Histories of Maize

Multidisciplinary Approaches to the Prehistory, Linguistics, Biogeography, Domestication, and Evolution of Maize

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CHAPTER 25

The Gift of the Variation and Dispersion of Maize
Social and Technological Context in Amerindian Societies

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Glossary

Early maturation Full development or ripeness in a short period of time.
Ceramics Articles made of earthenware, porcelain, or any product manufactured by the firing at a high temperature of a nonmetallic mineral (as clay).
Ceremonial contexts The associated surroundings or settings of behaviors that follow specific patterns of etiquette, pomp, or state; the associated surroundings or settings of sacred rites.
Fermented beverage A liquid for drinking that has undergone the breakdown of complex molecules in organic components caused by the influence of a ferment.
Fiber-tempered ceramics Articles made of earthenware, porcelain, or any product manufactured by the firing at a high temperature of a nonmetallic mineral (as clay) with inclusions of any fine threadlike objects usually of vegetable origin.
Macrobotanical remains Archaeological plant remains identified under low powered magnification, including fruits, seeds, tubers, wood, and other structures of vegetative origin.

Maize Corn, Zea mays L.
Phytoliths Opaline silica structures that form after deposition in epidermal and other cells of growing plants.
Pollen The fertilizing powder formed in the anthers of flowers.
San Jacinto 1 An archaeological site in northern Colombia, South America, with the oldest fiber-tempered ceramics in the New World (3950–3250 BC).
Savanna A type of vegetation where certain types of grasses dominate and where seasonal droughts and fires are normal ecological factors.
Seasonality The cyclical changes in environmental, climatic, and vegetative patterns that occur on a yearly basis in an area.
Territoriality Behaviors that occur in relation to the territory or extent of land under control or occupied by a particular group.
The gift Defined by Marcel Mauss as a mechanism of securing social and moral obligations between individuals and groups. Such obligations include to give, to receive, and to repay.

Models based on archaeological and ethnographic uses of maize in the Americas are developed to explain the variation of maize types in different parts of the Americas. These variations are linked to a hypothesized association between maize use and the development of ceramic technology in northern South America. Building on observations by Hugh Ilitis [47] and John Smalley and Michael Blake [123] that maize was probably first used for its sugars and as a fermented drink, the social manifestations of a link between fermented maize beverages and early ceramic use are explored. Such contexts appear to be related to gift giving.
and reciprocity [59]. Ceramic use for serving in such contexts was identified at the archaeological site of San Jacinto 1, Colombia, which has yielded the earliest fiber-tempered ceramics in the New World to date [77, 100]. Cultural practices surrounding reciprocity are explored to explain why ceramics and maize spread successfully into certain regions of South America (Peru) while scant evidence of maize and ceramics occurs in the Amazon Basin and the Caribbean. These data suggest that its use as a fermented beverage was only one option for developing reciprocal social (kinship) relations. The manufacture of intoxicating beverages from plants such as manioc tubers, potatoes, pineapples, and palm fruits would have limited the spread of maize into those regions where indigenous groups already used these alternatives or did not drink alcoholic beverages [120, pp. 51, 57]. Evidence of the spread of maize would only be noticeable archaeologically at certain thresholds with limited amounts of maize traveling into the Caribbean and North America from the Southeast–Gulf Coast region. Not until certain maize varieties (large kernel Eastern 8-row types) reached an area in North America, where early maturing characteristics were well adapted, does evidence of maize appear relatively suddenly around AD 900–1000 in the archaeological record at many sites in eastern and Midwestern North America (United States). This chapter will explore these different radiations and models of maize variation and the patterns of its spatial distribution in the Americas.

Let us now shift the subject and demonstrate that at least the obligation to give has a much wider distribution. Then we shall show the distribution of the other types of obligation and demonstrate that our interpretation is valid for several other groups of societies [59, p. 16].

INTRODUCTION

Hunter–gatherer subsistence cannot be understood without looking at the social settings within which they occur. Group interactions must be seen as a crucial factor in the resilient strategies, which hunter–gatherers employed to survive [36]. Resilience is the capacity that a group has to respond to changing environmental or cultural conditions to continue their existence. In this sense the use of plants can be seen as both playing an economic role and social role in the survival of the individual and the group within which he or she was actively involved. Such interactions must be tied to territorial behavior both at individual and group levels [7, 17, p. 49; 25, 87, 88, p. 62; 118, pp. 23, 33–51].

