Liste erstellt am 2014-08-06

References

Adair 2003

Mary J. Adair, *Great Plains Paleoethnobotany*. In: Paul E. Minnis (Hrsg.), *People and Plants in Ancient Eastern North America*. (Washington 2003).

Axtell 2002

Robert L. Axtell et al., *Population growth and collapse in a multiagent model of the Kayenta Anasazi in Long House Valley*. PNAS **99** (2002), 7275–7279.

Robert L. Axtell, Joshua M. Epstein, Jeffrey S. Dean, George J. Gumerman, Alan C. Swedlund, Jason Harburger, Shubha Chakravarty, Ross Hammond Jon Parker and Miles Parker

Long House Valley in the Black Mesa area of northeastern Arizona (U.S.) was inhabited by the Kayenta Anasazi from about 1800 before Christ to about anno Domini 1300. These people were prehistoric ancestors of the modern Pueblo cultures of the Colorado Plateau. Paleoenvironmental research based on alluvial geomorphology, palynology, and dendroclimatology permits accurate quantitative reconstruction of annual fluctuations in potential agricultural production (kg of maize per hectare). The archaeological record of Anasazi farming groups from anno Domini 200-1300 provides information on a millennium of sociocultural stasis, variability, change, and adaptation. We report on a multiagent computational model of this society that closely reproduces the main features of its actual history, including population ebb and flow, changing spatial settlement patterns, and eventual rapid decline. The agents in the model are monoagriculturalists, who decide both where to situate their fields as well as the location of their settlements. Nutritional needs constrain fertility. Agent heterogeneity, difficult to model mathematically, is demonstrated to be crucial to the high fidelity of the model.

Barlow 2002

K. Renee Barlow, *Predicting Maize Agriculture among the Fremont: An Economic Comparison of Farming and Foraging in the American Southwest*. American Antiquity **67** (2002), 65–88.

Variation in the costs and benefits of maize agriculture relative to local foraging opportunities structured variation in the relative intensity of agricultural strategies pursued by prehistoric peoples in the American Southwest. The material remains of Fremont farmers and horticulturists, long identified as the northern peripheryöf Southwestern archaeological traditions, are examined as a case representing extreme intersite variation in the economic importance of farming. New data quantifying the energetic gains associated with maize agriculture in Latin America are compared to caloric return rates for hunting and collecting indigenous foods. These data suggest that prehistoric maize farming was economically comparable to many local wild plants, but that intensive farming practices were most similar to very low-ranked seeds. The model predicts a continuum of prehistoric strategies that included horticulture within a system of indigenous resource collection and high residential mobility at one end, and at the other sedentary farmers heavily invested in agricultural activities with residences maintained near fields during a significant

portion of the growing season. Differences in agricultural strategies should have been strongly influenced by the effects of local ecology on the marginal gains for time spent in maize fields and the abundance of key, high-ranked wild foods, not harvest yields per se. Increasing agricultural investments are expected with decreasing opportunities to collect higher-ranked foods, while decreases in time spent farming are expected only with increases in alternative economic opportunities.

Bartlett 1969

Alexandra S. Bartlett, Elso S. Barghoorn & Rainer Berger, *Fossil Maize from Panama*. science **165** (1969), 389–390.

Abstract. Wild maize, agricultural maize, and associated Manihot fossil pollen indicative of early agriculture after about 7300 years ago have been discovered in the Gatun basin, Panama. The course of rising sea level in the Canal Zone during the past 11,300 years is calculated.

Benson 2003

Larry Benson, Linda Cordell, Kirk Vincent, Howard Taylor, John Stein, G. Lang Farmer & Kiyoto Futa, *Ancient maize from Chacoan great houses: Where was it grown?* PNAS **100** (2003), 13111–13115.

pnas100-13111-Supplement.zip

In this article, we compare chemical (87Sr/86Sr and elemental) analyses of archaeological maize from dated contexts within Pueblo Bonito, Chaco Canyon, New Mexico, to potential agricultural sites on the periphery of the San Juan Basin. The oldest maize analyzed from Pueblo Bonito probably was grown in an area located 80 km to the west at the base of the Chuska Mountains. The youngest maize came from the San Juan or Animas river floodplains 90 km to the north. This article demonstrates that maize, a dietary staple of southwestern Native Americans, was transported over considerable distances in pre-

Columbian times, a finding fundamental to understanding the organization of pre-Columbian southwestern societies. In addition, this article provides support for the hypothesis that major construction events in Chaco Canyon were made possible because maize was brought in to support extra-local labor forces.

Benz 1990

Bruce F. Benz & Hugh H. Iltis, *Studies in Archaeological Maize I: The "Wild" Maize from San Marcos Cave Reexamined*. American Antiquity **55** (1990), 500–511.

Cobs of the earliest known archaeological maize from San Marcos Cave in the Tehuacan Valley were reexamined to estimate their morphological similarity to extant Mexican maize races. Cursory examination of these 7,000-year-old specimens aroused suspicion that they are not very closely related morphologically to any thusfar-described modern Mexican race. Statistical comparison of the Tehuacan specimens with 30 races of Mexican maize fully confirmed this suspicion. However, the inclusion in our statistical analysis of an extant race of popcorn from Argentina morphologically similar to the Tehuacan specimens indicated that the two were virtually indistinguishable. These findings imply that the earliest maize from Tehuacan already was fully domesticated, its cobs exhibiting a morphology one would expect had maize evolved from teosinte by way of catastrophic sexual transmutation (Iltis 1983).

Boyd 2006

M. Boyd, C. Surette & B. A. Nicholson, *Archaeobotanical evidence of prehistoric maize (Zea mays) consumption at the northern edge of the Great Plains*. Journal of Archaeological Science **33** (2006), 1129–1140.

Analysis of starch granules, phytoliths, and plant macrofossils from archaeological features and carbonized food residue provides important new insight into the extent of prehistoric maize (Zea mays) consumption on the North American Great Plains. These data suggest that consumption of maize, and probably other cultigens, was widespread on the eastern Canadian Prairies between approximately AD 1000 and 1600. Domesticated plants may have been grown locally, acquired through trade, or transported into the region following dispersal of family groups from horticultural villages located elsewhere. However, the lack of strong artifactual evidence of gardening, and the small-scale nature of sites on the eastern Canadian Prairies indicate that local horticulture, if practiced, was non-intensive.

Bray 1976

Warwick Bray, *From predation to production: the nature of agricultural evolution in Mexico and Peru*. In: G. de G. Sieveking, I. H. Longworth & K. E. Wilson (Hrsg.), *Problems in Economic and Social Archaeology*, *Festschrift für Grahame Clark*. (1976), 73–95.

Bryant 2003

Vaughn M. Bryant, *Invisible Clues to New World Plant Domestication*. science **299** (2003), 1029–1030.

Bush 1989

Mark B. Bush, Dolores, R. Piperno & Paul A. Colinvaux, *A 6 000 year history of Amazonian maize cultivation*. nature **340** (1989), 303–305.

We present pollen and phytolith evidence for maize (Zea mays L.) cultivation in lowland Ecuadorian Amazonia as early as 5,300 radiocarbon years BP (before present), equivalent to about 6,000 calendar years BP'. This date for maize cultivation is more than 2,000 years earlier than any previously reported from the Amazon basin2. Although maize has been cultivated for at least 7,000 years in Mexico3'4, the manner of its dispersal through South America is still uncertain2'6. Evidence from coastal Ecuador6 suggests that maize had been taken south across the equator by 7,000 years BP. The oldest macrofossil evidence from Ecuador, however, is from about 3,400 years BP7. Our discovery of Zea microfossils in Amazonian lake sediments from Ecuador at about 6,000 years BP suggests that maize cultivation spread into the Amazon lowlands soon after its arrival in South America.

