Pre-Contact Maize from Ontario, Canada
Context, Chronology, Variation, and Plant Association

GARY W. CRAWFORD*, DELLA SALUNDERS†, AND DAVID G. SMITH‡
*Department of Anthropology, University of Toronto at Mississauga, Ontario, Canada
†Department of Anthropology, University of Toronto at Mississauga, Ontario, Canada
‡Department of Anthropology, University of Toronto at Mississauga, Ontario, Canada

Introduction 549
Middle Woodland, Late Woodland I, and Late Woodland II in Southern Ontario 550
Palaeoethnobotany of Middle Woodland, Princess Point, and Late Woodland II 551
Maize in the Northeast 552
Princess Point Maize 554
Late Woodland I Maize Morphology 556
Discussion 556

Glossary

Cupule  Fruitcase found in maize that is an inward folded internode associated with two spikelets, each of which produce a kernel.

Eastern Eight-Row  A landrace of maize that is likely the archaeological manifestation of Northern Flint.

Glen Meyer  Early Late Woodland II (AD 900–1300).

Late Woodland I  The period in the Northeast from AD 500–1100.

Late Woodland II  The period in the Northeast from AD 900–1100 to European contact.

Middle Woodland  The period in the Northeast from 400 BC to AD 650.

Northern Flint  A landrace of maize native to the Northeast with mainly eight-rowed cobs, distinct row pairing of large, crescent-shaped kernels.

Pre-Contact  Period before European influence in the Northeast.

Princess Point  Late Woodland I culture in south-central Ontario, found mainly along the Grand River and east to the western end of Lake Ontario.

Tiller  A branch stem that sprouts from the base of a grass plant.

The origins and development of the Northern Flint maize landrace (also known as Eastern Eight-Row in the archaeological record) is poorly understood. Genetic evidence indicates that it is closely related to southwestern maize, but the archaeological record pertaining to the specific ancestral landrace is ambiguous. The earliest evidence for maize in Canada is from the Princess Point culture Grand Banks site, Ontario (Figure 40-1) and has been AMS dated to about CAL AD 400–600 [5, 6]. Phytolith evidence from residue on pottery indicates maize was in present-day New York State about 500 years earlier [29]. Maize production was relatively unproductive until AD 1000–1200 when maize production intensified and began to support nascent longhouse villages. All indications are that Northern Flint maize was the main, or only, maize grown from AD 1200 until European contact in the province. The variation, chronology, cultural and spatial context, morphology, plant associations, and other details of maize dating from the ca. fifth to sixteenth centuries in southern Ontario, Canada, are examined. The evidence does not contradict the model that the ancestor of maize in the Northeast is a type of Eastern Eight-Row. Before AD 1000 in Ontario, maize is archaeologically associated with anthropogenic plant communities consistent with local food production rather than maize being a rare plant traded to hunter–gatherers. This context provided an environment in which selection and breeding could have occurred to produce the classic Northern Flint landrace.

INTRODUCTION

Late Pre-Contact and early Contact period maize in northeastern North America (including southeastern Canada) is associated primarily with Northern Mixed Economy, Eastern Collecting, and Eastern Coastal groups
Ethnographic and archaeological evidence document that the crop is not exclusive to any linguistic group. At most, maize provided about 50% of the dietary needs of indigenous people in the region [12]. Northern Flint maize is the main landrace of maize grown in the region in Post-Contact times. (Archaeological maize in the Northeast is often called Eastern Eight-Row maize because cobs with eight rows of kernels around the circumference are the most common in the population.) Furthermore, Midwestern Dent Corn, comprising about half the world’s maize production, is comprised of the genomes of two races, one of which is Northern Flint [8, 13]. Iroquoian peoples in the Northeast still maintain favorite varieties of Northern Flint maize. Intensified food production in the late Pre-Contact Northeast is linked to the development of Northern Flint maize. Thus, understanding its development and early context in the Northeast is important. Northern Flint appears to be related to maize grown by Pueblo Indians of northern New Mexico and Arizona, yet is quite distinct from it [8]. An analysis of DNA amplified from ancient cobs in the U.S. Southwest has found an allele, Su1-Mu1 common in Northern Flint lines, which seems to have become predominant in North America between 2000 and 1000 years ago [11]. The allele is quite common in southwestern landraces today (see Chapter 6). Charred maize remains from this period in the Northeast have not been assessed from the perspective of these genetic analyses, nor have the genetic analyses been checked against the charred remains. In this chapter we compare the Late Woodland I (LWI) maize with Late Woodland II (LWII) (following the terminology of Ron Mason [14]) maize to test whether the earliest substantial maize populations in the Northeast are a form of eight-row and whether there is evidence for the subsequent development of Northern Flint in the region. Critical to this comparison is a Late Woodland I dataset in Ontario that came to light beginning in 1993 from the ongoing Princess Point Project [4, 6, 7, 32]. We also examine the context and associations of the early Ontario maize collection to assess whether there was an anthropogenic setting in which selection and breeding could have taken place.

