southern Mexico (Figure 2; Table 2). Charcoal is usually poorly preserved in these moist tropical settings, and consequently, evidence for this initial dispersal of maize is entirely microbotanical, based on pollen, phytoliths, starch, and sediment cores collected from swamps and lakes. In sediment cores, the sudden appearance of pollen and phytoliths from cultigens, in conjunction with anomalous increases in charcoal and evidence of plants associated with disturbed habitats, indicate the beginnings of widespread slash-and-burn cultivation within the watershed.

Prior to 5000 B.C., simple horticulture became widespread in Central America and adjacent regions, focusing on plants such as squashes and gourds, arrowroot, manioc, leren, yams, and maize (Piperno, Andres, and Stothert 2000). Tree crops, such as palms and avocado, are also abundant in early sites, but wild and domesticated varieties cannot be distinguished. These early food-producing adaptations incorporated cultigens with dissimilar origins, suggesting this initial diffusion of horticulture occurred by spread of individual plants, rather than as a result of migrant agriculturalists (Dickau et al. 2007). For example, in central Pacific Panama, arrowroot, leren, and squash were grown prior to 5800 B.C., and a short time later, they were supplemented by manioc from South America and maize from Mexico.

There are no macrofossils of maize from this interval, and therefore, no direct evidence of its morphology. However, by examining assemblages of phytoliths from specific early horticultural contexts, Piperno and Pearsall (1998:221) argue that this early corn was intermediate between Balsas teosinte and modern maize. Working with material from central Panama, dating to around 5000 B.C., they found three types of phytoliths that today are found only

Figure 1. Early horticulture, 10,000 to 6,000 B.C. (see Table 1 for details).

Table 1. Early horticulture, 10,000-6000 B.C.

Site	Approximate Date	Species	Evidence	Reference
Santa Elena Peninsula coastal Equador (A)[a]	10,000-8000 B.C.	Squash	Phytolith	Piperno and Stothert 2003
	7300 B.C.	Bottle gourd	Phytolith	Piperno and Stothert 2003
	7300 B.C.	Leren	Phytolith	Piperno and Stothert 2003
Guila Naquitz, Mexico (B)	8000-6000 B.C.	Squash	Macrofossil	Erickson et al. 2005
Rio Balsas, Mexico (C)				
Xihuatoxtla	6700 B.C.	Maize	Starch, phytolith	Piperno et al. 2009; Ranere et al. 2009
		Squash	Phytolith	
Central Panama (D)				
Cueva de los Vampiros	6600 B.C.	Arrowroot	Phytoliths	Piperno and Pearsall 1998
Quebrada Jaguay, Peru (E)	6400 B.C.	Bottle gourd	Macrofossil	Erickson et al. 2005
Windover, Florida (F)	6100 B.C.	Bottle gourd	Macrofossil	Erickson et al. 2005

Note: Radiocarbon dates were calibrated using Oxcal v4.1.6, and are expressed as the median of the 1-sigma calibration, rounded to the nearest century.
[a]Letters correspond with Figure 1.

in teosinte fruitcases, as well as phytoliths that are only found in glumes from modern maize. Additionally, there were phytoliths that are common to both modern teosinte and the most primitive varieties of modern Mexican maize, Revenator and Maize Ancho. Moreover, high frequencies of certain phytoliths found in these sediments are more like teosinte than maize.

