The Origins of Agriculture: New Data, New Ideas

An Introduction to Supplement 4

by T. Douglas Price and Ofer Bar-Yosef

This introduction to the symposium and to this issue of *Current Anthropology* attempts to provide some sense of the topic, the meeting itself, the participants, and some of the initial results. Our symposium brought together a diverse international group of archaeological scientists to consider a topic of common interest and substantial anthropological import—the origins of agriculture. The group included individuals working in most of the places where farming began. This issue is organized by chronology and geography. Our goal was to consider the most recent data and ideas from these different regions in order to examine larger questions of congruity and disparity among the groups of first farmers. There is much new information from a number of important areas, particularly Asia. Following a review of the history of investigation of agricultural origins, this introduction summarizes the results of the conference. There are at least 10 different places around the world where agriculture was independently developed, and the antiquity of domestication is being pushed back in time with new discoveries. Our symposium has emphasized the importance of a multidisciplinary approach to such large questions in order to assemble as much information as possible. We anticipate that the results and consequences of this symposium will have long-term ripple effects in anthropology and archaeology.

In the middle of March 2009, we were part of a group of 22 individuals that included archaeologists, archaeobotanists, archaeozoologists, a geneticist, and a physical anthropologist that took a 6-day trip to a lovely hacienda near Merida in the Yucatan of Mexico. We were well cared for and well fed, but it was an intense and demanding journey and at the same time one of those rare opportunities for like-minded individuals (we use that term loosely) to get together and explore a subject of shared interest, even fascination. We spent those days trying to better understand the origins of agriculture. The people were passionate, the ideas powerful, the information thought provoking, and it is small meetings like this that are the ones that we remember, that leave an imprint, and that generate messages and ideas that form and transform our views of the past.

T. Douglas Price is Weinstein Professor of European Archaeology, Department of Anthropology, University of Wisconsin–Madison (5240 W. H. Sewell Social Science Building, 1180 Observatory Drive, Madison, Wisconsin 53706, U.S.A. [tdprice@wisc.edu]). **Ofer Bar-Yosef** is MacCurdy Professor of Prehistoric Archaeology, Department of Anthropology, Harvard University (Cambridge, Massachusetts 02138, U.S.A.). This paper was submitted 13 XI 09, accepted 1 III 11, and electronically published 19 VIII 11.

The Symposium and the Participants

We, the coorganizers of this symposium, first met in 1968 at the Paleolithic site of ʻUbeidiya in the rift valley of Israel. It was about 120°F in the shade. Doug was a graduate student visiting from another excavation. Ofer was digging in the hot sun and seemed to enjoy it a lot. We next spent a week together at a School for American Research Seminar in Santa Fe in 1993. We had a small, fine meeting on the earliest farming. We have been talking ever since, and a few years ago we decided that there was so much new information on agriculture that another meeting was needed, and we approached the Wenner-Gren Foundation.

Wenner-Gren has organized more than 140 symposia, so they have a pretty good feel for what works and for how to run a successful academic meeting. However, one of the complexities of small, intensive workshop meetings is that each participant arrives with his or her own set of perspectives, experiences, and biases that provide insight but that can also act as blinders. The insight is of course important, but the blinders can impede broader synthesis. We observe only the world we know. For example, Doug does archaeology in northern Europe, and from that perspective he witnesses only the arrival of farming, not its origins. But the larger questions

 0011-3204/2011/52S4-0002$10.00. DOI: 10.1086/659964

are often the same. Why do hunters become farmers? Why is agriculture so dynamic in changing human adaptation and behavior?

Our symposium brought a number of biases: there was an Old World bias, an East Asia bias, a plant bias, a male bias, and an age bias; someone even suggested an anticamel bias. Specific individual knowledge and bias were critical for our discussions. At the same time, most of the participants did manage to put aside their blinders and take a wider point of view.

The biases at our symposium can be documented in part by a brief glimpse at the background of the participants. There were 22 scientists invited to the symposium—nine archaeologists, six archaeobotanists, five archaeozoologists, a physical anthropologist/demographer, and an archaeological geneticist. These individuals came from eight countries and work in many major areas of agricultural origins and/or spread. A brief biography of each participant (in alphabetical order) may provide some sense of the perspectives at the symposium. Coauthors who did not attend the meeting are not included.

Ofer Bar-Yosef is an archaeologist and MacCurdy Professor of Prehistoric Archaeology at Harvard University. Among many other interests, he has investigated the origins of agriculture in both Southwest Asia and China. Anna Belfer-Cohen is professor of archaeology at the Hebrew University in Jerusalem with interests in the transition to farming in the Near East. Peter Bellwood is an Australian archaeologist and professor at Australian National University. His interests focus on Southeast Asia and the Pacific, and he is a proponent of the connectedness of culture, linguistics, and human biology. Jean-Pierre Bocquet-Appel is an anthropological demographer and research director at Centre National de la Recherche Scientifique in Paris. His current interest concerns the agriculture demographic transition worldwide.

David Joel Cohen is an archaeologist and adjunct assistant professor at Boston University, where he helped establish the International Center for East Asian Archaeology and Cultural History. His current research focuses on the origins of agriculture in East Asia. Gary W. Crawford is an archaeobotanist and professor at the University of Toronto Mississauga, Canada, and is interested in the origins and intensification of agriculture in China, Japan, Korea, and Eastern North America. Tim Denham is a research fellow at Monash University in Victoria, Australia. Over the past decade his research has focused on the emergence of agriculture in Papua New Guinea.

Dorian Q Fuller is a lecturer in archaeobotany at the Institute of Archaeology, University College London. His research focuses on the origins of agriculture in South and East Asia. A. Nigel Goring-Morris is an archaeologist at Hebrew University in Jerusalem. His interests are in the beginnings of complexity in the Near East and Neolithization processes. Greger Larson is a research fellow at Durham University in the United Kingdom. As an archaeological geneticist, his interests are concerned with ancient DNA and the evidence for domestication. Gyoung-Ah Lee is an assistant professor at the University of Oregon. Trained as an archaeobotanist, her interests focus on the origins of agriculture and its impact in East Asia, including Korea, China, and Japan.

Fiona Marshall is a professor at Washington University in St. Louis, where she directs research in African prehistory and zooarchaeology. Her interests are in domestication, pastoralism, climate change, and mobility. Mehmet Özdoğan is an archaeologist and chair of the prehistory department at Istanbul University. His research for the past 2 decades has focused on the emergence of early food-producing sedentary communities and the spread of agriculture from Anatolia to Europe.

Dolores R. Piperno is Senior Scientist and Curator of Archaeobotany and South American Archaeology at the National Museum of Natural History in Washington, DC, and the Smithsonian Tropical Research Institute, Balboa, Panama. Her interests are in domestication and tropical archaeology and paleoecology. T. Douglas Price is Weinstein Professor of European Archaeology at the University of Wisconsin–Madison and 6th Century Chair in Archaeological Science at the University of Aberdeen. His major interests involve the transition from hunters to farmers in northern Europe and archaeological chemistry. He is director of the Laboratory for Archaeological Chemistry in Madison. Peter Rowley-Conwy is a professor at Durham University, United Kingdom, and an archaeozoologist with interests in the spread of pigs and agriculture across Europe. Bruce D. Smith is Curator of North American Archaeology and Senior Research Scientist in Archaeobiology at the National Museum of Natural History in Washington, DC. He is currently interested in integrating biological and anthropological approaches to documenting plant and animal domestication.

