An Overview of Pre-Columbian Maize Agriculture in La Gran Chichimeca: Questions and Avenues of Research

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Corn (*Zea mays*) is the third most important food crop grown in the world today. Corn is a staple food throughout most of the Americas, the Caribbean, and Africa. It is truly the most important food crop the Americas gave the world. And if one believes the current techno buzz, corn may save the world in providing an alternative to fossil fuels such as oil and gas.

Zea mays is a tropical grass derived from teosinte (Zea mexicana parennis) its genetically closest relative. Of all the world's grains, corn is the most fully domesticated in that it has most completely lost its ability to disperse seed and reproduce without human intervention. The evolution of corn and the societies that domesticated and developed it are truly intertwined. Corn permeates the indigenous knowledge systems and symbolism of both Mesoamerica and the Gran Chichimeca including the American Southwest. Corn is a truly sacred giver of life. Given all of this, trying to understand the history of corn in the Gran Chichimeca from our multiple perspectives certainly requires much more time than I am allotted here and likely far more time than this entire symposium affords. Even trying to introduce the topic, would require many weeks of discussion about the world going far back to the beginning. This conference, I think, can only start a dialogue or “multilogue” that I hope will continue for years.

What I want to emphasize in my remarks here are some of the questions and the history of questions archaeologists have had about the evolution of corn and human societies in order to share one perspective on understanding corn and how it came to be the center of life in our region. In a number of very eloquent and learned talks I have attended recently about the history of our region, I have heard scholars give the sequence of events, known by their archaeological names, and when they do this, say “and then at about 3 thousand years ago, corn came up from Mexico.” Then, with corn, everything gets interesting. So, one has an explosion of symbols and ritual, of techniques of water control that we can study, the economy that enabled the founding and flourishing of Chaco Canyon, of the Hohokam, and of Paquimé. So the entire focus of inquiry about how did corn come up from Mexico is lost. Corn is a versatile crop, but it does not walk. It did not come on its own, up from Mexico, and it is part of our job I think to understand some of the complexities of how corn came up from Mexico. Archaeology can help with that context. Archaeology and botany can give us some information about the plant itself and the contexts in which the plant occurs. That information, I think, coupled with information from traditional farmers, history, ethnohistory and linuistics, can help us a lot. Since these sources of information involve different ways of knowing, I think it is important to explain where they are coming from, what kinds of assumptions are made or have been made by archaeologists and botanists, as well as things we really don’t know.

Botanists divide corn into a number of varieties, types or what they call land races that are thought to reflect its evolution (Figure 1).

Figure 1. Varieties of Zea mays.

The differentiation of races is based on morphological differences such as average row number, size and shape of cob, and shape of kernel. Corn is genetically extremely variable and morphologically plastic. This means that the dimensions used to categorize the races of maize are not straightforward measures of genetic relationships. Studies of isozymes, for example in the work of John Doebley, help get at the genetic relationships among varieties or landraces. Some recent work, for example by Vivienne Depres and her colleagues, are helping get at the genetics directly. It appears from botanical studies that kernel color is determined by just one gene – i.e. on locus on a DNA molecule. Yet we do not know the genetic relationships among the various morphological characteristics. How many genes determine the shape of the kernel? (We don't know). How many genes determine the number of rows? (We don't know). Through isolation and manipulation of maize, people have introduced and do introduce a tremendous amount of variation in form and appearance of corn. So there truly are an extraordinary number of varieties of maize grown today that are adapted to different soil conditions, climates, and topographic settings. The adaptability of maize is reflected by the fact that some corn (yellow flint) thrives at sea level in the Caribbean, whereas another kind (Puño) grows at 3800 m or 12,000 feet above sea level in the Andes. Some kinds of maize (like Chococeno maize of Columbia) grows in humid coastal area, whereas O'odham and Hopi corn grows successfully at fairly high elevations in semi-deserts. According to Gary Nabhan, some 300 different varieties of corn are grown around the world today. A number of studies, dating from the 1930s to very recent work, show that maize grown in the American SW today (O'odham and Hopi maize) is different in form from maize grown in more moist climates. The "mescotyl" of O'odham and Hopi maize grows to 25 to 50 cm in length compared to 10 to 15 cm in modern hybrid corn (Figure 2).

