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Comment: Rethinking the Origins of Agriculture

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The papers presented in "State University of New York Conversation in the Discipline: The Origins of Agriculture" present important contributions to our understanding of the transition to agriculture. In comparison with other volumes about this theme (e.g., Cowan and Watson 1992; Denham et al. 2007; Price and Gebauer 1994; Zeder et al. 2006), these papers focus on theoretical issues rather than case studies of specific crops, animals, or regions. To date, my own research has focused on a particular crop and region, chenopods in the south-central Andes (Bruno 2006), but I believe that such theoretical discussions are essential. They not only permit us to consider the threads that link individual cases but also serve to improve the questions and methods used to examine our particular data sets.

The papers in this volume address two main issues related to the process of adopting agriculture: (1) the transition from low-level food production (Smith 2001) to dependence on agriculture (Bettinger, Richerson, and Boyd 2009; Cohen 2009; Gremillion and Piperno 2009; Hayden 2009; Kuijt 2009; Pearsall 2009; Winterhalder and Kennett 2009; all in this issue) and (2) the consequences an agricultural diet has on the overall health and growth of human populations (Bellwood 2009; Gage and DeWitte 2009; Lambert 2009; Schoeninger 2009; all in this issue; also see discussion by Cohen [2009]). Within the former group, I was interested in the focus the authors placed on the "internal" factors that shaped this process. For example, Bettinger, Richerson, and Boyd (2009; Richerson et al. 2001) have summarized the important role that Holocene climate change played in permitting the possibility of domestication and agriculture, but they ultimately suggest here that the tempo and reasons why societies became fully agricultural lie within decisions and influences internal to society. I welcome this focus, but the range of theoretical approaches employed in this set of papers was quite narrow. With a few exceptions (Kuijt 2009; Schoeninger 2009), nearly all of the papers are rooted in an evolutionary perspective, most notably, human behavioral ecology (HBE). Even Hayden (2009), who presents perhaps the most "social" of the theories, claims that his is a behavioral ecological model wherein feasting ultimately served to reduce risk. In my opinion, this conversation would have benefited from including a wider range of theoretical perspectives, particularly those with historical and/or social insights.

I suggest that theories of practice provide an approach that has potential to aid in our understanding of the tempo, character, and consequences of adopting agriculture. Some researchers have begun to incorporate these theories (e.g., Atalay and Hastorf 2006; Denham 2005; Fairbairn 2005*a*, 2005*b*; Hastorf 2006), but they have received little attention compared with evolutionary approaches. Theories of practice examine how humans create macroscale features such as traditions or sociopolitical institutions (structures) through their own daily actions (agency; e.g., Bourdieu 1977; Giddens 1979; Ortner 1984). Daily activities or nondiscursive routines (habitus or praxis) not only reinforce these structures but also provide the contexts in which they can change. This approach is explicitly historical and attempts to trace how new traditions or dispositions arise out of old ones (Dobres and Robb 2000; Pauketat 2001).

We know from modern and ethnohistorical examples that practices associated with the production, procurement, processing, cooking, and consumption of food are highly structured and constitute a central aspect of daily life (e.g., Counihan and Van Esterik 1997; Goody 1982; Netting 1993). By examining the material remains of these activities, we can track how some of these practices structured the character of food procurement/production and identify where there were opportunities for change.

Following Bruce Smith's (2001) article, several of the papers in this volume discuss the long period of time during which societies maintained low-level production of domesticated species before adopting a fully agricultural economy. Practice theories permit us to examine the processes that help maintain traditions over long periods of time (Hodder and Cessford 2004). For example, cultural norms dictating what is a proper

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food and how it is prepared and served may have been one of the more conservative structures that shaped the integration of domesticated foods into household meals (Twiss 2007; Weismantel 1998). The manner and tempo in which they were incorporated would depend on existing recipes and technologies for cooking (Atalay and Hastorf 2006). By tracking how these domesticated items became more commonplace in relation to other food types, we may be able to understand how they eventually became the centerpiece of daily meals. Although foods for communal and celebratory settings may have increased the demand for domesticated species (Twiss 2008), we should also examine how the necessity for particular elements of a daily meal, such as starchy grains or tubers, might have influenced families or communities to increase their production.