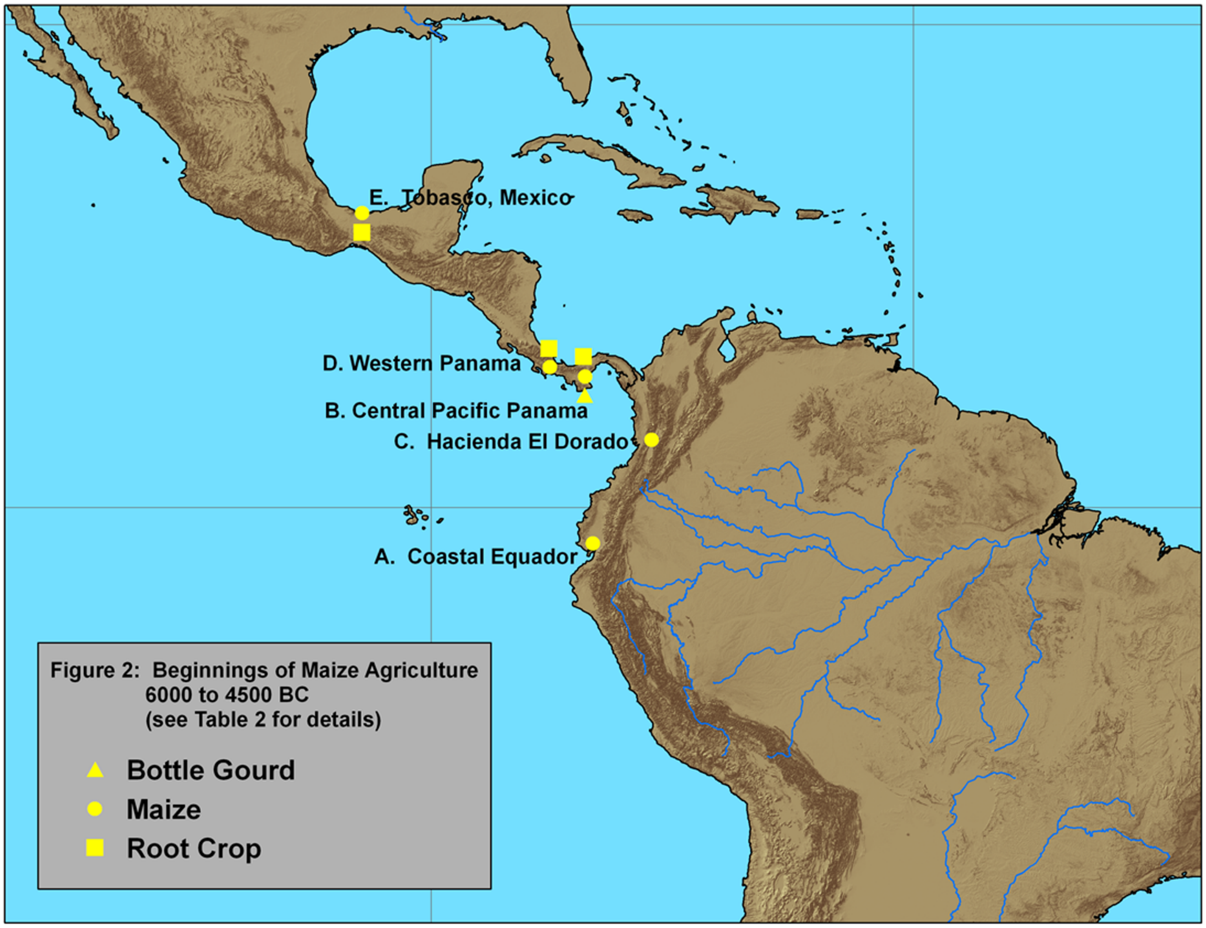

Figure 2. Beginnings of maize agriculture, 6000 to 4500 B.C. (see Table 2 for details).

Based on these observations, Pimperno and Pearsall (1998:222) suggest that the kernels of early maize at this location were at least partially enclosed by fairly hard glumes. Conversely, the earliest maize phytolith assemblages from the Rio Balsas region lack types indicative of teosinte fruitcases, suggesting that human selection was already affecting cob morphology. Starch evidence, also from early contexts in the Rio Balsas as well as from central Panama, indicates the kernels were composed of hard endosperm varieties, indicating popcorn rather than flour corn was present (Dickau et al. 2007:3654; Piperno et al. 2009).

In summary, between about 6000 and 4500 B.C., semimobile foragers in Central America and adjacent parts of southern Mexico and northern South America may have been experimenting with small-scale cultivation involving root and seed crops, including arrowroot, manioc, squash, and leren. Primitive maize was also part of this mix, but was likely lower in productivity than either modern varieties or varieties documented by macrofossils in later prehistoric sites. There is some suggestion of widespread forest clearance, indicating swidden agriculture during this period, especially in seasonally dry areas, such as central Pacific Panama (Dickau et al. 2007:3655).