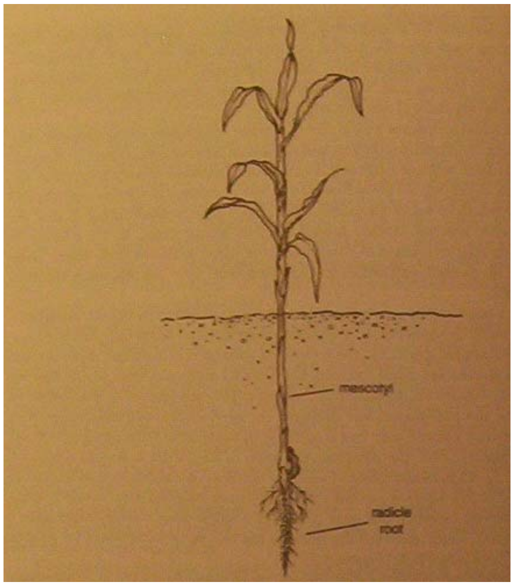

Figure 2. Mescotyl of O'odham and Hopi maize.

This allows O'odham and Hopi corn to be planted deep in the ground (where there is ground water that enables the seed to germinate) and still grow to the surface (Figure 3).

Figure 3. Hopi sand dune fields.

Also, most indigenous varieties of corn grown in La Gran Chichimeca do not grow very tall but do produce multiple ears of corn on each plant, unlike hybrid Iowa corn, that produces a single ear (Figure 4).

Figure 4. Hopi corn plants growing in a sand dune field.

As I indicated earlier, maize is a tropical grass. The earliest maize we have recorded comes from the Rio Balsas area of western Mexico, dating to about 7,200 B.C. This maize would not have had the long mescotyl or other characteristics of corn grown in semi-deserts. Two questions come from this observation. Was Rio Balsas corn the earliest domestic corn? And, how long would it have taken for early Rio Balsas maize to diversify? The first question can only be answered by saying that Rio Balsas corn is the oldest we know about today. In the future, somebody may find older corn in the Americas. Teosinte, the progenitor of corn, occurs widely throughout Mexico and elsewhere in tropical America, so there could be an earlier location. Until recently, the only way to identify maize archaeologically was by finding cobs or pieces of cobs or kernels or other plant parts or pollen (Figure 5).

Figure 5. Prehistoric corn cob.

These remains are "perishable," they decompose in moist soil of he tropics. Recent work by Dolores Piperno and others, demonstrates that phytoliths and starch grains of maize (and other plants) preserve in tropical soils. Maize phytoliths and starch grains are identifiable. That is one can distinguish them from other plants. But it is not yet possible to distinguish different varieties of maize from phytoliths – although folks are trying. So it may be that in the future we will find earlier corn in moist tropics than we know of from the Rio Balsas. As for how long it took to modify corn so that it developed the ability to germinate and flourish in semi-deserts…we don't know. Hugh Iltis, the paleobotanist who discovered the Rio Balsas corn, wrote that he believes change in the morphology of corn could be very rapid, largely because corn requires human propagation and people can isolate varieties that have the characteristics they want. However, there really is no information yet on how many genetic changes were required to modify corn and how quickly these could occur. **We do not know**.

The question about time for modification is also basic to our understanding of the introduction of maize into La Gran Chichimeca. In the 1950's, shortly after radiocarbon dating became available for archaeologists, the oldest dates on corn in the Americas came from Bat Cave in central New Mexico (Figure 6).

Figure 6. Bat Cave, New Mexico.

The site was excavated by Herb Dick. These early dates (which in fact did not date the corn itself but plant material around), caused a flurry of activity to find early corn, activity that sent Robert Lister and Paul Mangelsdorf to Swallow Cave and other sites in Chihuahua and Sonora, Paul Martin to Tularosa and Cordova Caves in the Mogollon highlands of New Mexico, and Scotty MacNeish to Tamaulipas and later to Tehuacan.

All of these locations are at relatively high elevations – i.e. they are in the mountains. The reason archaeologists went looking for corn in the mountains is because that's were there are caves, and caves are places where corn and other plant material plant that can be radiocarbon dated are preserved. In the 1950s, Emil Haury found corn pollen at the Cienega Creek site near Point of Pines, Arizona, an upland site that was not in a cave. But there was no datable material with the corn pollen because the site was open to the elements. Based on having found old corn –"primitive" looking corn, in caves in the mountains, Emil Haury proposed that corn had been moved through highland areas from central Mexico into the northern Southwest because there was more moisture at higher elevations and maize required more moisture. This model for the spread of farming into the northern American Southwest stood for about 20 years. The corn found in the mountain caves of central Arizona/New Mexico and Chihuahua and Sonora in fact does not look very productive, and there is no evidence that it was used by people who were sedentary and depending on it. Maize in this context was seen as supplemental to hunting and gathering of mobile populations. The corn itself was studied and determined to be "pre-chapalote" which is basically a type that is domestic corn that has interbred with teosinte. Maize and teosinte do in fact freely interbreed, and teosinte grows wild in many areas of Chihuahua and Sonora.