When concepts of territorially are used and tied to the notion of reciprocal gift giving, one can begin to understand the dynamics of the spread of maize and associated technologies such as ceramics, which help to foster sociable relationships [59]. Following Marcel Mauss [59], the gift is herein seen as a mechanism of securing social and moral obligations between individuals and groups. Such obligations include to give, to receive, and to repay and social drinking and eating. These are all seen as a form of enacting these obligations. These relationships may be required for various purposes, such as increased labor, marriage alliances, and conflict resolution, but all demand the need for a social setting in which gifts are made to solidify relationships whereby the knowledge of immediate or future return of the gift is assured. As Christine Hastorf [43, p. 147] pointed out: “The evidence that is now forming throughout Latin America is beginning to suggest that in fact maize is, in its early evidence, more of a social-symbolic artifact than a basic food stuff.”

In this social role maize (Zea mays ssp. mays) offered characteristics that, like other plants, could be used by humans to produce fermented beverages. Indeed, it is now believed that maize’s predecessor, teosinte (Zea mays ssp. parviglumis), was first used for its sugars by chewing the stalk or making fermented beverages [10, 47, 123]. The sugar content of teosinte and maize stalk thus offered a product that could be turned into fermented beverages. As food and beverages clearly fall under the rubric of gifts in that they are offered to guests in social and ceremonial contexts, such products would have fit nicely into the social relations of hunter–gatherers as they moved throughout their territorial ranges, or moved into new areas bringing maize with them. Clearly not a staple to early hunter–gatherers, the sweetness of maize and teosinte stalk would have offered an attraction to groups coming into contact with maize producers [2, 73, 97, 126, 127].

As modeled by various scholars, hunter–gatherers use differing amounts of space that fluctuates with time and environmental and human ecological constraints [17, 116]. Most agree that minimally constrained hunter–gatherers use larger territories, and the borders of these are fluid or open in nature. However, in highly seasonal savanna settings the availability of important plant resources such as small grass grains or palm fruits can tie group territoriality to an area

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1Ecosystem concepts in ecology that can be applied to human behaviors and group interactions note the following from Frank B. Golley [36, p. 196]: “A more modern approach to the existence of equilibrium is through the concepts of resistance and resiliency, which describe how an ecosystem might respond to or recover from a disturbance.” Further, “The capacity of an ecosystem to respond after being disturbed is called resiliency. Resilience is a function of the scale and intensity of the disturbance...”

2These concepts, taken together, do not preclude the development of other hypotheses concerning, for instance, the spread of human populations and languages (the early farming dispersal hypothesis) but instead can be tied into such hypotheses as mechanisms of and for social relationships [1].
where these resources seasonally occur\textsuperscript{2} [109]. Overlapping territorial ranges of groups would occur around these resources and would create a social setting with an increased emphasis on intergroup social relations. It is in these social settings of groups with restricted territories in highly seasonal environments where gift giving (as a need to create and perpetuate reciprocal relations) is hypothesized to have occurred. The increased contact among mobile hunters and gatherers leads to a greater emphasis on reciprocal social relations and on those technologies and products (i.e., fermented beverages, new technologies like ceramics), which can be ritually offered to cement these ties [3, pp. 26–29, 371, 401]. Ceramics and maize in this case may have functioned on a symbolic, as well as practical, level in small-scale social interactions [18, 19, pp. 39–58; 44].

THE DEVELOPMENT OF CERAMICS: ITS SOCIAL SETTING

How does the innovation of ceramics in northern South America fit into this picture? It appears to be that ceramics were used early on as serving containers in this area of the world (Figure 25-1, Table 25-1). At the site of San Jacinto 1 (3950–3250 BC), located in the savanna of Bolivar, northern Colombia, this function of serving has been verified through analyses of pottery size and shape and spatial comparison with fire-cracked rocks and earth oven features which were the basic means of cooking found at the site [77, 92, 93, 100–102]. As well, the earliest ceramics from the Valdivia settlements in southwestern Ecuador, dated later than those at San Jacinto 1 (3250 and 2450 BC), were also used for serving, drinking, and eating in the case of bowls and cooking in the case of jars [96, 98].

Analysis of vessel forms from San Jacinto 1 suggests little variability. Most were semiglobular pots and globular vessels with no evidence of fire clouding on the exterior surfaces (Figure 25-2) [92]. Despite evidence of continuous reoccupation, the spatial distribution of pottery was restricted and clearly apparent in excavations. In contrast, fire-cracked rocks are the most abundant archaeological material recovered, a pattern common in base camps of collectors. Pottery was never found with the fire-pits or the clusters of fire-cracked rocks that were used for cooking.

Lack of any clear contextual association with food preparation or processing should not discount the possibility that certain plants were fermented in the ceramic vessels [76, 77, pp. 102–107]. The evidence suggests that ceramics could have been used for serving purposes, possibly to serve beverages of a fermented fruit or water. However, the exact identification of the plants used to make the served product has yet to be determined.

