Early Zea Cultivation in Honduras: Implications for the Iltis Hypothesis

David Webster, David Rue, and Alfred Traverse

In a classic Economic Botany article, Hugh Iltis (2000) addressed two vexing questions concerning the origins and spread of maize in ancient Mesoamerica. Why did people ever use, much less domesticate, teosinte (Zea mays ssp. parviglumis), its unpalatable and otherwise unattractive wild ancestor? And why did teosinte (or early maize) take so long to become an important staple in the ancient diet? Iltis proposes two answers. First, we have erroneously assumed that use and selection focused on the mature grain of the plant, when instead teosinte was harvested for its sugary juice and/or eaten as a green vegetable. Second, the fundamental mutation that modified and essentially eliminated teosinte’s tough, cupulate fruit case, making the grain accessible for use, was lethal and exceedingly rare. Iltis (2004) estimates that it occurs in only one in four to five million individuals. For centuries after maize (Zea mays mays) was incipiently domesticated, moreover, it remained a sugar/vegetable crop. Archaeologists are increasingly endorsing this new perspective because it helps make sense of data from excavations and from isotopic signatures of ancient diet (e.g., Smalley and Blake 2003).

A prediction derived from Iltis’s reconstruction is that there should be considerable lag in many regions between the first appearance of Zea (whether domestic maize or local or “transplanted” teosinte) and the evidence for substantial farming populations and settlements. We here review evidence for just such a lag from a sediment core from the Aguada Petapilla, in the Copán Valley of western Honduras (Fig. 1). Our core spans the entire culture history of the Classic Maya Copán kingdom (ca. 400–820 A.D.), but it has much earlier levels that conform both to Iltis’s prediction and to other evidence for early maize in Mesoamerica (Benz 2001; Piperno and Flannery 2001).

Signs of cultivation long predate standard archaeological signatures of human occupation in the Copán Valley. Rene Viel, the Copán project ceramist, believes that early pottery was used in the region beginning about 1400 B.C. (pers. comm. to Webster, 1997), although the first well-dated artifacts signaling human presence appear around 1000–900 B.C. (Fash 1991).

Long, well-dated sediment cores from the Maya Lowlands are still rare. A recent review by Barbara Leyden (2002) lists 27 cores that have yielded pollen evidence. Twenty of these extend back before Preclassic times (ca. 2500 B.C.), but many lack Zea pollen and in others.

Key Words: Honduras; Zea; maize; palynology; charcoal; burning; early farming.

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Zea shows up only very late, leaving the issue of the plant’s origins and spread unclear. Sediment cores with early Zea signatures are particularly sparse from Honduras (ours is only the third example), although the region has important implications for the dispersal of maize from Mexico into Central and South America.

Our core from the Aguada Petapilla supplements a much shorter one from the same locale previously reported by David Rue (1987). We hoped the newer core would independently confirm inferences about the settlement and agricultural history of the ancient Copán kingdom (Wingard 1996; Webster, Freter, and Gonlin 2000; Webster 2002). As it turned out, the sediments proved very different from those in the first core. Conclusions derived from them generally supported our overall demographic reconstructions, but early concentrations of charcoal and Zea pollen unexpectedly indicated human landscape disturbance and farming by about 2600–2700 B.C., as much as 1,700 years before artifacts such as pottery, stone tools, or architecture more directly document human occupation of the region.

**Fig. 1.** Sites in Honduras with sediment cores or maize macrofossils.

**Fig. 2.** Location of the Aguada Petapilla in relation to the ruins of Copán (Main Group) and to the modern town.

For the last decade some archaeologists and paleobotanists have properly insisted that the best evidence for detecting early maize comes from macrofossils instead of pollen or phytoliths, and that accelerator mass spectrometer (AMS) 14C samples should be individual macrofossils (e.g., Smith 1995a). Raising the analytical bar in this fashion makes for extremely sound inferences, but also marginalizes useful circumstantial evidence. Leaving aside the contentious issue of phytoliths, it is doubtful that even stem and leaf macrofossils of Zea (as opposed to cobs and grains) can be unambiguously identified, or determined to be wild or domesticated (Lee Newsom, personal communication 2004). Our position is that the best evidence is not the only evidence, and we agree with Pohl et al.'s (2004) insistence that the pollen record continues to contribute important insights about many paleobotanical issues. The oldest Honduran maize macrofossils were recently recovered by Timothy Scheffer from El Gigante cave, but as we shall see below, directly dated samples are much younger than our pollen evidence.