Chapman 1987

Jefferson Chapman and Gary D. Crites, *Evidence for Early Maize (Zea Mays) from the Icehouse Bottom Site, Tennessee*. American Antiquity **52** (1987), 352–354.

Coltrain 2002

Joan Brenner Coltrain & Steven W. Leavitt, *Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin*. American Antiquity **67** (2002), 453–485.

Research reported here is based on the stable isotope (6'3C, 615N) and radiocarbon chemistry of Fremont burials from wetlands lining the eastern shores of the Great Salt Lake (GSL). Bone collagen stable isotope signatures covary with reliance on maize and intake of animal protein, facilitating useful reconstructions of past diet. Among the GSL Fremont, economic strategies vary over time with an initial increase in reliance on maize (A.D. 400-850)followed by a period of marked economic diversity (A.D 850-1150) then a return to reliance on wildfoods (afterA.D. 1150). During the period of greatest economic diversity, male andfemale diets vary significantly and male diets are correlated with status differences evidenced by grave goods. There is also a clear temporal correlation between the rapid abandonment of maize agriculture and significant moisture anomalies in regional tree-

ring chronologies and pollen profiles. These results are discussed in the context of recent arguments regarding economic diversity, social complexity, and the demise of the Fremont.

Conard 1984

Nicholas Conard, David L. Asch, Nancy B. Asch, David Elmore, Harry Gove, Meyer Rubin, James A. Brown, Michael D. Wiant, Kennet, *Accelerator radiocarbon dating of evidence for prehistoric horticulture in Illinois*. nature **308** (1984), 443–446.

With the development of direct detection radiocarbon dating, which uses an accelerator as part of a highly selective mass spectrometer, it is now possible to determine the age of milligram samples of organic materials1"5. One application of accelerator dating is in evaluating scanty, sometimes controversial evidence for early horticulture throughout the world. We have now used the technique to date small samples of carbonized, cultivated plant remains from archaeological sites in Illinois. The results, reported here, establish (1) that squash was introduced by 7,000 yr ago, 2,500 yr before eastern North American records previously reported; (2) that horticulture involving indigenous plants had begun by 4,000 BP in eastern North America with domestication of Iva anniio, a small-seeded annual; (3) that anomalous discoveries of Archaic period maize represent contaminants; and (4) that introduction of maize by initial Middle Woodland times (-2,000 BP) is questionable.

Cook 2007

Robert A. Cook, *Single component sites with long sequences of radiocarbon dates: The Sunwatch site and Middle Fort Ancient village growth*. American Antiquity **72** (2007), 439–460.

Radiocarbon dates from single-component prehistoric sites often span temporal sequences too long to be accounted for by spatial overlap in the patterning of features. One such example is the SunWatch site, which was long interpreted as a single-component occupation of relatively short duration (15-20 years), although the radiocarbon sequence comfortably spans a 500-year period (ca. A.D. 1000 to 1500). This study compares spatial contexts of the SunWatch radiocarbon dates with other temporal indicators, including architectural rebuilding, feature form and volume, and diagnostic artifact attributes. Two distinct portions of the radiocarbon sequence can be accounted for by reference to these other lines of evidence. Village growth is linked with internal and external processes, including the arrival of a small Mississippian group and the possibility of site reoccupation, common among shifting agricultural systems.

Crawford 1997

Gary W. Crawford, David G. Smith, Vandy E. Bowyer, *Dating the Entry of Corn (Zea Mays) into the Lower Great Lakes Region*. American Antiquity **62** (1997), 112–119.

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.

Crawford 2003

Gary W. Crawford & David G. Smith, *Paleoethnobotany in the Northeast*. In: Paul E. Minnis (Hrsg.), *People and Plants in Ancient Eastern North America*. (Washington 2003).

Diehl 1996

Michael W. Diehl, *The Intensity of Maize Processing and Production in Upland Mogollon Pithouse Villages A.D. 200–1000*. American Antiquity **61** (1996), 102–115.

Analyses of the size, shape, and wear on western Mogollon manos and metates reveal that the dietary importance of maize remained low and stable from the Early Pithouse period (A.D. 200-550) through the Georgetown phase (A.D. 550-700). The consumption of maize increased during the San Francisco phase (A.D. 700-825/850) and continued to increase through the Three Circle phase (A.D. 825/850-1000). Changes in the ubiquity of charred pieces of maize (Zea mays) from paleoethnobotanical samples also indicate an increase in maize consumption from the Early Pithouse period through the Three Circle phase. The onset of increased maize consumption roughly coincided with the introduction of an improved variety of eightrow maize, around A.D. 650-700 (Upham et al. 1987). The analyses presented in this study do not agree with recent suggestions (Gilman 1987; Mauldin 1991) that maize consumption in the western Mogollon region remained stable and low until the Classic Mimbres phase (A.D. 1000-1150).

Diehl 2005

Michael W. Diehl, *Morphological observations on recently recovered Early Agricultural period maize cob fragments from Southern Arizona*. American Antiquity **70** (2005), 361–375.

Metric analyses of recently excavated maize (Zea mays, L.) cupules and cob fragments from Early Agricultural period (2000 B.C.-A.D. 50) sites in southern Arizona indicate that early maize cultivars produced small cobs with small cupules. Although it is risky to generalize about the yield potential of a plant that may have no compelling modern analogues, this work provides further support for the claim that ancient Tucson Basin maize plants provided relatively low yields as compared with more recent varieties.

Elson 2002

Mark D. Elson, Michael H. Ort, S. Jerome Hesse & Wendell A. Duffield, *Lava, Corn, and Ritual in the Northern Southwest*. American Antiquity **67** (2002), 119–135.

Fifty-five pieces of lava with impressions of prehistoric corn have recently been recovered from NA 860, a small habitation site near Sunset Crater Volcano in northern Arizona. Archaeological, geological, and botanical information suggest that husked ears of corn were deliberately placed in the lava's path when the volcano erupted in the mid-to-late eleventh century A.D. Over 40 kg of basalt lava containing the hardened corn casts were then taken to NA 860 located 4 km away from the lava flow. At the site, the rocks underwent lithic reduction to expose the casts. We suggest that these corn rocksäre indicative of ritual practices, perhaps serving as an offering made to appease the forces responsible for the eruption. Although both prehistoric and modern offerings are commonly associated with volcanoes in other parts of the world, this is the first evidence from the Southwest United States of possible ritual behavior related to volcanism.

Eubanks 1997

Mary Eubanks, *Reevaluation of the Identification of Ancient Maize Pollen from Alabama*. American Antiquity **62** (1997), 139–145.

Fearn and Liu (1995) reported positive identification of a large Poaceae pollen grain recovered from a lake bed core in Alabama dating to 3500 B.P as Zea mays. Reinterpretation of old data and new data reported here indicate this identification is questionable. Review of the evidence at hand indicates the most likely identification of the pollen grain in question is Tripsacum, although it could be primitive maize, teosinte, or Zea ïndiana,ä hybrid between Tripsacum and teosinte. Until the sample size is expanded and a firm identification can be made, caution is urged in interpretations about the significance of thisfindfor early maize agriculture in eastern North America.

Eyre-Walker 1998

Adam Eyre-Walker, Rebecca L. Gaut, Holly Hilton, Dawn L. Feldman & Brandon S. Gaut, *Investigation of the bottleneck leading to the domestication of maize*. PNAS **95** (1998), 4441–4446.