The evidence from excavations at San Jacinto 1 suggests the occupants used highly seasonal resources [8, 9, 77, pp. 111–114, 142–143]. Early Valdivia settlements between the Chanduy and Valdivia River valleys appear to reflect a process of increasing sedentism and an association to specific geographical or territorial areas as well [96, pp. 41–44]. Group identity was no doubt important and could be expressed symbolically by the use of ceramics, as is common among ceramic producing hunter-gatherers in various regions of the Neotropics [117, pp. 13–28]. It is common among different societies to solidify social relationships through sharing food and drink. It can help to acquire needed labor from kin for activities that require more people than the immediate family or small group can supply [20, pp. 199–201, 304–309; 22, 34, 35, 46, 48, 66, 72, pp. 33–35; 79, pp. 100–103; 119].

We envision such a scenario for the continued success and spread of maize. From its possible initial use as a source of sugar from the stalks, the grains and/or other plant parts would have functioned well to make a fermented beverage or other food that was served as a gift of social and moral obligations in ceremonial settings of hunter–gatherers undergoing restrictions on their mobility.\textsuperscript{5} Ceramic innovation in northern South America also appears to be tied to serving and gift giving [21]. Definitive proof of this early association between maize and ceramic production is still lacking but as envisioned may help to explain the spread of their use into other parts of South America [125, p. 82].

CERAMICS AND MAIZE: DISPERSION IN SOUTH AMERICA AND THE CARIBBEAN

Early ceramic sites in northern South America have yielded indirect evidence of maize consumption in the form of phytoliths.\textsuperscript{3} With the appearance of Valdivia ceramics

\textsuperscript{3}Ehud Weiss, Wilma Wetterstrom, Dani Nadel, and Ofer Bar-Yosef [135] point to an early use of small grained grasses at the site of Ololo II (21,050 BC), Israel, as evidence of the broadening of resources to include low-ranked plant foods [28]. The reproductive nature of grasses (numerous seeds) and seasonal availability must play a role in their selection for inclusion into the diet [8]. It is possible that similar uses of small grained grasses before and during the early incorporation of maize into the diet of humans may be found (as indicated in the case of Setaria) [16]. The recovery of numerous metates and manos from the site of San Jacinto 1 may lend evidence to these processes as they occurred in South America [77, pp. 70–107].

\textsuperscript{4}However, Sergio Chávez [123, pp. 689–690] indicates that in the Andes the indigenous people do not chew on the maize stalk like in Mexico but rather only ferment the cob–kernel portion of the plant. This would suggest that maize was introduced into the Andes in a fully domesticated form.

\textsuperscript{5}Phytoliths are opaline silica structures that form after deposition in epidermal and other cells of growing plants [83, p. 356]. Phytoliths can therefore be considered as indirect evidence of plant remains as opposed to direct evidence from organic plant matter that contains DNA, such as seeds or pollen.
TABLE 25-1  Archaeological Sites with Documented Ceramics and Maize

