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REPORTS

MID-HOLOCENE EVIDENCE OF *CUCURBITA* SP. FROM CENTRAL MAINE

James B. Petersen and Nancy Asch Sidell

A fragmentary specimen of Cucurbita sp. has been recovered from an early context at the Sharrow site in central Maine. Directly dated to the mid-Holocene epoch on the basis of an accelerator mass spectrometer assay of 5695 ± 100 B.P. (AA-7491), this squash or gourd represents one of the earliest such finds in eastern North America. It greatly expands the distribution of mid-Holocene Cucurbita beyond previous finds in the Midwest, Midsouth, and Southeast. Three alternative hypotheses derived from this discovery are that (1) Cucurbita represents a previously unrecognized native plant in the far Northeast; (2) it was present in Maine as a trade item or an unintentional introduction; or (3) it was present as the result of early cultivation, whether introduced from Mesoamerica or elsewhere in eastern North American outside of Maine. Current evidence suggests that the first two hypotheses are unlikely. This leaves open the possibility that the presence of early Cucurbita at the Sharrow site represents the introduction of a cultivated plant into Maine during the mid-Holocene.

Se ha recuperado una muestra fragmentaria de Cucurbita sp. de un contexto temprano del sitio Sharrow en la parte central del estado de Maine (EE.UU.). Por medio de una prueba del AMS (accelerator mass spectrometer), la muestra ha sido fechada directamente en el Holoceno medio, dando un resultado de 5695 ± 100 a.P. (AA-7491). Esta calabaza o mate representa uno de los hallazgos más tempranos de este tipo en el este de Norteamérica, expandiéndose la distribución de la Cucurbita en el Holoceno medio más allá de los hallazgos previos en el medio oeste, sur-centro, y sudeste de Norteamérica. El hallazgo sugiere tres hipótesis alternativas: (1) que la Cucurbita representa una planta nativa previamente ignorada en el lejano noreste; (2) estuvo presente en Maine como objeto de intercambio o fue introducida casualmente; o (3) estuvo presente como resultado de una horticultura temprana introducida desde Mesoamérica o alguna parte del este de Norteamérica fuera de Maine. Las evidencias actuales sugieren que las dos primeras hipótesis son poco probables, dejando abierta la posibilidad de que la presencia de Cucurbita temprana en el sitio Sharrow represente la introducción de una planta cultivada en Maine durante el Holoceno medio.

Mid-Holocene evidence of *Cucurbita* sp., a squash or gourd rind,[1] from the deeply stratified Sharrow archaeological site in central Maine recently has been identified and radiocarbon dated by the accelerator mass spectrometer (AMS) technique (Gowlett 1987). Given its context and antiquity, the Sharrow site *Cucurbita* specimen contributes significantly to the ongoing debate about the timing and nature of plant cultivation and domestication in eastern North America.[2] The implications of this mid-Holocene *Cucurbita*, found far outside its expected range, are briefly explored in this paper.

Cucurbita rind fragments of mid-Holocene age (ca. 7000–4000 B.P.)[3] have been recovered from archaeological sites in Illinois, Missouri, Kentucky, Tennessee, and perhaps Pennsylvania[4] (Asch and Asch 1985; Conard et al. 1984; Cowan et al. 1981; Crites 1987; Kay et al. 1980; King 1985; Watson 1985). Still interpreted by some researchers as evidence of the first cultivated plant in eastern North America, early *Cucurbita* traditionally has been considered an introduction from Mesoamerica, where it was apparently domesticated by ca. 10,800–9890 B.P. (Whitaker and Cutler 1986:275–276; cf. Decker-Walters 1993:94; Fritz 1994). It could have existed in the Midwest and adjacent areas during the mid-Holocene either as a cultivated plant or as an unintentional "camp follower" (Asch and Asch

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Sidell 1992:240–260; Ford 1981, 1985; Kirkpatrick and Wilson 1988; Prentice 1986; Watson 1989; Watson and Kennedy 1991; Wilson 1990:451–453).

Allozyme, archaeological, and population studies now suggest that there may have been an indigenous *Cucurbita* that was the source of the early *Cucurbita* remains found at archaeological sites in the Midwest and elsewhere. It has been hypothesized that *Cucurbita pepo* ssp. *ovifera* var. *texana* (and perhaps var. *ozarkana*) once grew in Texas, the Midwest, Midsouth, and Southeast and that it was domesticated by about 4000–3000 B.P., or later, independently of the domestication of *C. pepo* in Mesoamerica (Cowan et al. 1981:71; Decker 1988; Decker and Newsom 1988; Decker-Walters 1990, 1993; Decker-Walters et al. 1993; Fritz 1990:405–407; Heiser 1985:63–66, Heiser 1989; Newsom 1994; Newsom et al. 1993; Smith 1987, 1989, 1992a, 1992b, 1993; Yarnell 1993).