ABSTRACT Maize (Zea mays ssp. mays) is genetically diverse, yet it is also morphologically distinct from its wild relatives. These two observations are somewhat contradictory: the first observation is consistent with a large historical population size for maize, but the latter observation is consistent with strong, diversity-limiting selection during maize domestication. In this study, we sampled sequence diversity, coupled with simulations of the coalescent process, to study the dynamics of a population bottleneck during the domestication of maize. To do this, we determined the DNA sequence of a 1,400-bp region of the Adh1 locus from 19 individuals representing maize, its presumed progenitor (Z. mays ssp. parviglumis), and a more distant relative (Zea luxurians). The sequence data were used to guide coalescent simulations of population bottlenecks associated with domestication. Our study confirms high genetic diversity in maize-maize contains 75is more diverse than its wild relative, Z. luxurians-but it also suggests that sequence diversity in maize can be explained by a bottleneck of short duration and very small size. For example, the breadth of genetic diversity in maize is consistent with a founding population of only 20 individuals when the domestication event is 10 generations in length.

Fagan 1993
Brian M. Fagan, *Das frühe Nordamerika, Archäologie eines Kontinents.* (München 1993). Original: Ancient North America (London 1991).

Fearn 1995
Miriam L. Fearn & Kam-Biu Liu, *Maize Pollen of 3500 B.P. From Southern Alabama.* American Antiquity **60** (1995), 109–117.
A large Gramineae pollen, positively identified as corn (Zea mays), from the sediments of Lake Shelby in coastal Alabama at a stratigraphic level securely dated to 3500 B.P. predates any other evidence for corn in eastern North America by at least 1,000 years. Currently, the most frequently cited and accepted date for corn in eastern North America is approximately 1800 B.P. from macrobotanical remains; however, several paleoecological studies have reported corn pollen in older contexts. The Lake Shelby pollen adds to a growing body ofmicrofossil evidence supporting the presence of maize in eastern North America much earlier than the macrobotanical records indicate. Corn was probably present in eastern as well as western North America by 3000 B.P.

Fearn 1997
Miriam L. Fearn & Kam-Biu Liu, *Identification of Maize Pollen: Reply to Eubanks.* American Antiquity **62** (1997), 146–148.
Eubanks bases her identification of the fossil pollen grain from Alabama as Tripsacum primarily on her calculated spinule density. To make those calculations, she used only our published photograph, and she assumed a grain expansion of 35 percent. She ignores the fact that the spinule density of the fossil pollen grain is actually the same as that of similarly treated Zea mays pollen. While there is always the possibility of a misidentification or of long-distance transport, the most likely interpretation remains that the 3500 B. P pollen grain is Zea mays and that it represents limited cultivation of ancient corn in southern Alabama.

Fish 1990
Suzanne K. Fish, Paul R. Fish & John Madsen, *Sedentism and Settlement Mobility in the Tucson Basin Prior to A.D. 1000.* In: Paul E. Minnis & Charles L. Redman (Hrsg.), *Perspectives on Southwestern Prehistory.* Investigations in American Archaeology (Boulder 1990), 76–91.

Fritz 1994
Gayle J. Fritz, *Are the First American Farmers Getting Younger?* Current Anthropology **35** (1994), 305–309.

Fussell 1994
Betty Fussell, *The Story of Corn.* (New York 1994).

Galinat 1984
Walton C. Galinat, Paul C. Mangelsdorf & Hugh H. Iltis, *The Origin of Maize.* science **225** (1984), 4093–4096.

Hart 2003

John P. Hart, Robert G. Thompson & Hetty Jo Brumbach, *Phytolith Evidence for Early Maize (Zea Mays) in the Northern Finger Lakes Region of New York*. American Antiquity **68** (2003), 619–640.

The timing of crop introductions, particularly of maize (Zea mays), has been of long-standing interest to archaeologists working in various regions of eastern North America. The earliest confirmed macrobotanical evidence for maize in New York is A.D. 1000. We report on the results of accelerator mass spectrometer (AMS) dating, phytolith analysis, and stable carbon isotope analysis of carbonized cooking residues adhering to the interior surface of pottery sherds from three sites in the northern Finger Lakes region of New York. Maize, squash (Cucurbita sp.), wild rice (Zizania aquatica), and sedge (Cyperus sp.) were identified in phytolith assemblages dating to as early as the first half of the calibrated seventh century A.D. The results demonstrate that low 613C values on cooking residues cannot be used to preclude the possibility that maize was cooked in vessels. Two of the maize-bean-squash crop triad were present in New York at least 350 years earlier than previously documented, and the Northern Flint Corn Complex was present in New York by at least the first half of the seventh century A.D. This research highlights the potential of cooking residues to provide new insights on prehistoric plantbased subsistence.

Hart 2005

John P. Hart & Hetty Jo Brumbach, *Cooking Residues, AMS Dates, and The Middle-To-Late Woodland Transition In Central New York*. Northeast Antropology **69** (2005), 1–34.

A series of 50 AMS dates on charred cooking residues removed from the interiors of pottery sherds is reviewed. The sherds were recovered from many of the key sites and components used by Ritchie and Funk to create the Woodland Stage of their New York culture history; we are now able to securely date these sites and components. The cooking residue dates demonstrate that the so-called Middle-to-Late Woodland transition in central New York is not as well understood as was previously thought. Pottery vessels attributable to Ritchie and MacNeish's early Point Peninsula types are dated as early as 300 B.C. to A.D. 5, and pottery vessels attributable to their Late Woodland Öwascotypes appear as early as AD 400-600. There is also substantial temporal overlap between types assigned to their Point Peninsula and Owasco types. These data, along with subsistence and settlement data published elsewhere argue that the last 2500 years of New York State's pre-European-contact Native American history is in need of substantial revision.

Hart 2007

John P. Hart, Hetty Jo Brumbach & Robert Lusteck, *Extending the phytolith evidence for early maize (Zea mays ssp. mays) and squash (Cucurbita sp.) in central New York*. American Antiquity **72** (2007), 563–583.

The timing of the adoptions of maize and squash across eastern North America has been a topic of long-standing interest among archaeologists and paleoethnobotanists. The use of flotation for macrobotanical remains beginning in the 1960s and 1970s coupled with the application of accelerator mass spectrometry dating beginning in the 1980s has led to substantial revisions of knowledge about the history of these crops in the region. A complementary source of evidence for the crops' histories in the eastern North America comes from opal phytoliths. Analysis of phytolith assemblages recovered from charred food residues has shown that maize

and squash were being used in central New York well before the macrobotanical record indicates. In combination with previously analyzed samples, 16 additional residue assemblages help to clarify the history of maize and squash in central New York. The results indicate that maize and squash were being used in New York by 2270 B.R and 2945 B.R, respectively.

Holst 2007

Irene Holst, J. Enrique Moreno & Dolores R. Piperno, *Identification of teosinte, maize, and Tripsacum in Mesoamerica by using pollen, starch grains, and phytoliths*. PNAS **104** (2007), 17608–17613.

pnas104-17608-Supplement.html, pnas104-17608-Supplement.zip

We examined pollen grains and starch granules from a large number of modern populations of teosinte (wild Zea spp.), maize (Zea mays L.), and closely related grasses in the genus Tripsacum to assess their strengths and weaknesses in studying the origins and early dispersals of maize in its Mesoamerican cradle of origin. We report new diagnostic criteria and question the accuracy of others used previously by investigators to identify ancient maize where its wild ancestor, teosinte, is native. Pollen grains from teosinte overlap in size with those of maize to a much greater degree than previously reported, making the differentiation of wild and domesticated maize in palynological studies difficult. There is presently no valid method for separating maize and teosinte pollen on a morphological basis. Starch grain analysis, a recently developed tool of archaeobotany, appears to be of significant utility in distinguishing the seeds of teosinte from maize. We propose that the differences in starch grain morphology and size between wild and domesticated maize defined in this study may be associated with domestication genes in Zea that have been documented in the starch biosynthesis pathway. As previously reported, phytoliths effectively discriminate the female reproductive structures of Tripsacum, teosinte, and maize. Multiproxy microfossil studies of archaeological and paleoecological contexts appear to be effective tools for investigating the earliest stages of maize domestication and dispersals.