<table>
<thead>
<tr>
<th>Site name</th>
<th>Location</th>
<th>Dates</th>
<th>Ceramic function/context</th>
<th>Maize evidence</th>
<th>Site context</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Jacinto 1</td>
<td>Colombia</td>
<td>3950–3250 BC (5900–5200 BP)</td>
<td>Serving</td>
<td>Not present</td>
<td>Hunter-gatherer logistic special purpose site</td>
<td>[77]</td>
</tr>
<tr>
<td>OGSE-80</td>
<td>Ecuador</td>
<td>8000–4600 BC</td>
<td>Not present</td>
<td>Phytoliths (6000 BC)</td>
<td>Ceremonial setting/burials</td>
<td>[81, 82, 86, 89]</td>
</tr>
<tr>
<td>Loma Alta and Real Alto</td>
<td>Ecuador</td>
<td>4400–3000 BC</td>
<td>Serving/cooking (3300–3000 BC)</td>
<td>Phytoliths</td>
<td>Ceremonial spaces present at sites</td>
<td>[84, 91, 96]</td>
</tr>
<tr>
<td>Real Alto</td>
<td>Ecuador</td>
<td>2800–2400 BC</td>
<td>Serving/cooking</td>
<td>Phytoliths, starch grains</td>
<td>Ceremonial spaces present at site</td>
<td>[85, 96]</td>
</tr>
<tr>
<td>La Emerenciana</td>
<td>Ecuador</td>
<td>2400 and 1650 BC</td>
<td>Serving of fermented maize</td>
<td>Phytoliths</td>
<td>Maize evidence directly recovered from ceramics in ceremonial contexts</td>
<td>[126]</td>
</tr>
<tr>
<td>Rio Chico area</td>
<td>Ecuador</td>
<td>800 BC</td>
<td>Possible burial offering</td>
<td>Kernels (2 varieties)</td>
<td>Tomb/Ceremonial context</td>
<td>[80]</td>
</tr>
<tr>
<td>La Ponga site</td>
<td>Ecuador</td>
<td>1200–800 BC</td>
<td>Present</td>
<td>Kernels and cupules (2 varieties)</td>
<td>Maize associated with ceramics</td>
<td>[53]</td>
</tr>
<tr>
<td>Aspero</td>
<td>Peru</td>
<td>ca. 2800–2600 BC</td>
<td>Not present/Pre-Ceramic levels</td>
<td>Cobs</td>
<td>Maize recovered from ceremonial mound</td>
<td>[136]</td>
</tr>
<tr>
<td>La Galgada</td>
<td>Peru</td>
<td>2662–1395 BC</td>
<td>Present (2295–1705 BC)</td>
<td>Cob</td>
<td>Maize recovered from ceremonial chamber in mound</td>
<td>[38, 124]</td>
</tr>
<tr>
<td>Curdal</td>
<td>Peru</td>
<td>1150–800 BC</td>
<td>Feasting</td>
<td>Cupule, phytoliths</td>
<td>Ceremonial and domestic contexts</td>
<td>[12, 15, 128]</td>
</tr>
<tr>
<td>Taperinha</td>
<td>Brazil, Amazonia</td>
<td>ca. 6050 BC (ca. 8000 BP)</td>
<td>Cooking, storage, or display</td>
<td>Not present</td>
<td>Shell mound</td>
<td>[113]</td>
</tr>
<tr>
<td>Abeja site</td>
<td>Colombia, Amazonia</td>
<td>2745 and 2380 BC (4695 and 4330 BP)</td>
<td>Not present/possible transitional period at end of Pre-Ceramic phase</td>
<td>Pollen</td>
<td>Semisedentary to sedentary with probable cultivated gardens and fields</td>
<td>[45, 64, 91]</td>
</tr>
<tr>
<td>Lake Ayauch</td>
<td>Ecuador, Amazonia</td>
<td>3350 BC (5300 BP)</td>
<td>Not present</td>
<td>Phytoliths, pollen</td>
<td>Lake core deposits</td>
<td>[90, 91]</td>
</tr>
<tr>
<td>En Bas Saline</td>
<td>Haiti, Caribbean</td>
<td>AD 1250</td>
<td>Feasting</td>
<td>Macrobotanical remains (2 varieties)</td>
<td>Maize recovered in association with ceramics, also in elite chiefly residence</td>
<td>[69–71]</td>
</tr>
<tr>
<td>Tuto</td>
<td>St. Thomas, Caribbean</td>
<td>AD 1140–1350</td>
<td>Not defined</td>
<td>Macrobotanical remains</td>
<td>Not defined</td>
<td>[71]</td>
</tr>
<tr>
<td>Maruca and Puerto Ferro</td>
<td>Puerto Rico, Caribbean</td>
<td>1295–890 BC (earliest contexts)</td>
<td>Not present</td>
<td>Starch grains (2 or more varieties)</td>
<td>Maize evidence recovered from ground stone lithics</td>
<td>[78]</td>
</tr>
</tbody>
</table>
around 3300 and 3000 BC, site locations are in valley areas usually near floodplains. These sites are also associated with specific geographical or territorial areas and indicate sedentism with task groups potentially sent to distant locations for resources [95, 96, pp. 41–49; see also 81, 82, 86, 89]. J. Scott Raymond [96, p. 46] argues that the uniform degree of standardization of Valdivia pottery over a large region points to a high frequency of social interactions and a shared cultural identity. He also indicates that the layout of the Early Valdivia settlements, particularly at Loma Alta and La Centinela, exhibit conceptual dimensions of ceremonial or ritual spaces. Other evidence of rituals includes small stone figurines and the association of burials with houses [52, 94].

Again the early use of ceramics is associated with ceremonial or ritual activities presumably for groups that had reduced territoriality.

Maize remains from the Loma Alta site include phytoliths from two samples (4400–3000 BC) and the Early Valdivia site of Real Alto include phytoliths of maize from one Valdivia 2 sample and possibly from one Valdivia 1 sample [84, pp. 223–225; 91, pp. 249–251]. Cob phytoliths and maize starch grains were also recovered from Real Alto stone tools dated to between 2800–2400 BC [85]. Phytolith assemblages representing maize cob chaff were directly recovered from the residues of three sherd samples directly accelerated mass spectrometry (AMS) dated to ca. 2200 and 1850 CAL BC at the site of La Emerenciana, also located in southern coastal Ecuador. These ceramics came from ceremonial contexts with ritual offerings and are interpreted as representing the consumption of maize in probably fermented liquid form [126]. The social context of this early pottery and potential use of maize appears to be supported in these cases.