**Context of the Petapilla Cores**

Both of our cores were recovered from the Petapilla bog (locally called an aguada) situated about 3.2 km northeast of the ruins of the great Classic Maya center of Copán, in extreme western Honduras (Fig. 2). The bog is located in the
east end of the Petapilla intermontane valley, an
enclosed basin perched 100 m above the adja-
cent alluvial valley floor of the main river. The
basin lies at about 710 m above sea level (asl)
and covers an area of approximately 9 ha. Mean
annual rainfall is 1,400–1,500 mm and is
drained away by several intermittent streams.
The bog is 140 m in diameter, has a small, pine-
covered island near its center, and is the only
permanent large water source in the basin.
Standing water is shallow (1–2 m) and is cov-
ered with a floating mat of vegetation including
Cyperaceae (sedges), Poaceae (grasses), Pieri-
dophyta (ferns), and Typha (cattail).

Sediments drain into the bog from most di-
rections, but the actual catchment area is quite
small, delimited by low (20–30 m) hills on the
north, south, and east. Drainage appears to be
internal, with no obvious outlets except for one
possible area on the southeast margin through
which the bog could drain today only if its water
level were exceptionally high. Water level was
probably lower in the past, so the bog is an ef-
fective sediment sink. Because of the constrain-
ting topography and the lack of any sizable pe-
rennial or intermittent stream, most sediments
deposited in the bog are of local origin except
for very light wind-borne pollen (e.g., pine).
Rapid inflows of water that could mix and re-
move sediments are minimized as well.

Geology of the basin is complex, and includes
white ash lacustrine sediments, rhyolite out-
crops, volcanic tuffs, and some limestone de-
posits. Bedrock outcrops visible immediately
around the bog are limestone. The bog might be
a sinkhole, although the larger landscape is cer-
tainly not a karstic one as common elsewhere
in the Maya lowlands.

Apart from some hilltops, the locale of the
bog today is heavily denuded of natural vege-
tation, which originally probably consisted of a
mesic deciduous tropical forest on the basin
floor, with pine (Pinus oocarpa) and evergreen
oak (Quercus) at higher elevations (Abrams
and Rue 1988). Both species still grow sparsely
around the bog, and the high hills bounding
the Petapilla basin to the northwest are covered with
pine, which is adapted to soils of low fertility
and high acidity. Maize is currently cultivated in
the west end of the intermontane basin and on
its northwestern slopes, although not right
around the bog itself.

Recent coring in Mexico's Lake Patzcuaro
demonstrates that unusually high rates of sedi-
mentation near large settlements can confuse
and obscure broader processes of infilling (Fish-
ner et al. 2003). Fortunately no ancient settle-
ments are found close to the bog, so such dis-
ortion is not a problem. We excavated remains
of small households in the west end of the larger
basin that were mainly occupied after around
A.D. 600–650.

THE FIRST CORE

Rue's original core from the northern edge of
the bog was very short—1.35 m (Rue 1987: Fig.
2b). Its deepest deposits were estimated to be
approximately 1,000 years old based on two un-
calibrated determinations of radiocarbon age
from associated bulk sediments (940 ± 60 B.P.
at 130 cm and 595 ± 60 B.P. at 70 cm). Poaceae
(grass) pollen percentages are high, Zea (maize)
pollen is present, and the deciduous trees Meli-
aceae (mahogany family) and Meliaceae-type
are nearly absent. Rue concluded that farmers
continued to completely clear forest from the
valley floors and foothills long after the collapse
of Copán's royal dynasty around the beginning
of the ninth century (see also Abrams and Rue
1988). Signs of reforestation are evident in the
upper 1.00 m zone of the core, or after about
A.D. 1200 by Rue's original reckoning, as in-
dicated by the rise of Pinus, Meliaceae, and Mel-
aceae-type vegetation in comparison to grasses.

