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EDITORIAL

After the harvest: investigating the role of food processing in past human societies

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Plant processing provides an essential framework for archaeobotanical interpretation since practices of processing lie between the ancient acquisition of plants and the preserved remains of archaeology. Crop-processing stages have received much attention as they contribute towards the interpretation of plants recovered from archaeological sites, linking them to routine human activities that generated these plant remains. Yet, there are many other important aspects of the human past that can be explored through food processing studies that are much less often investigated, e.g. how culinary practices may have influenced resource selection, plant domestication and human diet, health, evolution and cultural identity. Therefore, this special issue of *AAS* on "Food Processing Studies in Archaeobotany and Ethnobotany" brings together recent pioneering methodological and interpretive archaeobotanical approaches to the study of ancient food processing. This new research, which involves archaeobotany, ethnoarchaeology, ethnobotany and experimental methods, encompasses investigations into dietary choice, cultural traditions and cultural change as well as studies of the functional properties (i.e. performance characteristics) of edible plants, and the visibility as well as dietary benefits and consequences of different food processing methods.

This volume builds on a history of experimental food processing in archaeobotany that dates back almost 40 years. Dennell (1972, 1976) was the first to model explicitly the importance of plant processing activities in shaping the archaeobotanical record. However, it was Hillman (see Willcox 2009; Hillman 1973, 1981, 1984) who, using an ethnoarchaeological approach, pioneered methods for linking the archaeobotanical record with the types of human plant-use activities that they potentially represent. As a result of his observations of the non-mechanised crop-processing techniques used by modern Turkish farmers, and his systematic sampling of the macro-botanical materials produced during each stage in the crop-processing sequence, Hillman found that each stage produces a distinct plant assemblage that can be recognised from the specific types and condition of the plant parts represented. Building on Hillman's methods, Jones (1984, 1987) applied similar methods in Greece and instituted the use of quantitative methods to characterise the different plant macro-remain assemblages produced in each stage of the crop-processing sequence. More recently, Jones, along with Amy Bogaard, Mike Charles and their colleagues (e.g. see Jones 1992; Jones et al. 2005; Bogaard 2005; Charles et al. 2003) introduced functional ecology methods (FIBS) to further explore the types of information that the biological and ecological attributes of weeds found in archaeobotanical assemblages can provide about ancient crop-husbandry practices (crop sowing times, cultivation intensity and even ancient irrigation regimes). Such information is relevant to processing plants for food or other uses because crop-husbandry practices inevitably affect the composition and condition of harvested batches of a crop as well as the

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character of the "clean" (threshed, raked, winnowed and sieved) grain (cf Hillman 1973).

Indeed, crop-processing studies have become an established component of archaeobotanical methodology, particularly among archaeobotanists studying the origins, evolution and spread of cereal agriculture in Europe, the Near East, North Africa and the Americas (e.g. Anderson et al. 2003; Anderson-Gerfaud 1991; D'Andrea 2003; D'Andrea and Haile 2002; Hastorf 1988, 1998; Johanessen et al. 1990; Butler et al. 1999; Peña-Chocarro 1999; Peña-Chocarro and Zapata Peña 2003; Peña-Chocarro et al. 2009; Stevens 2003; van der Veen 1992), similar methodologies have also been implemented in the Far East and South Asia, e.g. ethnographic research on millet crop processing in Nepal and India by Lundström-Baudais et al. (2002) and Reddy (1997), respectively, and Thompson's (1998) study of rice crop processing in Thailand. Moreover, not only plant macro-remains but also, for the first time, micro-remains, such as phytoliths, have been used to investigate crop-processing in the work of Harvey and Fuller (2005).

Investigations into plant processing for the preparation of meals and/or specific food products, as well as applicable to other plant uses, with techniques such as pulverising, grinding, milling, boiling, roasting and baking, have more often been studied through processing equipment and resulting artefacts rather than the processed substance/mater resulting in the archaeobotanical remains incorporated in archaeological deposits (e.g. Andreoni 2010; Cueto et al. 2010; D'Andrea 2003; 10; Lyons and D'Andrea 2003; Peacock 2002; Procopiou and Treuil 2002a, b; Prevost-Demarkar 2002; Wright 1994, 2005). Procopiou and Treuil's (2002a, b) edited two-volume publication *Moudre et Broyer I and II*, for example, is a comprehensive collection of ethnographic and experimental studies on artefacts, tools and installations related to grinding and milling.

