



Ancient Plants and People: Contemporary Trends in Archaeobotany

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Since the 19th Century, there has been a long tradition of analyses and interpretation of plant remains from archaeological contexts. Many of those analyses have emphasized biological aspects and have been limited in many cases to a list of presence or absence of botanical remains. In recent years paleoethnobotanical analyses have had much more of an anthropological orientation (Butzer 1982). The anthropological perspective not only looks at socio-ecological dynamics of the use of wild plants and food production but also seeks to improve theoretical frameworks, recovery techniques and develop new methodologies such as DNA, phytolith, and starch analysis (Archila et al. 2008; VanDerwarker and Peres 2010).

Ancient Plants and People: Contemporary Trends in Archaeobotany is edited by members of a new generation of archaeobotanists: Marco Madella, Carla Lancelotti, and Manon Savard. After discussions about the meaning of archaeobotanical work during a symposium of the International Work Group for Palaeoethnobotany in 2013, in Holland, they decided to bring together the work of twenty researchers from different parts of the world, writing about ethnology, ethnoarchaeology, taphonomy and genetics in charcoal, phytoliths, seeds and fruits analyses, within relevant environmental and social contexts.

The volume is comprised of 14 chapters and organized into four sections: Methodologies in Archaeobotany, Case Studies in Archaeobotany and Vegetation History, Social Archaeobotany and Genetics in Archaeobotany. In this review, I highlight the main contributions of each chapter in terms of themes, theory and methodology. The first chapter is Sample Size Estimation and Inter-assembly Quantification in Archaeobotany by Gyoung-Ah Lee.

He designs a mathematical method to compare samples from multiple populations using seed densities and also attempts to define which measures are most likely to survive post-depositional processes. After applying the formula to samples from Korea, the author reflects on how using comparable samples is essential when making cultural inferences about how botanical remains were used. Gyoung-Ah Lee gives the reader a means to improve sampling decisions in the laboratory, to minimize time spent in analysis, and to assure comparability between archaeobotanical assemblages.

The second chapter by Luc Vrydaghs, Paul de Paepe, Katrien Rutten and Ernie Haerincx is a detailed study of regional exchanges in South-eastern Arabia during the Late Pre-Islamic period, using phytolith analysis. Their study is a methodological reflection on a new proxy: phytoliths from ceramic thin sections show consistency between phytolith, petrographic and chemical data from different clay samples. The study demonstrates that plant microfossil analyses are direct evidence of pottery manufacture and regional exchange. There are fewer problems with the context of these samples than with other archaeological studies of trade, exchange, and source provenance (Tykot 2004). The results challenge our assumptions concerning the choices potters made and regional pottery exchanges.

Closing this methodological section is the chapter Examining Agriculture and Climate Change in Antiquity, by Alexia Smith. This article starts with our current concerns about global warming and its impact on food production. She compares information from southwest Asia during the Bronze and Iron ages related to climatic changes and their effect on agricultural activities, using regional databases and



published data. Smith believes that the data may be biased due to the fact that it comes from different sources and has been analysed by various people. She recommends integrating records of flora and fauna in order to compare ancient climates and dates and their relationship to human activities. Finally, she reflects on the interrelationship between climate change and agriculture, and how the collapse of societies may be understood as the result of a more complex process involving the adaptation of people to climate change, rather than the result of a single cause. This methodological proposal gives ways to refine the analyses and approach the problematic of climatic change and the emergence of agriculture on different levels. Firstly, for future research, Smith takes into consideration both temporal and geographic scales. Secondly, her exercise of comparing multiple data sources allows the possibility of applying statistical tools, not only to create comparable data sets but also to correlate cultural and biological factors. Finally, from a theoretical point of view, the interpretations of the relationship between climate change and agriculture, rather than focusing either on mono- or multi-causality, re-directs the questions to the specific capacity for resilience and adaptation of each human group in the face of both environmental and social changes.

