DATING THE ENTRY OF CORN (*ZEA MAYS*) INTO THE LOWER GREAT LAKES REGION

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Five accelerator mass spectrometer (AMS) dates on corn (maize or Zea mays) from the Grand Banks site, Ontario, range from cal A.D. 540 to 1030. These are the earliest directly dated corn samples in the Lower Great Lakes region. The presence of corn during the Princess Point Complex, a transitional Late Woodland phase preceding the Ontario Iroquoian Tradition, is confirmed as is an early presence of the Princess Point culture in Ontario. Maize appears to have spread rapidly from the Southeast and/or Midwest to Ontario. The corn cupules and kernel remains are fragmentary, as they are elsewhere in the Eastern Woodlands during this period. The limited morphological data indicate that the corn is a diminutive form of Eastern Eight-Row, or Eastern Complex, maize.

Las fechas de los cinco espectrómetros aceleradores de masa (SAM) del sitio arqueológico Grand Banks, Ontario, se extienden desde 540 a 1030 a.D. Estos son los ejemplos de maíz más recientes que han sido directamente fechados. Aquí se confirma la presencia del maíz durante el Complejo Princess Point, una fase transitoria de Late Woodland (último periodo de las tierras boscosas) que precedió a la Tradición Iroquesa de Ontario, así como se confirma la presencia inicial del complejo Princess Point en Ontario. El maíz parece haber sido diseminado rapidamente a Ontario desde el sureste y el medio-oeste. Los restos de carozo y de granos de maíz se encuentran fragmentados de la misma manera que se encuentran en los Eastern Woodlands (bosques) del este durante este período. La limitada información morfológica señala que el maíz es una forma diminutiva del llamado "maíz de ocho" (Eight-Row), o complejo oriental de maíz.

The spread of corn (*Zea mays*) to, and within, eastern North America and its evolution there are still largely unresolved issues. In part this is due to the rarity of evidence in the form of minute carbonized fragments, the as-yet few directly radiocarbon-dated corn fragments, and the rare occurrences of corn pollen dating to the period of corn's introduction to the East (Conard et al. 1984; Fearn and Liu 1995; Fritz 1990, 1993; Riley et al. 1990; Riley et al. 1994). Northeastern North America, particularly the Lower Great Lakes, has largely been omitted from the discussion because of the long-held view that corn was not present there until after A.D. 800. Some equivocal evidence has suggested corn was introduced to the Lower Great Lakes before A.D. 800 (Stothers 1977; Stothers and Yarnell 1977), and only now can we confirm this.

Corn became a significant crop throughout the Lower Great Lakes region of North America, including Ontario, Canada, between A.D. 900 and 1100. Furthermore, the shift to a mixed economy with maize, bean (*Phaseolus vulgaris*), cucurbit (*Cucurbita pepo*), sunflower (*Helianthus annuus* var. *macrocarpa*) and tobacco (*Nicotiana rustica*) production combined with hunting, fishing, and gathering characteristic of later Iroquoians was largely complete in the Lower Great Lakes by A.D. 1100. The origins, timing and mechanism of this development in the region, however, have been matters of conjecture for some time (Ford 1985; Fritz 1990; Snow 1995; Yarnell 1964). While the situation with regard to Middle Woodland corn in southern Illinois and Ohio has been sorted out to some extent (Conard et al. 1984; Smith 1989), research on the question in the Lower Great Lakes has been hampered by a lack of corn confirmed to come unambiguously from contexts earlier than A.D. 1000. Corn potentially older than 1,000 years in the Lower Great