MIDDLE WOODLAND, LATE WOODLAND I, AND LATE WOODLAND II IN SOUTHERN ONTARIO

Throughout the Northeast, the earliest evidence of maize appears to be associated with the Middle to Late Woodland shift that began at ca. CAL AD 500. This shift heralded a number of profound economic and social changes, including the transition from a mobile hunter-gatherer-fisher subsistence economy to a sedentary, village-based, horticultural strategy by ca. CAL AD 1100. The archaeological evidence includes the appearance of maize, changes in material culture, and important modifications in settlement system.

On the basis of material culture, specifically pottery styles, the Middle Woodland period in southern Ontario has traditionally been divided into three major regional groupings; from east to west, these are Point Peninsula, Saugeen, and Couture. Increasingly, however, the internal homogeneity of these taxa is being questioned, and it seems more likely that there was a continuum instead of hard-and-fast borders. Pottery was generally coil manufactured with collarless rims; formal decoration consisted of dentate stamped and pseudo-scallop-shell impressions. Design structure was organized in horizontal bands with linear geometric patterns. Lithic manufacture was focused on the production of curated formal tools, characteristic of mobile hunter-gatherer-fishers. Social ranking is suggested in some regions by cemetery data such as burial mounds (e.g., Serpent Mounds) but, for the most part, Middle Woodland groups can be characterized as egalitarian bands practicing a scheduled, seasonal round of wild resource procurement [24]. In the spring and summer, macrobands apparently congregated at relatively large sites found in lacustrine, riverine, and wetland habitats to exploit seasonally rich resources such as fish and waterfowl. During the fall and winter, microbands dispersed to smaller inland sites to exploit upland forest resources [22, 25]. To date, no evidence for maize has been recovered from Middle Woodland contexts in southern Ontario.

The earliest charred maize remains in neighboring New York state date to AD 1000 [10]; however, phytoliths extracted from residues on pottery from the Fortin 2 and Vinette sites indicate maize was prepared in pots by 2000 CAL BP in the northern Finger Lakes region [29]. In nearby Michigan at the western end of Lake Erie, maize is associated with the Western Basin Tradition [28]. Eighteen kernels are from the Indian Island No. 4 site, an early Late Woodland I occupation [28]. Eighty kernels are reported from the
late Late Woodland I period in the same region [28]. None of the kernels have been directly dated, so there is some question about their actual age. Until direct dates are obtained, all we can say is that Michigan Late Woodland I people likely had maize. Maize is also reported from the Meadowcroft Rock Shelter in southern Pennsylvania and is associated with two radiocarbon dates of about 2300 BP [1].

Several specimens of maize from Ohio (Edwin Harness) and Tennessee (Icehouse Bottom) are directly dated to between 1700 and 1800 BP (see [6] for a discussion of early maize in eastern North America). Maize first appears in Ontario at the beginning of the Late Woodland I period (AD 500–1000). The earliest charred maize in Ontario, and in all of the Northeast for that matter, is AMS dated to the sixth and seventh centuries AD [5, 6]. Several groups with somewhat similar material culture have been identified: Riviere au Vase in southwestern Ontario, Princess Point in south-central Ontario, and Sandbanks to the east extending to the eastern end of Lake Ontario. Maize is reported from the Sandbanks component at the Lakeshore Lodge site on the northeastern shore of Lake Ontario [23]. This component yielded a tenth century AD radiocarbon date on wood charcoal [21], but the context of the maize from Lakeshore Lodge is not clear and it has not been directly dated. Recent fieldwork by Smith has recovered maize from a Riviere au Vase site in southwestern Ontario, but the remains have not yet been radiocarbon dated. Princess Point is the only one of the three Late Woodland I cultures in southern Ontario with well-documented and securely dated evidence of maize.