Regardless of whether one accepts the case for indigenous *Cucurbita* domestication in North America, the Sharrow site is located far beyond the postulated range of any known early native (or introduced) squash. The site is over 1,800–2,100 km to the northeast of the only other *Cucurbita* finds clearly attributable to the mid-Holocene in the Midwest and Midsouth or the midcontinent states of Illinois, Kentucky, Missouri, and Tennessee. Located in far northeastern North America, or the far Northeast, it is also one of the five or six earliest sites in North America with direct dates for *Cucurbita* on the basis of its dated stratigraphic association and a direct AMS date for the specimen itself (Petersen 1991:141–143; Petersen and Putnam 1992:46; see Newsom et al. 1993; Smith 1992b:Table 6.1).

The Sharrow site specimen has important implications concerning the history of *Cucurbita* in eastern North America. Briefly stated, three alternative hypotheses are that (1) *Cucurbita* was native over much of eastern North America including near the Sharrow site in the far Northeast during the mid-Holocene, with a mid-Holocene distribution much larger than previously recognized; (2) *Cucurbita* was introduced into the Gulf of Maine region during the mid-Holocene as a trade item or as an unintentional camp follower; or (3) *Cucurbita* was cultivated in Maine during the mid-Holocene, independent of its source of introduction.

Details about the Sharrow site, the context of the Sharrow *Cucurbita* specimen, and its identification and dating are provided before further exploration of these hypotheses and implications that follow from them.

Archaeological Contexts at the Sharrow Site

The Sharrow site (ME 90-2D) is located at the confluence of the Sebec and Piscataquis rivers in the upper headwaters of the Penobscot River drainage, a major drainage into the Gulf of Maine on the Atlantic Coast. The Sharrow site is situated about 83.5–84.5 m above current mean sea level near a constriction in the Piscataquis River, which is well-suited for fishing. It is one of a number of sites being studied as part of the Piscataquis Archaeological Project conducted by the University of Maine at Farmington Archaeology Research Center (UMF ARC) (Bartone and Petersen 1992; Heckenberger and Petersen 1990; Petersen 1986, 1991; Petersen et al. 1988; Petersen et al. 1986; Petersen and Putnam 1987, 1992; Putnam 1993, 1994; Thayer 1990).

The Sharrow site preserves a nearly 3.0-m-deep sequence of stratified cultural deposits in alluvium that span the Holocene epoch from ca. 10,000 to 9500 B.P. to modern times. These deposits document most of the span of prehistory in the far Northeast, including the Late Paleoindian period and more certainly the entire span of the Archaic and Woodland (Ceramic) periods, ca. 9000–400 B.P. About 28.5 m^2 of the deeply stratified portions of the site have been sampled. Copious artifacts and ecofacts that have been recovered include relatively common subsistence remains; both calcined faunal and carbonized botanical remains are associated with various types of cultural features. Over 55 cultural features have been defined and 22 radiocarbon dates have been obtained for the Sharrow site thus far. Of the calcined faunal remains, fish bones are relatively common throughout much of the occupational sequence, along with bones of various mammals and some birds and reptiles.

Carbonized botanical remains from cultural features at the Sharrow site have been analyzed by