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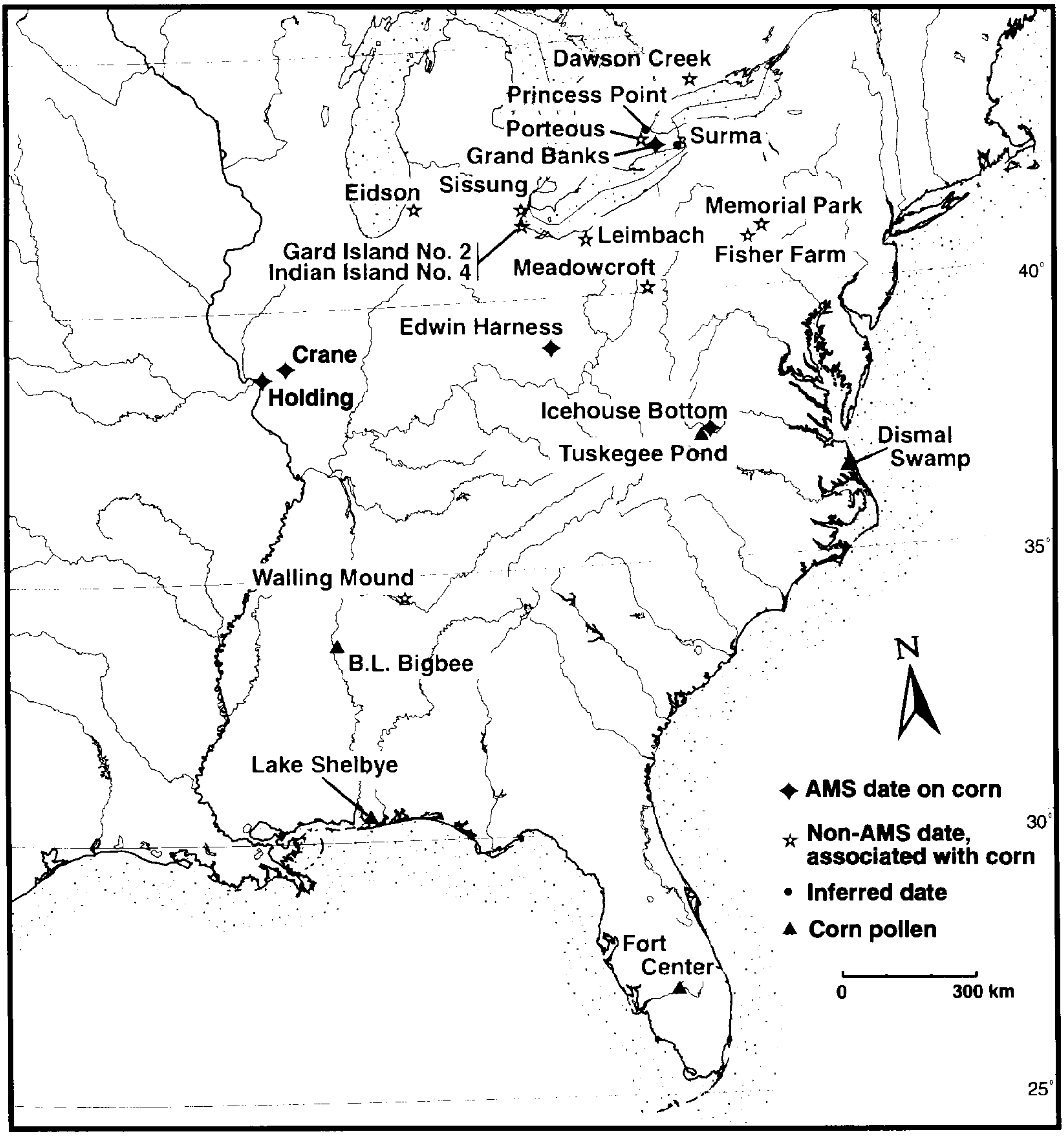

Figure 1. Location of sites mentioned in the text.

Lakes was not AMS dated until now. We report here five accelerator mass spectrometry (AMS) dates on carbonized corn remains recovered from the Princess Point Complex component of the Grand Banks site (AfGx-3), located in the Lower Grand River valley in southwestern Ontario (Figure 1). The dates range from cal. A.D. 540 to 1030 and provide the first direct evidence for the

Table 1. Radiocarbon Dates Cited in Text.