Jean-Denis Vigne is an archaeozoologist with interests in mammal domestication in Eurasia. He is employed by Centre National de la Recherche Scientifique, Paris, and is in charge of the laboratory of archaeozoology and archaeobotany at the French National Museum of Natural History. Ehud Weiss is a senior lecturer and the director of the archaeobotanical laboratory at Bar-Ilan University and the Weisman Institute of Science in Israel. He is interested in the beginning of plant domestication in the Near East through the prism of archaeobotany. Melinda A. Zeder is Senior Research Scientist and Curator of Old World Archaeology and Zooarchaeology at the National Museum of Natural History in Washington, DC. Her interests concern the domestication of animals in general and the social and environmental implication of early agriculture in the ancient Near East more specifically. Zhijun (Jimmy) Zhao is a staff scientist at the Institute of Archaeology, Chinese Academy of Social Sciences, Beijing. His research is focused on the origins of agriculture in China and East Asia using archaeobotanical evidence.

Definitions and Dates

Definitions

To enhance consistency in our discussions we have tried to define some terms of common usage. There was not universal agreement on the meaning of these words, of course, and the individual authors use these definitions or not as they find appropriate in the following articles. Our purpose here is not to set the final definitions of important terminology but rather simply to try to use these words consistently in the papers presented here. A number of authors have suggested definitions for these terms over the years (e.g., Harris 1996, 2007), but there are still no widely accepted meanings. In the papers in this issue of *Current Anthropology*, the following definitions will be used unless noted by the individual authors.

Mobility and sedentism. These are relative terms that describe a range from completely mobile to completely sedentary. Sedentism is difficult to measure in the archaeology of the last hunters and first farmers, and this definition attempts to recognize that. It was suggested that the presence of commensals, such as house mice, and the seasonal distribution of plant foods within the same site may indicate an annual long-term occupation.

Management. Manipulation and some degree of control of wild species (plants or animals) without cultivation or morphological changes. In the 1970s this kind of treatment was referred to as "cultural control."

Cultivation. Intentional preparation of the soil (*Oxford English Dictionary*) for planting wild or domesticated plants. Identified in many cases by arable weeds in cereal caches (Bogaard et al. 1999; Harris 2007). The term is often used to indicate cultivation of wild plants before domestication.

Domestication. Morphological or genetic changes in plant and animal species. Archaeozoologists also use criteria such as age profiles, milking, and osteological pathologies.

Farming. Utilization of domestic plants and/or animals for food as well as other resources.

Agriculture. Farming and/or herding predominate the activities of a particular community and determine the main diet, although hunting and gathering may continue.

There were also a number of terms that were not used often at the symposium. Words such as "horticulture," "arboriculture," "herding," "pastoralism," "husbandry," "storage," "agropastoralism," and "intensity of food production" may also be important and useful to scholars of early agriculture in both the Old and New Worlds. Bruce Smith and others, for example, found utility in the concept of "low-level food production" (Smith 2001). In an ideal world, all of these terms would have fixed meanings that could be used easily in discussions of the first farmers, but for the present such consensus does not exist.

Dating

Also for purposes of consistency, the authors in this issue have been asked to report radiocarbon dates in terms of calibrated years before present (BP cal) with ± 1 SD, unless otherwise noted. Authors were also asked to note the calibration program that was used.

The Organization of This Issue

Because of the number of participants and the size and format of this publication, we are limited to brief contributions and a few illustrations each. For these reasons as well, our introduction will be brief. All of the papers have been rewritten following the symposium to incorporate the ideas and input from our discussions. These revisions clearly reflect the impact of the discussions on the participants and the stimulus that was provided by the symposium.

The papers in this issue have been organized largely by chronology and geography to facilitate access for the reader. The earliest evidence for the origins of agriculture comes from Southwest Asia. Bar-Yosef (2011) writes about the role of climate change and the congruence in the chronology of agricultural origins in the Near East and China with the Younger Dryas cold episode at the end of the Pleistocene. Goring-Morris and Belfer-Cohen (2011; see also Belfer-Cohen and Goring-Morris 2011) have provided two contributions detailing the Neolithization process in the Near East as seen within the core area and from the larger region. One of the fascinating things about their contribution about the "Neolithic revolution" is that is has little to do with subsistence. Animal and plant management as well as domestication in the Near East are the focus of papers by Zeder (2011), Weiss and Zohary (2011), and Vigne et al. (2011). Zeder provides a thorough discussion of current evidence for domestication. Weiss and Zohary consider the evidence for the major founder species of plants. Vigne and colleagues provide a look at the remarkable evidence from Cyprus where Pre-Pottery Neolithic people brought plants and animals, essentially re-creating an Early Neolithic ecosystem on that rather barren Mediterranean island.

The next set of papers deals with East Asia, largely from an archaeobotanic perspective. Cohen (2011) offers an overview of the beginnings of agriculture in China in the context of interregional interaction. Zhao (2011) details the abundant new botanical data that have appeared in the past 10 years. Lee (2011) elaborates on agricultural origins in Korea. Crawford (2011) provides an overview of recent advances in our understanding of early cultivation in East Asia with a focus on Japan.

South Asia and Africa provide a very different statement on the beginnings of farming, and questions continue about the appearance of native domesticates. Fuller (2011) tracks this issue, finding plant domestication in the Indian subcon-

tinent. Animal domestication in Africa is the subject of the contribution by Marshall and Weissbrod (2011), with a focus on the donkey in particular and African pastoralism in general.

In the Pacific, two studies are presented. Bellwood (2011) provides an overview of Holocene population history of the region as a model for worldwide food-producer dispersals. Denham (2011), on the other hand, offers details of the evidence for domestication and early agriculture in New Guinea and Island Southeast Asia.

The spread of agriculture subsequent to its origins is the subject of papers dealing with the European evidence. Özdoğan (2011) provides an in-depth look at the archaeological evidence for the westward movement of early farmers from Anatolia to the Aegean and Balkans of Europe. The new evidence from European Turkey and Bulgaria is rewriting our understanding of this spread. Rowley-Conwy (2011) continues the story of westward movement from Central Europe to the Atlantic. The picture of the expansion of early farming across Europe is now one of repeated episodes of very rapid spread followed by long periods of stability. Bursts of regional expansion are not in contrast to the overarching model of continuous millennial-scale demic diffusion but provide a more detailed picture that brings the information closer to the social history of particular populations.

Turning to the New World, Piperno (2011) examines the evidence for origins of plant cultivation and domestication in the tropics of Central and South America. Abundant new evidence from starch grains and phytoliths as well as macrobotanical remains provides exciting new information and pushes back the dates for early domestication. Smith (2011) continues his documentation of an early center for domestication in Eastern North America with a consideration of the cultural context of this process, the evidence coming from archaeology.

Two papers were topical rather than areal and covered important aspects of the study of agricultural origins. Larson (2011) provides a refreshingly candid view of the role of genetics in the study of plant and animal domestication. There is great promise in this method, but serious problems remain to be solved. Jean-Pierre Bocquet-Appel (2011), proponent of the concept of the Neolithic demographic transition, describes the background and development of this model of population growth across the transition to agriculture (Bocquet-Appel and Bar-Yosef 2008).