Subsequent calibration of Rue's dates sug-
gests these processes were more protracted than
he originally thought, extending as late as the
fourteenth or even early fifteenth centuries
(Webster et al. 2000:115). This conclusion is
supported by more recent AMS radiocarbon de-
terminations from bone collagen in late burials
in the valley (Webster et al. 2004). But however
informative our first Petapilla core was concern-
ing late farming in the Copán Valley, it told us
nothing about its beginnings.

Rue retrieved another core from Lago Yojoa,
about 65 km to the east of Copán (Rue 1987),
whose sediments showed intimations of very
early agriculture dating to about 4500–3000 B.P.
At the time, these data were puzzling because
they long predated any more direct evidence of
early farmers. As we shall see, both Petapilla
Core 2 and the recent archaeological finds at El
Gigante support his interpretations and the Ilitis
model.
TABLE 1. AMS DATES ARRANGED BY DEPTH OF SAMPLE. ALL CALIBRATION INTERCEPTS ARE SHOWN HERE; ONLY THE SINGLE OR CENTRAL INTERCEPTS ARE SHOWN IN THE POLLEN DIAGRAM (FIG. 3).

<table>
<thead>
<tr>
<th>Sample/lab. number</th>
<th>Depth of sample in core (cm)</th>
<th>Radiocarbon age yr B.P.</th>
<th>Calibrated 2 σ age B.C./A.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-AA19780</td>
<td>111–113</td>
<td>1,278 ± 67</td>
<td>650 (721, 738, 768) 892 A.D.</td>
</tr>
<tr>
<td>8-AA19783</td>
<td>151–153</td>
<td>1,622 ± 73</td>
<td>253 (426) 608 A.D.</td>
</tr>
<tr>
<td>2-AA17720</td>
<td>207–209</td>
<td>2,268 ± 52</td>
<td>402 (372) 190 B.C.</td>
</tr>
<tr>
<td>3-AA17721</td>
<td>317–319</td>
<td>2,664 ± 54</td>
<td>908 (811) 780 B.C.</td>
</tr>
<tr>
<td>4-AA17722</td>
<td>372–379</td>
<td>2,363 ± 50</td>
<td>752 (400) 369 B.C.</td>
</tr>
<tr>
<td>6-AA19781</td>
<td>391–393</td>
<td>2,767 ± 73</td>
<td>1114 (905) 801 B.C.</td>
</tr>
<tr>
<td>1-AA17177</td>
<td>471–473</td>
<td>3,426 ± 53</td>
<td>1880 (1736, 1717, 1695) 1674 B.C.</td>
</tr>
<tr>
<td>7-AA19782</td>
<td>511–513</td>
<td>4,821 ± 67</td>
<td>3751 (3637) 3379 B.C.</td>
</tr>
</tbody>
</table>

PETAPILLA CORE 2

Rue recovered the second Petapilla core from close to the center of the bog where water stood to a depth of 1.65 m. Field examination confirmed that the sediments contained abundant organic material throughout its full 5.3 m length, but remains of small shelled animals suitable for oxygen isotope analysis were not recovered. Rue cut the core into 55 segments at roughly 10 cm intervals, and part of each segment was submitted to Alfred Traverse, who along with Rue had earlier analyzed Petapilla Core 1. Preparation of the samples in the Penn State Palyntological Laboratory was supervised by Traverse and generally followed conventional palyntological preparation methods as outlined in Traverse (1988).