Site	Lab No.	Sample	Radiocarbon Date (B. P.)	Calibrated Date
AMS Dates on Corn				
Grand Banks	TO-5875	cupules	970 ± 50	A.D. 990 (1030) 1210
Grand Banks	TO-4584	kernel	1060 ± 60	A.D. 880 (1000) 1150
Grand Banks	TO-4585	cupules	1250 ± 80	A.D. 650 (780) 980
Crane	NSRL-302	kernel and cupule	1450 ± 350	B.C. 180 (630) A.D. 1280
Grand Banks	TO-5308	cupules	1500 ± 150	A.D. 240 (570, 600) 870
Grand Banks	TO-5307	cupules	1570 ± 90	A.D. 260 (540) 660
Edwin Harness	N/A	kernel	1720 ± 105	A.D. 80 (340) 590
Edwin Harness	N/A	kernel	1730 ± 85	A.D. 120 (270, 330) 540
Icehouse Bottom	Beta-16576	kernel	1775 ± 100	A.D. 30 (250, 310) 530
Holding	AA-8718	kernel	2017 ± 50	B.C. 160 (0) A.D. 110
Holding	AA-8717	cob fragment	2077 ± 70	B.C. 350 (60) A.D. 80
Regular Radiocarbon Dates Associated with Corn				
Memorial Park	PITT-1073	charcoal	1190 ± 40	A.D. 730 (880) 970
Fisher Farm	UGa-2683	plant material	1245 ± 70	A.D. 660 (780) 970
Sissung	M-1519	charcoal	1250 ± 120	A.D. 600 (780) 1020
Leimbach	GX-1743	charcoal	1345 ± 180	A.D. 350 (670) 1030
Gard Island 2	DC-416	human bone	1340 ± 80	A.D. 590 (670) 880
Indian Island 4	DC-415	charcoal	1360 ± 95	A.D. 540 (670) 890
Indian Island 4	DC-414	charcoal	1410 ± 95	A.D. 440 (650) 790
Dawson Creek	S-2207	charcoal	1405 ± 60	A.D. 550 (650) 760
Eidson	N/A	charcoal	1650 ± 70	A.D. 240 (420) 590
Walling Mound	Beta-19990	charcoal	1680 ± 80	A.D. 210 (400) 560
Meadowcroft	SI-2051	charcoal	2325 ± 75	B.C. 760 (390) 190
Meadowcroft	SI-1674	charcoal	2290 ± 90	B.C. 750 (380) 110

Note: Calibrated at 2 sigma with the program CALIB 3.0 (Stuiver and Reimer 1993). Calibrations are rounded to the nearest 10 years. One or more intercepts are presented between the 2-sigma ranges.The Grand Banks dates have been corrected for isotopic fractionation

timing of the introduction of maize to the Lower Great Lakes region (Table 1).

Background

The cultural context for these dates is the Princess Point Complex, previously thought to date from A.D. 650–1000 (Stothers 1977). Princess Point represents the transition between Middle and Late Woodland in south-central Ontario. The possibility of corn dating before A.D. 1000 in the Lake Erie basin was raised when Princess Point was first defined (Stothers 1973; 1977; Stothers and Yarnell 1977; see also Noble and Kenyon 1972), although the evidence was equivocal. One kernel from the Grand Banks site and four from the multicomponent and disturbed Princess Point type site comprised the sole evidence from possible Princess Point contexts, while 44 kernels were recovered from the Porteous site, now interpreted as early Glen Meyer (Stothers and Yarnell 1977). Glen Meyer dates from about A.D. 1000 or possibly 900 to A.D. 1300 (Williamson 1990). Stothers also recovered corn from the Indian Island No. 4 and Gard Island No. 2 sites in southeastern Michigan, with three radiocarbon dates on wood charcoal associated with the corn ranging from cal A.D. 650 to 670 (Table 1 and Figure 2). Corn from the Sissung site, Michigan, is associated with a radiocarbon date only slightly later than this (Table 1 and Figure 2). A radiocarbon date associated with corn at the Leimbach site, Ohio, spans these dates from Michigan (Stothers and Yarnell 1977:227) (Figure 2). Based on this evidence, Stothers believed that corn was present in both south-central and southwestern Ontario as early as A.D. 650.