The State of Play

In order to place the results of our symposium and some of the new ideas and information that emerged in perspective, it may be useful to briefly review the development of ideas about the origins of agriculture and some of the explanations that have been proffered. We can best understand ideas about the origins of agriculture from a historical perspective, considering the early theories first. Explanations of why domestication occurred include the oasis hypothesis, the natural-habitat hypothesis, the population-pressure hypothesis, the edge hypothesis, the social hypothesis, and more. A consideration of these ideas also reveals much about the nature of archaeology and archaeologists.

During the first half of the twentieth century, the best information on early farming villages came from riverine areas or oases in Northeast Africa and Southwest Asia—along the Nile River in Egypt and at Jericho in the Jordan Valley, for example. Early views on the origins of agriculture focused on climate change. At that time, the end of the Pleistocene was assumed to have been a period of increasing warmth and dryness in the earth's climate. Scholars reasoned that because the ice ages were cold and wet, they should have ended with higher temperatures and less precipitation. Given that view of past climate, logic suggested that areas such as Southwest Asia, a dry region to begin with, would have witnessed significant aridity at the end of the Pleistocene when vegetation grew only around limited water sources. The oasis hypothesis suggested a circumstance in which plants, animals, and humans would have clustered in constrained zones near water. V. Gordon Childe, one proponent of this idea, argued that the only successful solution to the competition for food in these situations would be for humans to domesticate and control the animals and the plants. In this sense, domestication emerged as a symbiotic relationship for the purpose of human survival.

During the 1940s and 1950s, however, new evidence suggested that there had been no dramatic climatic changes in Southwest Asia at the close of the Pleistocene—no crisis during which life would concentrate at oases. The new information forced a reconsideration of the origins of agriculture. The late Robert Braidwood pointed out in his natural-habitat hypothesis that the earliest domesticates therefore should appear where their wild ancestors lived. That area, the "hilly flanks" of the Fertile Crescent in Southwest Asia, should be the focus of investigations. Braidwood and a large team of researchers excavated at the site of Jarmo in northern Iraq and elsewhere in the Fertile Crescent and found evidence of early agriculture, supporting his hypothesis that domestication did indeed begin in the natural habitat.

Braidwood did not offer a specific reason as to why domestication occurred other than to point out that technology and culture were ready by the end of the Pleistocene and that humans were familiar with the species that were to be domesticated. At that time, archaeologists and others generally considered that farming was a highly desirable and welcome invention providing security and leisure time for prehistoric peoples. Once human societies had recognized the possibilities of domestication, they should have immediately started farming following the perspectives of the time.

Lewis Binford (1968) challenged those ideas in the 1960s and focused on population. Binford argued that farming was backbreaking, time consuming, and labor intensive. Citing

studies of ethnographically known hunter-gatherers, he pointed out that they spend only a few hours a day obtaining food; the rest of their time is for visiting, talking, gambling, and the general pleasures of life. Even in very marginal areas, such as the Kalahari Desert of South Africa, food collecting is a successful adaptation, and people rarely starve. Binford argued, therefore, that human groups would not become farmers unless they had no other choice, that the origins of agriculture was not a fortuitous discovery but a last resort.

Binford made his point by positing an equilibrium between people and food, a balance that could be upset by either a decline in available food or an increase in the number of people. Because climatic and environmental changes appeared to be minimal in Southwest Asia, Binford thought it must have been increased population size that upset the balance. Population pressure was thus introduced as a causal agent for the origins of agriculture: more people required more food. The best solution to the problem was domestication, which provided a higher yield of food per acre of land. At the same time, however, agricultural intensification required more labor to extract the food.

Binford's concern with population was elaborated and extended as a global explanation by Mark Cohen (1977, 2009). Cohen argued for an inherent tendency for growth in human population, a pattern responsible for the initial spread of the human species out of Africa, the colonization of Asia and Europe, and eventually colonization of the Americas as well. According to Cohen, after about 10,000 BC, all the habitable areas of the planet were occupied, and population continued to grow. At that time, there was an increase in the use of less desirable resources in many areas. Land snails, shellfish, birds, and many new plant species were added to the human diet around the end of the Pleistocene. Cohen argued that the only way for a very successful but rapidly increasing species to cope with declining resources was for them to begin to cultivate the land and domesticate its inhabitants rather than simply to collect the wild produce.

Domestication for Cohen was a solution to problems of overpopulation on a global scale. There is, however, very little evidence for population pressure in the record of agricultural origins. Population is a notoriously difficult parameter to grasp in prehistory. In the very few cases where some information is available, such as in the Levant as presented in this issue by Belfer-Cohen and Goring-Morris (2011), there may even be some population decline shortly before the first appearance of domesticates. As Bocquet-Appel (2011) points out in this issue and elsewhere, most of the evidence for growing population comes after the origins of agriculture, not before.

Others, arguing that the transition to farming and food storage and surplus cannot be understood simply in terms of environment and population, have developed social hypotheses to explain the origins of agriculture. Barbara Bender (1975) and Brian Hayden (1992, 1995), among others, have suggested that the origins of food production may lie more in the ability of certain individuals to generate a surplus of food and to transform that surplus into more valued items, such as rare and valued materials and objects. From this perspective, agriculture was the means by which social inequality emerged and egalitarian societies became hierarchical. Such a view is intriguing if difficult to document. It is very much a chicken-egg question, like the issue of population pressure, of which came first. There is subtle evidence for social inequality in the Early Neolithic of the Near East (Price and Bar-Yosef 2010), but such reorganization of social relations and wealth accumulation may be a consequence of agricultural production rather than a cause.

There are a number of other intriguing theories about why human societies began to cultivate the earth along with some not so enlightening ideas. Geographer Carl Sauer (1952) suggested that agriculture began in the hilly tropics of Southeast Asia, where sedentary groups with knowledge of the rich plant life of the forest might have domesticated plants for poisons and fibers. Botanist David Rindos (1984) has argued that domestication was a process of interaction between humans and plants evolving together into a more beneficial symbiotic relationship.

In a fascinating volume titled *Naissance des divinités, naissance de l'agriculture: la révolution des symboles au Néolithique* (The *Birth of the Gods and the Origins of Agriculture*), French archaeologist Jacques Cauvin (1994) argued that the important changes associated with the "Neolithic revolution" were more cultural than economic. He meant that the transition to farming involved concepts and ideas as much as or more than food production. Specifically, he suggested that agriculture was preceded by the emergence of new cosmologies, religious practices, and symbolic behaviors. This transformation of hunter-gatherers that allowed them to view their habitat in a different way also promoted the more active exploitation of that environment according to the views of Cauvin.

In recent years, the school of evolutionary ecology in archaeology has provided its take on the origins of agriculture in a series of papers and volumes (e.g., Bleed and Matsui 2010; Gremillion and Piperno 2009; Winterhalder and Kennett 2006, 2009). Evolutionary ecology developed out of an earlier perspective known as cultural ecology, which focused on the dynamic relationship between human society and its environment using culture as the primary mechanism of adaptation. Culture is a giant concept and hard to work with, so evolutionary ecologists have emphasized human abilities to reason and to optimize their behavior. In this view, natural selection is thought to operate on the behavior of individuals. Evolutionary ecologists assume that natural selection designed organisms to adapt to local conditions in fitness-enhancing or optimizing ways.