CHRONOLOGY

Eight calibrated AMS 14C dates are associated with the core, as shown in Table 1 and Fig. 3. All samples were processed by the AMS Laboratory at the Department of Physics, University of Arizona. Webster calibrated the raw radiocarbon ages using the Radiocarbon Calibration Program of Stuiver and Reimer (1993 version—bi-decadal option). Multiple intercepts are each shown within the parentheses. Laboratory correction for isotopic fractionation was made in each case.

Samples consisted of 2 cubic cm plugs of bulk, organic-rich sediments, because large plant macrofossils were rare. They were submitted to the lab in two successive batches of four each. The first set of dates (numbered 1–4 in Table 1) made sense at their extremes, but the two middle dates (3 and 4) were stratigraphically inverted, not quite overlapping even at their 2 σ ranges. This raised the specter of heavily mixed depositions, an issue that we tested with the second set of dates (5–8). Fortunately all of these were in order. Nevertheless, the discrepancy still exists for unknown reasons. Because we have seven other dates in good chronological sequence, for the purposes of this analysis we eliminate date four, with the proviso that the sediments in this zone might be disturbed and any interpretations concerning them are thus suspect.

Rue selected sample five, the highest one, in an attempt to correlate an upper section of the second core with the lower sections of the first one. This sample produced the expected date—the mid-eighth to early ninth centuries—thus just predating the deepest levels of his first core. This period also marks the peak population of the Copán valley, and the time when anthropogenic disturbance of the natural landscape should be most intense, so it provided an important analytical benchmark.

We do not have a radiocarbon date from the base of the core. If we extrapolate back using the sedimentation rate from the lowest dated zone (Interval seven—see Table 3 below), the age of the basal sediments is approximately 4500 B.C. Even our lowest 14C date (seven) in the mid-fourth millennium B.C is far earlier than any direct archaeological indication of humans, so the sediments collectively represent the entire known occupational history of the valley.

Because the radiocarbon samples were recovered from a sinkhole-like feature in a locale that includes limestone deposits, the possibility of hard-water error must be addressed (Deevey and Stuiver 1964). Ancient limestone, which is 14C depleted, can dissolve in bodies of water, and when taken up by plants may have lower concentration of 14C than the atmosphere, thus pro-
Fig. 3. Pollen Summary Diagram.
Table 2. Sediment stratigraphy.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Depth</th>
<th>Sediment type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0–90 cm</td>
<td>Dark gray to black highly organic, fibrous peat.</td>
</tr>
<tr>
<td>B</td>
<td>90–105 cm</td>
<td>Gray peaty clay with coarse grit lens.</td>
</tr>
<tr>
<td>C</td>
<td>105–185 cm</td>
<td>Dark gray fibrous peat.</td>
</tr>
<tr>
<td>D</td>
<td>185–370 cm</td>
<td>Dark peaty with gritty lens at ca. the 285 cm level, and similar gritty lens of gray fluffy ash or gyttja at base.</td>
</tr>
<tr>
<td>E</td>
<td>370–480 cm</td>
<td>Dark gray clay; initially peatter than overlying zone but becoming less peaty with depth.</td>
</tr>
<tr>
<td>F</td>
<td>480–530 cm</td>
<td>Fine light gray clay.</td>
</tr>
</tbody>
</table>

Producing dates that are too old. If such an error occurred, we can assess its rough maximum magnitude by assuming that the uppermost or most recent date, which is 1278 B.P., in fact represents 0 B.P. (sediment surface) in the year the core was recovered. In this case, the error would be maximally 1,278 years (discounting the error ranges of the calibrated date). Even assuming this maximal error, the basal deposits would still be roughly 5,200 years old. Of course, the error cannot be this large because we know the sample was collected from more than 1 m below the surface, and the overlying sediments must have taken considerable time to accumulate. Fortunately, we also know that the Petapilla deposits are somewhat acidic. In all probability there is no serious hard-water error affecting our dates.