A date of cal A.D. 650 for corn from the Dawson Creek site near Rice Lake, Ontario, obtained on associated wood charcoal has also been used to suggest an early entry of corn to the province (Jackson 1983). Contamination from later deposits at Dawson Creek is a strong possibility because the site is multicomponent with a later Iroquoian occupation. One of us (Crawford)

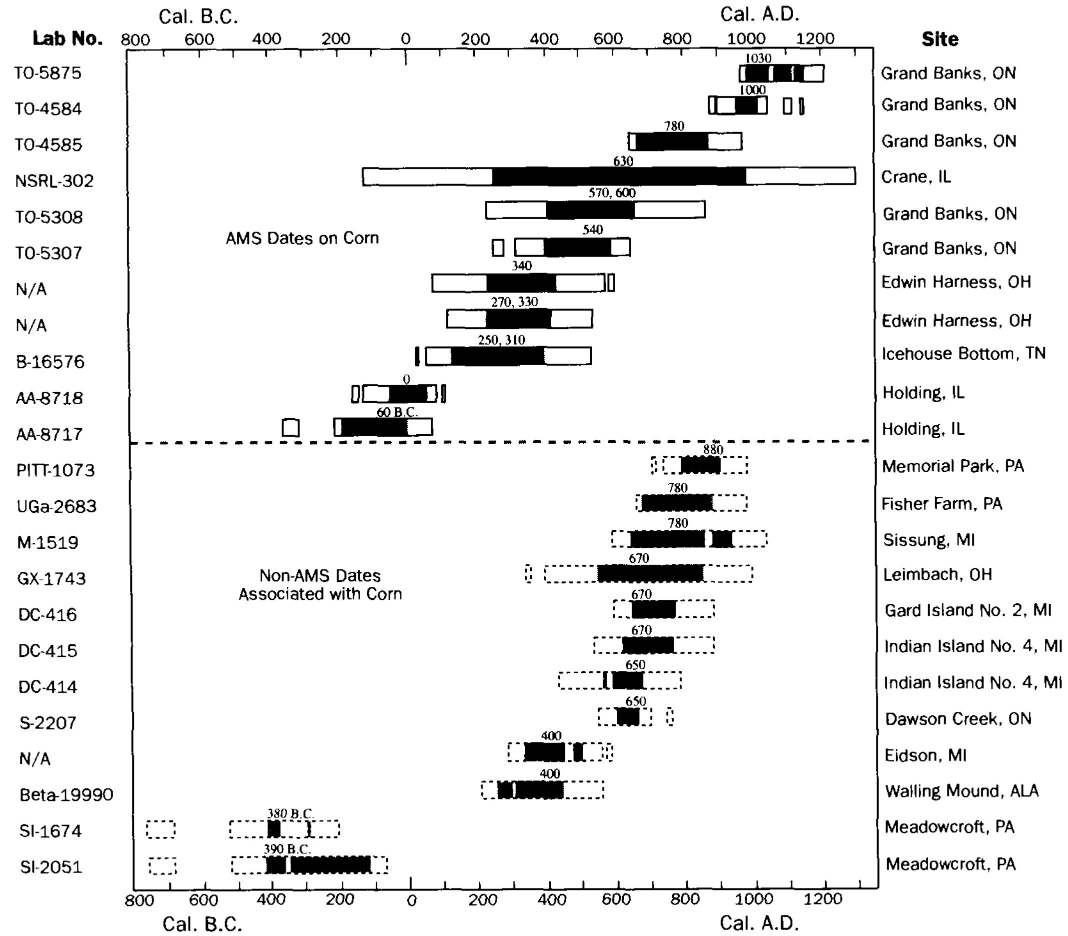

Figure 2. Bar chart of calibrated radiocarbon dates cited in text. The shaded boxes represent 1-sigma ranges while the open boxes represent the 2-sigma ranges. This chart is based on one produced with the program CALIB 3.0 (Stuiver and Reimer 1993).