One of the major tenets of this perspective involves a concept known as optimal foraging theory—borrowed from biology—to explain the food-getting behavior of humans, especially hunter-gatherers. Optimal foraging theory argues that

the most efficient foraging strategies produce the greatest return in energy relative to time and effort expended. Optimal foraging assumes that humans make rational decisions based on economic efficiency. Evolutionary ecologists examine the archaeological and ethnographic record looking for things such as "optimization goals," "currencies," and "constraints" and applying ecological and mathematical models to explain human behavior.

Ideas about the origins of agriculture have sometimes been categorized as either push or pull models. Hunter-gatherers are either pushed, or forced, to become farmers or they are pulled, drawn by the benefits of a new lifestyle. Population-pressure models, for example, force human societies to find new ways to feed growing numbers of members. Social hypotheses usually involve pull, in which members of society are drawn into relationships of inequality in order to benefit from new arrangements that reduce risk or increase wealth.

The perspective of evolutionary ecology involves push models. Hunter-gatherers operate on the premise of efficiency to acquire sufficient food to eat. Foods are ranked by net energy value, and lower-ranked subsistence resources (such as seeds) are added only as higher-ranked foods become unavailable. Such push perspectives appear to assume that hunter-gatherers are surviving among limited resources in difficult environments. One of the most important and enlightening realizations in recent years is the fact that agricultural origins take place in relatively abundant environments, not in places where little food is available (Price and Gebauer 1995). It is in such situations of sufficient subsistence resources, where risk is limited, that experiments leading to the origins of agriculture took place. Higher-ranked food resources do not appear to have declined or become unavailable in such contexts, bringing into question the utility of such optimal foraging models.

More recently, detailed information on climate change has come from a most unlikely place, the glaciers of Greenland. Deep corings of the ice sheets there have provided a layered record of changes in temperature and other aspects of climate for the past 100,000 years and more. One of the very interesting results of this research is the documentation of a 33% increase in atmospheric CO_2 at the end of the Pleistocene (Sage 1995). Higher levels of CO_2 would foster the expansion of temperate species such as grasses, which include many of the ancestors of the major domesticated species. The full implications of such changes in the atmosphere are not yet clear but may play a role in the transition from hunting to farming. The evolutionary ecologists have picked up on CO_2 and argue that climatic amelioration that followed in the Early Holocene and the accompanying rise in CO_2 made the origins of agriculture "compulsory" (Bettinger, Richerson, and Boyd 2009).

The simple fact is that we do not yet have a good grasp on the causes for the origins of agriculture. The how and the why of the Neolithic transition remain among the more intriguing questions in human prehistory. There is as yet no single accepted theory for the origins of agriculture—rather, there is a series of ideas and suggestions that do not quite resolve the question. At the same time, of course, the evidence we have is scanty and limited. A great deal more research and discussion needs to be done. That is why we convened this symposium.

Some Observations

The focal point of the symposium was, of course, the origins of agriculture. We hoped to bring together new data and new ideas to push our understanding of this remarkable phenomenon further along. The origins of agriculture is one of the most important developments in our past. Virtually everything we as humans know and do today stems from this remarkable transition. Detailed study of this issue—the presentation of evidence and the evaluation of potential answers—has significance for students of the past, for anthropology as a whole, and for a wide range of related areas of scholarly interest.

There are both practical and theoretical implications of the study of agricultural transitions. The documentation of when and where farming began provides a powerful statement regarding the global nature of this event. Investigation of the shift from hunting and gathering to farming invokes virtually all aspects of anthropological perspectives on human behavior and cultural change. The transition to agriculture is a common human experience that has effected us all in terms of rapid population growth and aggregation and social inequality. Is it "the worst mistake in the history of the human race" (Diamond 1987) or an inevitable step in the evolution of human society?

A multitude of developments concerned with the origins and spread of agriculture have taken place in recent years. New fieldwork and new sites in new and old places, more radiocarbon dates, and new methods have documented earlier transitions to agriculture in parts of Asia, the south Pacific, and the Americas. Studies of microscopic plants remains, especially starch grains and phytoliths, have revolutionized identification of plant exploitation before the emergence of cultivation as well as the appearance of domesticated plants. Advances in the genetics of domestication, such as utilizing ancient DNA to examine the relationships among prehistoric domestics, are beginning to resolve standing questions about where and when. It is time to assemble this new information, to sift and winnow, and to summarize our current understanding of the origins and spread of agriculture.

Our symposium on the state of the art in the study of the origins of agriculture was intended to provide a baseline for continuing and future work. We wanted to learn new facts, examine a wide range of variables, and use our knowledge to evaluate current explanations and to explore new ideas for understanding what took place at the origins of agriculture.

Above all we wanted to think in new directions about this large, complex, and obstinate issue.

There is too little collaboration and interaction between the varied disciplines investigating this question (e.g., genetics, botany, zoology, archaeology, linguistics, demography). An enormous amount of research is going on today in a rather uninformed context. This symposium was intended to integrate that context and provide shared perspectives on the question of agricultural origins. This work is going on around the world, and one of our primary goals was to bring together the leading scholars concerned with this question from diverse places and origins. Such gatherings are extremely rare and often very fruitful.

We were a volatile mix of scholars, from many times and places. At the end of our time together, we did not determine why agriculture originated. We did not even agree on whether its causes were global or local. Archaeozoologists decried the difficulties involved in identifying domestication and seek complex forms of evidence for the process (Zeder 2006*a*, 2006*b*); archaeobotanists seek changes in morphology and genetic makeup as indicators of changes in plants (e.g., Smith 2006; Zohary and Hopf 2000). These differences mean distinct views on the question of agricultural origins from the two subdisciplines. Some might conclude that our symposium was not successful.

In fact, we believe this symposium was a great success. Perhaps most importantly there was a strong sense of collaboration at the meeting. There was much new in terms of both information and ideas. There was a major emphasis on the origins of agriculture in East Asia. Lesser-known regions such as Papua New Guinea, Africa, and eastern North America were included in our discussions. Lots of new data were presented from East and West Asia, Africa, and Central and South America. We were able to put together a table of the latest information on the antiquity of agriculture in various parts of the world and recognized that there are at least 10 different places with claims as original centers of domestication (fig. 1). Information on estimated dates BP cal for domestication in these areas is provided in table 1 (see also fig. 1).

The antiquity of domestication has been pushed deeper into the past in many areas. Today, an eerie synchronicity in the timing of the first domesticates around the end of the Pleistocene is emerging. Another commonality among the cradles of agriculture is the rich environments in which farming originates. Experiments in domestication do not take place in marginal areas but amid concentrations of population and resources across the globe. It also appears that in each area where several different species are involved in the transition to agriculture, there are multiple centers of domestication within the region. A number of groups appear to be manipulating their natural world.