Hutchinson 1998

Dale L. Hutchinson, Clark Spencer Larsen, Margaret J. Schoeninger & Lynette Norr, *Regional Variation in the Pattern of Maize Adoption and Use in Florida and Georgia*. American Antiquity **63** (1998), 397–416.

Dietary reconstruction using carbon and nitrogen stable isotopes from archaeological human bone samples from coastal Georgia anil northern and Gulf Coast Florida dating between 400 B.C. and A.D. 1700 serves to Illustrate the complexity of the agricultural transition in that region. Isotope analysis of 185 collagen samples drawn from early prehistoric, late prehistoric, and contact-period mortuary sites encompasses two major adaptive shifts in the region, namely the adoption of maize agriculture in late prehistory and the increased emphasis on maize during the mission period. Prior to European contact- and especially before the establishment of Spanish missions among the Guale, Yamasee, Timucua, and Apahichee tribal groups-diet was strongly influenced by local environmental factors. Before contact, coastal and inland populations had different patterns of food consumption, as did populations living in Georgia and Florida. Coastal populations consumed more marine and less terrestrial foods than inland populations. In general, maize was adopted during the eleventh century A.D. by virtually all Georgia populations. However, with the exception of the Lake Jackson site, a major Mississippian center in northern Florida, Florida populations show little use of maize before contact. Following European contact, maize became widespread, regardless of location or habitat within the broad region of Spanish Florida. Missionization appears to have

been an important factor in the convergence of native diets toward agriculture and away from foraging. This increased emphasis on maize contributed to a decline in quality of life for native populations.

Jaenicke-Després 2003

Viviane Jaenicke-Després, Ed S. Buckler, Bruce D. Smith, M. Thomas P. Gilbert, Alan Cooper, John Doebley & Svante Pääbo, *Early Allelic Selection in Maize as Revealed by Ancient DNA*. science **302** (2003), 1206–1208.

Maize was domesticated from teosinte, a wild grass, by 6300 years ago in Mexico. After initial domestication, early farmers continued to select for advantageous morphological and biochemical traits in this important crop. However, the timing and sequence of character selection are, thus far, known only for morphological features discernible in corn cobs. We have analyzed three genes involved in the control of plant architecture, storage protein synthesis, and starch production from archaeological maize samples from Mexico and the southwestern United States. The results reveal that the alleles typical of contemporary maize were present in Mexican maize by 4400 years ago. However, as recently as 2000 years ago, allelic selection at one of the genes may not yet have been complete.

Kidder 1993

Tristram R. Kidder & Gayle J. Fritz, *Subsistence and Social Change in the Lower Mississippi Valley: The Reno Brake and Osceola Sites, Louisiana*. Journal of Field Archaeology **20** (1993), 281–297.

There are few systematic analyses of late prehistoric subsistence practices in the Lower Mississippi Valley. Nonetheless, traditional scenarios attribute the advent of large-scale social and political complexity during the Coles Creek (ca. A.C. 700-1200) and early Mississippi (ca. A.C. 1200-1500) periods to maize agriculture and a consequent food surplus. Subsistence studies, however, do not substantiate claims for intensive maize cultivation prior to A.C. 1000. The goal of the Osceola Project is to characterize subsistence practices and changes through time and to relate these patterns to innovations in social and political organization during the nearly 1500 years leading up to and including the Mississippi period. Information from several sites in the Tensas Basin of Louisiana points to a late Middle Woodland and early Late Woodland pattern of reliance on wild local foods, possibly supplemented by limited plant food production. Corn is found first in Late Coles Creekperiod contexts (ca,. A.C. 1000-1200) but was not necessarily an important dietary staple. Data from the Osceola Project suggest that the initial construction of planned sites with large earthen mounds during the Coles Creek period predates the appearance of an intensified food production economy by at least several hundred years.

Kohler 2008

Timothy A. Kohler, Matt Pier Glaude, Jean-Pierre Bocquet-Appel & Brian M. Kemp, *The Neolithic Demographic Transition in the U. S. Southwest*. American Antiquity **73** (2008), 645–669.

Maize agriculture was practiced in the U.S. Southwest slightly before 2000 B. C., but had a negligible impact on population growth rates until the development or introduction of more productive landraces; the ability to successfully cultivate maize under a greater variety of conditions, with dry farming especially important; the addition of beans, squash, and eventually turkey to the diet; increased sedentism; and what we infer to be the remapping of exchange networks and the

development of efficient exchange strategies in first-millenium-A.D. villages. Our estimates of birthrates and growth rates are derived from the proportions of immature individuals among human remains. These proportions are somewhat affected by warfare in our region, and perhaps also by climate. Nevertheless, there is a strong identifiable Neolithic Demographic Transition signal in the U.S. Southwest in about the mid-first-millennium A.D. in most subregions, visible a few hundred years after the introduction of well-fired ceramic containers, and more or less contemporaneous with the first appearance of villages. Independent genetic data derived from the mitochondrial genomes of present-day indigenous populations of the Southwest are also consistent with the hypothesis that a major demographic expansion occurred 1500–2000 years ago in the Southwest.

Little 1995

Elizabeth A. Little & Margaret J. Schoeninger, *The Late Woodland Diet on Nantucket Island and the Problem of Maize in Coastal New England*. American Antiquity **60** (1995), 351–368.

Carbon and nitrogen isotope ratios of () bone collagen from six burials of the Late Woodland Period at Nantucket Island, Massachusetts, and (2) a wide range of potential dietary materials provide data for evaluating coastal diets. Archaeological and historical data give evidence for the availability and use of dietary items. The bases of the food chains and trophic levels define the possible food groups: terrestrial C3 and C4 plants and their consumers, marine C3 or C4-like plants and their consumers, and marine carnivores. From these data, computer analysis of multiple linear mixing equations relating isotope ratios of human bone collagen to those of dietaryfood groups shows allowable ranges of these food groups in the diet. The results argue for a diet of 40-65 percent oceanic animals, with the rest consisting of substantial amounts of animals from salt marsh and eelgrass meadows or of maize, and minor amounts of C3 plants and their consumers.

Little 2002

Elizabeth A. Little, *Kautantouwit's Legacy: Calibrated Dates on Prehistoric Maize in New England*. American Antiquity **67** (2002), 109–118.

This paper (1) presents four new AMS dates taken directly on prehistoric maize found in New England; (2) collects in one place and in a common format the 16 currently available dates directly on maize from the region; (3) shows, by comparing dates on charcoal or shell associated with 10 of these maize samples, that charcoal and shell are not reliable proxies for dating maize; and (4) draws several archaeological inferences from the dataset. First, a cluster of dates between about cal A.D. 1250 and 1450 that are temporally concentrated but spatially widespread suggests a relatively sudden increase in the archaeological visibility of maize in New England at this time. The increase in visibility roughly coincides with an increase in maize consumption in the midcontinent, although further studies are needed to clarify the timing of the latter. Second and even more striking is the simultaneous increase in the archaeological visibility of beans as well as maize in New England during the same period, finally, preliminary evidence suggests that these increases may be related to the use of soils fertilized by alluvial limestone or old shell midden material.

Long 1989

Austin Long, B. F. Benz, D. J. Donahue, A. J. T. Jull & L. J. Toolin, *First Direct AMS Dates on Early Maize from Tehuacan, Mexico*. Radiocarbon **31** (1989), 1035–1040.

ABSTRACT. The Tehuacan region in Central Mexico is thought to be the locale of origin of Zea mays, or maize, a cultivated plant pivotal in the development of agriculture in the Americas (MacNeish, 1981, 1985). The age of the earliest maize, and its rate of dispersal are thus important components of cultural development in the New World. We have secured permission from the Federal Government of Mexico to date critical specimens from Tehuacan, which represent what are probably some of the earliest known stages of maize evolution. Twelve Zea mays samples have been dated, six from Cueva San Marcos and six from Cueva Coxcatlan. These were selected as having the best stratigraphic control and correlation with previously dated charcoal samples, and to represent the most ancient maize. Corn from Cueva San Marcos is oldest: four of the six specimens from this cave were within statistics of 4700 BP (uncalibrated). The oldest known domesticated corn is thus no older than 3600 cal BC (dendro-calibrated in calendric years).