examined the corn when it was first discovered. The corn morphology is consistent with classic eight-row corn and looks much like corn from post-A.D. 1100 collections in Ontario. Another date associated with corn seemingly supporting the suggestion of early corn in the Lower Great Lakes is from the Eidson site, Michigan (Parker 1984) (Table 1 and Figure 2), although the latter is described only as a "probable" corn cupule (Parker 1984:784).

Although Eastern Eight-Row corn is found regularly in large quantities only after A.D. 1000 on Glen Meyer sites (Williamson 1990), recent isotopic analysis of human bone evidences a significant change in dietary input of C_4 plants, primarily corn, sometime between A.D. 700 and 1200 (Katzenberg et al. 1995; Schwarcz et al. 1985). The early part of this date range is represented by the Surma site in Fort Erie, Ontario. Human bone isotopic data indicate corn was a significant part of the diet there at that time (Katzenberg et al. 1995); the age of the human bone from this site is, however, open to question because the bone has not been radiocarbon dated. Riley et al. (1994:496) also point out the difficulty for isotopic studies to determine the time of introduction of maize to a region; maize could be present in diets and yet not be detectable until it became a significant contributor to prehistoric subsistence.

Grand Banks Site and AMS Dates

Since 1993 we have been reinvestigating the Princess Point Complex and the origins of horticulture in southern Ontario. To date, we have concentrated much of our fieldwork on a cluster of sites in the Lower Grand River valley, including the Grand Banks site. Grand Banks is a stratified occupation with components representing the Late Archaic, Middle to Late Woodland transition, and Historic periods. The site is on a floodplain or, more specifically, a vertically accreted lateral bar (Crawford et al. 1996; Desloges and Walker 1995). As a result of alternating periods of alluvial deposition and stability of the bar's surface, two paleosols, PI and PII, are present (Figure 3). The shallower paleosol (PII) is a well-defined stratum about 20 cm thick that is sealed over much of the bar by recent alluvial deposits up to 60 cm thick. This layer yields distinctive Princess Point material and corn fragments. In addition there are a number of pit features, two of which have yielded Princess Point pottery in association with corn.

Flotation samples have been systematically collected from all excavation units, levels, and features at Grand Banks. So far, we have identified 40 kernel fragments and 29 cupules with a combined weight of about .27 g. The corn kernel density in the samples in which they occur is about 6 fragments per 10 liters of soil (overall 1 per 10 liters); the cupule density is about 3 per 10 liters (overall .7 per 10 liters). Other plant remains from Grand Banks include acorn (*Quercus* sp.), American nightshade (*Solanum americanum*), bramble (*Rubus* sp.), butternut (*Juglans cinerea*), chenopod (*Chenopodium* sp.), cleavers (*Galium* sp.), grasses (Poaceae, *Panicum* sp.), ground cherry (*Physalis* sp.), portulaca (*Portulaca oleracea*), strawberry (*Fragaria virginiana*), and sumac (*Rhus* sp.).