We have been investigating the Princess Point Complex, as it is traditionally known, since 1993. Many aspects of Princess Point material culture contrast with that of the earlier Middle Woodland. Pottery was manufactured by paddle and anvil instead of coiling, and formal decoration was primarily executed with a cord-wrapped instrument. On the other hand, design structure remained organized in horizontal bands with linear geometric patterns. Stone tool technology is characterized by informal flake production and, among the few formally prepared tools are Levanna type projectile points. The stone technology is similar to that of agricultural populations [20]. That is, the technology is generalized and based on flakes with little evidence that formal tools and curation were a major concern.

Princess Point occupations are mainly located near significant bodies of water. The majority of sites are along the Grand River, with other concentrations at the western end of Lake Ontario and on Long Point extending from the north shore of Lake Erie (see Figure 40-1). The Grand River occupations appear to have taken advantage of stable river bars. River bar occupations took advantage of rich bottomland during a period of relatively infrequent flooding. The locales also provided easy access to fish, shellfish, and migratory birds. Geomorphological research at the Grand Banks and Cayuga Bridge sites indicates that high water was channeled away from the river banks to the back of the river bars, allowing long-term settlements to flourish (Figure 40-2). Our investigation of the Meyer site shows a slight deviation from the Grand Banks and Cayuga Bridge pattern. Meyer is situated on a terrace immediately overlooking a river bar instead of on it. The river bar has a number of buried, abraded channels so it was less amenable to occupation. Nevertheless, the Meyer site people were able to take advantage of the river bar setting while not living directly on it. We have no data indicating that these settlements were seasonal.

Maize production had intensified by the beginning of the Late Woodland II period (ca. CAL AD 1000); by AD 1100–1200 maize is so common at archaeological sites in Ontario that it had likely become well integrated into the economy and culture. In south-central and southeastern Ontario, Late Woodland II peoples are interpreted to be Iroquoian. On the other hand, there is debate as to whether Late Woodland II societies in southwestern Ontario were Iroquoian or Algonkian speakers [16, 27]. Pottery styles demonstrate continuity with, and modification of, Late Woodland I styles. Design structure remains organized into horizontal bands with the same linear geometric patterns as Middle Woodland and Late Woodland I, although there was a shift in symmetry patterns. Late Woodland II sites in all of the southern regions of the province were primarily village communities with multiple longhouses that were often palisaded. A few sites have evidence of earthworks surrounding them. Late Woodland II Iroquoian sites in Ontario are most often situated in uplands some distance from major water bodies, although exceptions are numerous. Pottery was usually decorated with trailing or incising and rarely cord-marked.

Charred maize has been recovered from most contexts at Iroquoian sites. These contexts include pits both inside and outside houses, postholes, midden deposits, and hearths. In Post-Contact Ontario, maize culms or stalks, leaves and husks were, and in some cases still are, used for technological purposes (mats, masks, ropes, baskets, etc.). Kernels were prepared in many ways for food including roasting and as the main ingredient in gruel and a form of bread [18]. Maize also had medicinal uses, as well as symbolic relevance [18].