Remarkable new studies are documenting this evidence. Microscopic studies of starch grains in South America have identified a number of early crops, and more specific information on their origin and distribution is becoming available (Piperno 2011). New work is beginning to provide data from critical regions in Mesoamerica, one of the least understood regions of early agricultural origins (Piperno et al. 2009; Ranere et al. 2009). Archaeobotany is moving forward rapidly with a variety of techniques for recording information related to domestication (Allaby, Fuller, and Brown 2008; Fuller 2011). Genetic studies of modern and ancient DNA in domesticated plants and animals are also providing remarkable data on species distribution and evolution (e.g., Dobney and Larson 2006). Genetic markers for domestication are starting to be identified. At the same time, a note of caution regarding genetic studies, especially age estimation based on mutation rate, permeated the symposium and was reiterated by our resident archaeogeneticist (Ho and Larson 2006).

One of the most interesting phenomena we noted was not pattern but variation. In the one or two places where data on the transition are relatively rich, there appears to be a period of chaos, a "zone of variability" at the origins of agriculture (Weiss, Kislev, and Hartmann 2006). There seems to be a period for the auditioning of many possible new options in human adaptation. This is the beginning of a new way of life.

Three recent discoveries from the earliest Neolithic in the Near East highlight this zone of variability, change our understanding of this period in human prehistory, and raise enormous new questions. The colonization of the Mediterranean island of Cyprus by Late Pre-Pottery Neolithic A and Pre-Pottery Neolithic B people carrying domestic plants and domestic and wild animals by boat is an extraordinary story (Guilaine et al. 1998, 2000; Peltenburg and Wasse 2004; Peltenburg et al. 2000; Simmons 2007; Vigne et al. 2000). Excavations at Göbekli Tepe in southern Turkey have revealed a series of remarkable shrines or centers associated with large stone architecture and art from the same time period (Peters and Schmidt 2004; Schmidt 2001, 2003, 2006; Schmidt and Hauptman 2003). The roughly contemporary burial ground of Kafar HaHoresh in Israel documents enormous new variation in the treatment of the dead and indications of emerging social inequality at this time (Goring-Morris 2005; Goring-Morris et al. 1998).

A number of potentially important variables involved in the shift from foraging to farming were discussed at the symposium. These include sedentism, storage, population density, population pressure, resource abundance, resource availability, niche construction, processing and harvesting technologies, climate and environmental changes, ownership of produce and resource localities, potential domesticates, competition, inequality, risk reduction, nutritional requirements, choice, chance, and a receptive social/cultural context.

Some Conclusions

Farming is a way of obtaining food that involves the cultivation of plants and the controlled herding of animals. But

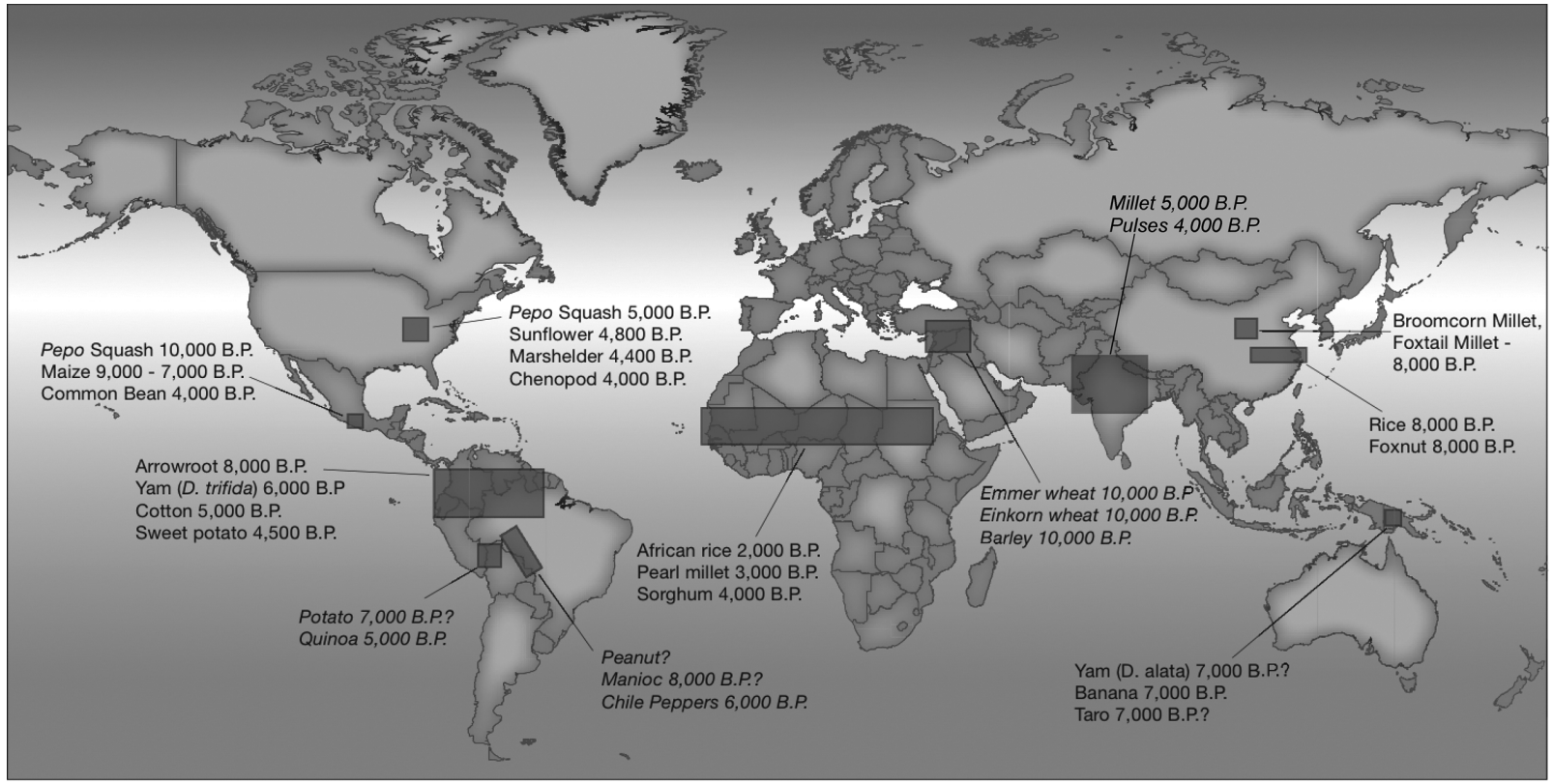

Figure 1. Major centers of domestication and dates for earliest plants and animals. Illustration by Marcia Bakry. A color version of this figure is available in the online edition of *Current Anthropology*.

Table 1. Approximate dates for the appearance of domesticated species in various parts of the world

Place and species	Date of appearance (cal BP)
Southwest Asia:	
Plants	11,500
Animals	10,500
China:	
Millet	10,000
Rice	>7000
Mexico:	
Corn	9000
South America:	
Plants	10,000
Animals	6000
New Guinea:	
Plants	>7000
South Asia:	
Plants	5000
Animals	8000
Africa:	
Plants	5000
Animals	9000
Eastern North America:	
Plants	5000

the beginnings of new subsistence systems were much more than cultivation, herding, or the ensuing domestication of various species. This revolution entailed major long-term changes in the structure and organization of the societies that adopted this new way of life as well as a totally new relationship with the environment. Humans truly began to harness the earth. While hunter-gatherers live off the land in an extensive fashion, generally exploiting a diversity of resources over a broad area, farmers utilize the landscape intensively and create a milieu that suits their needs.