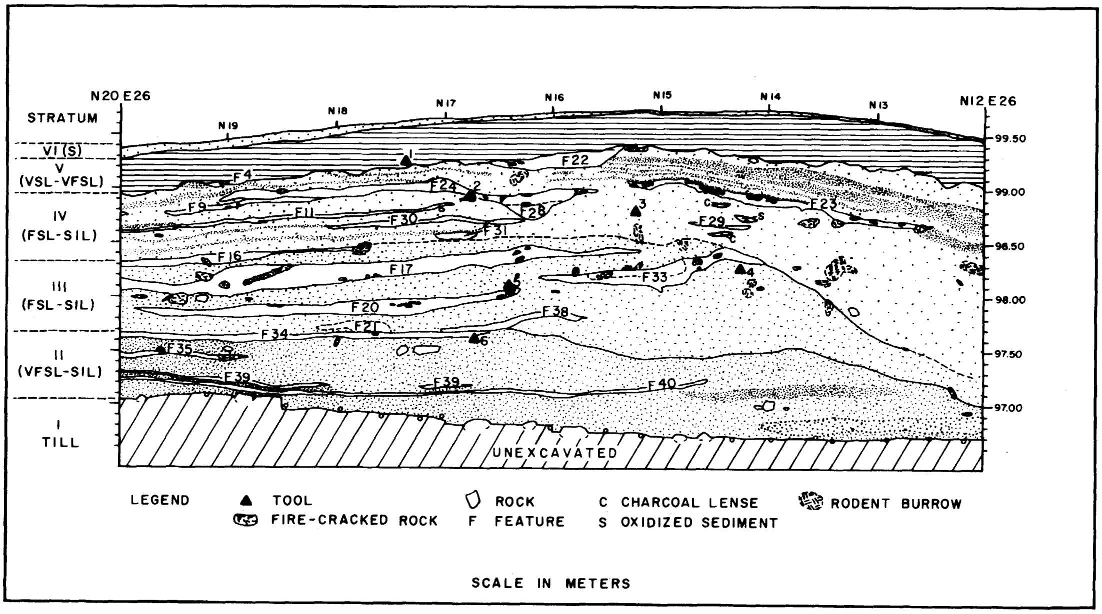

Figure 1. Stratigraphic profile of east wall of trench units N12–N20 along E26 at the Sharrow site (ME 90-2D), Piscataquis County, Maine. Note radiocarbon-dated features: feature 40 ca. 9500–8700 B.P.; feature 39 ca. 9000 B.P.; feature 35 ca. 8100 B.P.; feature 34 ca. 7600 B.P.; feature 21 ca. 7200 B.P.; feature 20 ca. 6300 B.P.; feature 17 ca. 6000–5900 B.P.; feature 16 ca. 5800 B.P.; feature 31 ca. 4700 B.P.; feature 11 ca. 4000 B.P.; feature 9 ca. 3100 B.P.; and feature 22 ca. 1500 B.P.

Asch Sidell (see Petersen 1991:Tables 23 and 24). Botanical remains were recovered by sequential water screening through 3.2-mm and 1.6-mm mesh, after dry screening through 6.4-mm hardware cloth.[5] The subsample selected for botanical analysis was taken from one single unit column for the full depth of the cultural deposits at the site.

A single small, fragmentary *Cucurbita* rind fragment was identified by Asch Sidell in one of the many samples from cultural feature 20. This feature is a sloping, oxidized, charcoal-infused living floor, with an associated pebble lens apparently for heat reflection. It is situated within the lower-middle portion of sediment stratum III, a sandy loam in the site stratigraphy, that has been cumulatively dated to between ca. 7500 and 5000 B.P. based on eight radiocarbon dates (Petersen 1991:36–38).

Sharrow feature 20 was excavated only partially during three episodes of field work (1986, 1987, and 1989), but it is a minimum of about 3.6 m x 3.0 m in size and about 3–15 cm thick. It is situated between 140 and 176 cm below the current site surface on the landward side of a levee formation (Figure 1). Importantly, feature 20 is very well isolated and seemingly little disturbed. It has been dated to 6320 ± 110 B.P. (Beta-18234 uncalibrated, as for all dates cited here) and lies stratigraphically between overlying features 16 and 17 and underlying feature 21. The analyzed feature 20 samples represent a total weight of about 171 g of carbonized botanical remains (Asch Sidell 1991; Petersen 1991:Table 23). Along with the single *Cucurbita* rind, feature 20 also produced eight acorn (*Quercus* spp.) nut fragments, 12 hawthorn (*Crataegus* spp.), 20 bedstraw (*Galium* spp.), and two raspberry (*Rubus* spp.) seed fragments; unidentified seeds; and wood, bark, twig, and pitch remains. The identified wood from feature 20 includes maple (*Acer* spp.), sugar maple (*Acer saccharum*), birch (*Betula* spp.), hawthorn (*Crataegus* spp.), beech (*Fagus grandifolia*), ash (*Fraxinus* spp.), butternut (*Juglans cinerea*), ironwood (*Ostrya virginiana*), spruce (*Picea* spp.), pine (*Pinus* spp.), cherry (*Prunus* spp.), red oak group (*Quercus* spp.), basswood (*Tilia americana*), and American

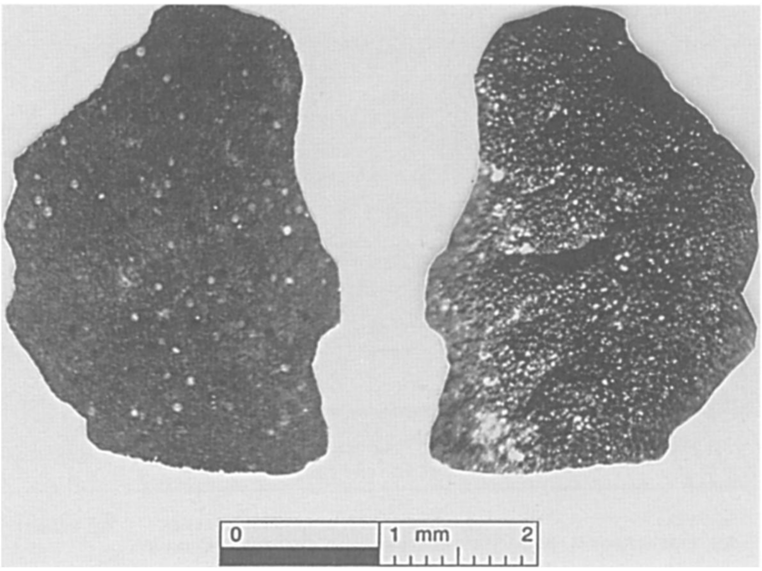

Figure 2. Composite photographs of Sharrow site *Cucurbita*, illustrating exterior and interior surfaces at left and right, respectively (photographs by Nancy Asch Sidell). Note characteristic epidermal pits and whitish cystolith deposits on the exterior.

elm (*Ulmus americana*). Calcined faunal remains from feature 20 include beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), shad (*Alosa sapidissima*), and possible American eel (*Anguilla rostrata*) (Petersen 1991:Table 22; Spiess 1992:184–185).