**PALEOETHNOBOTANY OF MIDDLE WOODLAND, PRINCESS POINT, AND LATE WOODLAND II**

Plant remains at Ontario Middle Woodland and Princess Point sites differ from one another both qualitatively and quantitatively, reflecting a substantial difference in subsistence ecology [5]. The main difference is the creation of dependable, productive anthropogenic habitats at the longer-term Princess Point occupations. These habitats included the
first known gardens or small-scale fields in the province. Southern Ontario Middle Woodland plant use emphasized black walnut (*Juglans nigra*), butternut (*J. cinerea*), hickory (*Carya* sp.), and acorn (*Quercus* sp.) [5]. The type of nuts varies by location, perhaps because of regional variation in species distribution. Nut resources can be managed and their productivity increased by burning and clearing [9], but their small quantities at sites in Ontario suggest that this was not the case. No cultigens have been confirmed to be associated with the Middle Woodland in Ontario [5]. Princess Point plant use continued to include nuts but added a wide range of fleshy fruits and weedy herbaceous plants indicative of local habitat disturbance. Maize was a significant introduction, whereas sunflower (*Helianthus annuus*) and tobacco (*Nicotiana* sp.) were in use by the end of the Princess Point period [19]. Plants particularly common at Princess Point sites but not at Middle Woodland sites include knotweed (*Polygonum* sp.), chenopod (*Chenopodium cf. berlandieri*), purslane (*Portulaca oleracea*), American nightshade (*Solanum americanum*), and ground cherry (*Physalis* sp.). This plant assemblage is qualitatively quite similar to that of the Late Woodland II. From a quantitative perspective, Princess Point plant assemblages differ from those of the Late Woodland II; the latter assemblages are outside the range of variation found at Princess Point sites [19].

There is little evidence that the Eastern Crop Complex such as chenopod (*Chenopodium berlandieri*), sumpweed (*Iva annua* var. *macrocarpa*), maygrass (*Phalaris canariensis*), little barley (*Hordeum pusillum*), and erect knotweed (*Polygonum erectum*), had any significance in the Pre-Contact economies of the Northeast. Other crops important in the Pre-Contact Northeast were cucurbits, probably the eastern pepo gourds and Mesoamerican squash (*Cucurbita pepo*), the common bean (*Phaseolus vulgaris*), sunflower, and tobacco.

**MAIZE IN THE NORTHEAST**

Indigenous maize in the Northeast, for the most part, is considered to be Northern Flint [8]. Northern Flint kernels have a range of soft (flour) to hard (flint) kernels arranged for the most part in 8, and less often 10, rows of kernels around the cob. Archaeological maize in the region is usually called
Eastern Eight-Row, because the cobs generally have eight rows of kernels and because of the difficulty classifying maize to modern lines such as Northern Flint using strictly morphological characteristics. Nevertheless, late Pre-Contact (late Late Woodland II) maize morphology, is consistent with that of Northern Flint. Archaeological cobs in Ontario have between roughly 150 and 180 kernels and sometimes as many as 220, row-pairing is distinct, and kernels are crescent shaped, that is, they are much broader than they are long (Figure 40-3). The crescent shape is related to the low number of kernel rows. A hundred kernels from each of three early seventeenth century sites in Huronia on Georgian Bay illustrate the pattern [15]. The kernel measurements from Auger, Ball, and Bidmead are as follows: length—7.7, 7.3, 7.3 millimeters; width—10.3, 9.4, 10.0 millimeters; thickness—6.0, 5.5, 6.1 millimeters. These measurements show that the kernels are, on average, almost 30% broader than they are long, with a width/length (w/l) ratio of about 1.3 (see Figure 40-3). Maize from the Seed-Barker site is about 65% 8-row, whereas the rest is 4-, 6-, 10-, and 12-row [5]. Ten-row cobs represent 20%, whereas 4-, 6-, and 12-row cobs are rare. The latter group is usually represented by cob segments rather than by complete cobs. They are likely cob bases and tips that are often malformed. A few complete 4- and 6-row cobs are usually no more than 10 centimeters long and are probably cobs from tillers.