Long 2001

Austin Long & Gayle J. Fritz, *Validity of AMS Dates on Maize from the Tehuacan Valley: A Comment on Macneish and Eubanks*. Latin American Antiquity **12** (2001), 87–90.

MacNeish and Eubanks (2000) reject the AMS radiocarbon dates on maize from the Tehuacdn Valley, claiming that the specimens were contaminated with a substance called Bedacryl. We do not believe that the dated fragments were contaminated, and we review the processes by which they were selected and analyzed. We also describe Bedacryl and conclude that, had it been present as a contaminant, the resulting I4C ages should have been older rather than younger than expected. Considered along with recent AMS dates on cuitigens from Tamaulipas, it seems evident that post-depositional disturbances in rock-shelter sites sometimes caused mixing of older and younger objects. Direct AMS radiocarbon daring is currently the best and least destructive way to determine whether or not an individual plan! specimen is the same age as seemingly associated wood charcoal.

McClung 1992

Emily McClung de Tapia, *The Origins of Agriculture in Mesoamerica and Central America*. In: C. Wesley Cowan & Patty Jo Watson (Hrsg.), *The Origins of Agriculture, An International Perspective*. (Washington 1992), 143–171.

McClung 2005

Emily McClung de Tapia, Irma Domínguez Rubio, Jorge Gama Castro, Elizabeth Solleiro & Sergey Sedov, *Radiocarbon Dates From Soil Profiles in the Teotihuacán Valley, Mexico: Indicators of Geomorphological Processes*. Radiocarbon **47** (2005), 159–175.

ABSTRACT. Radiocarbon dates largely obtained from bulk soil samples in 24 soil profiles in the Teotihuac • n Valley, Mexico, are reported insofar as they represent a first step towards developing a sequence of soil formation, erosion, vegetation change, and human impact during the Holocene. Limitations of 14C dating in the area are considered, particularly the absence of charcoal in sediments and poor preservation of pollen. A broad temporal scheme is proposed to guide future research in which 4 periods are defined: 5000-2000 BP (relative stability with short, intermittent episodes of erosion); 2000-1500 BP (erosion-sedimentation, deforestation, and intensive agriculture); 1500-1000 BP (relative stability, depopulation, and partial recovery of the landscape); and 1000-500 BP (erosion-sedimentation, deforestation, and intensive agriculture).

MacNeish 2000

Richard S. MacNeish & Mary W. Eubanks, *Comparative Analysis of the Rio Balsas and Tehuacan Models for the Origin of Maize*. Latin American Antiquity **11** (2000), 3–20.

This paper examines the archaeological and biological evidence for shifts in human subsistence strategies during the transition from hunting and foraging to maize agriculture as posited in the Rio Balsas, or lowland origin of maize, model and the Tehuacdn, or highland origin of maize, model. These are two different interpretations of the genetic evidence for the ancestry of maize, the archaeological evidence for plant exploitation, and the ecological evidence for paleoenvironments and climate change in the two regions. In contrast to Panama, where there is good evidence for progressive intensification of human forest disturbance by 10,000 B.P, horticulturalforest clearing by 8000 B.P, and slash-and-burn agriculture by 6000 B.P., the evidencefor Mesoamerica, where maize agriculture originated, fits a different picture of biocultural evolution. The lowland regions of Mexico, Guatemala, Belize, and probably Honduras, were apparently undisturbed, semi-evergreen forests around 10,000 B.P. New findings from experimental maize genetics, combined with the comprehensive archaeological picture from Tehucdn, Oaxaca, Tamaulipas, and the Valley of Mexico, support a highland Mesoamerican origin of maize.

MacNeish 2001

Richard S. MacNeish, *A Response to Long's Radiocarbon Determinations That Attempt to Put Acceptable Chronology on the Fritz*. Latin American Antiquity **12** (2001), 99–104.

Long and Fritz argue that AMS dates on early maize were rejected because MacNeish suspected they were contaminated with bedacryl. In fact a letter from MacNeish to Long in 1988 addressed several possible explanations for the problems with the dates. The dates were rejected because they were inconsistent with well-established stratigraphic sequences and associated artifacts and ecofacts. The evidence is briefly summarized here, and the inconsistencies in [he Arizona dates pointed out. It appears that the problem lies less with possible contamination with bedacryl, and more with the treatment of the samples by the Arizona laboratory.

Mangelsdorf 1938

P. C. Mangelsdorf & R. G. Reeves, *The Origin of Maize*. PNAS **24** (1938), 303–312.

Martienssen 1997

Rob Martienssen, *The origin of maize branches out*. nature **386** (1997), 443–445.

Matsuoka 2002

Yoshihiro Matsuoka, Yves Vigouroux, Major M. Goodman, Jesus Sanchez G., Edward Buckler & John Doebley, *A single domestication for maize shown by multilocus microsatellite genotyping*. PNAS **99** (2002), 6080–6084.

pnas099-06080-Supplement.zip

There exists extraordinary morphological and genetic diversity among the maize landraces that have been developed by preColumbian cultivators. To explain this high level of diversity in maize, several authors have proposed that maize landraces

were the products of multiple independent domestications from their wild relative (teosinte). We present phylogenetic analyses based on 264 individual plants, each genotyped at 99 microsatellites, that challenge the multiple-origins hypothesis. Instead, our results indicate that all maize arose from a single domestication in southern Mexico about 9,000 years ago. Our analyses also indicate that the oldest surviving maize types are those of the Mexican highlands with maize spreading from this region over the Americas along two major paths. Our phylogenetic work is consistent with a model based on the archaeological record suggesting that maize diversified in the highlands of Mexico before spreading to the lowlands. We also found only modest evidence for postdomestication gene flow from teosinte into maize.

Minnis 1992

Paul E. Minnis, *Earliest Plant Cultivation in the Desert Borderlands of North America*. In: C. Wesley Cowan & Patty Jo Watson (Hrsg.), *The Origins of Agriculture, An International Perspective*. (Washington 1992), 121–141.

Murphy 1971

James L. Murphy, *Maize from an Adena Mound in Athens County, Ohio*. science **171** (1971), 897–898.

Abstract. The discovery of a carbonized ear of maize in an Adena burial mound at Athens, Athens County, Ohio, is the first indisputable evidence of Adena maize horticulture. The mound contained typical middle Adena features, including a bark prepared burial, and has yielded charcoal radiocarbon dated at 280 B.C. +/- 140 years.

Pääbo 1999

Svante Pääbo, *Neolithic genetic engineering*. nature **398** (1999), 194–195.

Pearsall 1990

Deborah M. Pearsall & Dolores R. Piperno, *Antiquity of Maize Cultivation in Ecuador: Summary and Reevaluation of the Evidence*. American Antiquity **55** (1990), 324–337.

Identification of maize phytoliths from the Preceramic Vegas and Formative period Real Alto sites, Guayas Province, Ecuador, has raised the issue of the antiquity of maize in Ecuador. This paper reviews how maize is identified using phytoliths and addresses criticisms of this technique. Our reexamination of the original Vegas and Real Alto samples using Piperno's three-dimensional variant method confirms the presence of maize in western Ecuador by at least 5000 B.C. Remains of charred maize from other sites suggest that more than one race was being utilized by the Formative period.