Archaeobotanical studies of plant processing for the preparation of specific foods, include those of Samuel (1997, 2000, 2006) on bread and beer, Mangafa et al. (1998, 2001) on wine, Valamoti (2002) and Valamoti et al. (2008) on ground cereals, Capparelli (2008) on Andean legumes and Wollstonecroft (2007 and Wollstonecroft et al. 2008) on wild wetland tubers. These experimental studies involved ethnographic observations and the replication of plant processing methods, followed by the examination of the resulting foods under high power microscopy, and subsequent comparisons of their morphological and anatomical features with those of archaeological plant remains. Among the objectives of these studies are the creation of comparative materials to assist in the identification of archaeological food and fibre types, as well as learning about the types of equipment, materials, stages and labour involved in the preparation of various plant products, e.g. food, baskets, thread, etc. (Palmer 2002; Ertug 2000a, b, 2006). Additionally, these types of studies have provided a means for investigation connections between the plant-related activities and the social relationships of the group(s) under study, e.g. the rise of social hierarchies and gender issues (Hosoya 2009; Hastorf 1996, 1998).

Another important but less known branch of food processing research encompasses studies of the dietary aspects of ancient food processing (Hillman 2004 and in preparation; Samuel 1997, 2006; Wandsnider 1997; Wollstonecroft 2007; Wollstonecroft et al. 2008). Yen (1980, 1989) and later Stahl (1984, 1989) were among the first to consider the dietary and nutritional benefits of food processing as well its potential for increasing abundance and influencing human dietary selection and dietary change. Yen (1980) observed that processing provided people with a means of expanding the food uses of individual resources by permitting the production of a variety of foods from a single plant/plant part and/or preservation and storage. Stahl (1984, 1989) investigated the dietary advantages of food processing, observing that processing can facilitate the release of energy, nutrients and other important compounds (e.g. antioxidants) from foods (see also Johns 1999), as well as ensuring wholesomeness by improving palatability and destroying undesirable compounds. Given the universality of food processing among human societies, its likely time depth and the dietary implications, Stahl (1989) concluded that archaeologists should regard processing "…as an independent variable in our attempts to model the subsistence decisions made by prehistoric populations" (p 171).

Eight archaeobotanical/ethnobotanical/experimental studies on food processing are included in this volume. Six of these studies were first presented at the V International Congress of Ethnobotany (ICEB), in Bariloche, Argentina, September 2009, in a symposium organised by Capparelli, Valamoti and Wollstonecroft on "Recent research in post-harvest traditions in human prehistory: Old and New World palaeoethnobotanical approaches to linking the archaeology and ethnobotany of plant processing", briefly summarised in the ICEB conference proceedings (Pochettino et al. 2010).

The papers presented here expand on the ICEB papers, providing detailed case studies on ancient food processing from three different continents (Asia, Europe and South America). Hosoya investigates ancient nut (e.g. chestnuts, pasanea nuts) processing and consumption through a combined use of archaeobotanical remains and ethnographic observations on modern nut processing in various parts of East Asia (Japan and China), highlighting the significance of such studies towards our understanding of the contribution of nuts to diets of past human populations; Valamoti describes and discusses archaeobotanical recognition and the economic and nutritional significance of specific ways of bulk processing of cereal grain for piecemeal consumption through a combined examination of archaeobotanical, ethnographic and textual evidence, as well as food science research, from Greece and circum-Mediterranean countries; and Stika investigates cereal malting and fermenting techniques used in the production of beers in Late Iron Age and early Medieval Germany. Borrowing a "post-harvest" approach from agronomy (see Wollstonecroft 2007; Capparelli and Lema 2010; Capparelli et al. 2010), Capparelli and Lema, Capparelli, Lema, Lopez et al. and Wollstonecroft investigate the functional links between the technological choices of ancient peoples and physiological properties of the plants that they processed; based on the data gathered from these investigations, these authors subsequently discuss the implied ecological and technological skills and knowledge of the ancient people under study. Capparelli and Lema, Capparelli and Lopez et al. explore the visibility of legume (*Prosopis* spp.) and pseudocereal (*Chenopodium quinoa*) processing in prehistoric Andean contexts of Northwest Argentina and Bolivia, and Lema analyses how processing and preservation practices may have influenced gourd (*Cucurbita maxima*) domestication. Wollstonecroft examines how innovations in food processing by *Homo* ancient ancestors may have influenced human evolution.

We are confident that the contributions of this special AAS issue will stimulate archaeologists to recognise that plant processing is a critical variable in human economies and social and symbolic systems; therefore it is essential to include it when modelling the life ways of past societies.

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