Another potentially useful aspect of practice theories for the study of agricultural origins is their consideration of "unintended consequences" (Giddens 1979, 56–58). Although people act within the limitations of a given structure and with a particular intention, these actions can bring about consequences that were not anticipated. It is often these unintended consequences that bring about significant changes in the macroscale features of society, such as opening opportunities for increased social inequalities (Pauketat 2000) or creating buildings that forever change the space and experience of a village (Joyce 2004). One of the major themes in this volume, the reduced overall health of agricultural populations, points to perhaps the greatest unintended consequence of adopting agriculture. We can observe this consequence in retrospect, but it was likely not part of the information these societies had available when enacting the practices that made them more dependent on agriculture.

Within the realm of unintentional consequences, practice theories can also provide an important perspective on the effects that the transition to agriculture had on the natural environment. In some ways, this is where practice theories intersect with evolutionary theories. When human activities begin to change the life cycle or ecology of plant and animal populations, they open new possibilities in the evolution of those species. I agree with several of the authors in this volume who argue that initial domestication may have been an unintentional result of people interacting with species they collected or encouraged through disturbance of the landscape (Anderson 1952; Rindos 1984).

I am very interested in Gremillion and Piperno's (2009) discussion of evolutionary development (evo-devo) and how changes in the environment can "trigger" gene expression and the appearance of new phenotypic variation. They note that climatic changes associated with the Pleistocene-Holocene transition may have provided some of the environmental perturbations necessary to cause new gene expression, but they also acknowledge the role humans had in this process. They suggest employing niche construction theory to address this problem, but, following Pearsall's (2009) suggestion, I think historical ecology offers a useful approach. Similar to practice theories, historical ecology focuses on how long-term, accumulative human activities cause observable material changes in the natural environment, thus creating a "landscape" (Balée 1998; Balée and Erickson 2006; Crumley 1994). Landscape creation can include the construction of new landforms such as drainage canals, raised fields, or terraces, as well as more subtle modifications to soil characteristics and the composition of local flora and fauna. Thus, archaeologists can track patterns and changes associated with the adoption of agriculture by studying dynamics of the landscape. Both Piperno and Pearsall have been pioneers in examining changes in landscapes related to food production, using pollen, phytoliths, and charcoal (e.g., Pearsall 2007; Piperno 1990; Piperno and Pearsall 1998). This is also possible with macrobotanical remains by tracking changes in wood and wild seed-producing species that are sensitive to environmental perturbations (Fairbairn 2008; Jones et al. 1999). I have been able to track changes in flora associated with agricultural intensification in the Lake Titicaca basin (Bruno 2008), but no such study has been conducted for agricultural origins in the area.

Finally, perhaps there were unintended consequences of low-level food production that required humans to dedicate more time to tending domesticated species, eventually leading to a greater reliance on them. Tilling and clearing for crops create new habitats for other plants and animals that are adapted to such "disturbed" environments (Dean 2005; Jones et al. 1999). These "weedy" species compete with the crops, requiring that humans increase their efforts in clearing, weeding, and processing. These practices could have also led to new innovations in production and possibly increased overall yields.

In this brief discussion, I have attempted to show how practice theories and historical ecology can also contribute to a conversation about the origins of agriculture. I agree with several of the authors here (Kuijt 2009; Pearsall 2009; Winterhalder and Kennett 2009) and in other publications (e.g., Fritz 1990; Hildebrand 2003) that there were likely multiple pathways and explanations for the adoption of agriculture. To proceed with this discussion and to test the variety of hypotheses generated by the theoretical approaches presented here, we need to continue to collect data. In many regions of the world, including the Andes, we are currently lacking the detailed data sets needed to address these questions. Only when we have a more complete picture of the individual histories of each region can we truly address the larger theoretical questions.

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