ARCHAEOLOGY SOUTHWEST *magazine*

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Although Preservation Archaeology begins with the active protection of archaeological sites, it doesn't end there. We utilize holistic, low-impact investigation methods in order to pursue big-picture questions about what life was like long ago. As a part of our mission to help foster advocacy and appreciation for the special places of our past, we share our discoveries with the public. This free back issue of *Archaeology Southwest Magazine* is one of many ways we connect people with the Southwest's rich past. **Enjoy!**

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Archaeology Southwest

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Early Maize in the Greater Southwest

William H. Doelle, President, Center for Desert Archaeology

Maize is such an essential element of Southwestern native cultures that few consider a time before maize. The tremendous growth in knowledge about the spread of maize across the Greater Southwest is explored in this premier issue of *Archaeology Southwest*.

WITH our large number of contributors to this issue, we present several themes. One theme is to provide a historical context for this new knowledge. Brief considerations of maize by Michael Diehl and of radiocarbon dating by David Gregory are essential starting points. Jonathan Mabry provides an overview of the role of the Cochise culture concept in the southern Southwest, and R. G. Matson looks at the Basketmaker concept on the Colorado Plateau. The map on pages 8 and 9 puts the sites discussed here in their geographic context, and also presents many of the earliest direct radiocarbon dates on maize.

Jonathan Mabry

Jonathan Mabry

Archaeologists working ahead of construction projects are revealing ever-older maize. Las Capas (above), Santa Cruz Bend (below).

Another central theme is the diversity of sites where early maize has been found across the Greater Southwest. Many are very large open sites, with Los Pozos and Las Capas in Tucson, La Playa in Sonora, and Cerro Juanaqueña in Chihuahua, all featured here. The scale of these sites has been one of the particular surprises of recent work. Historically, rock shelters have been major sources of information on early maize, and sometimes relatively small-scale revisits to such sites can provide new insights, as the articles on Bat Cave, McEuen Cave, and Fresnal Shelter illustrate.

David Gregory cautiously considers issues of population size and degree of sedentism for early Southwestern farmers. Sidebars throughout the issue address early irrigation and show some of the details that can be gleaned from the archaeological record. A particularly intriguing view of this distant past is provided by historical linguist Jane Hill.

In the crush of discovery, it is impossible not to be impressed with the dramatic archaeology that is only partly presented here. Keep in mind that this information is still very fresh. It needs a great deal of tedious analysis and careful evaluation before conclusions regarding population size or degree of sedentism can be drawn. This process is under way and seems likely to yield even more surprises before it is over.

Welcome

This new quarterly publication, *Archaeology Southwest,* has developed out of 12 years of the Center's quarterly *Archaeology in Tucson* newsletter. The content and writing in *Archaeology Southwest* are aimed broadly at professionals, students, and general readers. We will often feature some of the most recent developments in archaeology. At other times, we may delve into the history of an important person, institution, or site. Expect diversity. We are expanding both the geographic scale of our coverage and the size of our publication. This is a special 16-page issue; David Gregory has served as editor. Our next issue will look at warfare in the Greater Southwest, a topic guaranteed to generate interest and controversy.

Archaeology Southwest is a Quarterly Publication of the Center for Desert Archaeology

Zea mays: The Bountiful Crop

Michael W. Diehl, Center for Desert Archaeology

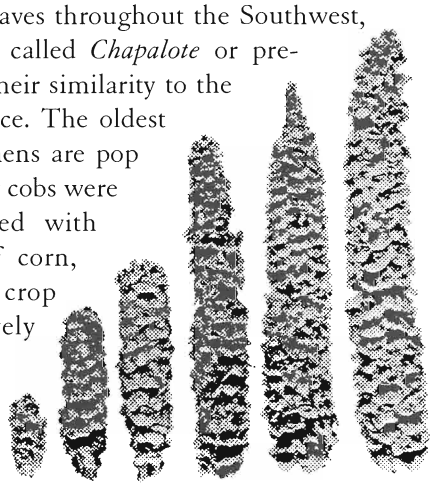
MAIZE, or corn, (*Zea mays*) is an important dietary staple for many people. American "corn belt" maizes are economically vital crops that are used to feed livestock, and produce sweeteners, starches, oils, and even antibiotics. Maize comes in countless varieties, including ancient types observed only in archaeological samples, "Indian corn" varieties grown by Native Americans in the northern and southern hemispheres, and innumerable industrial hybrids. All are the descendants of one or a few plants that were developed as crops in central Mexico around 3500 B.C.

Maize and most major agricultural grains are related to common grasses. Maize has unusual chemical properties that allow it to thrive in arid, intensely sunny environments, and on average it produces greater quantities of edible grain per acre than any other major food crop. These are probably some of the reasons prehistoric Southwesterners included maize among the many foods that they enjoyed, and eventually came to depend on it as a dietary staple.

Since maize is vital to the world economy, its history, prehistory, growth habits, and modern economic and food uses are subjects of intensive research by archaeologists, ethnobotanists, and agricultural scientists. Archaeologists typically concentrate on several interrelated questions surrounding maize cultivation: When was maize introduced to the Southwest? Why did people "take up farming" and how did the transition from foraging to farming affect their lives? How are different kinds of prehistoric, "primitive" contemporary, and modern types of maize related?

The names of different types of maize ("races" or "cultivars") are derived from agricultural science, and botanical and ethnobotanical research. Archaeologists examine differences in the anatomical details of cobs and kernels to characterize ancient maize. Other sciences consider additional attributes such as kernel color, the appearance and growth habits of the plants, and sometimes the presence of certain genes. Thus, when archaeologists use a term like *Chapalote* or *Harinoso de ocho* to describe prehistoric specimens, they mean that the size, shape, and general configuration of a set of prehistoric corncobs or fragments match the known size and shape distributions for one of the botanically documented modern races.

In this issue of *Archaeology Southwest*, archaeologists are concerned with specimens of maize grown in the Southwest between 2,000 and 4,000 years ago. The oldest Southwestern maizes generally produced small cobs with small kernels. The most complete specimens have been recovered from dry caves throughout the Southwest, and they have been called *Chapalote* or pre-*Chapalote* based on their similarity to the modern *Chapalote* race. The oldest Southwestern specimens are pop corns, and since their cobs were very small compared with modern varieties of corn, some suspect that crop yields were relatively low.



Chapalote-type maize cobs from Bat Cave *(see page 13).*

Corn: Its Origin, Evolution and Improvement, Paul C. Mangelsdorf

Radiocarbon Dating

When radiocarbon dating was invented in the late 1940s, it provided a revolutionary new tool for archaeologists as well as scientists in other disciplines. For the first time, there was a way to measure time that could be applied anywhere in the world. Walter Libby was awarded the 1960 Nobel Prize in chemistry for his discovery of the technique.

Although details of the chemistry and physics involved are complex, the basis for the technique is relatively simple. Radioactive carbon-14 (^{14}C) is present in the earth's atmosphere and is taken up by plants and animals along with the nutrients they use to survive. When a plant or animal dies, this process ceases and the ^{14}C present begins decreasing through radioactive decay. The rate of decay is a known constant, and by counting the amount remaining, the age of a sample can be determined. The original technique counts this amount using radiometry, which is similar to counting the ticks given off by a Geiger counter.

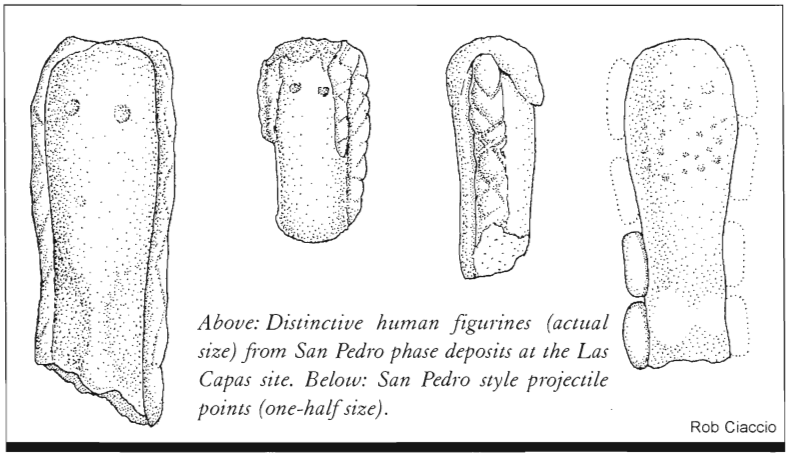
In recent decades, radiocarbon dating has been refined. The greatest advance has been the development of accelerator mass spectrometry (AMS), beginning in the early 1970s. AMS dating uses a particle accelerator to count the number of ^{14}C atoms remaining. This technique allows much smaller samples to be measured. Using charcoal, standard radiometric dating requires about enough material to fill a 35 mm film canister, while AMS dating can be successful with samples the size of the head of a pin. This technique has been extremely important in the dating of early maize because it allows individual fragments of maize to be dated.