Two other examples from Ecuador, although dated later to 1200 to 800 BC, also bear out this point. In one case, a Chorrera Phase vessel (ca. 800 BC) was recovered from a sunken tomb in the Rio Chico area of the Manabí province. Within this vessel were 644 carbonized maize kernels. These maize kernels appear to represent two types of maize, a probable 8- to 10-rowed maize type and a 12-rowed type. The 8- to 10-rowed maize is believed to be a “low altitude variant of the narrow, broad kernel line of maize, with the distinctive configuration of kernels that are wider than they are long, and very narrow” [80, p. 349]. The closest existing race appears to be the Andaquí of Colombia, a variant found in the northern and eastern lowlands of Colombia [105, pp. 57–59]. Charred maize kernels (80 fragments) and cupules (about 50 fragments) were also recovered from the
La Ponga Site (1200–800 BC). The authors [53, p. 122] note that, "a significant portion of the Machalilla maize samples was associated with the earliest Machalilla pottery recognized to date." These remains also fell into two types: a broad cupule type representing few rowed races of maize and a more elongate cupule type representing 14-rowed and 10-rowed races [53, p. 123].

The evidence for maize at these early Valdivia sites provides a basis for maintaining an early association between maize, ceramic use, and social ceremonial contexts. Maize (phytoliths and macrobotanical remains) were either directly recovered from ritual vessels or were associated with ceremonial contexts at the previously mentioned sites. Once established, does this association occur throughout the rest of South America?

Numerous authors have argued that maize agriculture was not the foundation for early monumental building and social complexity in Peru [11, 60, 61, 67, 68]. Pre-Ceramic sites with maize have been identified in the literature, but the stratigraphic and other contextual associations are still debated [5, 6, 40, 56, 57, 60, 61, 136]. However, the importance of early maize use to ceremonial contexts is clear, as evidenced by the recovery of 49 maize cobs in the ceremonial mound at Aspero [136]. Although the Pre-Ceramic context of these has been questioned, the ceremonial function of the temple in this area of the site is indisputable [61].

At Peruvian sites with early ceramics, the association of maize to ceremonial contexts and the probable use of fermented maize drinks served in ceramics are also evident [14]. When ceramic innovation spreads throughout the coast during the Initial period in Peru, maize again does not appear to represent a major economic staple and shows up at only a few sites such as La Galgada (2662–1395 BC) on the Tablachaca River, a tributary to the Santa River; Cardal (1150–800 BC) on the Lurin River in central Peru, and Caral in the Supe Valley (see Chapter 28) [12, 15, 38, 121, 124]. These sites yield evidence of ceremonial monumental architecture featuring U-shaped pyramidal mounds. The use of fire-pits at these sites for burnt offerings is also noted [39, pp. 50–59].

A single 10-rowed maize cob was recovered from a ceremonial chamber in the south mound in the upper portion of La Galgada, presumably from the ceramic bearing levels of this mound (ceramics occur between 2295 and 1705 CAL BC) [37, pp. 124, 185–191]. Coastal shellfish also appear in ceremonial contexts and different species of mollusks were used to make personal adornments at this site [68, p. 42]. Maize and ceramics occur at Cardal [15], and evidence of broken serving vessels in the open space between the mounds appears to be a result of ritual feasting in that area of the site [12, p. 367, 15]. The macrobotanical evidence is tentative, as only one possible maize cupule was recovered behind the central mound in a probable domestic structure [128, pp. 62–63, Table 16]. Large cross-shaped phytoliths indicative of maize were identified in both ceremonial and domestic contexts at Cardal [128, p. 38]. Pottery at other early Initial Period sites in coastal Peru is scarce with the continued recovery of fire-cracked rocks suggesting that ceramics did not replace these as a method of food preparation [13, p. 60]. Although a limited data base, the co-occurrence of maize and ceramics in a ceremonial chamber at La Galgada and an open plaza interpreted as used for rituals at Cardal again points to the likely function of the two in social contexts.

As maize grows well in Peru today, it is a readily available plant source to make fermented beverages, which is used by numerous ethnic groups for social and ceremonial purposes. It is still the preferred (required) beverage for ceremonies in the traditional villages, even when commercial beer is available. Before the introduction of commercial beer, it was the main source for fermented beverages in this region. In Colombia and other places, it was called chicha [120, pp. 272–273; 54, pp. 354–356; 63, pp. 109–141].