Identification and Dating of the *Cucurbita* Specimen

The single *Cucurbita* rind specimen from the Sharrow site weighed only 1.4 mg, measured about 3.30 mm long x 2.25 mm wide, and was maximally about 0.65–0.7 mm thick. It can be conclusively classified as *Cucurbita* on the basis of small epidermal pits containing whitish cystolith deposits[6] on the outer surface (Figure 2) and regular isodiametric cells visible in cross-section[7] (e.g., Asch and Asch 1985; Asch and Asch Sidell 1992:240–241; Conard et al. 1984). Prior to its destruction through AMS dating, the rind fragment was submitted to another paleobotanist, Frances B. King, who confirmed it as *Cucurbita*.

As noted above, cultural feature 20 had provided a radiocarbon date of 6320 ± 110 B.P. prior to the identification of the *Cucurbita*. This date is seemingly reliable given its sealed context and radiocarbon dates of 5820 ± 110 B.P. (Beta-18233) for overlying feature 16 and 7200 ± 140 B.P. (Beta-18236) for underlying feature 21. Sharrow feature 17, located stratigraphically between features 16 and 20, was subsequently dated to 5900 ± 100 B.P. (Beta-34296) and 6000 ± 130 B.P. (Beta-34297), further confirming the integrity of the stratified contexts in Sharrow stratum III and the date of 6320 B.P. for feature 20. Unless these wood charcoal dates are all consistently biased because of the burning of "old" wood, this series of dates, in correct stratigraphic order, helps to establish the reliability of the conventional radiocarbon date for feature 20.

To confirm its antiquity, a direct AMS date was obtained for the *Cucurbita* specimen to eliminate any possibility that it was intrusive into mid-Holocene feature 20 or that it represented a laboratory error of some kind at the UMF ARC (see Gowlett 1987; Minnis 1981). It should be emphasized that *Cucurbita* remains of any age are rare in the far Northeast.

The Sharrow *Cucurbita* specimen was first submitted to a commercial laboratory for possible AMS dating, but the sample was deemed too small to be dated. It was subsequently reasoned that the potential age of the specimen was so extreme in local contexts (i.e., the oldest previously dated *Cucurbita* in the region was only ca. 800–900 B.P.) that a mid-Holocene date of any sort would corroborate its antiquity. The National Science Foundation (NSF) University of Arizona AMS Facility was then contacted and, given the merits of the associated research issues, agreed to date the specimen by the AMS technique. The NSF Arizona facility returned an AMS date of 5695 ± 100 B.P. (AA-7491; squash rind; uncorrected for isotopic fractionation).

Although the direct AMS date for the *Cucurbita* is somewhat younger than the previous date of 6320 ± 110 B.P. for feature 20, this determination confirms the mid-Holocene antiquity of the specimen. It is possible that the AMS date for the *Cucurbita* specimen is somewhat young, perhaps because of the small sample size, handling contamination, or laboratory background noise (e.g., Gowlett 1987). Botanical samples from overlying features 16 and 17 were analyzed, but these did not yield any *Cucurbita* remains, leaving it uncertain whether the feature 20 specimen is somehow related to one of these younger features. Thus, the most likely date range for the specimen is ca. 6210–6430 B.P., whereas a more cautious range is ca. 5500–6500 B.P.

Implications of the Sharrow *Cucurbita*

The singular nature of the Sharrow *Cucurbita* specimen, albeit now reliably dated ca. 5595–6430 B.P., precludes an exhaustive consideration of the nature and timing of plant cultivation in eastern North America. Three alternative hypotheses seem derivable from the mid-Holocene evidence of *Cucurbita* at the Sharrow site in any case.

Hypothesis 1. The Sharrow Cucurbita represents a previously unrecognized native plant in the far Northeast. The present distribution of uncultivated, free-living *Cucurbita* gourds, whether native or feral, extends along river systems from southeastern Texas to central Illinois and east along the Gulf of Mexico coastal plain to Mobile, Alabama, and peninsular Florida. Free-living *C. pepo* gourds have not been documented east of Powell County, Kentucky (Smith 1992a). During the mid-Holocene, *Cucurbita* was present at habitation sites in Illinois, Missouri, Kentucky, and Tennessee, as noted above. Although Kentucky and Tennessee appear to be outside the more or less continuous range of modern free-living *Cucurbita*, they are certainly located near its general modern extent. However, no one has suggested previously that free-living *Cucurbita* could possibly grow in the less temperate far Northeast, especially in central Maine and the broader Gulf of Maine region.

Regional palynological and other evidence suggest that the mid-Holocene epoch was the climatic optimum relative to the entire postglacial period in the far Northeast, as elsewhere in continental and broader contexts (e.g., Davis 1983; Dincauze 1989; Joyce 1988; Webb et al. 1983). In fact, broad regional data for the mid-Holocene in eastern North America suggest that average temperatures were somewhat higher than modern temperatures. For example, average July temperatures in central Maine were about 20°C as inferred for ca. 6000 B.P., approximately 1°C warmer than modern conditions (Bartlein and Webb 1985:Figure 9). This might make the Gulf of Maine region slightly more favorable for *Cucurbita*, but even so the area would have been 4–7°C colder on average in July, for example, than the areas where other mid-Holocene (and older) *Cucurbita* have been recovered in eastern North America.