FIGURE 40-3 Charred maize kernels, dorsal and distal (end) views from the Late Woodland II Wallace site, Ontario. The kernels are large and crescent-shaped, typical of Northern Flint. (Courtesy of Gary Crawford)
The Northern Flint genome points to a United States Southwest origin; however, Southwest 8-row maize has chromosomal knobs, whereas Northern Flint does not [8]. A small founder population from which Northern Flint descended is a likely explanation for this distinctiveness [8], rather than a gradual adaptation to local northeastern environmental circumstances. Maize without chromosomal knobs is found only in cool temperate regions; however, there is no evidence that the knobs are linked to an adaptation to cool conditions. The hypothesis that Northern Flint/Eastern Eight-Row maize evolved from a high row number maize, perhaps a Chapalote-derived Pima-Papago race, that was introduced to the East [2] appears to be contradicted by the genetic evidence. This high row number maize was a hypothetical Midwest Twelve-Row that was a variant of Pima-Papago that was common throughout the Southwest and northern Mexico for two millennia preceding Eastern Eight-Row maize. A high row-number landrace ancestry is worth considering for Northern Flint in the East because it has a long history in the Southwest [30]. Support for this model comes from the Meadowcroft Rockshelter where the oldest cob is 16-row from Stratum IV [1]. Eight-row maize appears to have evolved from Chapalote in the Southwest where a primitive 8-row cob recovered in New Mexico has been radiocarbon dated to 1235 CAL BC [30]. Leonard Blake and Hugh Cutler [2] had long been aware that higher row-number maize became less prominent over time and by AD 500–700 60% of the cobs in some areas were 8-row. Eight-row maize is also distributed throughout Mexico and South America. However, early 8-row maize outside North America has small kernels, whereas North American 8-row has large, crescent shaped kernels. Thus, the evolution of North American 8-row maize is unrelated to the evolution of Mexican and South American 8-row maize.

**PRINCESS POINT MAIZE**

Maize is the most common of the cultigens in both Princess Point and Glen Meyer sites [17, 19]. Maize has been recovered from all Princess Pofh sites from which flotation samples have been collected; nevertheless maize and other cultigens are far less common than other categories of plant remains. Maize quantities vary from site to site, but Grand Banks and Meyer have the highest densities. Bull’s Point in Cootes Paradise near Lake Ontario has only few and fragmentary maize remains. Maize appears to have played an important role in the Lower Grand River Princess Point culture. Both kernels and cupules are represented at all the sites sampled, but Grand Banks had the most maize remains, whereas Bull’s Point had the least. The predominance of cultigens increases over time, becoming the third most common category during the succeeding Glen Meyer culture, and the most common seeds in Pre-Contact Neutral sites. Not only were cultigens, particularly maize, not as well represented as other types of plants during Princess Point times but the occurrence of maize at the time was relatively low as well as variable. Princess Point maize density is about 1/20th that of Glen Meyer samples where cultigens are found with a density of about 2 parts per liter of soil. The density of maize fragments ranges from about 0.02 at Forster to about 0.20 per liter at the Grand Banks site. This is consistent with a shift from an economy far less dependent on maize production early in its LWI development than it was in immediate Pre-Contact times.

**Contexts**

To some extent, maize representation varies contextually at Princess Point sites. Most of the samples at Grand Banks are from a sheet midden in the palaeosol. Maize occurs throughout the palaeosol but in low densities (about 0.05 fragments per liter). One of the palaeosol maize fragments has been AMS dated to CAL AD 400–600 [6]. Two particularly large and distinct features at Grand Banks are Features 1 and 210 with much higher densities of maize (averaging about 0.23 fragments per liter). Feature 1 is a shallow pit about one meter in diameter. In the uppermost fill was a metate with a Princess Point rim sherd adhering to the surface (Figure 40-4) The feature contained three maize cupules, 19 maize kernel fragments, as well as seeds of chenopod, wild grasses (Poaceae), American nightshade, cleavers (Galium sp.) and sumac (Rhus sp.). One kernel fragment from the pit is dated to CAL AD 990 (TO-4584) [6]. At Grand Banks the bulk of the plant remains are from Feature 210, a deep, cylindrical pit. A small percentage of the total remains from Feature 210 are maize kernels (an estimated 39 kernels). The density and types of plants represented in Feature 210 is similar to that of Glen Meyer sites. A maize cupule from the pit has been AMS dated to CAL AD 1030 (TO-58751), which makes this pit the latest Princess Point context sampled on the river bar. Given the late Princess Point date for Feature 210, the relatively high density of maize and weedy plant remains are more similar to Glen Meyer plant remains assemblages than they are to those from earlier Princess Point sites.