However, when turning to the tropical humid forests of South America such as the Amazon and Orinoco Basins, the occurrence of maize and ceramics together in the same cultural context appears to lag behind their documented co-occurrence in Peru. The reasons for this appear to be that maize does not grow as well in tropical humid climates because of fungus and insect attacks [130, p. 251], and that other plant products, such as palm fruits, pineapples, and manioc, served groups in this broad region as the source for making fermented beverages. These beverages no doubt served the same purpose as did fermented maize drinks, being a means of unifying group ties, obtaining reciprocal relations involving notions of the gift, and helping to dissipate conflicts. However, it is hypothesized herein that maize played only a limited role in social interactions and encounters in these areas due to the use of other plants.

Interestingly, the earliest dated ceramics in the New World from Tapinha, located near Santarem, Brazil, had vessel shapes limited to bowls which are presumed to have cooked soup or stew [62, pp. 27–32; 99, 111, 112, 113, 122, 137]. This utilitarian function (cooking) is unlike that indicated for early ceramics in northern South America though storage or display functions have also been hypothesized [111, p. 126]. It is possible that these early ceramics in the lower Amazon of Brazil were not used in the same social contexts as in other parts of South America.

In a volume aptly titled "Unknown Amazon," José Oliver [75] reviews the current state of knowledge on agricultural production in the Amazonia and indicates a scarcity of data, especially for the Formative Period (2050–50 BC). The only early evidence of maize in this area is at the Abeja site dated to 2745 and 2380 BC. This site is located in the region of Araracuara on the Caquetá River in Colombia where maize
and manioc pollen has been identified [45, 64, 91, p. 263]. The Pre-Ceramic Tubabonita phase occupation may have ended around 2750 BC, marking the recovery of maize pollen at a transitional period at the end of the Pre-Ceramic phase [75, p. 83]. Phytolith and pollen evidence of maize has been recovered from core deposits dated to approximately 3350 BC at Lake Ayacu in Amazonian Ecuador [90, 91, pp. 262–265]. However, the human socioeconomic contexts of these finds are unclear. Although paleobotanical and subsistence data are currently lacking, by 2050–1550 BC sites with elaborate ceramic assemblages are located throughout the lowlands. It is unknown if maize occurred at any of these sites but ceramic griddles (budares) to bake or cook cassava or farinha from manioc do occur [75, p. 66].

We believe that the initial spread of maize and ceramics though Venezuela and the Orinoco River to the Caribbean would also have encountered the same functional obstacles as found in the Amazon Basin. Maize may not have grown particularly well in the tropical forest setting of the Orinoco, and other plants would have already filled the niche in providing fermented beverages [110]. In the Caribbean, definitive evidence in the form of macrobotanical remains of maize occurs at only two sites from En Bas Saline, Haiti, and Tutu, St. Thomas [71, p. 358]. These sites are dated to ca. AD 1250 and AD 1140 to 1350, respectively. Maize starch grains, the earliest recovered from contexts dated to 1295–890 BC, have also been identified from lithic tools at two sites, Maruca and Puerto Ferro, in Puerto Rican territory. Other important domestic, cultivated, and wild plants were also identified [78].

Information from the sites tends to corroborate conclusions that maize was not a staple of the diet. Its early use in socially important functions, such as for making beer for ritual purposes, may have been obscured by later migrations of groups (Arawak speakers) into the area from northern South American in the first millennium BC [50, 74, 106–108, 114, 115]. Later mainstays of the West Indies’ diet focused on root crops, and ethnographic accounts of maize do not list a use as a fermented beverage. Indeed, Carl Sauer [120, p. 51] notes that the Arawak speaking groups that migrated to these islands drank no alcoholic beverages. A maize variety (a white, soft maize, probably not a flinty corn) with a short growing season of 3 to 4 months is noted, although it is not clear if this was grown on these islands or Tierre Firme (the mainland of the Caribbean coast of present day Panama).

At En Bas Saline, more than half of the remains of maize were recovered from one feature in association with sherds from 140 ceramic vessels in a context interpreted as representing the result of ritual feasting activities. Other remains came from the elite chiefly residence [69, pp. 327–328; 70, p. 209]. Interestingly, two types of maize kernels are also identified at this site, one being a popcorn variety and the other a shorter and broader “flour-type” [70, p. 212]. At Maruca and Puerto Ferro the recovered maize starch grains also appear to represent two or more different varieties, with the earliest maize starch grain recovered at Maruca having a form similar to that of modern Pollo from Colombia and early Caribbean varieties from the Antillas [78, p. 22]. Maize’s limited archaeological appearance in the Caribbean and Southeastern United States may thus be related to the disappearance or replacement of its use as an offering in small-scale social gift giving settings where migrating groups already had other resources with which to perform these functions.