Both techniques have statistical errors associated with them, expressed as a "+/-" number following the date. This number represents one standard deviation in a statistically determined range of age probabilities. For example, a date of 2400 B.P. +/- 50 means that the radiocarbon age has a 65 percent chance of falling between 2,350 and 2,450 years ago, and a 95 percent chance of falling between 2,300 and 2,500 years ago (two standard deviations). The B.P. following the date means "before present"; by long-standing convention, "present" is defined as A.D. 1950.—*David A. Gregory, Desert Archaeology, Inc.*

Changing Concepts of the First Period of Agriculture in the Southern Southwest

Jonathan B. Mabry, Desert Archaeology, Inc.

DURING the 1930s, Edward Sayles and Ernst Antevs defined the "Cochise culture" based on their investigation of the stratigraphic relationships of buried preceramic sites in southeastern Arizona. They believed that this hunting and gathering adaptation lasted nearly the entire 10,000 years since the end of the last Ice Age. The "San Pedro stage" was the third and final stage of the Cochise culture and geological correlations suggested that San Pedro stage sites dated between about 3000 and 500 B.C. Resemblances were noted between San Pedro stage artifacts and those from Basketmaker II sites on the Colorado Plateau, previously the oldest known cultural remains in the Southwest.



Above: Distinctive human figurines (actual size) from San Pedro phase deposits at the Las Capas site. Below: San Pedro style projectile points (one-half size).

Rob Ciaccio

Over the next two decades, the geographic range of the Cochise culture was expanded by discoveries of similar artifact assemblages in southwestern Arizona, western and central New Mexico, and Sonora, Mexico. In the assemblage of artifacts from Ventana Cave in southwestern Arizona, Emil Haury and Malcolm Rogers recognized a blending of the Cochise culture with the Amargosa industry of the lower Colorado River Valley. Haury found San Pedro stage remains in the Mogollon highlands of eastern Arizona. In those remains, he saw the common root of the Hohokam and Mogollon cultures of later prehistory.

The oldest pit structures in the Southwest were identified at San Pedro sites in the 1950s; by the early 1960s the identification of maize pollen at several sites led archaeologists to associate the arrival of agriculture from Mexico with the San Pedro stage. The first radiocarbon dates obtained from these and other sites indicated a timespan of about 1500 B.C. to A.D. 1.

Some archaeologists challenged the reported associations of the radiocarbon-dated materials with the maize pollen and with San Pedro stage materials. Not until carbonized maize fragments were recovered from sites in southeastern Arizona during the 1980s was agriculture confirmed as part of San Pedro subsistence. Direct radiocarbon dates of the maize fragments ranged between about 1000 and 400 B.C. During the same decade, the continuity of the Cochise culture was cast into doubt by Michael Waters' reinvestigation of the stratigraphic relationships and ages of some of the type sites, and its distinctiveness became increasingly less certain when comparisons were made at the scale of western North America. In the southern Southwest, the San Pedro stage came to be called the "Late Archaic period," a subdivision of the "Southwestern Archaic tradition."

New fieldwork at sites in southeastern Arizona during the early 1990s led Bruce Huckell to propose: 1) that sites with early remains of cultigens be assigned to the "Early Agricultural period"; and 2) that in southeastern Arizona the period be divided into two phases based on differences in age, projectile point styles, architectural forms, and types of ground stone tools and marine shell jewelry. Common to both phases are abundant maize remains, bell-shaped storage pits, and fired-clay human figurines. The earlier "San Pedro phase" sites typically have large-bladed points with shallow side notches, oval pit structures, and limited varieties of ground stone tools and shell ornaments, while "Cienega phase" sites have triangular points with deep corner notches, round pit structures, and diverse ground stone and shell assemblages. These distinctions assign most of the sites formerly referred to as San Pedro stage, and many of the material culture traits that defined the stage, to the Cienega phase.

R. Jane Sliva

Currently available radiocarbon dates place the San Pedro phase between about 1200 and 800 B.C. Maize dates between about 1700 and 1200 B.C. have recently been reported from several sites in the middle Santa Cruz Valley, but it is not yet known whether the material traits of the San Pedro phase were present during this interval. The available set of dates from Cienega phase sites ranges between about 800 B.C. and A.D. 150.

New research has benefited greatly from large suites of new radiocarbon dates. The presence of crude pottery, canals, and cemeteries has recently been documented at both San Pedro and Cienega phase sites. Interestingly, one of the most important elements of current research is the environmental information that can be derived from the alluvial contexts of the sites–the same contexts that were so critical to the original definition of the San Pedro stage.

Cerro Juanaqueña

Robert J. Hard, University of Texas at San Antonio, and John R. Roney, Bureau of Land Management, Albuquerque

THE phenomenon of a large Early Agricultural period riverine settlement is now recognized as being present in the Chihuahuan Desert grasslands. This finding is a result of our work over the last several years at Cerro Juanaqueña. The site is located on the sides and top of a 140-meter-high basalt hill, immediately adjacent to the floodplain of the Rio Casas Grandes. It consists of a complex of 486 terraces, 109 rock rings, and associated deposits. Six radiocarbon dates on maize and other annual plants, as well as a large assemblage of projectile points, show that the site dates to approximately 1150 B.C.

The total volume of rock and dirt included in the terraces at Cerro Juanaqueña is about 31,500 cubic meters and, using a modern 40-hour work week, construction would have required 30 person-years of labor.

It appears that the Cerro Juanaqueña terraces were designed to create flat living space upon which houses could be constructed and daily activities carried out. The terrace surfaces and excavations in the terraces themselves produced ample evidence of household debris: heavily worn, massive basin metates, manos, projectile points, flaked stone debris, and substantial deposits of domestic refuse—the latter including ashy sediments containing charcoal and charred plant remains and large quantities of burned and unburned animal bone. While no houses have been defined, we have found two small postholes in one terrace and compact occupational surfaces in others. In addition to their residential function, it is possible that small kitchen gardens were grown on the terraces as well.

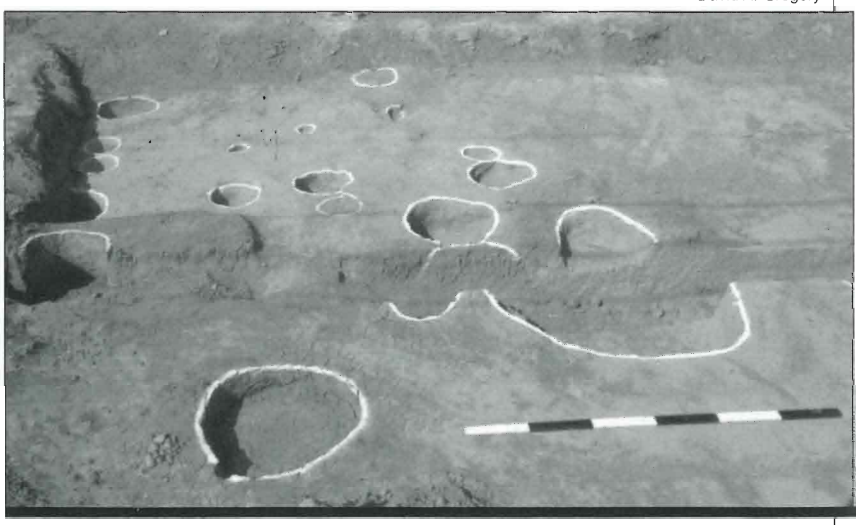
The terraces were constructed by first piling the local basalt cobbles to form berms or low walls that bowed out in the center and pinched in at the ends against the slope. The pocket between the apex of the berm and the slope behind was then filled in with smaller rocks and soil to form relatively level surfaces that average about 18 meters long and 7 meters wide. Many of these features occur in small groups of 3 to 7 individual terraces connected end-to-end along the same contour, and in one case 25 joined terraces form a 400-meter-long alignment along the northern, eastern, and southern site perimeter.