PII was of particular concern to us because of the Princess Point assemblage within it, so soil was collected from it in 2 to 5 cm intervals to resolve any possible vertical differentiation of the paleosol contents. As a result, we were able to choose three confidently identified corn samples for AMS dating from the deepest portions of PII (and not from discrete features) and two from pit

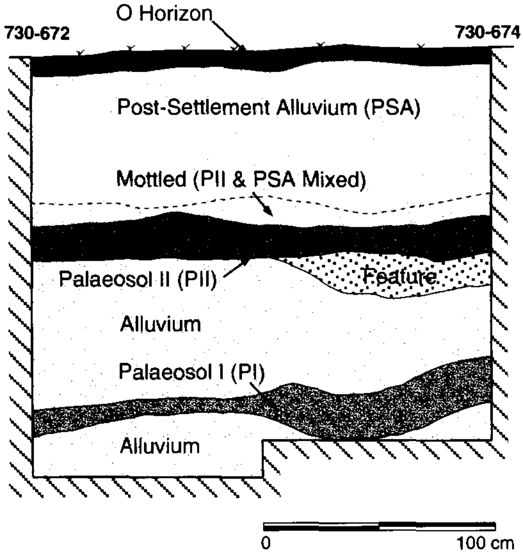

Figure 3. Stratigraphic profile from Area A, north wall, Grand Banks site.

features. TO-5307 and 4585 are from unit 729-671, 80 cm below surface; TO-5308 is from 729-670, 68–69 cm below the surface; TO-4584 is from a pit, Feature 1, unit 731-699, about 30 m to the north of the area from which the other three samples were taken; and TO-5875 is from a cylindrical pit, Feature 210, unit 730-680. The dating results, along with other samples for comparison, are summarized in Table 1 and Figure 2. The graphical representation of the dates (Figure 2) suggests at least two or perhaps three periods spanned by the corn. The latest dates, TO-4584 and TO-5875, indicate that the Grand Banks occupation may span the early Glen Meyer, although we are aware of no material evidence of a Glen Meyer occupation at Grand Banks. At any rate, late Princess Point and early Glen Meyer assemblages are difficult to distinguish (Crawford and Smith 1996).

Discussion

These are the first AMS assays on corn dating to the transition from the Middle to the Late Woodland in the Northeast. They confirm the presence of corn in the Lower Great Lakes region during the period from A.D. 500 to 1000. The earliest AMS-dated carbonized corn fragments in eastern North America are from the Holding site in the American Bottom (60 cal B.C. and cal A.D.

0), Edwin Harness, Ohio (cal A.D. 270–340), and the Icehouse Bottom site, Tennessee (cal A.D. 250, 310) (Chapman and Crites 1987; Fritz 1993; Riley et al. 1990; Riley et al. 1994). Holding is roughly 1,000 km from Grand Banks, while Edwin Harness and Icehouse Bottom are only 500–600 km distant. The time lag between Grand Banks, Icehouse Bottom, and Edwin Harness suggests that the movement of maize to the Lower Great Lakes from regions where it had been previously established in Ohio and Tennessee was significantly faster than previously supposed.

Another AMS radiocarbon date on corn is from the Crane site in west-central Illinois (Conard et al. 1984) (Table 1 and Figure 2). The 1-sigma and 2-sigma ranges are large, making the date for Crane not significantly different from the three earliest Grand Banks dates (Figure 2). Less conclusive data for early corn are from four sites in west-central Illinois with associated wood charcoal radiocarbon dates ranging from 1370 ± 75 B.P. to 1190 ± 70 B.P. (Asch and Asch 1985:198). Earlier dates for maize in the Northeast are suggested for both Meadowcroft Rockshelter, Pennsylvania, and the Eidson site, Michigan (Adovasio and Johnson 1981; Parker 1984) (Figure 2). The calibrated dates for the stratum IV corn associations at Meadowcroft are unusually old compared to other corn in the Northeast (Table 1 and Figure 2). Furthermore, corn is not otherwise reported in Pennsylvania until the Clemson Island culture where the earliest corn is associated with radiocarbon dates of cal A.D. 780 at Fisher Farm and cal A. D. 880 at Memorial Park (Hart and Asch-Sidell 1996; Hatch 1980) (Table 1 and Figure 2). The Eidson site calibrated date, on the other hand, overlaps considerably with the two earliest Grand Banks dates (Figure 2) and may be correct. These potentially early Michigan and Pennsylvania dates, however, must await AMS dating in order to confirm or disconfirm their ages.