**TIMING OF MATURATION OF MAIZE**

We hypothesize that the spread of maize out of Mexico and into northern South America occurred in numerous waves whereby the plant accompanied different groups in a patchwork fashion similar to that as explained by John Hart [42] for North America [29]. In this scenario certain maize populations would have survived, while others would have died out. Some populations as well would have become isolated from their parental population and would have taken on adaptive qualities that would have allowed them to survive in a given environmental setting [32].

Although archaeological evidence of early isolated populations of maize in northern South America is still lacking, there is no doubt that maize reached these areas and would have had to undergo genetic changes to adapt to environments different from which it initially spread. One such environment is the highly seasonal savannas typical of northern Colombia and the Llanos regions of Colombia and Venezuela. In these regions, the seasonal cycle of rains and dry periods can be abrupt with dry seasons lasting from 4 to 7 months in some instances. In these savanna environments grasses and maize die off just after the rains end and in some instances such as in northern Colombia this can occur within a month.

Maize would have had to adapt to strong seasonality in these regions, and we suggest that such adaptations involved characteristics for early maturation (potentially a response to both the climate and human selection). Early maturation would have allowed maize cobs to be ready for collection.

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*The context of the maize pollen is unreliable. The authors do not address the fact that the area was heavily cultivated with maize decades earlier in a development project that failed. The area was used for intensive agricultural production to supply the state prison of Araracuara. This use is common knowledge by the indigenous groups and prison workers [129]. Years after the closure of the state prison, the Corporation of Araracuara tried to reintroduce maize to the indigenous peoples but failed, because they refused to eat it instead using it as chicken feed.*
in 1 to 3 months after the rains ended. Varieties of corn that matured in 2 months have been reported ethnographically for the Colombian and Venezuelan Llanos [41, p. 431; 65, p. 46]. This scenario has not been confirmed by the archaeological recovery of maize in these savanna settings. However, it does help to explain how early maturing varieties could have spread through northern South America, the Caribbean, or Gulf coastal regions into eastern North America by a pathway somewhat different from that of maize that entered the present-day United States in the Southwest [4, pp. 10–11; 27, 33, p. 6; 51, 104, 134].

One of the most interesting questions for anyone working on the origins of agriculture and the spread of maize into North America is why do two distinct varieties of maize occur in the archaeological record? This diversity is particularly noticeable in the Midwest with cobs of 12 rows or higher found predominately in the archaeological record early on only to be replaced by eight-rowed cobs possibly coming from the east [4, p. 96]. Why is this?

Although the origins of Eastern Eight Row maize (Maize de Ocho, Northern Flint) are still unclear, Thomas Riley, Richard Edging, and Jack Rossen [104] hypothesized that separate entry routes were the primary reason for the existence of two distinct varieties of maize in North America [27, 32, 51]. One of potentially numerous routes of entry for Eastern Eight Row maize (including from northwestern Mexico) may have been through the southeastern United States, presumably from maize in the West Indies that has affinities to that from the Caribbean coast of South America and the Central American lowlands [26, pp. 21–23; 49]. Twelve-rowed or higher maize with small cobs and kernels is known to have reached the present-day United States from the Southwest and Mexico [4, p. 96; 32, 104]. One of the interesting points here is that Eastern Eight Row maize with its large kernels is an early flowering, early maturing variety adapted to short growing seasons and severe environmental conditions [4, p. 10; 32, p. 270]. Such an early maturing variety of maize would have been well adapted to the short growing seasons of the Northeast and parts of the Midwest [104, p. 528; 134, p. 44]. Alternatively, early maturation could have been a postdispersal adaptation acquired once maize reached the Northeast and further investigation on this topic would be useful.

It is further hypothesized that an early maturing variety of maize, which had initially developed in highly seasonal environments in lowland Central America or northern South America, was introduced into North America in a piecemeal fashion [51; see 42]. Genetic and allozyme data indicate a definite subgroup or clustering of short maturing varieties linked to maize from the southwest United States [26, 58]. Doebly and colleagues [26, 27] also show a clear separation between northern flint maize and Mexican dent maize to the degree that they state, "... 'T' between Northern Flints and Mexican Dents fall into the range typical of separate species" ('T' measuring the degree of similarity) [27, p. 66]. The development of such distinct genotypes and isozymes could be explained by their long-term isolation from other populations of maize—teosinte, which would have likely included the time period it took the fast maturing maize variety to reach the eastern United States. Therefore, one explanation for this could be that the dispersal pathways or routes of these distinct varieties of maize were different allowing for the development and maintenance of such genetic diversity over time (see 27, p. 68, for an explanation involving genetic drift).