To better understand the effort required to construct the terraces, we built one during our 1997 field season. We selected a hillside near Cerro Juanaqueña with a similar slope and the same dense concentration of basalt cobbles with thin soil. In this setting, two local men, under the direction of a third person, constructed a terrace similar in size and shape to those at the site. This experimental terrace, as well as the prehistoric ones, could be built relatively quickly since the rocks were simply picked up and moved a short distance, tossed, or sometimes even rolled only a few feet before being put in place. The modern team built the terrace in 65 person-hours, and used about 30

Spectacular Results from Modest Remains

Michelle N. Stevens, Desert Archaeology, Inc.

David A. Gregory

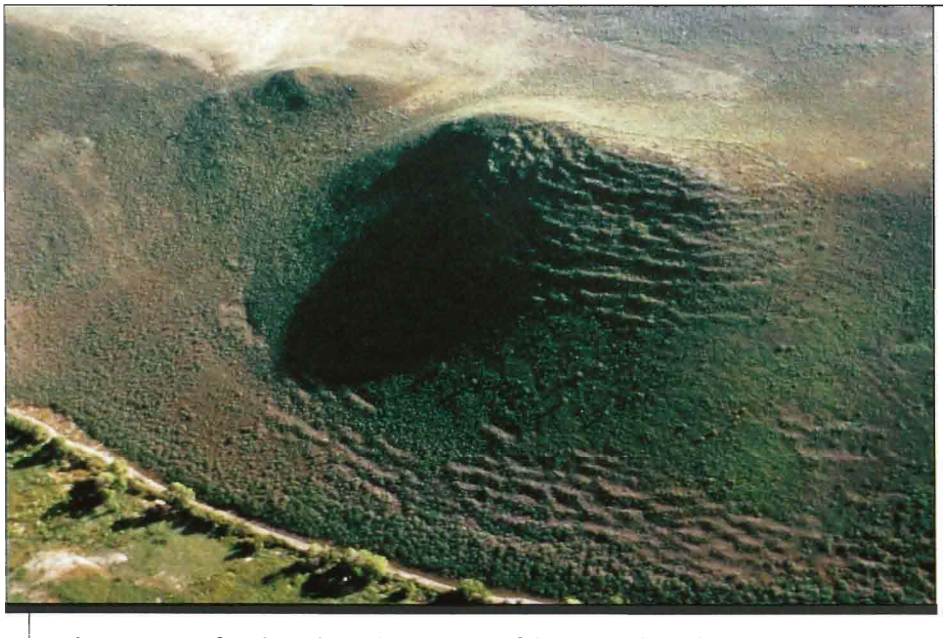


Below: Unimposing pits at the Sweetwater locus produced surprisingly early dates on maize (scale in photo is 3 m long).

WHAT makes an archaeological site interesting? Every investigated site allows us to address particular questions about human prehistory. Intellectually, we know that. Still, certain sites stand out because of their size, age, stratigraphy, architecture, preservation, exotic or specialty items, or stylistic and technological attributes of the artifact assemblage. Recent excavations in the Tucson Basin by Desert Archaeology, Inc., underline the importance of sampling even those sites that at first appear unremarkable.

Los Pozos ("The Wells") is a multicomponent site, with Middle Archaic to Hohokam period occupations, first studied in 1995. The work was sponsored by the Arizona Department of Transportation (ADOT), prior to road improvements along Interstate 10 in Tucson.

During the 1995 data recovery phase, two main areas of



Baker Aerial Photography

Artificial terraces created flat living spaces on the sides of Cerro Juanaqueña, a natural eminence overlooking the Rio Casas Grandes.

cubic meters of rock and 4 cubic meters of dirt. Based on this experiment, and using detailed maps, cross sections, and computer analysis, estimates of the labor and materials that went into the prehistoric features were derived: The total volume of rock and dirt included in the terraces at Cerro Juanaqueña is about 31,500 cubic meters (58,000 metric tons) and, using a modern 40-hour work week, construction would have required 30 person-years of labor.

Why did these people expend the time and effort to build their settlement on the sides of a relatively steep hill? Not only are construction costs substantial, but the daily energy costs of transporting water, wood, and food up the hill would have been significant. The long-standing interpretation of such hillside and hilltop sites is that they were defensive in character, and this is one idea being considered for Cerro Juanaqueña. People may have been motivated to live on the hill because raids from competing groups were common. The terraces did not serve as defensive fortifications per se, but by aggregating on the hill, the occupants were able to retain an effective defensive posture. The steep hillslopes would have been difficult to attack, particularly if the only available weapons were thrusting spears or darts used with spear-throwers (atlatls).

Some evidence suggests that Early Agricultural period peoples in southern Arizona also created sites similar to Cerro Juanaqueña. There is a complex of terraces and rock rings on the slopes and top of Tumamoc Hill in Tucson. Paul and Suzanne Fish of the Arizona State Museum recovered maize from deposits behind one of these terraces that dated to 2470 B.P. +/- 240 B.P. However, later pottery is also associated with the Tumamoc Hill features, and evidence for an Early Agricultural origin of the terraces and other features remains inconclusive. Additional excavations at this site are planned for the near future and should provide new data and perspectives concerning Early Agricultural period use of terraced hillside sites.

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the site were investigated. In the eastern area, two deeply buried Middle Archaic occupations dating between 3600-2800 B.C. and 2600-1900 B.C. were identified. The central area contained a large Early Agricultural period settlement with more than 200 pithouses dating between 400 B.C. and A.D. 150 (see pages 14-15). A southern area, called the Sweetwater locus, was dated stratigraphically to the Early Agricultural period, but the locus was not chosen for study in 1995. The expansion of the ADOT right-of-way provided an opportunity to return to Los Pozos in 1998. Work once again concentrated on the central area, with some excavations at the Sweetwater locus.

Although two pithouse structures were present at the locus, they were poorly preserved. In general, the small pits that were relatively common contained few artifacts, few fire-cracked rocks, little charcoal, and were unburned. The texture and color of the feature fill closely resembled the natural strata, making it difficult to trace the features, and the hard, compact soil made them physically difficult to excavate. On many days, a crew of 10 people would find only 10 artifacts. The small artifact assemblage recovered from the locus consisted primarily of flaked stone wastage and a few pieces of animal bone; no projectile points were discovered.

From the characteristics of the features, we knew that the Sweetwater locus probably dated to the Early Agricultural period. The predominance of extramural pits over houses resembled some other sites in the Tucson Basin, suggesting the site dated to the Early Cienega phase (800-400 B.C.) or the San Pedro phase (1200-800 B.C.). Kernels of burnt maize from four different pits were selected for AMS radiocarbon dating. We were surprised when we learned that all four samples dated between about 1700 to 1300 B.C., several hundred years earlier than expected!

Additional samples for dating have been submitted. The significance of the Sweetwater locus at the moment is in establishing a suite of early maize dates from good geological and archaeological contexts. Such a solid suite lends support to the other early direct dates on maize that represent single early dates from otherwise younger sites. Slowly, the dating of maize in the Greater Southwest is being pushed ever-earlier.

Preliminary Investigations at La Playa, Sonora, Mexico

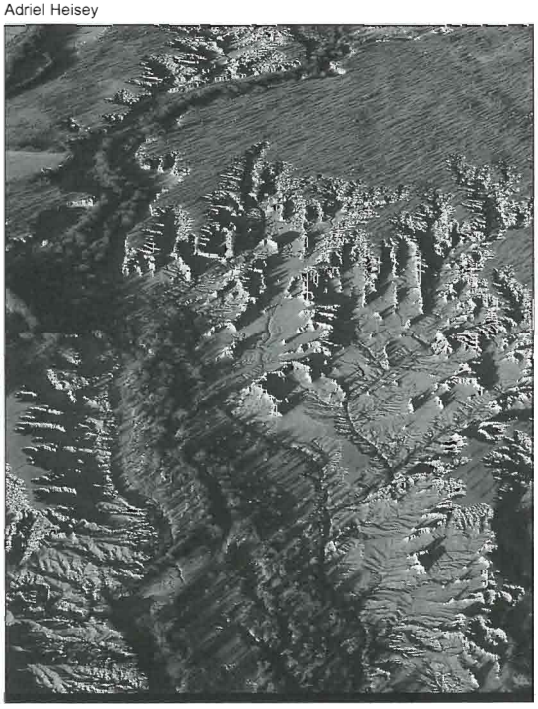
John P. Carpenter, Wichita State University,
Guadalupe Sanchez de Carpenter, University of Arizona, and
Elisa Villalpando C., Instituto Nacional de Antropología e Historia-Centro Sonora

THE archaeological site of La Playa extends over approximately 10 square kilometers along both margins of the Rio Boquillas. La Playa has been known to the archaeological community since the early 1930s. We began extended reconnaissance at the site in 1992, and in 1995, the Proyecto La Playa, with funds provided by the Instituto Nacional de Antropología e Historia, began salvage excavations of features under imminent threat of destruction from erosion.