Stratigraphy and sedimentation

Rue identified six visibly distinct macrostratigraphic zones as shown in Table 2. Most non-wind-borne sediments probably originated very locally, and the bog could have received high loads of both mineral and organic sediments if the nearby hills were anthropogenically or otherwise denuded of vegetation. Another sediment source is the natural production of vegetation on or immediately adjacent to the bog itself.

We estimated sedimentation rates (Table 3) by using the central dates of the radiocarbon determinations listed in Table 1. Rates are fairly rapid and fall into the lower end of the range noted for tropical lake sediments, which can be on the order of 0.5 to 5.0 mm/yr. (Curtis et al. 2001: 36). Deposits in the upper sections of the core (Intervals 1–3) broadly reflect the known later human utilization of the Copán Valley, but will not be discussed here.

As expected, the lowest rates occur during Interval seven when there were few humans in the region and minimal disturbance of the environment. The five-fold increase in Interval six is generally coeval with our first archaeologically detected indications of human presence in the valley at about 1400 B.C. Farming populations were firmly established during Interval four and the sedimentation rate reaches its highest mean value of 2.5 mm/yr. at this time.

That early farmers were active in the Petapilla-intermontane basin is surprising because the deep alluvial soils of the main valley floor at first glance seem to be the most attractive resource zone. Direct evidence of Middle Preclassic (900–300 B.C.) human occupation has been found there (Fash 1991). On the other hand, it is very probable that much of the valley floor was then more poorly drained than it is today. Assuming that early inhabitants had a mixed economy based on farming and foraging, the Petapilla bog locale might have been quite an attractive one, given its permanent water supply and access to upland resources.

Palynological Analysis

Despite the abundance of organic materials in our second core, microscopic analysis revealed very low absolute amounts of pollen of all kinds (see Fig. 3). Most fossil pollen represents fungal and fern spores instead of the more diagnostic angiosperm (flowering plant) and gymnosperm (conifer) pollen. Fungal and fern spores are expected in swampy environments, but their dominance throughout Core 2 is not. Chemical conditions in this part of the bog were obviously not overly destructive or fungal and fern spores would have been poorly preserved as well.

Fern, fungal, and moss spores were also abundant in our first core but did not overwhelm pollen from more diagnostic species. Pine pollen is consistently present throughout both sequences,
but oak pollen, common in Core 1, is not found in Core 2, which also lacks pollen from more diagnostic tropical tree species. Disturbance indicators such as Gramineae and Asteraceae occur in lower proportions in Core 2. Despite its puzzling deficiencies, our second core does have two conspicuous and highly suggestive patterns shown by charcoal and Zea pollen.

Several huge pulses of charcoal and microscopic, unburned plant particulate matter are apparent, beginning near the very base of the deposits. Neither kind of material was probably transported into the bog from great distances, given local topographic and hydrographic characteristics. Charcoal particles are shown separately on the right of the Fig. 3 display (graphed using a logarithmic scale that visually underrepresents the massive frequencies found in some samples).

Heavy charcoal inputs are commonly attributed to natural fires and/or to fires set by humans (see Rue, Webster, and Traverse 2002 for a brief discussion of the possible implications of the Petapilla charcoal). Such charcoal might reflect very early natural fires in the Petapilla locale. Uncontrolled burns are common in the Copán Valley today, but unfortunately we know of no studies of regional fire ecology. Some fires are undoubtedly caused by lightning strikes, but most occur in April or May when people burn their fields and some fires inevitably escape. Wild fires in the pine-covered uplands are generally of low intensity, consuming litter and undergrowth but not developing into canopy fires. Because so much of the rest of the landscape has been cleared of its original broadleaf vegetation, the vulnerability of this forest community to natural fires is unknown. Studies in Florida suggest that natural fires in hardwood forests are rare, typically not very large or intense, and that they usually originate in some other neighboring vegetation community (Platt and Schwartz 1990: 215).