EARLY MAIZE CULTIVATION: 4500 TO 2000 B.C.

If the reconstructions outlined above are valid, sometime prior to 4250 B.C., further morphological change in maize resulted in varieties that more closely resemble modern maize, and that were presumably more productive than the primitive maize of earlier times. In the lowlands of Central America and adjacent regions, this change is marked by much more evidence of slash-and-burn cultivation. Sediment cores show decreases in arboreal pollen, dramatic increases in charcoal and pollen from disturbance plants, and in some cases, the first occurrence of maize phytoliths and maize/teosinte pollen. At the same time, there were expansions in both the environmental range and the geographic range of maize (Figure 3; Table 3).

In Mexico, maize macrofossils have been found in the highlands of Oaxaca dating to 4250 B.C., and in the semiarid Tehuacan Valley of Puebla at 3450

Table 2. Beginnings of maize agriculture, 6000-4500 B.C.

Site	Approximate Date	Species	Evidence	Reference
Coastal Equador (A)[a]				
Vegas	5800-5600 B.C.	Maize	Phytoliths	Piperno and Pearsall 1998:187
Central Pacific Panama (B)				
Cueva de los Ladrones	5800-5500 B.C.	Maize	Starch	Dickau et al. 2007
Aguadulce Shelter	5800-3800 B.C.	Manioc, maize, arrowroot, yam (?)	Starch	Piperno, Ranere, Holst, and Hansel 2000
	Pre-5800 B.C.	Leren, bottle gourd	Phytoliths	Piperno and Pearsall 1998:213
	Circa 5800 B.C.	Maize	Phytoliths	Piperno and Pearsall 1998:214
Cauca Valley Columbia (C)				
Hacienda El Dorado	6100-5100 B.C.	Maize	Lake sediments	Bray et al. 1987, cited in Pohl et al. 2007; also Piperno and Pearsall 1998:262
Western Panama (D)				
Hornito	Circa 5000 B.C.	Maize	Starch	Dickau et al. 2007
Casita de Piedra	Circa 5400 B.C.	Arrowroot	Starch	Dickau et al. 2007
	3600 B.C.	Manioc	Starch	Dickau et al. 2007
Tobasco, Mexico (E)				
San Andres	5300 B.C.	Maize	Phytoliths, pollen	Pohl et al. 2007
	Circa 4600 B.C.	Manihot	Pollen	Pope et al. 2001

Note: Radiocarbon dates were calibrated using Oxcal v4.1.6, and are expressed as the median of the 1-sigma calibration, rounded to the nearest century.
[a]Letters correspond with Figure 2.

B.C. (Piperno and Flannery 2001). In southwestern Ecuador, maize starch has been recovered from burned residue on cooking pot sherds dating to 3300 B.C. (Zarillo et al. 2008). As has been seen, maize may have been present in Ecuador at a much earlier date, but for the first time, starches indicative of soft endosperm are present, another indication of morphological change associated with greater maize productivity (Whitt et al. 2002).

As will be discussed, there is very little archeological information from this crucial period, but the data that are available seem to suggest a sudden increase in the range of maize cultivation in both North and South America at about 2500 B.C., an expansion that brought this cultigen rapidly into what is now the southwestern United States (Figure 4; Table 4). In South America, the highland southern Peruvian site of Waynuna has yielded maize phytoliths and starch dated to roughly 2000 B.C., along with starch from arrowroot (*Maranta* sp.) and perhaps potato (cf. *Solanum* sp.) (Perry et al. 2006). This site is 1,500 km beyond the pre-2500 B.C. southern distribution of maize. Even further south, in southeastern Uruguay, Iriarte et al. (2004) report phytoliths diagnostic of both maize and domesticated squash also dating to the third millennium B.C.

A similar expansion in the range of maize occurred at about the same time in North America. In Tamaulipas, both bottle gourd and squash were cultivated as early as 4400 B.C., and maize was added at around 2400 B.C., based on direct dating of macrofossils (Smith 1997). Tamaulipas is about 600 km north of the central Mexican Highlands, where maize was grown during the preceding interval. As is now well known, maize reached the southwestern United States, almost 2,000 km north of central Mexico, only 300-400 years later. This radiation is remarkable not just in terms of distance, but also in the range of habitats and environmental constraints that were transcended.