By any means of radiation, the initial introductions of maize would have been on a scale comparable to its early use in gift giving and ritual contexts of hunter-gatherers and other small-scale social groups, only later undergoing production intensification. Such archaeological evidence has been hard to uncover though maize’s early role in ceremony and ritual in North America has been identified by numerous authors [31, 55]. This social context may explain the limited presence of maize in the archaeological record of the Midwest and eastern North America until about AD 800 [30, 131–133] when Eastern Eight Row corn reached an environmental setting with short growing seasons to which it was already genetically well adapted [33]. The difficulty in locating early remains of maize may also be because of a bias in excavating sites found on landscapes that are stable and highly visible. These locations are probably not where early maize use and exploitation first occurred (for instance also consumed in a green state), as such landscapes would be expected to be in natural floodplain settings. It is in the context of landscapes with high sedimentation like that found at the site of San Jacinto 1 in Colombia that can give more accurate knowledge of the early context of maize food consumption and latter of maize production.

CONCLUSIONS

In conclusion, the spread of maize appears to have been initially tied to its use for sugars, at first from the stalks of teosinte, but later from the maize cobs, kernels, and perhaps other parts. Tentative hypotheses [47, 123] also suggest that early maize was made into fermented beverages related to its high sugar content and only available in a short span of time [47, 123]. This means that the visibility of maize in the archaeological record during the cycle of logistic and residential mobility of an indigenous group is limited and obscure. Maize's seasonal consumption seems to be tied to sites of extremely low visibility and unstable landscapes such as edges of creeks, rivers, and lakes, as well as inundated floodplains. This narrows the possibility of finding hard evidence of maize to a limited situation in space and
time in the yearly cycle of the lives of the hunter–gatherer populations that domesticated maize. These products were used by hunter–gatherer groups in their social lives as a form of gift, whereby reciprocal relations of social and moral obligations could be negotiated and maintained through acts of giving beverages and food during the limited times of social networking or agglomeration common in the dry season. We have to remember the strong tendency of groups to disperse during the rainy season and reunite in the dry season around short times of abundant resources. Maize falls into that spectrum of use initially.

The settings of such social activities would have of necessity been tied to territoriality and of small scale given the level of social development and population of such hunter–gatherer groups. It appears that a decrease in territorial ranges and a focus on seasonal plant resources became necessary. Into this scenario the development of ceramics for serving fermented beverages, though not initially verifiable as maize, would have offered another marker of group and territorial identity as reinforced in the gift-giving process. Containers made of other materials were no doubt also used to serve fermented beverages made of maize and other plants. However, the pliability of clay to produce images and symbols may have been vital in its initial origins and spread [103]. Such symbols could mark group identity or ownership over seasonal resources that were not always visible on the landscape or territory of a group [77, pp. 157–164]. The plants, themselves, further may have taken on “special meanings or identities due to their links to places, events and histories” [44, p. 40; also see 23, 24, 125, pp. 74–75].

The subsequent spread of maize and ceramics into Peru seems to be tied to the use of maize in ceremonial contexts, probably in the form of a fermented beverage. The development of maize along the desert coasts of Peru may have helped it to obtain a dominant role as the food–beverage that was offered in ceremonial settings. On the other hand, the humid tropical climates of the Amazon and Orinoco Basins would have hindered maize’s growth and ability to take on a dominant role in social settings of gift exchange in these regions. Other plants more adapted to these environments would have been more suitable to such functions and currently play a major role in these areas.

The spread of maize into South America and North America must be seen as occurring through different radiations, times, and populations. Each population and pathway would have required the development of adaptive characteristics for the maize populations under question. The development of early maturation could have only occurred in areas where this was required such as the highly seasonal savannas of northern South America or lowland Central America. One hypothesized radiation to explain the distinctive genotypes and isozymes of early maturing, large kernel, and lower row number cobs from the Gulf coastal areas of central and northern South America through the Caribbean and southeastern United States is presented.

Although the ideas presented in this chapter are clearly hypothesized expectations to be tested, the evidence from the archaeological record generally supports models of a low-level use of maize often with ceramics in gift-giving social settings. Such models may also help to explain the spread of maize out of Mexico and into South and North America. This chapter can be seen as a call for model building made by Richard Ford at the 69th Annual Meeting of the Society for American Archaeology (Montreal, 2004) Symposium on “The Stories of Maize.” It is hoped that this chapter will be read as just that: Models of the spread of maize that need to be tested and revised as further archaeological, biological, and botanical contextual evidence comes to light.

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