Subsequently, Chip Wills re-excavated Bat Cave, and used AMS dating of corn directly to “correct” Herb Dick’s dates (Figure 7).

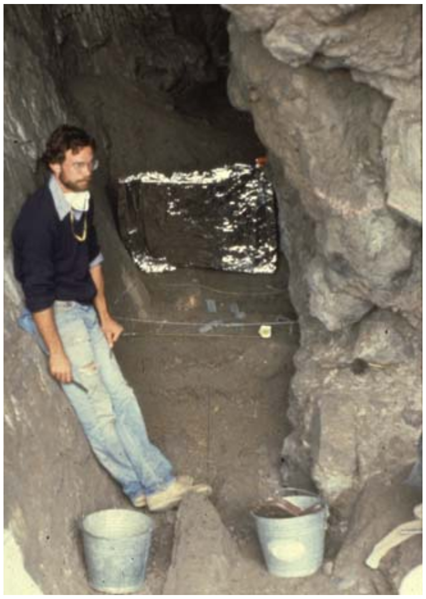

Figure 7. Chip Wills digging at Bat Cave, New Mexico.

The corn from Bat Cave is old, dating to about 3,200 to 2,100 years ago, but it is not as old as Dick thought it was (he thought 5,000 years ago; Figure 8).

Figure 8. AMS Corn samples at Bat Cave, New Mexico.

The notion that is a corollary of Haury's hypothesis – that corn had little affect on people's lives because they remained non-sedentary hunters and gatherers came into question in the 1990s. Work in lower elevations in the Santa Cruz River Valley (near Tucson), by Huckell and Mabry, recovered corn dating to 2,500 to 3,000 years ago. These were very deep excavations occasioned by highway salvage work – they revealed settlements, corn, and evidence of canal irrigation (Figure 9).

Figure 9. Stratigraphic evidence for prehistoric irrigation canals.

This work demonstrated that corn was not adopted through a chain of elevations, that it was cultivated by folks who were sedentary and in fact using irrigation canals.

Then, and this you will hear more of from the horse's mouth [John Roney and Robert Hard's paper in this conference], corn was found in pre-ceramic contexts at Cerro Juanaqueña in Chihuahua – a Trincheras site and in open pithouse sites on the Colorado Plateau (by Dennis Gilpin). In these contexts, corn also dates to about 3,000 years ago. And I hope to learn here, what new dates and new contexts we have.

So, as of now, it seems that corn came into the Gran Chichimeca at ca. 2,500 to 3,000 years ago into a variety of contexts: Places where there were mobile populations apparently not depending much on corn (in the Mogollon highlands), places where folks were depending a lot on corn (some parts of the Colorado Plateau, the Santa Cruz Valley, and Tucson Basin), and other places like Cerro Juanaqueña. If the botanists are correct, and I suspect they are, the development of different varieties of maize – adapted to different conditions – depends on isolation of different varieties and selection. These are accomplished through traditional farming strategies –like planting different sorts of corn – perhaps different colors of corn – in different fields. How much time does it take for corn varieties to develop? Unknown at this time. Is the early corn from the different settings: mountains, plateaus, low desert basins, the same genetically or morphologically? I don't know.

The early canal irrigation in the Santa Cruz valley seems like a setting in which people could intensify without moving. They could do this by expanding the irrigation canals. Elsewhere, corn was adopted by more mobile people and may have remained a supplemental resource. In these locations, it is hard for me to envision separation of fields that would lead different varieties of corn. I suspect thought that even on the Colorado Plateau, there was more variety in how much people depended on corn than elsewhere. My personal perspective is to see human behavior as variable – people moving from one a more intensive to more extensive strategy depending on what their needs were. I don't see much in the way of "cultural" boundaries at this time. I think it will take a combination of perspectives and scales of observation to provide answers, and I truly hope the multi-logue will continue.

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