Visitors to the site are struck by its immense size and the overwhelming number of features and artifacts that have been exposed by extensive erosion of two or more meters in some areas. PreHispanic features include at least 20 artificial earthen-core mounds, several thousand roasting features, in excess of 200 inhumations, and uncounted cremation burials, dog burials, bell-shaped storage pits, shell ornament production areas, knapping stations, tool caches, and a schist quarry.

La Playa has yielded a probable Paleoindian component, evidence of a Middle Archaic period occupation (circa 3500-1500 B.C.), and nearly continuous occupation from the Late Archaic/Early Agricultural period through the Colonial Spanish period. The majority of the site assemblage, however, appears to date to the Early Agricultural period (circa 1500 B.C.-A.D. 200). Only seven conventional radiocarbon dates are available, and five from roasting features fall in the 400 B.C. to A.D. 150 range. Of 150 projectile points, 23 percent are Middle Archaic types, 54 percent are San Pedro phase types, 17 percent are Cienega phase types, and only 6 percent represent subsequent Trincheras or Protohistoric types. Overall, the artifact assemblage is similar to Early Agricultural period assemblages in southern Arizona, with both one- and two-sided cobble manos, tabular or shallow-basin metates, and numerous "eared" palettes. A newly identified pottery type, temporarily designated as "Plain A," appears to be associated with these components, and may be related to the Cienega phase incipient plain wares in the Tucson Basin.

Adriel Heisey



Extensive, severe erosion has been a destructive force at La Playa, but thousands of unexplored features and deposits remain intact.

Subsistence and Diet

Abundant roasting features and an extensive pavement of fire-altered rock indicate that food processing with thermal features was the most common activity at the site. These features range in diameter from less than 1 meter to over 20 meters. Analyses of 14 roasting features indicate that maize is ubiquitous. Additionally, amaranth, chenopods, purslane, chia, panic grass, cholla, prickly pear, and mesquite are also present, along with the charred bones of mule deer, rabbit, hare, desert tortoise, small rodents, and, possibly, desert bighorn sheep.

Burials represent the second most abundant feature type at La Playa. Both inhumation and cremation burials were practiced. Inhumations are typically flexed, with one hand grasping the knees and the other placed in front of the face. At least four rectangular crematoria pits, large enough to receive a flexed body, have been identified. Cremated bone was apparently placed upon the surface surrounding the crematoria or occasionally in small, prepared rectangular pits. The single date from a cremation burial suggests a shift in burial practices in the early years of the Christian era, paralleling trends in the Tucson Basin. Funerary accompaniments are extremely rare among the La Playa burials. Two of the flexed burials, however, had pronounced hematite staining on and around the lower limbs. Preliminary osteological analyses by Penny Minturn and Lorrie Lincoln-Babb reveal that the La Playa population enjoyed relatively good health.

Regional Significance

The preliminary data from La Playa offer the only evidence for preceramic maize cultivation known within Sonora. Extensive surface mapping has established the huge size of this impressive site. Ongoing salvage efforts will help to refine the chronology of site development. Results from La Playa underscore the need for a broad regional perspective in attempts to understand the spread of maize into the Greater Southwest.

Fresnal Shelter

Martyn D. Tagg, Headquarters, Air Force Material Command

FRESNAL Shelter is located in the Sacramento Mountains 16 miles northeast of Alamogordo, in a narrow, steep canyon that drains into the Tularosa Basin to the northwest. The shelter is at the base of a south-facing limestone cliff overlooking a permanent spring-fed stream. It is situated in the pinyon-juniper transition zone at an elevation of 6,250 feet. The site was professionally excavated between 1969 and 1972, but this work has never been completely reported.

Over 30 small cylindrical pits, small hearths, one human burial, and a large volume of domestic refuse were excavated. Thousands of artifacts and samples were recovered, including flaked and ground stone, bone, vegetal material, sandals, basketry fragments, cordage, wooden tools, feathers, animal hides, and shell fragments. Of particular interest are hundreds of specimens of cultivated plants, including maize (cobs, kernels, and husks), beans, and cultivated amaranth (*Amaranthus cruentus*). Studies of the maize have identified varieties morphologically similar to corn from Early Agricultural period sites in southern Arizona, and at least five varieties of the common bean (*Phaseolus vulgaris*) are also present in the assemblage.

The Fresnal Shelter dates show that early agriculturalists were present in southern New Mexico by approximately 1100 B.C.

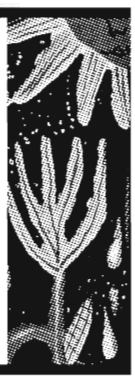
Twenty-seven radiocarbon dates and some limited analyses of recovered materials suggest that Fresnal Shelter was occupied intermittently and seasonally (late summer to early fall) to exploit local resources over a 5,600-year period between about 5900 and 300 B.C. Direct radiocarbon dates on cultivated plants include nine from maize and three from beans. The two earliest maize dates (2945 +/- 55 and 2880 +/- 60 B.P.) compare well with early dates on maize from sites in several other parts of the Greater Southwest (see map, pages 8-9).

Fresnal Shelter has provided the most reliable evidence thus far for the earliest use of this plant in southern New Mexico, but evidence for early maize has also been reported from three other sites in the region. Tornillo Shelter, located in the Organ Mountains 10 miles east of Las Cruces, yielded 10 corncobs representing early varieties, and a conventional radiocarbon assay on a composite sample of eight cobs produced a date of 3175 +/- 240 B.P. The remaining cobs were associated with an obsidian chip dated by hydration to around 3000 B.P. In Pendejo Cave, located approximately 40 miles north of El Paso, Texas, early corncobs were recovered from a stratigraphic level that produced wood charcoal dated to 5480 +/- 60 B.P. Finally, at the Keystone Dam site, a preceramic pithouse settlement also near El Paso, corn pollen was recovered from a stratigraphic level radiocarbon-dated between 4310 and 3540 B.P. The evidence from these sites remains somewhat tentative. The early direct date from Tornillo came from a composite sample, and evidence from the other two sites is based on association rather than on direct dating of maize remains.

The Fresnal Shelter dates show that early agriculturalists were present in southern New Mexico by approximately 1100 B.C. The vast array of domestic debris and the presence of younger features cut into older stratigraphic levels, along with the large numbers of corncobs and kernels recovered, imply intensive site use during the Early Agricultural period. Hundreds of corncobs, kernels, husks, and unburned beans from the site remain to be analyzed and dated, and there is the potential for new direct dates on maize remains from Tornillo Shelter and Pendejo Cave as well. Material from these three sites may produce even earlier dates on maize and thus important new data concerning the arrival and spread of maize in southern New Mexico.

The data from Fresnal Shelter, and tentative evidence from the other sites, conform to current knowledge about Early Agricultural period agricultural sites in the Southwest. The presence of maize and beans in the three rockshelters supports the hypothesis that maize was introduced into the Southwest from Mexico following the foothills of mountain ranges and the terraces of major rivers. Rockshelters along this route were obvious focal points for shelter and food storage by early prehistoric agriculturalists.