**Plant Associations**

Distinct plant remains assemblages are associated with Palaeoindian, Archaic, Early, Middle, and Late Woodland cultures in the Northeast [5]. Late Woodland, Pre-Contact assemblages representing mixed economies contrast fundamentally with earlier periods in the same geographic locations because of the presence of cultigens and anthropogenic habitats directly resulting from food production and sizeable
human populations. In Ontario, maize production is not preceded by a native food production system based on Eastern Complex crops. The transition to food production is heralded by maize production with the eventual inclusion of tobacco, sunflower, squash and the common bean (*Phaseolus vulgaris*). Some evidence for Eastern Complex crop production is found in parts of southern Pennsylvania and southern New York [5]. A plant use system involving a wide range of weedy annual seed and fleshy fruit producers, as well as anthropogenic, shrubby fleshy fruits such as bramble (*Rubus* sp.), is associated with Pre-Contact food production in Ontario. Common annuals found rarely in earlier periods include knotweeds, chenopod, grasses, ground cherry, and American nightshade. Strawberry is quite common at Ontario Late Woodland sites with abundant crops. Shrubs include extraordinary quantities of bramble. Not only is maize present, but the plant ecology changes along with maize production primarily as a result of the creation of expanses of successional plant communities and mosaics of ecological communities representing a range of successional stages.

Plant assemblages at Princess Point sites vary considerably, possibly because of the relatively small sample size compared with later Pre-Contact Late Woodland sites, as well as the lack of different types of contexts sampled at each site. This plant composition is quite similar to later mixed economy assemblages that emphasized crops, particularly maize. Bull's Point has a similar assemblage with the addition of blueberry (*Vaccinium* sp.), crowberry (*Emetrum* sp.), elderberry (*Sambucus* sp.), strawberry (*Fragaria* sp.), and witch hazel (*Hamamelis* sp.). Cat-tail (*Typha latifolia*), cleaver, St. John's wort (*Hypericum* sp.), sassafras (*Sassafras albidum*), and wood sorrel (*Oxalis* sp.) are also part of the assemblage reflecting both the local ecology at the western end of Lake Ontario as well as plant assemblages typical of mixed economies.
LATE WOODLAND I MAIZE MORPHOLOGY

Maize immediately postdating Princess Point in south-central Ontario is generally all Eastern Eight-Row and similar to the maize from sites such as Auger, Ball, and Bidmead in Huronia (see Figure 40-1). Late Pre-Contact (LWII) Neutral (late Pre-Contact and early Contact period in southcentral Ontario) kernels average 9.8 millimeters wide, 7.5 millimeters long, and 5.9 millimeters thick [17]. The w/l ratio is 1.3, typical of crescent shaped Eastern Eight-Row kernels. Glen Meyer kernels are slightly smaller, averaging 8.8 millimeters wide, 6.6 millimeters long, and 5.3 millimeters thick. The w/l ratio is identical to the Pre-Contact Neutral ratio of 1.3. Glen Meyer and Neutral kernels are similarly shaped, although they differ in width by about 10%. In contrast, nine kernels from Grand Banks average 6.5 millimeters wide, 4.9 millimeters long, and 3.6 millimeters thick, significantly smaller than either Glen Meyer or late Pre-Contact Neutral kernels (Figure 40-5). The kernel width in particular is about 34% shorter than the late Pre-Contact kernels and 26% shorter than the Glen Meyer kernels. The mean ratio of kernel w/l is 1.3 so the kernels have similar proportions to later ones, indicating they are from low row number cobs. Only one measurable kernel is from a context other than Feature 210 at Grand Banks. It is significantly smaller than the other kernels, measuring 5.2 by 3.9 by 3.2 millimeters but it, too, has a w/l ratio of 1.3 as do the rest of the kernels from Grand Banks.

David Stothers and Richard Yarnell [28] describe maize kernels from the LWI Indian Island No. 4 site in Michigan as small and not clearly crescent shaped. They suggest the corn is an early form of Eastern Eight-Row [28]. Two LWI kernels from Michigan borrowed from David Stothers are illustrated in Figure 40-6. They are slightly larger than the Princess Point kernels. The kernel illustrated in Figure 40-5 (row A) is unusually flat and, as Stothers and Yarnell report, not particularly crescent-shaped. The other Michigan LWI kernel in Figure 40-5 (row B), on the other hand, is crescent-shaped. The kernel in Figure 40-5 (row C) is an LWI example from the Dymock site, one of only a few kernels known from this period in southwestern Ontario. It is quite similar in form to the Western Basin kernel in the middle row of Figure 40-5. Unlike the Western Basin examples that were recovered without flotation, the Dymock example is from a flotation sample. The samples contain a wide range of anthropogenic plant remains such as bramble and sumac consistent with an agricultural ecology [3]; that is, the maize was likely grown locally, something not evidenced yet at the Michigan Western Basin sites.