Perry 2006

Linda Perry, Daniel H. Sandweiss, Dolores R. Piperno, Kurt Rademaker, Michael A. Malpass, Adán Umire & Pablo de la Vera, *Early maize agriculture and interzonal interaction in southern Peru*. nature **440** (2006), 76–79.

Over the past decade, increasing attention to the recovery and identification of plant microfossil remains from archaeological sites located in lowland South

America has significantly increased knowledge of pre-Columbian plant domestication and crop plant dispersals in tropical forests and other regions1-4. Along the Andean mountain chain, however, the chronology and trajectory of plant domestication are still poorly understood for both important indigenous staple crops such as the potato (Solanum sp.) and others exogenous to the region, for example, maize (Zea mays)5,6.Here we report the analyses of plant microremains from a late preceramic house (3,431 6 45 to 3,745 6 65 14C BP or ,3,600 to 4,000 calibrated years BP) in the highland southern Peruvian site ofWaynuna. Our results extend the record of maize by at least a millennium in the southern Andes, show on-site processing of maize into flour, provide direct evidence for the deliberate movement of plant foods by humans from the tropical forest to the highlands, and confirm the potential of plant microfossil analysis in understanding ancient plant use and migration in this region.

Piperno 1994

Dolores R. Piperno & Gayle J. Fritz, *On the Emergence of Agriculture in the New World, And Reply.* Current Anthropology **35** (1994), 637–643.

One wonders how she has the temerity to relegate every cultivated/domesticated plant of the tropical forest and adjacent forest margins (e.g., Sauer 1950, Hawkes 1989) to a food production system that began no earlier than mid-Hokic nt times. Many of these plants are notoriously difficult to document with the macrobotanical record because they do not carbonize well, the tropical climatic conditions quickly destroy plants deposited in habitation sites, and the sites themselves are difficult to locate and study with the traditional methods of field archaeology. Consequently, our knowledge of the history of a host of tropical crop plants is still frustratingly limited. However, placing the beginning of food production everywhere in the Neotropics to after 5,500 B.P. seems injudicious and is in fact refuted by recent pollen and phytolith studies of perennially wet areas near former occupation sites.

All the other records of microfossil maize from lake sediments cited by Piperno postdate 5,500 B.P., even after dendrocalibration. [...] One final point requires clarification. It is true that a later date for domestication of maize, squashes, and beans brings the Mesoamerican transition to farming more in line with the Old World Levantine transition by beginning with less mobile populations. [...] Phytolith analysis has been ignored and criticized in spite of the brilliant methodological advances pioneered by Piperno and other colleagues. The integration of microfossil evidence into the archaeological record vastly improves our understanding of past vegetation, climate, and subsistence. Chronometry, however, is a serious weakness in some pollen and phytolith studies. Until dating procedures are tightened up-with AMS dating of lake cores and far more dates per core or sediment column being an immediate option-I cannot accept the claims for 7th- or early 6th-millennium B.P. microfossil maize.

Pohl 2007

Mary E. D. Pohl, Dolores R. Piperno, Kevin O. Pope, & John G. Jones, *Microfossil evidence for pre-Columbian maize dispersals in the neotropics from San Andrés, Tabasco, Mexico.* PNAS **104** (2007), 6870–6875.

pnas104-06870-Supplement.html

The history of maize (Zea mays L.) is one of the most debated topics in New World archaeology. Molecular and genetic studies indicate that maize domestication took place in tropical southwest Mexico. Although archaeological evidence for

the evolution of maize from its wild ancestor teosinte has yet to be found in that poorly studied region, other research combining paleoecology and archaeology is documenting the nature and timing of maize domestication and dispersals. Here we report a phytolith analysis of sediments from San Andre' s, Tabasco, that confirms the spread of maize cultivation to the tropical Mexican Gulf Coast >7,000 years ago (7,300 calendar years before present). We review the different methods used in sampling, identifying, and dating fossil maize remains and compare their strengths and weaknesses. Finally, we examine how San Andre' s amplifies the present evidence for widespread maize dispersals into Central and South America. Multiple data sets from many sites indicate that maize was brought under cultivation and domesticated and had spread rapidly out of its domestication cradle in tropical southwest Mexico by the eighth millennium before the present.

Powell 1990

Shirley Powell, *Sedentism or Mobility: What Do the Data Say? What Did the Anasazi Do?* In: Paul E. Minnis & Charles L. Redman (Hrsg.), *Perspectives on Southwestern Prehistory*. Investigations in American Archaeology (Boulder 1990), 92–102.

Reber 2004

Eleanora A. Reber & Richard P. Evershed, *Identification of maize in absorbed organic residues: a cautionary tale*. Journal of Archaeological Science **31** (2004), 399–410.

Starchy grains are an essential part of human diet in most agricultural groups, and are attributed an important role in the development of complex societies. Maize is a starchy grain domesticated in Mesoamerica that was an important foodstuff throughout the Americas before Contact, and around the world afterwards. An experimental study of the degradation of maize lipids suggests that the unsaturated fatty acids comprising the majority of maize lipids degrade rapidly, producing a virtually unidentifiable organic residue after 3 months deposition. Compounds in maize lipids decompose variably, depending upon depositional environment, making calibration of organic residue degradation impracticable. Variable decomposition of components of absorbed organic residues makes a wider range of improved experimental studies important, and suggests that identifying maize, and by implication starchy grains, from chemical analysis of absorbed organic residues requires a wider range of approaches than those previously attempted.

Riley 1990

Thomas J. Riley, Richard Edging, Jack Rossen, George F. Carter, Gregory Knapp, Michael J. O'Brien & Karl H. Scherwin, *Cultigens in Prehistoric Eastern North America: Changing Paradigms [and Comments and Replies]*. Current Anthropology **31** (1990), 525–541.

The widely accepted view that eastern North America was a separate center of plant domestication has resulted in an increasingly isolationist perspective on the region's culture history and a neglect of research on the diffusion into it of tropical cultigens. New data on archaeobotanical macromorphologies, the chemical and chromosomal composition of archaeobotanical specimens, and the geographical distribution of archaeobotanical remains challenge old paradigms. In particular, the diffusion of tropical cultigens across the Caribbean must now be seriously considered. This paper reports on current research suggesting alternatives to existing paradigms in relation to four plants (maize, tobacco, beans, and chenopods) and

stresses prehistoric eastern North America's relationship to, instead of isolation from, Mesoamerica and South America.

Riley 1994

Thomas J. Riley, Gregory R. Walz, Charles J. Bareis, Andrew C. Fortier & Kathryn E. Parker, *Accelerator Mass Spectrometry (AMS) Dates Confirm Early Zea Mays in the Mississippi River Valley*. American Antiquity **59** (1994), 490–498.

Two accelerator mass spectrometry (AMS) dates obtained from samples of Zea mays from the Holding site, 1 JMS1] 18, in the American Bottom near East St. Louis, Illinois, establish the presence of maize in the Mississippi Valley between 170 B.C. and A.D. 60. The dates finally establish the occurrence of Middle Woodland maize in Illinois and are the earliest dates thus far for maize east of the Mississippi River. Other reports of early Middle Woodland maize in the Midcontinent region should not be discounted unless AMS dating and other supporting information show the maize to be a contaminant at the site at which it occurs. Recent stable carbon-isotope experiments suggest that the relative contribution of maize to Middle Woodland diets is still an open question.

Römkens 1998

Paul F. A. M. Römkens, Jan Hassink & Johannes van der Plicht, *Soil Organic ^{14}C Dynamics: Effects of Pasture Installation on Arable Land*. Radiocarbon **40** (1998), 1023–1031.