The second major section, Case Studies in Archaeobotany and Vegetation History, starts with Sara Walshaw's work on the archaeobotanical evidence of Swahili Urban Food Production. Walshaw concludes, after comparing botanical with linguistic and ethnohistorical data, that Swahili food production occurred at a household level and was integrated with Asian exchange networks. Her chapter is a comprehensive study of plant food production and the use of indigenous resources in sub-Saharan Africa. Walshaw integrates the analysis of plant remains from archaeological sites in the specific context of East Africa with other data sources such as linguistics and history. In an economic framework, Walshaw touches upon universal anthropological topics such as diffusion of knowledge and acculturation processes.

Danièle Martinoli explores the use of the optimal foraging model in relation to the exploitation of plants by hunter-gather communities in Oküzini and Karain B in Anatolia. The author uses this model as an interpretative aid to understand the absence of small seeds in the archaeological record as the

cumulative product of day-to-day human decisions favouring nuts and roots, guided by a set of microeconomic optimizing principles. Martinoli reflects on the need to improve the identification of plants in archaeological contexts in order to re-think the interaction between ancient human groups, and the exploitation of plants for food and surrounding environments. This application of behavioural ecology to the study of human agency and interaction with the environment is an interdisciplinary incursion by Martinoli to explain cultural change in Anatolia. As Zeder (2009) points out, Anatolia, as part of the Near East, has the oldest and most comprehensive record of culture change related to agricultural origins. However, few case studies have used models from evolutionary biology. Martinoli's chapter shows that the optimal foraging models have something to offer in understanding the transition from foraging to farming in the Near East.

Naomi Miller evaluates climate reconstruction in West Asia in relation to the origins of agriculture and the collapse of societies. She uses diverse data such as ancient texts, archaeological, and botanical data to conclude that the interactions between farmers and pastoral nomad communities, plants, and climate are highly complex. Firstly, the most important result of her chapter is the emphasis on how archaeobotanical data demonstrates the impact of human populations in ancient Iran. Secondly, her comparisons question the geographical spread of the Younger Dryas and its role in the collapse and resilience of West Asian communities. Miller's results lead to a better understanding of how ancient agricultural societies fared under a fluctuating climate and regionally diverse environmental conditions. Finally, she gives a cautionary note about methods and interpretative models of the Near East, given their unsuitability to accommodate the multi-causal responses of human societies to high variability in natural and process-related effects in Mesopotamia. This concern is also shared in isotopic studies (Maxwell et al. 2014; Riehl et al. 2014).

Following a similar line, Simone Riehl's study presents a case of the relationships between environment and crop husbandry in Syria during the late Bronze and early Iron ages. She bases her archaeobotanical study on the remains of wild plant taxa. Using Correspondence Analysis, the author concludes that the wild plant taxa not only reflect crop husbandry practices but are also the result of



differences in climate, vegetation and soil type at the sites. In other words, archaeobotany helps clarify how the environment is influenced by people. The use of multivariate statistical tools places this study beyond classical archaeobotanical research of the composition of woodland vegetation and the use of dung through time as an additional source of information. The author is aware of various methodological challenges such as different geographical areas of plant production, absence of radiocarbon dates and limited botanical samples. Riehl's chapter is an important contribution to the under-investigated area of the western central Levant. Her investigation fills research gaps concerning the Late Bronze and Iron Age economic and environmental history of southern Syria.

Kristen Gremillion's chapter deals with the role of crop diffusion on the Cumberland Plateau in North America. The author believes that a key aspect of Cumberland Plateau's agriculture is not only influence from Mesoamerican knowledge but the various alternative indigenous farming systems that were adapted to particular ecological conditions. Her study is an example of how North American studies of plant production have gradually shifted from description to explanation. Since beginning this study in 2004, Gremillion has shown that the origins and spread of agriculture in Kentucky was complex and this complexity becomes increasingly apparent as data accumulates. In previous studies Gremillion used behavioural ecology models along with opportunity-cost arguments to generate and evaluate predictions about the circumstances in which cultigens were adopted at the Cumberland Plateau. Therefore, to address the limitations of models, the author uses migration and diffusion, not as they are used within the culture-historical paradigm, but rather as a complement that best explains observed data in Kentucky. She posits that migration and diffusion were mechanisms that shaped autochthonous developments in the transition to farming on the Cumberland Plateau.