We think it probable that much of the Petapilla charcoal is a result of deliberate human burning beginning in very early times (see Horn and Sanford [1992] and Horn [1993] for evidence of Holocene burning from sediments in Costa Rica). Isotopic evidence from similar carbon concentrations elsewhere sometimes indicates that the fuel for such fires was C4 vegetation (e.g., Hodell et. al 1995:392). Concentrations of 813C associated with our AMS dates have values in the -20.9 to -25.1 range, and reflect instead the burning of C3 plants.

Zea pollen, interestingly, is more consistently present in Core 2 than in Core 1, and is distributed in small amounts throughout the sequence except at the deepest levels (Zea pollen is illustrated in Fig. 3 simply as a succession of traces rather than a percentage because numbers are very low, a pattern common in many cores from southeastern Mesoamerica [see Leyden 2002 for examples]). Traverse identified the pollen as domestic maize on the basis of large size and exine characteristics, but whether it is maize or some sort of introduced teosinte makes little difference to the issues considered here.

Zea first shows up at about the 4.90 m level, or just about in the middle of Interval seven. If the 14C dates are accurate and we assume constant sedimentation during this period, then Zea is present by about 2600-2700 B.C. While Zea pollen occurs as early as the first pulse of burning, it is perfectly possible that Late Archaic (4000-2500 B.C.) populations used fire for purposes other than to propagate maize, or, for that matter, any crop at all.

Three main interpretations present themselves concerning the nature and origins of the Zea represented. First, it could be some indigenous wild form of teosinte (Fig. 4). No ancestral teosinte (Zea mays ssp. parviglumis) is currently known from anywhere near western Honduras, although this plant is adapted to comparatively high altitude zones and rainfall regimes not dissimilar to those of the Copán Valley. Smith (1995a) notes the presently restricted distribution of teosinte in general, but cautions that it might have been much more widespread in ancient times. Bearing
this possibility in mind, our pollen might be from some form of teosinte not ancestral to maize. One such population (Zea mays ssp. huehuetenangensis) is known from the mountains of Guatemala (Matsuoka et al. 2002), and Iltis (2006:13) notes that a separate species, the annual Zea luxurians (also known from Guatemala) grew in recent times in southeastern Honduras but is now probably extinct. Iltis further suggests that although parviglumis might have been the first teosinte used for sugar, this cultural practice could easily have spread to other teosinte populations in regions where parviglumis was absent (personal communication to Webster 2004).

Second, the pollen could be from some kind of non-local teosinte introduced into the region during the very early stages of human manipulation of the plant. In this case it would almost certainly represent the ssp. parviglumis. Given the considerably earlier presence of domestic proto-maize at Gual Naquitz in the Mexican highlands ( Piperno and Flannery 2001; Ben 2001) the chronology does not fit this possibility very well. Smalley and Blake (2003:676) and Iltis (2000) remark on the extreme paucity of macrofossil remains of any kind of teosinte in older archaeological deposits anywhere in Mesoamerica. More specifically, Iltis points out to us the tiling absence of the indestructible teosinte cupulate fruit cases from old archaeological deposits where these would be expected (personal communication to Webster 2004). According to Iltis, these fruit cases are very difficult to overlook in paleobotanical samples.

The third possibility is the most parsimonious one: the pollen in Petapilla Core 2 represents cultivated or domesticated maize (Zea mays mays)—the interpretation we prefer. Zea pollen does not normally travel very far. Bellon and Brush (1994:203) estimate that cornfields with different lineages must be about 200 m apart to prevent hybridization. Its presence in the Petapilla bog, along with the associated charcoal, suggests that burning and cultivation occurred in the immediate locale.

**Implications**

Assuming that the Petapilla pollen has been correctly identified as Zea and that it has not migrated down into the sediments, aceramic farmers appear to have lived in the Copán Valley
as much as 1,700 years prior to our first direct archaeological materials, or by about 2600–2700 B.C. Because Zea pollen occurs only as traces, it is conceivable that the plant was present in the valley even earlier, and that its absence below the 4.90 m level reflects stochastic deposition or insufficient sampling of these deep sediments rather than the absence of Zea in the wider environment. However circumstantial massive charcoal deposition or Zea pollen might be separately, their co-occurrence strongly suggests that early human cultivators altered Copán’s landscape.