Have you visited the Center for Desert Archaeology website?
If not, you're in for a treat!
If you have, you might want to take a second look for recent updates
and suggested readings to accompany the articles in this issue of
Archaeology Southwest.
You can find us at *http://www.cdarc.org*



LINGUISTICS

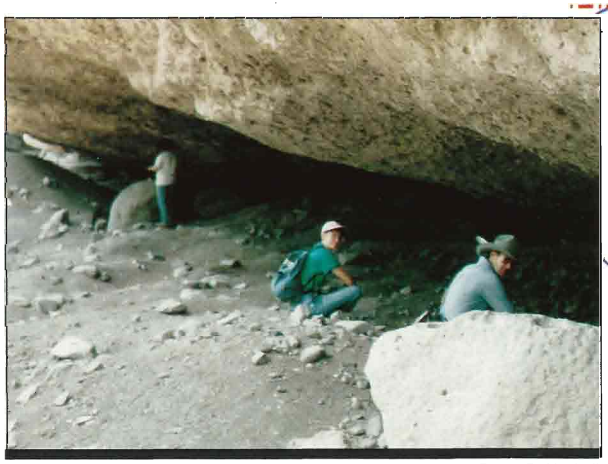
Jane Hill, University of Arizona

By examining the words used in different languages to refer to the same plants, animals, other material objects, body parts, and kinsmen, linguists are able to define historical relationships between languages and language groups. Detailed comparisons of such words provide the basis for estimating the approximate length of time that two or more languages have been separated from one another. This method can also provide clues to the relationships between prehistoric groups identified on the basis of archaeological evidence.

Of the five distinct linguistic stocks represented in the Greater Southwest today, only the one named Uto-Aztecan was continuously distributed between the Southwest and Mesoamerica at the time of first European contact. Similarities in the languages that compose this stock indicate to linguists that at some time in the past a single linguistic community existed in which a common ancestral language, or protolanguage, was spoken: Proto-Uto-Aztecan. Since all of the modern Uto-Aztecan speakers in the Greater Southwest were sedentary agriculturalists who grew maize (and other crops), and since their distribution extends into central Mesoamerica where maize was first domesticated, the Proto-Uto-Aztecan speakers are promising candidates for being the groups responsible for the spread of maize into the Greater Southwest.

Linguistic evidence suggests that by approximately 6,000 years ago (4000 B.C.), a continuum of Proto-Uto-Aztecan speakers existed in montane regions from roughly the highlands of Chihuahua and Sonora to the San Francisco Peaks in northern Arizona. These peoples were largely hunters and gatherers. Sometime before about 4,000 years ago (2000 B.C.), some of these populations adopted maize cultivation and subsequently split into two linguistic groups: Proto-Northern Uto-Aztecan and Proto-Southern Uto-Aztecan. The fact that this separation occurred after the adoption of maize cultivation is significant in that an increasingly sedentary lifeway may have reduced interaction between groups and thus served as a stimulus for linguistic differentiation. The linguistic evidence for the adoption of maize cultivation prior to about 2000 B.C. comports quite well with the emerging picture of the spread of maize based on archaeological data (see map at right).

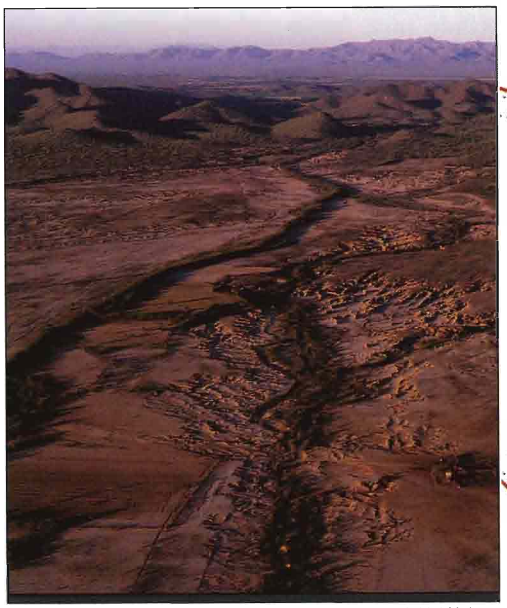
Dating the Arrival and Spread of



McEuen Cave

Bruce B. Huckell

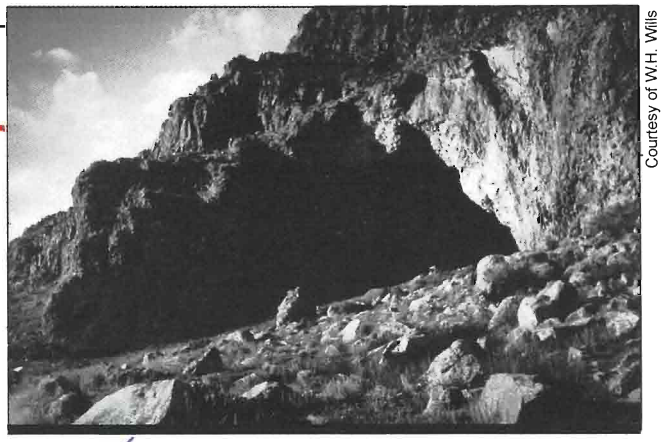
Adriel Heisey



La Playa

Adriel Heisey

aize in the Greater Southwest



Courtesy of W.H. Wills

14
3050+/-50
3135+/-45
3445+/-45

15

Flagstaff

13
3370+/-60
Albuquerque

Bat Cave

12
3060+/-110
3120+/-70
3740+/-70

2780+/-40
2790+/-50
11

7
2880+/-60
2945+/-55

8
9
3175+/-240

0+/-50
0+/-60
0+/-60
3, 4, 5, 6
Tucson

10
El Paso

AZ
NM
TX

SON
CHI

2

1
2890+/-50
2930+/-50
2980+/-50
Nuevo Casas Grandes

Miles
0 50

Kilometers
0 50 100

N

KEY:

1. Cerro Juanaqueña
2. La Playa
3. Las Capas
4. Los Pozos
5. Tumamoc Hill
6. Milagro
7. Fresnal Shelter
8. Tornillo Shelter
9. Pendejo Cave
10. Keystone Dam
11. McEuen Cave
12. Bat Cave
13. LA 10577
14. Lukachukai
15. Salinas Springs

The Spread of Maize to the Colorado Plateau

R. G. Matson, University of British Columbia

THE prehistoric populations known as Basketmaker II (BM II) have long been recognized as an early stage in the Anasazi cultural sequence, the tradition that gave rise to the modern Pueblo Indians. Basketmaker II was named for the extraordinary collections of baskets and other perishable materials recovered from dry shelters and cave sites on the Colorado Plateau in the late nineteenth and early twentieth centuries. BM II dates from the late centuries B.C. to about A.D. 400.

In the last 15 years our understanding of Anasazi origins has changed dramatically, partly as a result of the convergence of research on the Colorado Plateau and elsewhere in the Greater Southwest. Migration theories have become an essential part of our understanding of Anasazi origins, and BM II populations now appear to have derived in part from one or more migrations from farther south. This new understanding is based on three findings: the discovery of Early Agricultural period settlements dating to at least 1100 B.C. in southeastern Arizona and northern Chihuahua; the discovery that most BM II populations were maize cultivators; and an emerging consensus about ethnic differences among BM II groups.

Changing Perspectives and New Data

In 1985 I proposed that the earliest evidence for maize cultivation in the Greater Southwest would be found in the lowland floodplains of the Basin and Range Province in southern Arizona and New Mexico and northern Sonora and Chihuahua. Direct AMS dating of early maize remains from central Mexico indicates that maize was domesticated around 3500 B.C. The earliest maize-based villages in Mexico currently date no earlier than about 2500 B.C., although such settlements spread very rapidly across Mexico after about 2000 B.C. Direct dates on maize from the Greater Southwest older than 1700 B.C. suggest that the northward spread of maize cultivation was extremely rapid. One possibility is that this was accomplished through the migration of maize farmers into floodplain niches suitable for cultivation. If this hypothesis is correct, one would expect the earliest maize-based villages to be found not on the Colorado Plateau, but in the Basin and Range Province to the south. I also reasoned that the Anasazi tradition, and thus the Pueblo peoples, might be the end result of such a process.

Unknown to me, evidence for maize cultivation associated with pithouse settlements and dating to at least 1100 B.C. had just been discovered at the Tucson Basin site of Milagro by Bruce and Lisa Huckell. More recent work (see page 4) has extended the date of maize cultivation in this area back to at least 1500 B.C. By around 600 to 700 B.C., relatively large pithouse settlements are found along the Santa Cruz River floodplain in the Tucson Basin (see page 14). The site of Cerro Juanaqueña, in northwestern Chihuahua (see page 4), has produced three maize dates of about 1100 B.C. as well as projectile points similar to those found in contemporaneous sites in the Tucson Basin. Recently, David Hyland and his colleagues reviewed the perishable, chronological, and cultigen evidence for the Jornada Basin in New Mexico. They conclude that at least one migration from Mexico occurred, introducing maize agriculture and new styles of perishables.