The symposium at Temozon and the papers proffered in this issue attempt to describe some of the latest evidence and to comprehend these extraordinary developments. Here, we hope to provide some sense of the results of the symposium and our own perception of the state of knowledge concerning the origins of agriculture. We learned a great deal. Some of the major threads woven throughout the symposium included the importance of integrating the subdisciplines, the abandonment of dichotomies for the study of process and transformation, the chaos of transitions (a period of "auditioning," as Bruce Smith termed it), the importance of attention to detail in the study of landscapes and species as well as archaeological sites, the punctuated nature of agricultural spread, the many major gaps in our knowledge, and the necessity for critically reevaluating existing information. There was also lots of terminology, much new data, some innovative ideas about causality, and many remaining questions.

It is important to separate the origins of agriculture from the process of domestication and to distinguish biology from culture in the transition from hunting to farming. The criteria for identifying domestication differ significantly for plants and animals. Plants rather quickly exhibit distinct morphological changes; animals are much slower to show such developments. Archaeozoology has introduced a number of important new concepts regarding the process. Three classes of domesticates can be identified: (1) commensals, adapted to a human niche (e.g., dogs, cats, guinea pigs); (2) prey animals sought for food (e.g., cows, sheep, pig, goats); and (3) targeted animals for draft and nonfood resources (e.g., horse, camel, donkey). Changes related to domestication may be more species specific in animals. These differences mean that nonmorphological criteria, such as changes in age profiles of herds, may be required for fauna.

Increasing site size is one of the primary archaeological indicators of changes in human subsistence and organization associated with the agricultural revolution. This increase is a reflection of population growth as well as new forms of settlement and organization. One of the more striking developments associated with the arrival of farming is the increasing visibility of a human presence in the archaeological record. Hunter-gatherers rarely leave visible traces, few bumps in the landscape. Shell middens, some ditches, and other features remain today, but even the most complex hunter-gatherer adaptations did not modify the landscape to a large extent or leave many traces that are visibly on the surface of the earth today.

The phantom of causality floated at the edge of our deliberations at Temozon, always there but not often addressed. This transition from hunting to farming poses one of the most intriguing questions about the human past and one of the most difficult to answer: why did hunters become farmers? Causality is such a thorny issue. There is no common playing field or shared rules of engagement. The evidence from different parts of the world varies in both quantity and quality. That discordance is disconcerting. Variation generates many perspectives and divergence. Consensus on fundamentals is lacking.

Are there general causes? The almost simultaneous development of agriculture in so many different places is not simple coincidence. Should we invoke climate, environment, population, subsistence intensification, brain capacity, religion, inequality, entrepreneurs? Are there specific conditions? Are there immediate and local causes distinct from global ones? Are the origins of agriculture the results of a "perfect storm" of factors that forced or encouraged human societies to domesticate plants and animals?

The division between generalists and particularists was clear at Temozon. Particularists wanted to look at each individual case of agricultural origins as unique; generalists sought a more global explanation that would encompass all of the areas where early agriculture appeared. Some in the group insist that causality is a local or regional phenomenon that varies across time and space. Zeder and Smith (2009) have argued

at some length that global views, "one-size-fits-all" approaches to the explanation of agricultural emergence and dispersal, are not feasible. Bruce Smith enlivened the symposium one morning by arguing that "causality is in the eye of the beholder"—that generalization was not possible because of the complexity of individual contexts.

Others believe that the simultaneity of the origins of agriculture in time argues for general or global causes. It is completely remarkable that the process of domesticating plants and animals appears to have taken place separately and independently in a number of areas at about the same time. Given the long prehistory of our species, why should the transition to agriculture happen within such a brief period, a few thousand years in a span of more than 6 million years of human existence? An important and dramatic shift in the trajectory of human adaptation would seem to demand general explanation. But such answers are hard to reach.

Anna Belfer-Cohen brightened the symposium room one morning with a quote from Nigel Barley (1989, p. 205): "Anthropology largely neglects the individual to deal in generalizations. Generalizations always tell a little lie in the service of greater truth." Conclusions, of course, involve generalizations. It is important to recognize some of the limitations and constraints on such broad speculation. In spite of extraordinary advances in a variety of fields, many detailed at the symposium, we really know very little about the origins of agriculture. There is some information from Southwest Asia, a little data from East Asia and North America, and next to nothing from the rest of the world. We are still in the early stages of the process of identifying and understanding this transition from hunting to farming.

Moreover, as we learn more about a specific region, it becomes clearer how complex the past was, exhibiting much more variability than we have admitted or realized. The Near East is the prime example. There is more information from this region about the origins of agriculture than anywhere else in the world: more sites, more excavations, more analyses, more publications, and so on. Yet new discoveries in the past 20 years have completely altered our understanding of this area and revealed levels of complexity not even imagined 2 decades ago.

A number of important general factors in the origins of agriculture were recognized at the symposium. These factors can be categorized as exogenous, or natural (e.g., climate/environment, population growth), and endogenous, or cultural (e.g., social change, religion). Theories on the transition to agriculture have most often focused on external factors such as climatic change or inherent growth in population as problems solved by the cultivation of plants and animals. Exogenous factors are generally natural forces over which human groups have little control; endogenous factors reflect internal change within society and decisions that humans make.

A series of significant variables involved in the shift from foraging to farming were discussed at Temozon. The most important factors in the transition from the perspective of the authors presented here include, in order of suggested importance, available protodomesticates, human sedentism, higher population density, resource abundance, geographic and/or social constraints, processing and harvesting technology, storage, and wealth accumulation. A change from community to household levels of economic organization observed in several areas may have accompanied the transition to agriculture, including a shift from communal sharing to familial or individual accumulation. Economic intensification and competition were frequent companions of the Neolithic revolution society (Price and Bar-Yosef 2010). Wealth accumulation and status differentiation appear at the individual, household, or lineage level.

We were, however, unable to agree on the primacy of causal factors or on the major issue of general versus specific explanation. The frustrations of explanation leave us asking questions—many important questions were raised at the symposium. Beyond the specific details of local sequences, the nuances of plant and animal domestication, and concerns with the meaning of the evidence, certain larger questions arose again and again. What determines where the first farmers appeared? What makes centers of origin special places? Why do humans domesticate plants and animals? Why are some plants and animals selected for manipulation and not others? Is the domestication process determined solely by the biology of the selected species? What can we say about timing? How long does it take to domesticate plants and animals? How does the timing of this process interlace with developments such as sedentism, population growth, and social inequality? Why was agriculture such a successful adaptation? How does agriculture spread quickly to areas with different cultures, climates, and environments? Can the spread of agriculture tell us about its origins? What spreads, people or things? How do we best explain the origins of agriculture?

Questions provide the right subject to end our introduction and enter the assembled essays that follow. Questions and curiosity, of course, are inherent in the pursuit of knowledge; unanswered questions drive continuing research. Archaeology is concerned with questions about the past. The origins of agriculture is one of the most important and most obstinate. Yet we have no doubt that while it will be a long and arduous journey, our search for answers will have a successful end.

Our goal for the symposium was to develop and explore a rich and productive dialog among scholars from diverse branches of archaeology and related disciplines focused on the beginnings of farming. Through the course of the symposium there was a growing respect and a leveling of boundaries between the subdisciplines. There was lots of news—much information and inspiration. We believe that the participants in this symposium returned home with renewed optimism about the state of research—both data and ideas—on the origins of agriculture. It is our hope that enthusiasm will be conveyed through the continuing studies of the participants and will be passed to their colleagues and students.