With smaller kernel widths at Princess Point sites, cupule widths should be smaller as well and to some extent this is true. Glen Meyer cupules average 7.0 millimeters wide, whereas Neutral cupules average 7.4 millimeters wide [17]. Princess Point cupules from Lone Pine are much narrower averaging 5.3 millimeters (n = 8) by 2.4 millimeters with a mean width/thickness (w/t) ratio of 2.3. The Meyer sample is also narrow averaging 5.6 millimeters (n = 3); by 2.6 millimeters; the mean w/t ratio is 2.2. The Forster cupule measurements are slightly larger than cupules from Lone Pine and Meyer averaging (n = 7) 6.9 millimeters by 2.8 millimeters with a mean w/t ratio of 2.5. The cupules from Grand Banks are not as narrow as the other Princess Point samples. Twenty-nine cupules from Grand Banks average 7.0 by 2.6 millimeters and have a w/t ratio of 2.8. Feature 210 (n = 20) cupules average 7.0 by 2.6 millimeters with a w/t ratio of 2.7.

DISCUSSION

The development of highly productive Northern Flint is still a significant problem for evolutionary biologists and archaeologists alike. Without AMS-dated maize remains and with only a small sample of maize from the East, Blake and Cutler [2] proposed that Eastern Eight-Row (Northern Flint) arose from an early introduction of Pima Papago corn from the Southwest and that a Midwest Twelve-Row landrace was an early form that developed from Pima-Papago maize introduction. Genetic research indicates that this is likely not the case, and that a Northern Flint–related maize developed in the Southwest and was introduced to the East. We would expect to see an early form of Northern Flint developing over time into the productive, modern Northern Flint in eastern North America. Gail Wagner [31] pointed out that a developmental sequence in the East was not apparent at the time she was writing and that we did not know how many introductions occurred, or whether corn was introduced as a food or for other reasons.

Our research in Ontario in the context of data from neighboring New York, Michigan, and Pennsylvania demonstrate that maize, indeed, has a long history in the Northeast extending back at least 2000 years. Charred remains have been dated in Ontario to a few centuries later. The early kernels and cupules from Princess Point sites are morphologically consistent with the maize being a form of Eastern Eight-Row. LWI kernels and cupules are smaller and somewhat more variable than those from LWII. Furthermore, maize phytoliths recovered from residues on pots dating from AD 600–650 in New York State show affinities with Northern Flint as well [10]. Plant associations at Princess Point sites indicate that maize was not simply an introduction to hunter–gatherers but was part of an agricultural ecology. Princess Point people had a form of food production that was smaller in scale than later food production, with maize comprising significantly less of the plant remains assemblages than it does in later periods. The material culture of the Ontario LWI also contrasts with that
FIGURE 40-5 Late Woodland I Princess Point kernels, ventral and distal (end) view. Rows 1 and 2 show relatively complete kernels with embryo scars. The row 3 kernel is missing its proximal end (the end nearest the cob). (Courtesy of Gary Crawford)
of the local Middle Woodland. Much of the LWI technology is functionally related to food production, particularly the stone technology that Chen Shen [20] characterizes as generalized rather than specialized. Flotation sampling also indicates that Princess Point maize was associated with day-to-day activities and did not have a specialized symbolic or religious role. Charred maize remains are found in all contexts just as they are in later sites. Its agricultural ecology context also suggests that the setting was suitable for plant breeding and selection. Early Ontario maize cobs appear to be significantly smaller and less productive than later cobs. By the twelfth century AD maize was significantly larger than its predecessor and continued to develop. By the sixteenth century AD maize in Ontario was a highly productive Eastern Eight-Row (Northern Flint).

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References Cited