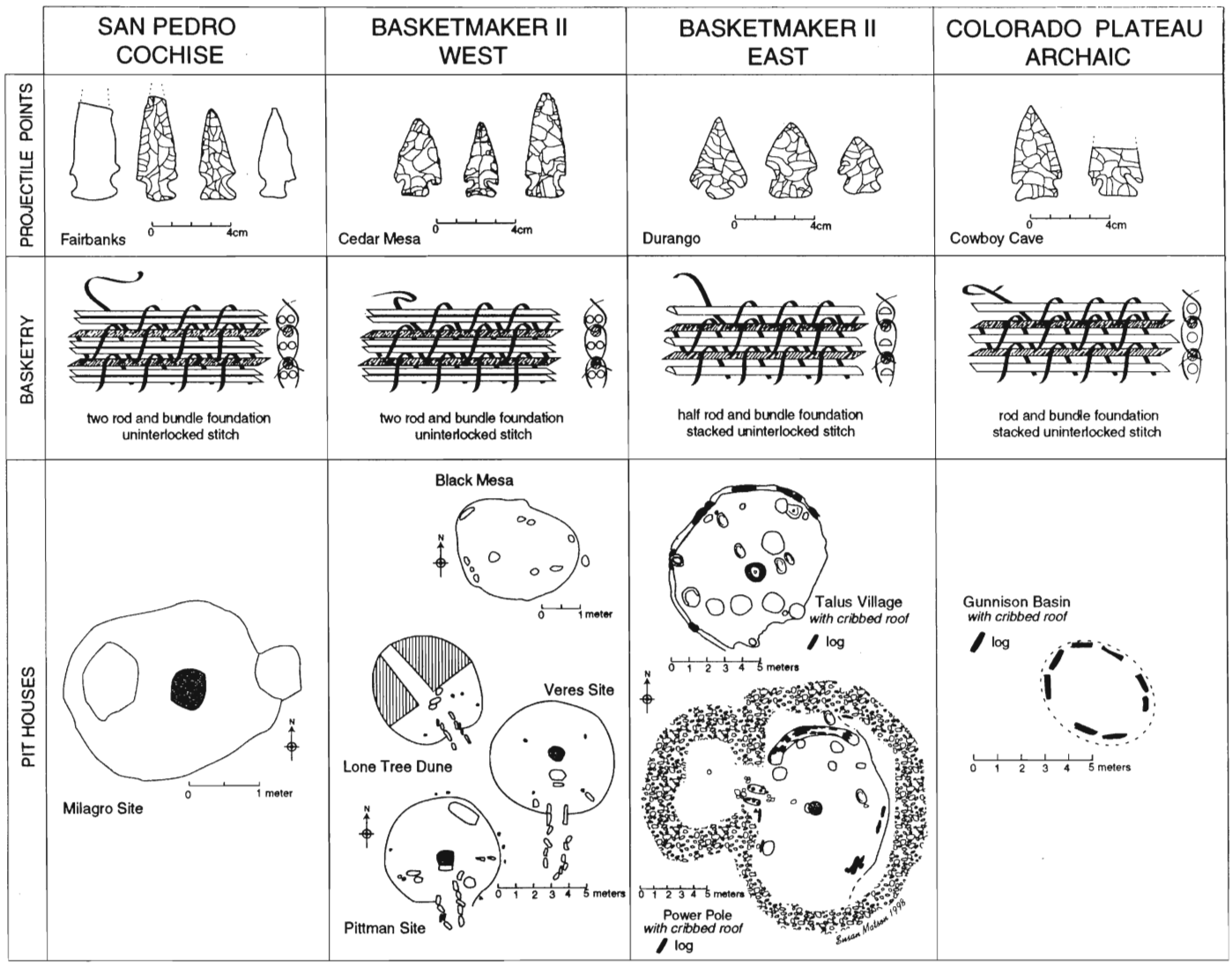
Thus, an accumulating body of data supports the hypothesis that the maize-cultivating populations represented by San Pedro Cochise and related cultures were migrants from farther south.

Basketmaker II Subsistence and Ethnicity

BM II subsistence has been the subject of controversy in the past. Some scholars have long held that at least some BM II groups in northwestern New Mexico and southwestern Colorado must have been maize-dependent agriculturalists, while others argued that extensive maize use did not occur until A.D. 1000. Recent research has put this controversy to rest, and convincing evidence has accumulated that BM II populations all across the Colorado Plateau were dependent on maize. At Cedar Mesa, Utah, for example, four independent lines of evidence from analyses of settlement patterns, human coprolites, midden materials, and stable carbon isotope concentrations in human remains all indicated that maize cultivation played a major role in subsistence.

Geographic contrasts in BM II material culture have been recognized, and clear "ethnic" distinctions between Eastern and Western variants of BM II are seen in perishable items such as basketry and cordage. In addition, there are a number of similarities between Eastern BM II assemblages and those of earlier Colorado Plateau Archaic manifestations. They include projectile point types, cribbed roof pithouses, one-rod-and-bundle-stacked basketry foundations, and some cordage types. Western BM II manifestations do not exhibit these same affinities with earlier indigenous materials (see figure at right).

However, some items of Western BM II material culture are similar to those found in San Pedro phase assemblages from southern Arizona, including projectile points, two-rod-and-bundle basketry, and some sandal types. Thus Eastern BM II groups appear to be the descendants of local Archaic populations, while Western BM II can be argued to represent (at least in part) the descendants of migrants from the south, groups who probably introduced maize cultivation to the Colorado Plateau. The idea that BM II derived from San Pedro Cochise was first seriously pro-



Similarities between San Pedro Cochise and Western Basketmaker II items of material culture (columns 1 and 2 above) contrast with similarities between Eastern Basketmaker II and Colorado Plateau Archaic populations (columns 3 and 4 above).

posed by Earl Morris and Robert Burgh in the 1950s and more recently by Claudia and Michael Berry.

Further support for this hypothesis comes from a variety of sources. Studies of dentition patterns by Christy Turner of Arizona State University show that Western BM II populations share more genetic similarities with central Mexican populations than with Eastern BM II. Perishable items and projectile points from McEuen Cave (see page 12) appear similar to both San Pedro Cochise and Western BM II, and linguistic evidence is also consistent with an interpretation of San Pedro Cochise-Western Basketmaker II relationships (see page 8). Finally, pre-BM II direct dates on maize have been derived from Colorado Plateau sites within or near Western BM II territory. Although the associated material culture is not sufficiently distinctive to provide conclusive evidence, such sites as Lukachukai and Salinas Springs may represent early southern migrants.

To summarize, most BM II groups are now known to have been maize-dependent agriculturalists. No longer can the Anasazi tradition be thought of as being descended from indigenous hunter-gatherers who became dependent on agriculture only after the BM II stage. The origin of maize cultivation on the Colorado Plateau now appears to have much more direct links to Mexico. The new discovery of maize-dependent agriculture "villages" in the Basin and Range Province shows that these are both earlier and of a greater size than previously recognized, certainly much larger and earlier than the earliest BM II villages dating to A.D. 100. The origin of the Pueblo cultures can now be seen in part as the end result of Mexican maize-growers filling up the niche of floodwater arable land (at least where the population density of indigenous hunter-gatherers was not high). Although the Eastern BMII do appear to be descendent from indigenous groups, Western BM II most likely derives from one or more migrations of San Pedro Cochise peoples to the Colorado Plateau. Our further understanding of the evolution of the Anasazi is now dependent in part on discovering the timing and character of these migrations. The traditional view of Anasazi developments prior to about A.D. 1100 as essentially independent of Mexico is clearly no longer viable.

McEuen Cave

Bruce B. and Lisa W. Huckell, Maxwell Museum, University of New Mexico, and M. Steven Shackley, Phoebe Hearst Museum of Anthropology, University of California at Berkeley

LOCATED in a deep canyon in the rugged Gila Mountains some 30 kilometers northwest of Safford, Arizona, McEuen Cave was first investigated by Byron Cummings and University of Arizona students more than 60 years ago. This impressive shelter is some 90 meters long, with a maximum front-to-back depth of 15 meters and a height of 2.5 to 3 meters. It is located at an elevation of about 1,340 meters (4,400 feet), and is surrounded by oak-juniper woodland and broadleaf riparian woodland. Cummings' work, and excavations by the McEuens (who discovered and reported the site), were focused on the dry portion of the deposits under the overhang. From this part of the shelter came about two dozen burials, numerous sandals, bits of cordage, basketry, and other woven artifacts, wooden atlatls, fending sticks, portions of darts and arrows, as well as abundant flaked and ground stone artifacts, some potsherds, and quantities of animal bones and vegetal refuse.