In this way, our symposium will have a large impact on the archaeological community, and we can help to push future research along a well-lit path.

Acknowledgments

Special thanks to Leslie Aiello, whose presence we enjoyed at the symposium and whose constant interest and occasional participation were much appreciated. Leslie has also played a key role in the final editing of this issue of *Current Anthropology*. Kudos and enormous thanks to Laurie Obbink of the Wenner-Gren Foundation, who is responsible for the logistics and function of these meetings and has been doing a magnificent job for many years. Our symposium ran remarkably smoothly and enjoyably. Carolyn Freiwald of the University of Wisconsin–Madison attended the symposium as an invited graduate student, and her presence was appreciated by all. Thanks also to the staff of the Hacienda Temozon who went beyond the call of duty to ensure a pleasant stay for all of us with wonderful food, flower-strewn rooms, and much individual attention. David Meiggs has done a masterful job of editing the manuscripts for publication.

References Cited

Allaby, R. G., D. Q Fuller, and T. A. Brown. 2008. The genetic expectations of a protracted model for the origins of domesticated crops. *Proceedings of the National Academy of Sciences of the USA* 105:13982–13986.

Barley, Nigel. 1989. *Not a hazardous sport*. London: Penguin.

Bar-Yosef, Ofer. 2011. Climatic fluctuations and early farming in West and East Asia. *Current Anthropology* 52(suppl. 4):S175–S193.

Belfer-Cohen, Anna, and A. Nigel Goring-Morris. 2011. Becoming farmers: the inside story. *Current Anthropology* 52(suppl. 4):S209–S220.

Bellwood, Peter. 2011. Holocene population history in the Pacific region as a model for worldwide food producer dispersals. *Current Anthropology* 52(suppl. 4):S363–S378.

Bender, Barbara. 1975. *Farming in prehistory: from hunter-gatherer to food-producer*. New York: St. Martin's.

Bettinger, R., P. Richerson, and R. Boyd. 2009. Constraints on the development of agriculture. *Current Anthropology* 50:627–631.

Binford, Lewis R. 1968. Post-Pleistocene adaptations. In *New perspectives in archaeology*. L. R. Binford and S. R. Binford, eds. Pp. 313–341. Chicago: Aldine.

Bleed, P., and A. Matsui. 2010. Why didn't agriculture develop in Japan? a consideration of Jomon ecological style, niche construction, and the origins of domestication. *Journal of Archaeological Method and Theory* 17:356–370.

Bogaard, A., C. Palmer, G. Jones, and M. Charles. 1999. A FIBS approach to the use of weed ecology for the archaeobotanical recognition of crop rotation regimes. *Journal of Archaeological Science* 26:1211–1224.

Bocquet-Appel, J.-P., and O. Bar-Yosef, eds. 2008. *The Neolithic demographic transition and its consequences*. Dordrecht: Springer.

Bocquet-Appel, Jean-Pierre. 2011. The agricultural demographic transition during and after the agriculture inventions. *Current Anthropology* 52(suppl. 4):S497–S510.

Cauvin, Jacques. 1994. *Naissance des divinités, naissance de l'agriculture: la révolution des symboles au Néolithique*. Paris: CNRS.

Cohen, David Joel. 2011. The beginnings of agriculture in China: a multiregional view. *Current Anthropology* 52(suppl. 4):S273–S293.

Cohen, Mark. 1977. *The food crisis in prehistory: overpopulation and the origins of agriculture*. New Haven, CT: Yale University Press.

———. 2009. Introduction: rethinking the origins of agriculture. *Current Anthropology* 50:591–595.

Crawford, Gary W. 2011. Advances in understanding early agriculture in Japan. *Current Anthropology* 52(suppl. 4):S331–S345.

Denham, Tim. 2011. Early agriculture and plant domestication in New Guinea and Island Southeast Asia. *Current Anthropology* 52(suppl. 4):S379–S395.

Diamond, Jared. 1987. The worst mistake in the history of the human race. *Discover*, May.

Dobney, Keith, and Greger Larson. 2006. Genetics and animal domestication: new windows on an elusive process. *Journal of Zoology* 269:261–271.

Fuller, Dorian Q. 2011. Finding plant domestication in the Indian Subcontinent. *Current Anthropology* 52(suppl. 4):S347–S362.

Goring-Morris, A. Nigel, and Anna Belfer-Cohen. 2011. Neolithization processes in the Levant: the outer envelope. *Current Anthropology* 52(suppl. 4):S195–S208.

Goring-Morris, N. 2005. Life, death and the emergence of differential status in the Near Eastern Neolithic: evidence from Kfar Ha-Horesh, Lower Galilee, Israel. In *Archaeological perspectives on the transmission and transformation of culture in the Eastern Mediterranean*. J. Clarke, ed. Pp. 89–105. Oxford: Council for British Research in the Levant/Oxbow.

Goring-Morris, N., R. Burns, A. Davidzon, V. Eshed, Y. Goren, I. Hershkivitz, S. Kangas, and J. Kelecevic. 1998. The 1997 season of excavations at the mortuary site of Kfar Hahoresh, Galilee, Israel. *Neo-Lithics* 98:1–4.

Gremillion, K. J., and D. R. Piperno. 2009. Human behavioral ecology, phenotypic (developmental) plasticity, and agricultural origins: insights from the emerging evolutionary synthesis. *Current Anthropology* 50:615–619.

Guilaine, J., F. Briois, J. Coularou, P. Deveze, S. Philibert, J.-D. Vigne, and I. Carrère. 1998. La site neolithique preceramique de Shillourokambos (Parekklisha, Chypre). *Bulletin de Correspondance Hellenique* 122:603–610.

Guilaine, J., F. Briois, J.-D. Vigne, and I. Carrère. 2000. Decouverte d'un neolithique preceramique ancien chypriote (fin 9e debut 8e millenaires cal. BC), apparente au PPNB ancien/moyen du Levant nord. *Earth and Planetary Sciences* 300:75–82.

Harris, David R. 1996. Domesticatory relationships of people, plants, and animals. In *Redefining nature: ecology, culture, and domestication*. R. Ellen and K. Fukui, eds. Pp. 437–463. Oxford: Berg.

———. 2007. Agriculture, cultivation and domestication: exploring the conceptual framework of early food production. In *Rethinking agriculture: archaeological and ethnoarchaeological perspectives*. T. Denham, J. Iriarte, and L. Vrydaghs, eds. Pp. 16–35. Walnut Creek, CA: Left Coast.

Hayden, B. 1992. Models of domestication. In *Transitions to agriculture in prehistory*. A. B. Gebauer and T. D. Price, eds. Pp. 11–19. Madison, WI: Prehistory.

———. 1995. A new overview of domestication. In *Last hunters, first farmers: new perspectives on the transition to agriculture*. T. D. Price and A. B. Gebauer, eds. Pp. 273–300. Santa Fe, NM: School of American Research.

Ho, S. Y. W., and G. Larson. 2006. Molecular clocks: when times are a-changin'. *Trends in Genetics* 22(2):79–83.