Given the tremendous importance of this early period of maize cultivation, it is amazing how little actual information is available. In the archeological literature of Mesoamerica, this period is represented by a few rockshelters (Oaxaca, Puebla, Tamaulipas), a few coastal shell middens (Guerrero; see Kennett et al. 2006), and a single lacustrine/riparian site (Basin of Mexico; see Niederberger 1979). There is very limited testing information from a few other locations, such as lacustrine settings and rockshelters in the Balsas Basin (Piperno et al. 2007) and rockshelters in the Sayula-Zacoalco Lake Basin (Benz 2002). Currently, the most important assemblage pertaining to early maize agriculture in Mexico is a collection of approximately 20 formal artifacts excavated recently by Ranere et al. (2009) in the central Balsas region.

Several researchers have commented on the dearth of information about settlements between 3000 and 2000 B.C., even in well-studied locations,

Figure 3. Early maize agriculture, 4500 to 3000 B.C. (see Table 3 for details).

such as Tehuacan and the Valley of Oaxaca (Niederberger 1979). This is sometimes attributed to a propensity for research focusing on later time periods, when ceramics accentuate site visibility. However, several recent projects have specifically targeted preceramic times, with less than spectacular results. For example, in the central Balsas watershed, Piperno et al. (2007) found a very small assemblage of lithic artifacts associated with radiocarbon dates on soil and pollen in the 4300-5300 B.C. range, but cultural materials were much more abundant in later sediments. Similarly, Benz (2002), working in the Sayula-Zacoalco Basin of western Mexico, reported only minimal evidence of Archaic period occupations. Mountjoy (1998:252-253) comments on the curious scarcity of Archaic remains in western Mexico, and lists several intensive large-scale archeological survey projects in both highland and coastal western Mexico that failed to find a single Archaic site. He attributes this dearth to a relative scarcity of natural food resources.

Geomorphic processes might also account for a dearth of Archaic materials. Kennett et al. (2006) argue that their posited base camps on the coastal plain are deeply buried beneath more recent alluvium, and they provide some limited evidence in support of this hypothesis. Archaic materials in the Valley of Mexico were buried 1-4 m below modern ground surface, and the lakeshore Archaic materials dated by Piperno et al. (2007) in the Balsas Basin were 2.9 m to 4.4 m below the surface.

Another reason for difficulty in finding early agricultural materials in Mesoamerica may relate to the nature of the archaeological evidence itself. If early agricultural adaptations were primarily small-scale horticultural societies, they may not have left much of an archaeological signature. Also, ironically, the methodological advancements allowing work with small particles have surpassed our ability to work in the old-fashioned way, that is, finding and digging sites. With the conspicuous exception of the Tucson Basin, in most regions, much more is now known about early cupules, pollen, phytoliths, and starch than about early settlements and societies.

DISCUSSION

Several important points stand out in a review of early maize agriculture in Mesoamerica. First, all

Table 3. Early maize, 4500-3000 B.C.

Site	Approximate Date	Evidence	Reference
Oaxaca, Mexico (A)[a]			
Guila Naquitz	4300 B.C.	Macrofossils	Piperno and Flannery 2001
Ecuadorian Amazonia (B)			
Lake Ayauchi	4200 B.C.	Lake sediments	Bush et al. 1989
Columbian Amazon (C)			
Abeja	3800 B.C.	Lake sediments (?)	Mora et al. 1991, cited by Pohl et al. 2007
Costa Rica (D)			
Laguna Martinez	3500 B.C.	Lake sediments	Arford and Horn 2004
Western Honduras (E)			
Lake Yojoa	3500 B.C.	Lake sediments	Rue 1989
Puebla, Mexico (F)			
San Marcos Cave	3400 B.C.	Macrofossils	Fritz 1994
Northern Belize (G)			
Cob Swamp	3400 B.C.	Pollen	Pohl et al. 1996
Cauca Valley, Columbia (H)			
Hacienda Lusitania	3200 B.C.	Lake sediments	Monslave 1985, cited by Rue 1989; also Piperno and Pearsall 1998:261
Coastal Ecuador (I)			
Loma Alta	3100 B.C.	Starch	Zarrillo et al. 2008

Note: Radiocarbon dates were calibrated using Oxcal v4.1.6, and are expressed as the median of the 1-sigma calibration, rounded to the nearest century.
[a]Letters correspond with Figure 3.

adaptations during this interval are small scale societies with economies based on either foraging or a mixture of foraging and horticulture (Piperno 2006a). All documented subsistence systems relied heavily on hunting and gathering, and no architectural remains have been found. The agricultural village pattern typical of much of Mesoamerica did not emerge until after 2000 B.C.