Cummings never reported on the site, but he referred to it as primarily a Basketmaker burial cave in several newspaper articles and other venues. Unfortunately, he also declared that the site had been thoroughly destroyed by looters by the end of 1935. In the late 1970s, the Bureau of Land Management, which manages the wilderness area where the shelter is located, fenced the site to prevent additional looting. This action was critical in saving what remained of the site.

In 1994, and again in 1995, we visited the shelter and found that, despite the ravages of time, it still appeared to have significant research potential. Accord-ingly, in June of 1997, we mapped the shelter, conducted controlled surface collections, and excavated two 1-m-by-1-m test pits into what we suspected were undisturbed deposits slightly outside the dripline. One of these extended to a depth of 1.2 meters before bottoming out on fluvial boulder gravel. As luck would have it, the upper 60 centimeters of the unit consisted of a prehistorically backfilled, ceramic period roasting pit. However, the lower 60 centimeters of deposits yielded clearly preceramic artifacts in great abundance, in a matrix of loosely consolidated silt thoroughly mixed with ash and charcoal.

Flotation samples from these levels produced carbonized maize—as well as abundant wild plant remains—that yielded radiocarbon dates extending from about 2800 B.P. at the base of the sequence up to 2200 B.P. at the base of the intrusive ceramic period roasting pit. In tandem with a suite of obsidian hydration measurements, the radiocarbon dates indicate a remarkably undisturbed deposit in at least this front portion of the site. Of particular interest was one anomalous maize date of about 3700 B.P.; although out of the clear stratigraphic sequence of dates, it did occur in the same level as two Middle Archaic points (Chiricahua and Cortaro), suggesting that the maize and the points may have been redeposited into the younger level from some nearby primary deposit. Surface collection in the disturbed, dry deposits produced about 50 uncarbonized maize cobs, a number of which Lisa Huckell identified as morphologically early, displaying small overall size and triangular to subsquare cupules. A date of 2800 B.P. from one of these cobs confirmed the morphological assessment.

Our testing has suggested that significant data concerning the Early Agricultural period can still be gained from investigation of McEuen Cave and the existing collections of materials at the Arizona State Museum. We are pursuing funding for an extended excavation of the shelter deposits, as well as study of museum collections of Early Agricultural period sites from the Mogollon Highlands. Thus, McEuen Cave may provide a valuable window into maize evolution, subsistence in upland environments, and relationships between southeastern Arizona farmer-foragers and coeval populations in the Mogollon Highlands and on the Colorado Plateau.

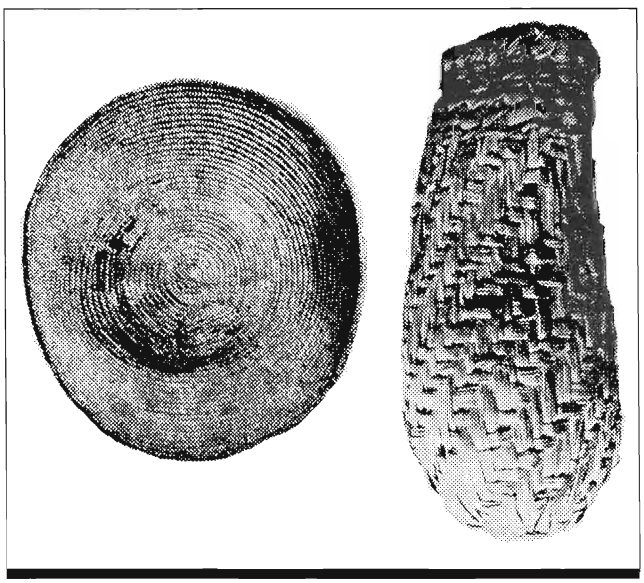
Bruce B. Huckell

Riparian vegetation lines the drainage below McEuen Cave, first excavated over 60 years ago. Recent testing revealed untapped research potential.

Bat Cave

W. H. Wills, University of New Mexico

THE rapidly changing picture of early prehistoric agricultural economies in southern Arizona has an important influence on the way researchers interpret archaeological evidence for incipient agriculture in other regions of the Southwest. Until the 1980s, the apparent lack of preceramic maize-producing sites in the Sonoran Desert gave archaeologists reason to believe that southern Arizona had little, if any, role in the introduction of farming to the region. Although various theoretical models suggested that desert river valleys should have been natural corridors for the diffusion of domesticated plants, the empirical record seemed to suggest otherwise. Consequently, efforts to explain the earliest adoption of maize focused on archaeological sites in cooler, more temperate portions of the Southwest.



In addition to evidence for early maize cultivation, shelters such as Bat Cave have produced remarkable assemblages of perishable items including baskets (above), sandals, woven garments, and wooden artifacts.

The best known Early Agricultural site in the northern Southwest is probably Bat Cave, a large rockshelter located on the western edge of the San Augustine Plains in west-central New Mexico. First investigated in the late 1940s, the site revealed deep cultural deposits containing large numbers of perishable objects in preceramic contexts, including unburnt maize cobs. One of the first sets of radiocarbon dates in the world was obtained from charcoal samples associated with these cobs. Dates of 6000 to 4000 B.P. established Bat Cave as the oldest archaeological site with maize in North America known to archaeologists at that time, a distinction it has retained through numerous generations of textbooks. Models that attempted to account for the rise of farming in the Southwest thus had to begin by explaining why evidence for cultivation at Bat Cave was so early. The most common explanation was that the cool, wet, local climate was more suited to maize production than hotter, drier regions at lower elevations.

In 1981 and 1983, I directed new excavations at Bat Cave to evaluate the reliability of the original radiocarbon dating and obtain new archaeological information on the Early Agricultural period occupation of the site. Working with Richard Ford and John Speth of the University of Michigan, I demonstrated that the original radiocarbon dates attributed to maize were inaccurate due to stratigraphic displacement, and that the oldest maize from the site was actually between 3,500 and 4,000 years old. These new dates bring Bat Cave into line with the oldest radiocarbon-dated maize in other areas of the Greater Southwest (see pages 8-9). Interestingly, one of the questions we now ask about the presence of maize at Bat Cave is why people were growing this cultigen at such high elevations in the first place, since colder temperatures make for a short growing season and therefore a high-risk economic strategy.

The newly emerging view of preceramic riverine farmers in southern Arizona may help answer that question. Large pithouse settlements, such as those in Tucson's Santa Cruz Valley, are unknown in the northern Southwest (although a recently discovered site near Albuquerque may prove to be similar in size and age), not just for the preceramic, but for any time period. Even after the development of pottery making and fairly obvious indications of residential sedentism by 400 A.D., nowhere are there pithouse settlements that exceeded a couple of dozen dwellings, and these are rare indeed. After more than 2,000 years of involvement with maize cultivation, populations in the northern Southwest continued to occupy small settlements for relatively brief intervals. As important as maize undoubtedly was in their diet, agriculture nevertheless did not promote large sedentary communities. This indicates that the overall economies of early agricultural populations in different parts of the Southwest were probably quite variable, not surprising given the very different environmental settings of the Sonoran Desert and the forested Colorado Plateau or Mogollon Rim. For example, the early farmers who used Bat Cave may have had access to abundant large game animals and wild nut crops that were unavailable at lower elevations, and thus invested less of their time and energy in growing maize.

Bat Cave reflects one of what were likely a wide range of economic options available to early farmers throughout the Southwest. It is intriguing that similar large settlements do not occur outside the Sonoran Desert, as it suggests that this form of residential organization was either unattractive or impractical elsewhere. Of course, just as archaeologists only recently realized that large early agricultural settlements exist in the Santa Cruz Valley, perhaps in the near future we will discover that such sites also exist elsewhere in the Southwest.

Las Capas and Early Irrigation Farming

Jonathan B. Mabry, Desert Archaeology, Inc.

Repeatedly occupied for about 2,000 years, Las Capas ("The Layers") is a stratified site buried in the floodplain of the Santa Cruz River in the Tucson Basin.