ABSTRACT. In a study addressing composition and recovery of soil carbon following pasture installation on arable land, radiocarbon isotope ratios were measured in size- and density-separated soil organic matter (SOM) fractions in a pasture and maize plot. The average soil carbon age increased with depth from 444 yr in the 0-30-

cm layer to 2456 yr in the 60–80-cm layer in the pasture soils, and from 42 to 1625 yr in the maize-cultivated soil. Weight fractionation of the macro-organic matter (size >150 um) in a light (density <1.17 g cm-3) intermediate (1.17 g cm'3 < density < 1.37 g cm'3), and heavy fraction (density >1.37g cm-3) resulted in markedly different ages for different fractions with ages increasing from 2 yr in the light fraction to >3000 yr in the heavy fractions. 13C and 14C (accelerator mass spectrometry (AMS)) isotope ratios in the <20 um fraction in the 60-80-cm layer indicated that vertical displacement of colloidal organic material occurred during maize cropping. The physical fractionation method, in combination with natural level 13C and 14C analysis, resulted in a better insight in carbon dynamics that occur after the conversion of arable land to pasture.

Rose 2008

Fionnuala Rose, *Intra-Community Variation in Diet During the Adoption of a New Staple Crop in the Eastern Woodlands*. American Antiquity **73** (2008), 413–439.

This study investigated intracommunity variation in diet during the introduction and adoption of a new staple crop (maize) into an indigenous horticultural system. Carbon and nitrogen isotopes of human bone collagen were analyzed from five sites in west-central Illinois, dating from the Middle Woodland to Mississippian periods, and the results contrasted with evidence from neighboring river valleys and the wider Eastern Woodlands area. Contrary to speculation, neither the initial adoption of maize nor subsequent intensification in its use were correlated with status, gender, or age. A striking bimodal distribution was observed in consumption of

native and introduced crops; growing or eating small amounts of maize was apparently not practiced. Fluoride dating confirms the burials are contemporary, and the pattern persists over several hundred years. Possible explanations include issues related to the economics of maize growing, household requirements for storage, exchange, or levies, or individual taste. Also notable were earlier-than-expected dates for intensive exploitation of the maize in this area, in the early Late Woodland, possibly as early as A.D. 400. Nitrogen isotope ratios were higher for males at all sites and time periods; the cause may have been greater access to dietary protein, or could be the result of physiological differences.

Rue 1989

David J. Rue, *Archaic Middle American Agriculture and Settlement: Recent Pollen Data from Honduras*. Journal of Field Archaeology **16** (1989), 177–184.

Data on Late Archaic period (5000-1000 B.C.) agriculture and settlement in SE Mesoa-merica and Lower Central America are reassessed in view of recent findings. Pollen data from Lake Yojoa in western Honduras are presented to support a re-synthesis of views on the development of food production systems in the region. Traditional interpretations of the cultural sequence surest that the area was colonized by agriculturalists relatively late (1000 B.C.) . Pollen from a core taken at Yojoa indicate that the region was inhabited by people practicing slash-and-burn maize horticulture by 3000 B.C., probably as a supplement to hunting and gathering systems. These and other data from throughout Middle America show that diffusion of maize cultivation from Mexico occurred earlier than expected to many areas of the Central American tropics.

Schroeder 1999

Sissel Schroeder, *Maize Productivity in the Eastern Woodlands and Great Plains of North America*. American Antiquity **64** (1999), 499–516.

Archaeologists and ethnohistorians have long been interested in quantifying potential maize productivity for late prehistoric and early historic Native Americans of the Eastern Woodlands. Maize yields obtained by Native Americans using traditional farming techniques in the nineteenth century are compared to yields obtained by nineteenth-

century Native Americans using plows, and nineteenth- and twentieth-

century farmers in Illinois and Missouri. The result is a notion of average resource productivity for maize that is more reasonable and modest than previous estimates. In this study, the mean yield of maize for nineteenth-century Native American groups who did not use plows was 18.9 bu/acre (stdev=4.1) (1,185.4 kg/ha [stdev-254.1]). Yields on the order of 10 bu/acre (627.2 kg/ha) probably are closer to the average prehistoric yields that were available for subsistence purposes. The mean size of gardens cultivated by nineteenth-century Native American families without plows was .59 acre (stdev=.45) (.24 ha [stdev=.18]). These newly compiled data are used to generate a model of nuclear family household economy and minimal and maximal garden sizes given different levels of maize productivity and consumption. Population estimates made on the basis of previous assessments of high rates of resource productivity will need to be reevaluated.

Sears 1982

Paul B. Sears, *Fossil Maize Pollen in Mexico*. science **216** (1982), 932–934.

Siemens 1988

Alfred H. Siemens, Richard J. Hebda, Mario Navarrete Hernández, Dolores R. Piperno, Julie K. Stein & Manuel G. Zolá Báez, *Evidence for a Cultivar and a Chronology from Patterned Wetlands in Central Veracruz, Mexico*. science **242** (1988), 105–107.

The patterning found in certain wetlands of lowland Mesoamerica has added an important element to the subsistence system that may be attributed to pre-Hispanic inhabitants of the region. The form of the remains, largely expressed in terms of surface vegetation, suggests agriculture on planting platforms, separated by canals. The physical and chemical aspects of the stratigraphy have clarified depositional environments but have not indicated agricultural horizons. Maize phytoliths at about 1 meter below the surface in two Central Veracruzan wetlands do confirm the practice of agriculture. Associated ceramics indicate wetlands agriculture was practiced by A.D. 500 and perhaps earlier.

Simmons 1986

Alan H. Simmons, *New Evidence for the Early Use of Cultigens in the American Southwest*. American Antiquity **51** (1986), 73–89.

Recent excavations near Chaco Canyon in northwestern New Mexico have yielded evidence for the use of cultigens by the early second millennium B.C. and continuing into the first millennium B.C. This information comes from four sites, all of which have been radiocarbon dated. The evidence for the oldest use of a cultigen, maize, is in the form of pollen; however, macrobotanical specimens of maize or squash were also recovered from sites dating to the Late Archaic. These data are summarized, as are their significance and implications.

Sluyter 2006

Andrew Sluyter & Gabriela Dominguez, *Early maize (Zea mays L.) cultivation in Mexico: Dating sedimentary pollen records and its implications*. PNAS **103** (2006), 1147–1151.

A sedimentary pollen sequence from the coastal plain of Veracruz, Mexico, demonstrates maize cultivation by 5,000 years ago, refining understanding of the geography of early maize cultivation. Methodological issues related to bioturbation involved in dating that record combine with its similarity to a pollen sequence from the coastal plain of Tabasco, Mexico, to suggest that the inception of maize cultivation in that record occurred as much as 1,000-2,000 years more recently than the previously accepted 7,000 years ago. Our analysis thereby has substantive, theoretical, and methodological implications for understanding the complex process of maize domestication. Substantively, it demonstrates that the earliest securely dated evidence of maize comes from macrofossils excavated near Oaxaca and Tehuaca'n, Mexico, and not from the coastal plain along the southern Gulf of Mexico. Theoretically, that evidence best supports the hypothesis that people in the Southern Highlands domesticated this important crop plant. Methodologically, sedimentary pollen and other microfossil sequences can make valuable contributions to reconstructing the geography of early maize cultivation, but we must acknowledge the limits to precision that bioturbation in coastal lagoons imposes on the dating of such records.

Smith 1989

Bruce D. Smith, *Origins of Agriculture in Eastern North America*. science **246** (1989), 1566–1571.

As a result of research carried out over the past decade, eastern North America now provides one of the most detailed records of the origins of agriculture available. Spanning a full three millennia, the transition from forager to farmer in eastern North America involved the domestication of four North American seed plants during the second millennium B.C., the initial emergence of food production economies based on local crop plants between 250 B.C. and A.D. 200, and the rapid and broad-scale shift to maize-centered agriculture during the three centuries from A.D. 800 to 1100.

Smith 1992

Bruce D. Smith, *Prehistoric Plant Husbandry in Eastern North America*. In: C. Wesley Cowan & Patty Jo Watson (Hrsg.), *The Origins of Agriculture, An International Perspective*. (Washington 1992), 101–119.