Second, early horticulture involved several different species and different combinations of species. By 6000 B.C., squash and bottle gourd were widely cultivated. In tropical lowland settings, leren, arrowroot, yams, and manioc were widespread at 5000 B.C. The practice of slash-and-burn agriculture may have also begun at about this time. In the Valley of Mexico, Niederberger (1979) suggests that amaranth (*Amaranthus*), goosefoot (*Chenopodium*), ground cherry (*Physalis*), and teosinte (*Zea* sp.) may have been objects of horticultural experimentation between 6000 B.C. and 4500 B.C. Third, maize was usually added to preexisting horticultural complexes, and the timing of its addition varied widely at different locations within its zone of distribution.

Finally, maize was a component of several different classes of settlement-subsistence systems. In semiarid settings, with a pronounced dichotomy between wet and dry seasons, relatively mobile settlement-subsistence systems are envisioned, with maximum dispersion during the dry season and aggregation during the wet season based on exploitation of cereals and other plants in especially favored settings. This is the pattern described for the Tehuacan Valley, the Valley of Oaxaca, and presumably, for Tamaulipas.

Along the Pacific coast of southern Mexico at Soconusco, Kennett et al. (2006) posit a central place foraging pattern, with essentially permanent settlements adjacent to rivers on the coastal plain, 10-15 kilometers inland. From these semipermanent camps, logistically organized parties exploited a broad range of microenvironments. The most archaeologically visible component of this pattern is a series of large Archaic shell midden sites on the coast itself. The investigators argue that initially shellfish (small marsh clams) were exploited during the dry season. In this context, maize (its presence inferred from phytoliths) begins to appear at about 2600 B.C., during a gradual shift to wet season exploitation of shellfish. Accumulation of the shell middens ended here at 1500-1000 B.C., when fully agricultural villages began to appear throughout the region. Archaic shell middens are relatively common all along the Pacific coast of Mexico, and analogous processes could have occurred elsewhere.

In the Valley of Mexico, Niederberger (1979) argues that the site of Zohapilco hosted a largely sedentary population as early as 6000 B.C., with an economy based primarily on wild plant and animal resources. As mentioned, teosinte rather than maize was used during the early occupation of this site,

Figure 4. Early maize agriculture, 3000 to 2000 B.C. (see Table 4 for details).

and even during the later occupation at 3000-2200 B.C., it is not clear that *Zea mays* ssp. *mays* was present. Nevertheless, this is the kind of situation in which agriculture could have flourished. This site is on the shores of Lake Chalco, an especially luxuriant setting characterized by Niederberger (1979) as riparian. She points out that estuary settings are similar, and that there are many lakes in closed basins of Mesoamerica. One such setting in northern Mexico that has not yet been intensively studied is the Lagunera District near Gomez Palacio, Durango, and Torreon, Coahuilla, where the great Rio Nazas ends in a vast closed basin.

NORTHERN MEXICO

Our own recent research, in collaboration with Art MacWilliams, Karen Adams, and William Merrill, has focused on early agriculture in the broad zone between Mesoamerica and the southwestern United States. It grew out of excavations at Cerro Juanaqueña and other Early Agricultural *cerros de trincheras* in northwestern Chihuahua. As reported elsewhere (Hard and Roney 2005; Roney and Hard 2004), these massively constructed hilltop villages were occupied during two brief intervals, first and most intensively at about 1200 B.C., and again at about 250 B.C. Evidence from these sites suggests a relatively sedentary residence pattern and a maximum population at Cerro Juanaqueña of around 200 people. Faunal and macrobotanical remains were well preserved. As might be expected in a desert grassland setting, cottontails and jackrabbits were the most common game animals. Even though maize was, by far, the most ubiquitous plant species (excluding wood charcoal), there was also microbotanical evidence of a wide range of wild plant species, including chenopodium, plains lovegrass, bulrush, chia, milk vetch, horse purslane, barrel cactus, globemallow, and wild gourd. The chenopodia included amaranth, which may have been domesticated, based on scanning electron microscopic measurement of seed coat thickness.