We are not yet able to contribute substantially to the understanding of the evolution of the Eastern Eight-Row corn variety. Elsewhere in the Eastern Woodlands, early corn is so fragmentary that it is difficult to describe (Fritz 1990:408). Basketmaker II corn, from which eastern corn was likely derived, was successfully adapted to temperate regions (Fritz 1990:409); so no biological barriers stood in the way, assuming the Southwest was the source. In Ontario the earliest diagnostic corn remains are from Glen Meyer sites, and the corn is clearly Eastern Eight-Row. The presumably early Indian Island No. 4 and Gard Island No. 2 corn in Michigan is all Eastern Eight-Row, but the kernels are not the classic wide, long, kidney shape of this type, and the cupules are smaller than classic Eastern Eight-Row cupules (Stothers and Yarnell 1977:218). The single complete corn kernel from Grand Banks is also relatively narrow and small (7.6 mm wide and 5.4 mm long); its shape is within the range of kernels from eight-row cobs. Two cupules measure 2.2 and 4.8 mm wide. The Grand Banks corn, apparently Eastern Eight-Row, is smaller than later corn in Ontario. Until more measurable corn remains from Grand Banks and contemporaneous sites are recovered, we cannot rule out the possibility that the cupules are small because they are from the distal tip of the cob.

The AMS dates reported here indicate that the introduction of corn to the Lower Great Lakes and southern Ontario occurred by the sixth century A.D. The conservative interpretation is that corn diffused from regions to the south and/or west over a period spanning six centuries; once it was present in southern Ohio and Tennessee, it took only two or three centuries to move to Ontario. For the time being, we do not accept that the pollen evidence for pre-2000 B.P. corn in the Southeast is "convincing" (Fearn and Liu 1995:111). The Dismal Swamp, Virginia, date of 2200 B.P. is an extrapolation (Whitehead 1965); the B. L. Bigbee corn is a sample of two pollen grains from a core with evidence of root disturbance (Whitehead and Sheehan 1985); the Lake Shelby sample has one corn pollen grain and no substantiating archaeological evidence nearby (Fearn and Liu 1995); and Fort Center is a complex site spanning as much as 2,000 years with most of the corn pollen coming from samples post-dating A.D. 200 and no maize macrofossils reported (Sears 1982). In addition are general concerns with pollen evidence for crop dispersal. For example, considerable pollen evidence for early agriculture in southern Scandinavia and northern Germany, Norway, and northern Sweden, and Britain and Ireland in particular, is proving to be inconsistent with other lines of evidence, particularly AMS dates on domesticated plant and animal remains (Rowley-Conwy 1995). The same problem with palynological evidence may be arising in North America. Only in Tennessee do the pollen record from Tuskegee Pond and the macrofossil evidence from Icehouse Bottom concur on a Middle Woodland introduction of corn to the region (Delcourt et al. 1986:347). So far, the best dates for corn in the Southeast are from Icehouse Bottom and from Walling Mound, Alabama (Table 1 and Figure 2) (Chapman and Crites 1987; Scarry 1990). The radiocarbon date associated with maize from Walling Mound is on charcoal from a posthole containing cupules and corn stalk.

The evidence from the Northeast does not necessarily mean that the many other examples of potentially early corn in the Northeast are correctly dated by association to the Middle and early Late Woodland (Figure 2). Conard et al. (1984) and Fritz (1994) have documented all too clearly how interpretation of radiocarbon dates associated with corn can be incorrect. However, the Grand Banks dates lend some credence to these corn-associated radiocarbon dates, particularly the ca. A.D. 650 and later dates. Finally, the dates establish an earlier presence for the Princess Point Complex and the transition from Middle to Late Woodland in southern Ontario than had previously been inferred (Crawford and Smith 1996). Research on Clemson Island and other transitional Woodland complexes between Ontario, on the one hand, and Illinois and Tennessee, on the other, should help clarify the timing and routes of the introduction of maize to the Northeast.

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