Not even the northernmost portions of the previously postulated range of native *Cucurbita* (i.e., central Illinois) begin to approach the climatic limitations that would have pertained to Maine in the mid-Holocene. In Maine, any native (or other) *Cucurbita* would have had a relatively short growing season (today about 115–120 frost-free days on average near the Sharrow site) and long, cold continental winters on the basis of modern conditions in the noncoastal, interior portions of the Gulf of Maine region (Fobes 1946; Petersen 1991:7–11).

The local mid-Holocene forest would have been generally similar to modern conditions—that is, consisting of a mixture of species reflective of an intermediate position between predominantly coniferous and deciduous forests (Shelford 1963; Westveld et al. 1956), although perhaps with slightly more deciduous tree species than typically are present today. This suggestion is made on the basis of the mid-Holocene macrobotanical samples from the Sharrow site and elsewhere, along with palynological studies that include several dated pollen cores in relatively close proximity to the Sharrow site (e.g., Anderson et al. 1992; Davis et al. 1975; Jacobson et al. 1987).

Of particular note, the Sharrow site area lies at or beyond the known limit of late prehistoric/ethnohistoric aboriginal maize-beans-squash horticulture in the far Northeast (Bennett 1955; Dimmick 1994; Heckenberger et al. 1992). Direct evidence of these domesticates in late prehistoric and early historic contexts is confined to Lake Champlain and the Connecticut, Merrimack, Saco, and Kennebec River drainages, from west to east, in Vermont, New Hampshire, and Maine (Asch Sidell 1990, 1992; Heckenberger et al. 1992). The local Piscataquis River drainage and the broader Penobscot River drainage, within which it lies, as well as areas farther east and north in Maine and New Brunswick were characterized by hunter-gatherer adaptations at the time of first substantial European contact, ca. 400–300 B.P. on the basis of available ethnohistoric information for native groups such as the Penobscot, Passamaquoddy, and Malecite (e.g., Erickson 1978; Prins 1992; Snow 1978; Speck 1940).

In summary, the hypothesis that *Cucurbita* was a native plant in the far Northeast, whether present there before or only during the climatic optimum, seems unlikely to account for the Sharrow *Cucurbita* in a mid-Holocene context, given local and regional ecological information. This may be the least plausible of the three alternative hypotheses posited here, although of the alternatives, it is perhaps the most easily testable with further paleobotanical research, assuming that additional samples can be identified, especially seeds and more intact rind fragments, among other botanical evidence. The available distributional information for the postulated native *Cucurbita* in eastern North America suggests a preference for warmer growing conditions in the Midwest and to the south, east, and west. The specific setting of the Sharrow site in the far Northeast makes it unlikely that a native *Cucurbita* was ever present there, although mid-Holocene conditions may have been more favorable for its introduction and cultivation than modern data would suggest.

Hypothesis 2. Cucurbita was present in Maine during the mid-Holocene as a trade item or as an unintentional camp follower introduction. Both variants of this hypothesis recognize that human introduction of *Cucurbita* into Maine without local cultivation may account for its presence at the Sharrow site, whether brought there as the outcome of external trade or as an unintentional camp follower. Each of these variants is discussed below.

The Sharrow site *Cucurbita* may have been cultivated elsewhere and brought to the Gulf of Maine region in the far Northeast as a trade (or exchange) item.[8] In fact, trade is a mechanism that could account for relatively rapid transport of such an item over large distances. However, there is little evidence for local and regional long-distance trade during the Early and Middle Archaic periods, ca. 9000–6000 B.P. In spite of growing evidence of early to mid-Holocene habitation and cemetery sites in the far Northeast, very little evidence is available to document long-distance trade in local, regional, and extraregional contexts (Robinson et al. 1992).

Some transmission of various technological developments (e.g., ground stone tools, stone boiling, etc.) and diagnostic artifact types (e.g., bifurcate projectile points, etc.) occurred across eastern North America during the early to mid-Holocene after the Paleoindian period. Both technologies and artifact styles linked aboriginal groups on a general level, but increasing regionalization seems to have been more pervasive across the broad region during the Early and Middle Archaic periods. In general, this was apparently the most insular time span in broad regional prehistory with few, if any, demonstrated long-distance trade networks (e.g., Bourque 1994; Hockensmith et al. 1988; Petersen 1995; Phillips and Brown 1983; Reinhart and Hodges 1990; Stewart 1989).

It is certainly possible that the regional record underrepresents the degree of long-distance trade during the early to mid-Holocene, especially if this trade was largely conducted in perishable items, such as *Cucurbita* artifacts or foodstuffs, among many other potential forms. The extensive literature on archaeological and ethnographic trade does document a wide array of trade materials, both perishable and nonperishable in nature, among aboriginal populations in North America (e.g., Baugh and Ericson 1994; Hudson 1976; Spielmann 1983; Wood 1980; Wright 1967). Thus, the Sharrow *Cucurbita* may represent a plant grown elsewhere and traded into the far Northeast as a food item or more likely as a container or another artifact form, but this scenario is not obviously supported by evidence for long-distance trade per se during the early and mid-Holocene.