When these sites were excavated, their early dates were within a few centuries of the earliest maize in the southwestern United States. Other *cerros de trincheras* had been reported further south in Chi-

Table 4. Selected sites, early maize, 3000-2000 B.C.

Site	Approximate Date	Evidence	Reference
Southeast Uruguay (A)[a]			
Los Ajos	2800 B.C.	Phytoliths, starch	Iiarte et al. 2004
Western New Mexico (B)			
Old Corn	2300 B.C.	Macrofossils	Huber and Van West 2005
Bat Cave	2100 B.C.	Macrofossils	Wills 1988:109
Tucson Basin (C)			
Los Pozos	2600 B.C.	Macrofossils	Gregory and Baar 1999
Las Capas	2100 B.C.	Macrofossils	Whittlesey et al. 2009
Clearwater	2100 B.C.	Macrofossils	Mabry 2006
Coastal Ecuador (D)			
Real Alto	2500 B.C.	Phytoliths	Zarillo et al. 2008
Tamaulipas, Mexico (E)			
Ocampo Caves	2400 B.C.	Macrofossils	Smith 1997
Western Pacific Panama (F)			
Trapiche	2400 B.C.	Starch	Dickau et al. 2007
Southeastern Arizona (G)			
McEuen Cave	2100 B.C.	Macrofossils	Huckell et al. 2001
Andean Peru (H)			
Waynuna	2000 B.C.	Starch, phytoliths	Perry et al. 2006
Northwestern Arizona (I)			
Three Fir Shelter	2000 B.C.	Macrofossils	Smiley 1994

Note: Radiocarbon dates were calibrated using Oxcal v4.1.6, and are expressed as the median of the 1-sigma calibration, rounded to the nearest century.
[a]Letters correspond with Figure 4.

huahua, and it seemed possible that those in northwestern Chihuahua were part of a larger phenomenon associated with the initial spread of maize agriculture into this part of North America. To test this hypothesis, a program of reconnaissance survey and testing in southern Chihuahua was initiated. The project has emphasized *cerros de trincheras* and rockshelters, because these kinds of sites were known to occasionally contain evidence of the Early Agricultural period, because they are conspicuous and easy to find, and because dateable macrobotanical remains are more likely to be preserved and concentrated in these contexts.

Open artifact scatters, rockshelters, and *cerros de trincheras* have all yielded projectile points suggesting Archaic dates, but it is now clear that the principal use of the southern Chihuahua *cerros de trincheras* was during the Ceramic period, around A.D. 600 or 700, coincident with a northward expansion of the Mesoamerican frontier. Our earliest maize date is 1700 B.C., although an anomalous isotope value and lack of corroborating chronometric dates are problematic. We remain convinced that evidence of early agriculture will be found in the Sierra Tarahumara and along its eastern flanks, although we have yet to see any clear evidence of a robust agricultural adaptation in this region. Instead, it is likely that early agriculture took the same form it did in most of the rest of North America, with small-scale social organization, a mobile and flexible residence pattern, and continued heavy reliance on wild plants and animals for subsistence.

In this context, the scale of the San Pedro occupations and dependence on farming at the *cerros de trincheras* in northwestern Chihuahua and in the Tucson Basin are unique and singular phenomena. In northwestern Chihuahua, the massive archaeological remains, in conjunction with a very narrow range of radiocarbon dates, implies a large population with significant reliance on agricultural production. Although the size of Early Agricultural period populations at any given point of time in the Tucson Basin remain under debate, the simple intensity of use of the landscape there alone is remarkable, as seen in settlements, structures, storage pits, and irrigation. The causes and conditions for these parallel phenomena on the Rio Casas Grandes and the Santa Cruz River are significant areas for future research.

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