So far the oldest Honduran maize macrofossils (mainly cobs and cob fragments) come from stratified deposits in the El Gigante cave (Timothy Scheffler, pers. comm. 2004). Direct AMS dates on cobs fall into the range of only 2000–2400 B.P., although cobs were also recovered from deeper levels otherwise dated as early as 3440 B.P. The El Gigante collections have produced no signs of teosinte’s hard, cupulate fruit cases (grains enclosed by hard rachis and outer glume), although they have not yet been completely examined. Quids are common and seem to be agave, although chewed teosinte stalks cannot be absolutely ruled out. Both the Potquil and the El Gigante finds are thus consistent with the signs of agricultural disturbance at 4500–3000 B.P. in Rue’s Lago Yojoa core.

All these convergent Honduran data strongly support Ilitis’s model of teosinte/maize use. Although the early inhabitants of the Copán Valley were in some sense farmers or cultivators (judging from the concurrent signs of burning), they probably practiced a mixed economy that included many wild resources. Whatever form of Zea was present by 2600–2700 B.C. (and again it does not matter much if it was maize or an introduced teosinte), it seems not to have been locally used and manipulated in ways that stimulated the rapid emergence of a staple, storable grain. Furthermore, domestic maize with large, well-developed ears (wherever it was domesticated) seems not to have been introduced early on into either the Copán Valley or the El Gigante region.

Joyce and Henderson (2001) report remains of well-established farming settlements at Puerto Escondido in northern Honduras dating to about 3600 B.P., a reasonable threshold for such a cultural adaptation both there and elsewhere in Mesoamerica. Even this late, however, there is no necessary implication that sedentary, pottery-using villagers consumed maize as a staple. Stable isotope analysis of ancient human bone rarely indicates even moderate dietary dependence on maize anywhere in Mesoamerica before 3000 B.P. (Smalley and Blake 2003:684). Copán’s farmers might still have consumed it as a vegetable or as a sugary juice as recently as Middle Preclassic times. A large sample of late Copán burials has isotopic signatures of very high maize intake (Reed 1997), but with no comparable information from Preclassic skeletons we do not know how early this dietary pattern became established.

Significant in this regard is that even the comparatively late Honduran cobs so far examined from El Gigante cave are very small, typically two inches or so in length. By this time, of course, the little ears were certainly a source of grain, although not necessarily major sources of caloric intake. Smalley and Blake (2003) suggest that the early sociocultural impact of teosinte and early maize derived from its use as the basis for a mildly alcoholic “beer” or chicha.

Moving farther afield, all these Honduran data are consistent with a picture of early horticulture now emerging elsewhere in southern and eastern Mesoamerica (Pohl et al. 1996) and Central America as far south as Panama (see discussion in Smith 1995b). Horn and Kennedy (2001) report Zea pollen and charcoal data very similar to our own from wetlands in Costa Rica. Large Zea pollen has been dated to as early as 5,000 calendar years B.C. in the Grijalva River delta of Mexico, along with slightly earlier signs of forest clearing (Pope et al. 2001). If the most recent reconstructions of the chronology of maize domestication are correct (Matsuoka et al. 2002), the presence such early Zea in the tropical lowlands is perfectly plausible. We seem to be broadly detecting vegetation signatures of human activity long before well-documented archaeological evidence for the presence of farming populations, just as Ilitis predicts. Some of these signatures predate, although not by much, the earliest accelerator mass spectrometer date on Mesoamerican maize macrofossils—4250 B.C.—as recently reported by Piperno and Flannery (2001) and Benz (2001).

Nor should this be surprising. Many archaeologists overlook (or at least fail to mention) that the Caribbean tradition of maize use accords very well with Ilitis’s model for early Mesoam-
ECONOMIC BOTANY

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