Alternatively, the Sharrow *Cucurbita* specimen may represent an unintentional camp follower introduction in Maine. In this scenario (Smith 1987:21–23, 1992a:47–49), *Cucurbita* could have been introduced by humans, as in the case of trade, but the introduction would have been unintentional. Recognized as a plant that potentially propagates and "thrives unassisted" (Smith 1987:22), like several present-day gourds, or at least propagates "without much human aid" (King 1985:78), *Cucurbita* may have spread as a by-product of cumulative disturbance of localized settings all across eastern North America. Cucurbits could have colonized ground disturbed by human activities, in other words, and thus represent camp followers or "unhusbanded gourds" (Smith 1987, 1992a; Yarnell 1993). This is an intriguing variant of the hypothesis for human introduction of *Cucurbita* without local cultivation, but it assumes that this plant could have grown in Maine without human tending.

The introduction of *Cucurbita* into any area of eastern North America as an unintentional camp follower does not seem to be supported by morphological or other evidence (Asch and Asch Sidell 1992:259; cf. Smith et al. 1992). Asch and Asch Sidell (1992:258) note that seeds of cultivated *Cucurbita* are continually introduced into human-disturbed settings, yet these cucurbits do not show evidence of persistence that would warrant their inclusion in the list of spontaneous midwestern flora, except for the success of the *C. pepo* gourd as a soybean-field weed and as a component of more natural Ozark riverine environments. This suggests that present-day wild, feral, or domesticated forms of *C. pepo* do not provide close analogs for the postulated prehistoric weedy, unhusbanded camp follower. If the camp follower form was significantly different from modern *C. pepo*—that is, if it had characteristics that allowed it to spread through eastern North America without husbanding—then it would be even more difficult to account for the subsequent disappearance of this hypothetical weed (Asch and Asch Sidell 1992:258).

The Sharrow *Cucurbita* specimen nonetheless is possibly accounted for by this variant of the hypothesis for human introduction without local cultivation. However, the environmental information for the mid-Holocene in Maine, as summarized above, suggests that local settings would not have been particularly favorable for a self-propagating, camp follower *Cucurbita*, which likely would have required warmer growing conditions. This variant of the human introduction hypothesis thus seems unlikely in the present case.

Hypothesis 3. Cucurbita was cultivated in Maine during the mid-Holocene epoch. Only about 700–1,300 years separate the oldest recorded archaeological appearance of *Cucurbita* in the midcontinent and its early date at the Sharrow site in the far Northeast (see Smith 1992b:Table 6.1). In the Southeast, evidence of late Pleistocene and Holocene *C. pepo* "gourds" was recently obtained from the Page-Ladson site in Florida. The oldest gourd seeds have been directly AMS dated to ca. 12,570 ± 100 B.P., and others found in association with what is believed to be mastodon dung have been dated to 12,545 ± 80 B.P. and 12,375 ± 75 B.P. (Newsom et al. 1993:Table 1). These and younger finds in Florida suggest that *Cucurbita* in some form was indigenous in eastern North America and perhaps was once widespread in Florida and adjacent areas to the west around the Gulf of Mexico (Newsom 1994; Newsom et al. 1993). Of further note, the early presence of bottle gourds (*Lagenaria siceraria*) has also been substantiated for a mid-Holocene burial context at the Windover site in Florida, although it is uncertain whether it was wild, cultivated, or domesticated at that time (Doran et al. 1990).

Assuming that there was indeed indigenous *Cucurbita* in Florida and along the Gulf of Mexico during the late Pleistocene, why did it take 5,500 years for it to appear at archaeological sites in Illinois and other areas of the midcontinent? At about 7000 B.P. *Cucurbita* rinds appeared in the archaeological record at the

Koster and Napolean Hollow sites, located about 35 miles apart in the Illinois River valley. At the Koster site, extensive analysis of older occupations (>7000–8500 B.P.) revealed no *Cucurbita* rind; altogether more than 1,775 samples were examined from 10 cultural components below Horizon 8B (Asch and Asch 1980). It should be noted, however, that the earliest horizon was undersampled because of the difficulties of excavating at a depth of over 9.1 m (30 feet).

Similarly, it is possible that a sampling, processing, and/or a preservation bias has kept *Cucurbita* from being recognized in other older contexts in the Midwest, Midsouth, and Southeast. Nevertheless, the evidence from the well-sampled Koster site seems to suggest that there was an abrupt appearance of *Cucurbita* in west-central Illinois at about 7000 B.P. If *Cucurbita* had been growing in the area before this time as a native plant, it might well have appeared in the archaeological record because of its potential utility for containers and other uses.[9] By 4000 B.P., the distribution of *Cucurbita* at archaeological sites included Kentucky, Tennessee, and possibly Pennsylvania and Maine, far outside the modern continuous distribution of *Cucurbita*. The seemingly sudden appearance of *Cucurbita* in the archaeological record of west-central Illinois, taken together with a mid-Holocene distribution that exceeds the modern distribution, may accordingly support the hypothesis of Asch and Asch Sidell (1992) that the presence of *Cucurbita* in Illinois represents cultivation of a nonlocal plant, introduced either from Mesoamerica or from the Gulf Coast.