Larson, Greger. 2011. Genetics and domestication: important questions for new answers. *Current Anthropology* 52(suppl. 4):S485–S495.

Lee, Gyoung-Ah. 2011. The transition from foraging to farming in Prehistoric Korea. *Current Anthropology* 52(suppl. 4):S307–S329.

Marshall, Fiona, and Lior Weissbrod. 2011. Domestication processes

and morphological change: through the lens of the donkey and African pastoralism. *Current Anthropology* 52(suppl. 4):S397–S413.
Özdoğan, Mehmet. 2011. Archaeological evidence on the westward expansion of farming communities from eastern Anatolia to the Aegean and the Balkans. *Current Anthropology* 52(suppl. 4):S415–S430.
Peltenburg, E., and A. Wasse, eds. 2004. *Neolithic revolution: new perspectives on Southwest Asia in light of recent discoveries on Cyprus*. Oxford: Oxford University Press.
Peltenburg, Edgar, Sue Colledge, Paul Croft, Adam Jackson, Carole McCartney, and Mary Anne Murray. 2000. Agro-pastoralist colonization of Cyprus in the 10th millennium BP: initial assessments. *Antiquity* 74:844–853.
Peters, Joris, and Klaus Schmidt. 2004. Animals in the symbolic world of Pre-Pottery Neolithic Göbekli Tepe, south-eastern Turkey: a preliminary assessment. *Anthropozoologica* 39:179–218.
Piperno, D. R., A. J. Ranere, I. Holst, J. Iriarte, and R. Dickau. 2009. Starch grain and phytolith evidence for early ninth millennium B.P. maize from the Central Balsas River valley, Mexico. *Proceedings of the National Academy of Sciences of the USA* 106:5019–5024.
Piperno, Dolores R. 2011. The origins of plant cultivation and domestication in the New World tropics: patterns, process, and new developments. *Current Anthropology* 52(suppl. 4):S453–S470.
Price, T. Douglas, and Ofer Bar-Yosef. 2010. Traces of inequality at the origins of agriculture in the ancient Near East. In *Pathways to power: new perspectives on the origins of social inequality*. T. Douglas Price and Gary M. Feinman, eds. Pp. 147–168. New York: Springer.
Price, T. Douglas, and Anne B. Gebauer, eds. 1995. *Last hunters, first farmers: new perspectives on the prehistoric transition to agriculture*. Santa Fe, NM: School for American Research.
Ranere, A. J., D. R. Piperno, I. Holst , R. Dickau, and J. Iriarte. 2009. The cultural and chronological context of Early Holocene maize and squash domestication in the Central Balsas River valley, Mexico. *Proceedings of the National Academy of Sciences of the USA* 106:5014–5018.
Rindos, D. 1984. *The origins of agriculture: an evolutionary perspective*. Orlando, FL: Academic Press.
Rowley-Conwy, Peter. 2011. Westward ho! the spread of agriculture from Central Europe to the Atlantic. *Current Anthropology* 52(suppl. 4):S431–S451.
Sage, R. F. 1995. Was low atmospheric CO_2 during the Pleistocene a limiting factor for the origin of agriculture? *Global Change Biology* 1:93–106.
Sauer, Carl O. 1952. *Agricultural origins and dispersals*. Washington, DC: American Geographical Society.
Schmidt, K. 2001. Göbekli Tepe, southeastern Turkey: a preliminary report on the 1995–1999 excavations. *Paléorient* 26:45–54.
———. 2003. "Kraniche am See": Bilder und Zeichen vom frühneolithischen Göbekli Tepe (Südosttürkei). In *Der Turmbau zu Babel: Ursprung und Vielfalt von Sprache und Schrift: eine Ausstellung des Kunsthistorischen Museums Wien für die Europäische Kulturhauptstadt Graz 2003*, vol. 3A. Wilfried Seipel, ed. Pp. 23–29. Milan: Skira.
———. 2006. *Sie bauten den ersten Tempel: das rätselhafte Heiligtum der Steinzeitjäger: die archäologische Entdeckung am Göbekli Tepe*. Munich: Beck.
Schmidt, K., and H. Hauptmann. 2003. Göbekli Tepe et Nevali Cori. *Dossiers d'Archéologie* 281:60–67.
Simmons, Alan H. 2007. *The Neolithic revolution in the Near East: transforming the human landscape*. Tucson: University of Arizona Press.
Smith, B. D. 2001. Low level food production. *Journal of Archaeological Research* 9:1–43.
———. 2006. Documenting domesticated plants in the archaeological record. In *Documenting domestication: new genetic and archaeological paradigms*. M. A. Zeder, D. G. Bradley, E. Emshwiller, and B. D. Smith, eds. Pp. 15–24. Berkeley: University of California Press.
Smith, Bruce D. 2011. The cultural context of plant domestication in eastern North America. *Current Anthropology* 52(suppl. 4): S471–S484.
Vigne, J.-D., I. Carrère, J.-F. Saliege, A. Person, H. Bocherens, J. Guilaine, and F. Briois. 2000. Predomestic cattle, sheep, goat and pig during the late 9th and the 8th millennium cal. BC on Cyprus: preliminary results of Shillourokambos (Parekklisha, Limassol). In *Archaeozoology of the Near East IV*. H. Buitenhaus, M. Mashkour, and F. Poplin, eds. Pp. 83–106. Groningen: Archaeological Research and Consultancy.
Vigne, Jean-Denis, Isabelle Carrère, François Briois, and Jean Guilaine. 2011. The early process of mammal domestication in the Near East: new evidence from the Pre-Neolithic and Pre-Pottery Neolithic in Cyprus. *Current Anthropology* 52(suppl. 4):S255–S271.
Weiss, Ehud, Mordechai E. Kislev, and Anat Hartmann. 2006. Autonomous cultivation before domestication. *Science* 312:1608–1610.
Weiss, Ehud, and Daniel Zohary. 2011. The Neolithic Southwest Asian founder crops: their biology and archaeobotany. *Current Anthropology* 52(suppl. 4):S237–S254.
Winterhalder, Bruce, and Douglas J. Kennett, eds. 2006. *Behavioral ecology and the transition to agriculture*. Berkeley: University of California Press.
———. 2009. Four neglected concepts with a role to play in explaining the origins of agriculture. *Current Anthropology* 50:645–648.
Zeder, M. A. 2006*a*. Archaeological approaches to documenting animal domestication. In *Documenting domestication: new genetic and archaeological paradigms*. M. A. Zeder, D. Bradley, E. Emshwiller, and B. D. Smith, eds. Pp. 171–180. Berkeley: University of California Press.
———. 2006*b*. Central questions in the domestication of plants and animals. *Evolutionary Anthropology* 15:105–117.
Zeder, Melinda A. 2011. The origins of agriculture in the Near East. *Current Anthropology* 52(suppl. 4):S221–S235.
Zeder, Melinda A., and Bruce D. Smith. 2009. A conversation on agricultural origins: talking past each other in a crowded room. *Current Anthropology* 50:681–691.
Zhao, Zhijun. 2011. New archaeobotanic data for the study of the origins of agriculture in China. *Current Anthropology* 52(suppl. 4): S295–S306.
Zohary, D., and M. Hopf. 2000. *Domestication of plants in the Old World: the origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley*. 3rd edition. Oxford: Oxford University Press.