Fieldwork by Desert Archaeology, Inc., for ADOT during summer and fall of 1998 revealed cultural layers between 1 and 3 meters below the present ground surface. So far, 18 radiocarbon dates fall between about 2900 B.C. and 900 B.C., and the oldest direct date on maize is about 1100 B.C. Some 460 features were excavated and more than 100,000 artifacts were recovered. Analyses of the rich artifact and sample collections from this site are just getting under way.

Ellen Ruble

The characteristic u-shaped cross section marks the course of one of the oldest canals in North America in this stratigraphic exposure at Las Capas.

The oldest occupation, between about 2900 and 1200 B.C., was characterized by repeated, probably seasonal, encampments. Whether maize is present in this stratum is not yet known.

The most dramatic discovery is the presence of irrigation canals at this site by about 1200-1100 B.C. Bell-shaped pits to store agricultural surpluses were used during this early San Pedro phase occupation. The late San Pedro phase occupation between about 1000 and 900 B.C. was the most intensive in the site's long history. More canals and pits were dug, pit structures were built for habitation and storage, and the dead were buried in a cemetery. The inhabitants began to make pottery in small quantities. About 900 B.C., a large flood filled the canals, covered the habitation area, and caused the final abandonment of the site.

Perspectives on Early Agricultural Period Population Size and Sedentism

David A. Gregory, Desert Archaeology, Inc.

THE documented period of time between the arrival of maize and the emergence of the later, well-known ceramic-producing traditions of the Greater Southwest—the Hohokam, Mogollon, and Anasazi—is now approaching 2,000 years. The Early Agricultural period thus lasted at least twice as long as any of these later manifestations, which have been studied intensively for over a century: Literally thousands of Hohokam, Mogollon, and Anasazi sites have been excavated, and decades of analysis, debate, and intellectual ferment have focused on these cultures. Yet our understandings continue to be refined by ongoing research, and even after long study, we are frequently surprised by new findings.

By contrast, study of the lengthy and extremely important Early Agricultural period is in its infancy. Despite the rapid accumulation of data over the past decade—resulting both from work at previously unknown or unstudied sites (such as Cerro Juanaqueña, Santa Cruz Bend, Los Pozos, Las Capas, and Lukachukai) and from restudy of previously investigated sites (such as Bat Cave, McEuen Cave, and Fresnal Shelter)—only a few dozen sites dating to this interval have been intensively investigated. A recent feature article in the journal *Science* suggested that findings from these sites have "exploded" existing views of prehistory in the Greater Southwest. Gathering up and making sense of the fragments produced by this explosion will ultimately occupy decades of additional data collection, analysis, and interpretation. Two related issues are now and will continue to be a focus of research: the size of the populations that occupied these settlements, and the degree to which the populations were sedentary. That is, how many people lived there, and did they occupy the sites continuously over the annual period and year after year for many years?

The sheer scale of some sites is remarkable. The nearly 500 terraces constructed at Cerro Juanaqueña, and an estimated 500-600 pit structures at Santa Cruz Bend and 700-800 structures at Los Pozos, in each case spread over thousands of square meters, represent unquestionably impressive remains. But do large sites mean large populations? How much time is represented in the total span of occupation, and how many of these structures or terraces were built or occupied at one time? The temporal resolution available with radiocarbon dates is not sufficient to completely resolve this question, and other ways of looking at this problem are necessary.

In the analysis of data from Los Pozos, estimates of the use-life of individual structures, combined with analyses of the stratigraphic characteristics of structure and pit fills are being used to attack this problem. Based on the materials used in construction, evidence of frequent rebuilding and refurbishing of structures, and consideration of the effects of termites and infestations of other pests in the grass thatching, it has been estimated that individual structures probably

Adriel Heisey

Closely spaced pit structures and extramural pits at Los Pozos. Ongoing analyses indicate that these small structures were used for only 3-5 years, and that—despite the large number of them at the site—perhaps only 12-15 of the houses were occupied at one time.

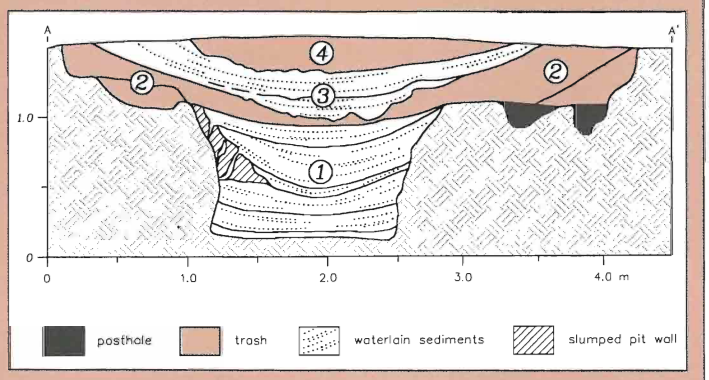
were used for about three to five years by a single nuclear family. Several lines of evidence support the idea that people lived in these structures year-round, including the seasonal availability of plant remains found in trash deposits, large storage pits, and the presence of hearths in most of the structures.

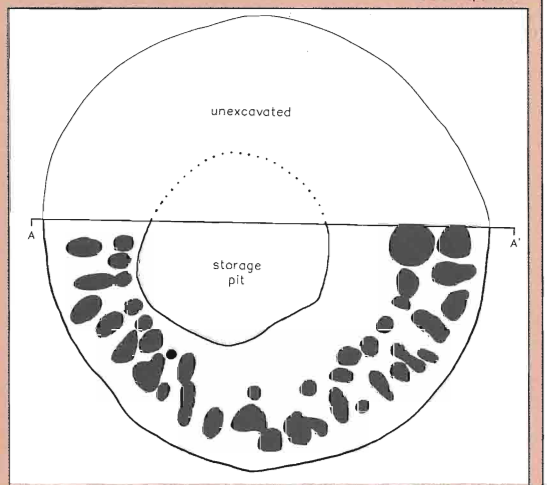
When a structure was abandoned and collapsed (or was intentionally dismantled), the depressions that remained were used consistently as a convenient place to discard the residues of everyday life. Some features are completely filled with such refuse and show no evidence for a hiatus in the process of filling. Yet others show stratigraphic breaks between deposits of trash, during which natural sediments accumulated in the depressions (see below). These deposits represent materials washed and blown in by rain and wind, and are largely devoid of artifacts and other cultural materials. Thus there was no one in the immediate vicinity producing and depositing trash during these intervals. By plotting the differential distribution of these various stratigraphic signatures across the site area, it is hoped that groupings of structures may be identified that will inform on the dual question of group size and continuity of the occupation.

The picture emerging from preliminary analyses of the Los Pozos data is one of relatively small groups—perhaps on the order of 15 to 40 people—that occupied the site year-round for periods of a decade or perhaps more. It also appears that there were repeated intervals of several years when the population abandoned the site and lived elsewhere before returning. Future investigations at other sites may likewise show that the populations responsible for these impressive sites were relatively small and that the occupations were not continuous.

Lessons from the Stratigraphy of a Pit Structure

Geo-Map, Inc.





Successive deposits reveal the complex history of a pit structure. Before the structure was built, there was a large, covered storage pit in this location. The cover for this pit was simply a smaller version of the thatch-covered framework used in houses, and is marked by the inner row of postholes in the drawing. This pit was used for some time and then abandoned, after which it filled with natural sediments washed and blown in from the surrounding surface (1); it took perhaps 4 or 5 years for these deposits to accumulate. At some point, a round pit structure was built over the abandoned pit, with the floor of the structure being at the same level as the filled-in pit. Following some period of use (3-6 years?), the house was abandoned and the remaining house pit was used as a place to dump trash (2) for a period of perhaps 2 years. During a 1- or 2-year hiatus in trash deposition, more water- and wind-borne sediments accumulated (3). Finally, trash dumping resumed (4), and within 1 or 2 years the former house pit was filled to the level of the surrounding ground surface.—*David A. Gregory*

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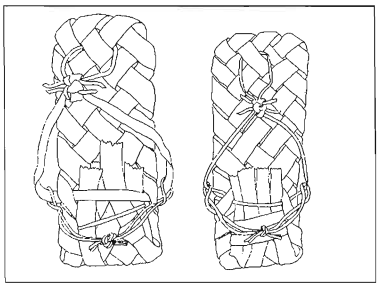

Drawings of Early Agricultural period footwear. Sandals of yucca fiber executed in a variety of styles are commonly recovered from dry caves and shelters.

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