If the 7000 B.P. *Cucurbita* remains from Koster and Napolean Hollow represent locally cultivated and perhaps domesticated specimens, then the spread of this cultivated plant to the far Northeast in about 1,000 years was rather rapid, assuming it was not native there. If the Sharrow *Cucurbita* represents a cultivated plant, it is by far the earliest known example in the far Northeast and adjacent areas (e.g., Adovasio and Johnson 1981; Bendremer and Dewar 1994; Bendremer et al. 1991; Fritz 1990; Heckenberger et al. 1992).

It is important to note that *unequivocal* domesticated squash appears in the archaeological record of eastern North America much more recently than the Sharrow *Cucurbita* date would suggest (but see Asch and Asch Sidell 1992; Watson and Kennedy 1991:263). Some tentative supporters of the hypothesis that domesticated *Cucurbita* was derived from a regional native suggest that the wild progenitors may have coexisted with domesticated forms in eastern North America at some point during the early to mid-Holocene, that is, by 8000–5000 B.P. or earlier in the midcontinent (cf. Chapman and Watson 1993:34–36).

On the basis of potentially useful but necessarily conservative data, others suggest that squash domestication did not occur until ca. 4300–4000 B.P. (e.g., Fritz 1990:Table II; Yarnell 1993:23–24), ca. 3000 B.P., or even later (Smith 1987, 1992a:41–45; Smith et al. 1992:74–75; Yarnell and Black 1985). Domesticated squash is recognized on the basis of changes in seed size, perhaps seed morphology, and rind thickness, and rind texture in some cases, as only typically evident in well-preserved archaeological specimens (e.g., Decker and Newsom 1988; Kay et al. 1980; King 1985; Smith 1985, 1987, 1989, 1992a, 1992b; Smith et al. 1992; Yarnell 1993).

A flexible guideline sometimes known as "King's Rule" has been used to suggest that squash rinds thinner than 2.0 mm do not conclusively represent domesticated examples (King 1985:91; Smith 1992a:41; cf. Asch and Asch Sidell 1992). None of the older rind specimens are that thick and seeds older than those from Phillips Spring, dated ca. 4300–4000 B.P., are unknown, with the exception of the recent Florida finds and perhaps a few others (Newsom 1994; Newsom et al. 1993; Smith 1992b:Table 6.1). However, some modern domesticated and "wild" *Cucurbita* species have rinds thinner than 2.0 mm (Asch and Asch Sidell 1992:243). In any case, by ca. 3000 B.P., rind thickness and seed length at Cloudsplitter Rockshelter and Salts Cave, both in Kentucky, seemingly reflect domesticated squash, providing a minimum estimate of 4000–3000 B.P. for squash domestication (Smith 1987, 1989, 1992a:41–45).

Even if the mid-Holocene *Cucurbita* found in the midcontinent are considered native, noncultivated specimens, and if one accepts a relatively late date for *Cucurbita* domestication, ca.

4000–3000 B.P., it is still necessary to consider the possibility that *Cucurbita* was cultivated long before recognizable morphological/phenotypic changes occurred and domestication can be safely inferred (cf. Smith et al. 1992:107–108). This is a characteristic problem related to the recognition of domesticates in the archaeological record.

The Sharrow site *Cucurbita* could represent a plant introduced by humans and cultivated locally in the far Northeast. However, one would need to extend the time depth for squash cultivation back into the mid-Holocene, older than the Sharrow dates, to support this hypothesis. Acceptance of the mid-Holocene *Cucurbita* specimens in the midcontinent, dated ca. 7000–4000 B.P., as cultivated plants strengthens this scenario (e.g., Asch and Asch Sidell 1992; Chapman and Watson 1993). A mechanism for introduction is still needed, however, which is made problematic by the above-mentioned paucity of evidence for long-distance trade during this period. Perhaps it came as an introduced cultivated plant along with broadscale technological developments rather than as a long-distance trade good per se.

Conclusions

A recently identified specimen of mid-Holocene *Cucurbita* from the Sharrow site, directly and indirectly dated to ca. 6320–5695 B.P., remains enigmatic because of its location in the far Northeast, in an area until recently perceived as marginal for human habitation or even unoccupied during the early-middle Holocene (Petersen 1995; Robinson and Petersen 1993; Robinson et al. 1992). Whether *Cucurbita* was domesticated in North America or Mesoamerica or both, it seems likely that its occurrence at Sharrow represents an intentional human introduction there during the mid-Holocene epoch. In other words, it is unlikely that *Cucurbita* was ever native in the far Northeast or that it arrived as a camp follower, and it more likely represents either an introduced trade item or a locally cultivated plant at the Sharrow site. However, long-distance trade networks during the mid-Holocene have yet to be documented in the far Northeast and current evidence leads us to favor the hypothesis that *Cucurbita* was cultivated at the Sharrow site.