Smith 1997

Bruce D. Smith, *Reconsidering the Ocampo Caves and the Era of Incipient Cultivation in Mesoamerica*. Latin American Antiquity **8** (1997), 342–383.

In northeastern Mexico, near Ocampo, Romero's and Valenzuela's caves have been central to explanations of agricultural origins in Mesoamerica for more than four decades. Along with caves in Tehuacdn and Oaxaca, these Öcampo caves"have provided almost all of the available evidence for the initial appearance of a number of key Mesoamerican crop plants, including maize, beans, and squash. This article reanalyzes the cultural and temporal context of five crop plant assemblages in the Ocampo caves: maize (Zea mays), bottle gourd (Lagenaria siceraria), and three species of squash (Cucurbita argyrosperma, C. moschata, C. pepo). Fifteen AMS radiocarbon dates on early domesticates both confirm the stratigraphic integrity of the two caves and substantially revise the temporal framework for initial appearance of core domesticates in northeastern Mexico, showing the transition to food production in Tamaulipas took place more recently than previously thought. A substantially foreshortened chronology for Ocampo crop plants confirms the northern periphery role of Tamaulipas in the origins of agriculture in Mexico, while also underscoring the need for establishing AMS-based archaeobotanical sequences across Mesoamerica to gain an adequate context for understanding the temporal, environmental, and cultural contexts of initial plant domestication in the region.

Tagg 1996

Martyn D. Tagg, *Early Cultigens from Fresnal Shelter, Southeastern New Mexico*. American Antiquity **61** (1996), 311–324.

Fresnal Shelter is one offew known preceramic sites in southern New Mexico with evidence of early agriculture. Recent tandem accelerating mass spectrometer (TAMS) radiocarbon determinations on corn and bean samples indicate that cultigens were used at this site as early as 2945 ? 55 B.P. In addition to providing more evidence of Late Archaic agriculture in the desert regions of the American Southwest, these new data and other previously unpublished radiocarbon dates from the site also illustrate the problem of relying on wood charcoal dates in association with cultigens to determine the age of early agriculture.

Wang 2005

Huai Wang et al., *The origin of the naked grains of maize*. nature **436** (2005), 714–719.

Huai Wang, Tina Nussbaum-Wagler, Bailin Li, Qiong Zhao, Yves Vigouroux, Marianna Faller, Kirsten Bomblies, Lewis Lukens & John F. Doebley

The most critical step in maize (Zea mays ssp. mays) domestication was the liberation of the kernel from the hardened, protective casing that envelops the kernel in the maize progenitor, teosinte1. This evolutionary step exposed the kernel on the surface of the ear, such that it could readily be used by humans as a food source.Here we show that this key event in maize domestication is controlled by a single gene (teosinte glume architecture or tga1), belonging to the SBP-

domain family2 of transcriptional regulators. The factor controlling the phenotypic difference between maize and teosinte maps to a 1-

kilobase region, within which maize and teosinte show only seven fixed differences in their DNA sequences. One of these differences encodes a non-conservative amino acid substitution and may affect protein function, and the other six differences potentially affect gene regulation. Molecular evolution analyses show that this region was the target of selection during maize domestication. Our results demonstrate that modest genetic changes in single genes can induce dramatic changes in phenotype during domestication and evolution.

Whitehead 1965

Donald R. Whitehead, *Prehistoric Maize in Southeastern Virginia*. science **150** (1965), 881–883.

Abstract. Five fossil maize-pollen grains were identified in a peat profile from Dismal Swamp. Extrapolation from the radiocarbon age of peat lower in the section suggests an age of 2200 years. The find suggests that a small clearing within the swamp was cultivated and thus supports the hypothesis that agriculture had diffused into coastal regions before the end of Early Woodland time.

Wills 1995

W. H. Wills, *Archaic Foraging and the Beginning of Food Production in the American Southwest*. In: T. Douglas Price & Anne Brigitte Gebauer (Hrsg.), *Last Hunters–First Farmers, New Perspectives on the Prehsitoric Transition to Agriculture*. (Santa Fe 1995), 215–242.

Windes 1996

Thomas C. Windes & Dabney Ford, *The Chaco Wood Project: The Chronometric Reappraisal of Pueblo Bonito*. American Antiquity **61** (1996), 295–310.

The inventory and analysis of 4,294 pieces of wood remaining in Pueblo Bonito are described. This site, long a keystone for interpreting the Chacoan Phenomenon in the San Juan Basin of northwestern New Mexico, reveals a fascinating history in the procurement, use, and reuse of wood through time. The long use of the site portrays a complex picture of wood procurement for construction from the A.D. 800s through the early A.D. 1100s, and its reuse in both prehistoric and historic times. Major construction periods are tree-ring dated to the mid-A.D. 800s, between A.D. 1047 and 1049, and between A.D. 1077 and 1082. Many of the construction events appear causally related to decade-long wet periods, when food surplus could accumulate. The use of wood at Pueblo Bonito mirrors a larger system of cultural behavior important for our interpretation of the development and demise of the Chacoan system.

Zarrillo 2006

Sonia Zarrillo & Brian Kooyman, *Evidence for berry and maize processing on the Canadian plains from starch grain analysis*. American Antiquity **71** (2006), 473–499.

The ethnographic and ethnohistoric records from the Northern and Canadian Plains indicate that a variety of plants were utilized by past peoples. These accounts provide two important insights into plant use in this region where very little archaeological evidence exists for plant utilization. First, plant processing tools are most likely to be unmodified lithic tools that may escape our recognition. Second, a variety of plants, which can be identified via starch grain analysis, were processed with these tools. This project analyzed the residues from two unmodified lithic grinding tools, identified as possible plant processing tools, for starch grains. Our results indicate that not only were a nuinber of wild plant species, such as choke cherry (Prunus virginiana), saskatoon berry (Amelanchier alnifoliaj and likely prairie turnip (Psoralea esculenta), processed with these implements, but so too was maize (Zea mays). These results not only provide important insight with respect to identifying a tool class, plant use, and trade within our study area, but also provide an exceptional window into the use of wild plant species, an aspect of human history that is poorly understood in many regions of the world in addition to the Northern Plains.

Zarrillo 2008

Sonia Zarrillo, Deborah M. Pearsall, J. Scott Raymond, Mary Ann Tisdale & Dugane J. Quon, *Directly dated starch residues document early formative maize (Zea mays L.) in tropical Ecuador*. PNAS **105** (2008), 5006–5011.

pnas105-05006-Supplement.pdf

The study of maize (Zea mays L.) domestication has advanced from questions of its origins to the study-and debate-of its dietary role and the timing of its dispersal from Mexico. Because the investigation of maize's spread is hampered by poor preservation of macrobotanical remains in the Neotropics, research has focused on microbotanical remains whose contexts are often dated by association, leading some to question the dates assigned. Furthermore, some scholars have argued that maize was not introduced to southwestern Ecuador until 4150-3850 calendar years before the present (cal B.P.), that it was used first and foremost as a fermented beverage in ceremonial contexts, and that it was not important in everyday subsistence, challenging previous studies based on maize starch and phytoliths. To further investigate these questions, we analyzed every-day cooking vessels, food-

processing implements, and sediments for starch and phytoliths from an archaeological site in southwestern Ecuador constituting a small Early Formative village. Employing a new technique to recover starch granules from charred cooking-pot residues we show that maize was present, cultivated, and consumed here in domestic contexts by at least 5300-4950 cal B.P. Directly dating the residues by accelerator mass spectrometry (AMS) radiocarbon measurement, our results represent the earliest direct dates for maize in Early Formative Ecuadorian sites and provide further support that, once domesticated 9000 calendar years ago, maize spread rapidly from southwestern Mexico to northwestern South America.