This discovery provides another example of the prime utility of the AMS dating technique, especially as it applies to the rapidly evolving study of the development of agriculture in eastern North America (e.g., Chapman and Crites 1987; Chomko and Crawford 1978; Conard et al. 1984; Crites 1987; Doran et al. 1990; Fritz 1990:397; Gowlett 1987; Kay et al. 1980; Newsom et al. 1993; Riley et al. 1994; Smith and Cowan 1987). For the first time, it is possible to conclusively date most, if not all, significant paleobotanical samples. As might be expected, however, the problems inherent in recognizing cultivated versus native plants and other complicated taxonomic issues still make it difficult to reach a consensus on the implications of such finds.

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Notes

1. The genus *Cucurbita* L. (Cucurbitaceae family) includes five domesticated species and about 22 wild species. Among the cultivated species, squash and gourds are collectively known to botanists as *Cucurbita pepo*. Because the common name "squash" implies an edible fruit, whereas "gourd" implies a hard-shelled inedible fruit, we use the generic term *Cucurbita* to refer to the Sharrow specimen. Some researchers now recognize *C. pepo* as including one or more native gourds, whereas exogenous bottle gourds are *Lagenaria siceraria* (e.g., Newsom et al. 1993). *C. pepo* ssp. *pepo* was domesticated in Mesoamerica and perhaps eastern North America, and it exists only as a cultivated plant, not free-living. Ornamental gourds, *C. pepo* ssp. *ovifera* var. *ovifera*, may have been domesticated in eastern North America and they currently exist only as cultivated plants. The "Texas wild gourd," *C. pepo* ssp. *ovifera* var. *texana* and var. *ozarkana*, seemingly represent self-sustaining or "spontaneously derived" forms in eastern North America (Decker 1988; Decker-Walters 1990, 1993; cf. Asch and Asch Sidell 1992:241).

2. As used here, a "cultivated plant" is one that is intentionally propagated but not obviously altered genetically; a "domesticated plant" demonstrates phenotypic signs of alteration (cf. Fritz 1990:391; Scarry 1993:6—7). "Agriculture" is used in the broad sense and, as such, includes the terms "plant husbandry" and "horticulture."

3. There is no convention for use of early, middle, and late Holocene epoch designations, overall ca. 10,000 B.P. to present. At the Sharrow site, stratigraphic distinctions led to the use of ca. 7500—5000 B.P. for the mid-Holocene epoch (Petersen 1991). However, to be consistent with recent usage (Smith 1992a:40), this paper considers the mid-Holocene to be 8000-4000 B.P., although only the later portion, ca. 7000-4000 B.P., has produced *Cucurbita* remains.

4. The mid-Holocene distribution of *Cucurbita* may also include Pennsylvania. Two thin (0.7 mm) fragments of *Cucurbita* have been identified at the stratified Memorial Park site from a Late Archaic period (late Laurentian tradition) charcoal concentration (Asch Sidell 1993). Five dates obtained from the late Laurentian component, but not from the feature containing *Cucurbita*, fall within the range 5200—4900 B.P. An Early Woodland period feature with two Meadowwood bifaces yielded 10 *Cucurbita* rind fragments—two thin fragments (0.5 mm, 0.7 mm) and eight thicker ones (1.4—3.6 mm; mean 2.1 mm). Plant remains in 211 flotation samples from 12 components at the Memorial Park site were examined, ranging from the Middle Archaic to Late Woodland periods, 7090—565 B.P.; samples were selected by John Hart, principal investigator.

5. Full details of field and laboratory work procedures relevant to the artifact and ecofact samples are reported elsewhere (Petersen 1991:17—26).

6. The epidermal pits containing whitish deposits previously have been interpreted as cystoliths containing "calcium carbonate formations" that occur in lithocyst cells (Asch and Asch 1985:155), following Esau (1965:150) for recognition of cystoliths and lithocyst cells. However, this interpretation has been rejected more recently, in part because the whitish cystoliths are no longer believed to be calcium carbonate (Asch and Asch Sidell 1992:341). One of the anonymous reviewers of this paper suggested alternatively that the cystoliths are actually "opaline silica bodies," or "phytoliths."

7. See Asch and Asch (1985:Figure 6.2) and Crawford (1982:Figure 3) for depiction of analogues for the Sharrow *Cucurbita* rind fragment.

8. The precise function of early *Cucurbita* sp. in eastern North America as some sort of artifact or food plant or both is uncertain, but given their postulated small size and hard and presumably bitter rind it seems likely that they first served as containers, among other possible artifact uses such as rattles, net floats, etc., much like bottle gourds. One

reviewer suggested that early *Cucurbita* sp. seeds may have been quite edible, especially after parching. In any case, with time and domestication, they more likely became an increasingly important food plant.

9. Admittedly, organic artifacts of all types, especially those of vegetal raw materials, are generally rare in prehistoric archaeological deposits all across eastern North America (see Petersen 1996).

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