Dorian Fuller, Chris Stevens and Meriel McClatchie discuss the analytical implications of charred plant assemblages from crop remains as a result of incidental loss or waste disposal from routine activities. In my opinion, this is the most interesting article in the book because, from archaeobotanical, taphonomical and transcultural points of views, the authors question the relationship between context and

archaeological assemblages based on how and why plant remains become charred and deposited within archaeological contexts. This article includes diagrams of crop processing activities, potential variables affecting pre-depositional, depositional, post-depositional stages of charred assemblages, and the relationship between cereal disarticulation assemblages. Using the content of the assemblages themselves, the authors suggest that archaeobotanical remains could be a result of recurrent activities of crop processing, storage strategies, craft production, and dung burning activities. The remains studied were from Iron Age Ireland, Britain and Neolithic Villages in South India and Pakistan; the studies question the assumption that assemblages reflect the function of the context itself. The authors observed differences in composition of archaeobotanical assemblages, including phytolith morphotype frequencies, crop processing stages, and frequency of botanical remains. These were later compared and interpreted to understand aspects of social organisation, in particular the timing of food production, procurement, and storage activities.

In chapter ten, Marco Madella briefly explores the role of plants and food choices in Indus civilizations and the factors involved in those choices. In the author's opinion, these factors are environmental and social aspects whose dynamics determines the exploitation of plant resources such as rice production. Based on this case study, Madella suggests that the adoption of rice is either a result of environmental changes that create shortages of staple autochthonous foods or a social consequence to higher surpluses and the legitimization of roles of social display in the Harappa culture. The central argument of this article is that most studies examine archaeobotanical rice as an indicator of human ecology, food procurement strategies, and economic systems. The acquisition and use of rice should also be considered in the context of the belief systems of human groups.

The next chapter, by Rita Scheel-Ybert and Maria Dulce Gaspar, presents a rare archaeobotanical study from the Brazilian coast, which diverges from the common 'laundry list' studies attached to old reports. Plant remains, specifically dead wood, were used in the past to produce charcoal now found in Brazilian *sambaquis* (shell mounds), which the authors studied with archaeobotanical and taphonomic techniques. These botanical remains are interpreted to be a result



of prehistoric sustainable exploitation of the surrounding landscape during a long period of climatic variations. The study of various shell mounds on the coast of Brazil provides an unprecedented paleoenvironmental reconstruction for this region and also gives alternative insights into the use of plant remains as fuel and food consumption. The conservation of several plant fragments in *sambaquis* shows that plants were far more important in the diet of ancient residents than is considered usual for people who exploited aquatic resources. These results contradict the normative view that groups using aquatic resources are nomadic societies subject to climatic change (Archila et al. 2008). Instead, these sedentary groups show a higher sociocultural complexity and had territorial stability.

Finally, the fourth section discusses the relationship between genetics and archaeobotany and begins with an article by Yo-Ichiro Sato. This author, based on genetic studies and the use of statistical tools such as Discriminant Function, suggests that the cultivation of incipient *Oryza japonica* was carried out in the middle and lower basins of Yangtze River. According to DNA analyses, the author re-evaluates old theories, such as those that suggest that rice originated from one common source. This study shows that *indica* and *japonica* belong to two different races from different domestication events and both were the result of changing environmental conditions that pushed people to begin rice cultivation.

The next chapter is another genetic study by Ken-Ichi Tanno who questions that six-row barley was derived from two-row cultivated barley. The general assumption is that increase in seed production was a common goal during the domestication of cereal crops. Using an experiment to determine the origin of six-row barley, he implies that it might be derived from two independent mutation events from two-row barleys. Furthermore, the author suggests the need for more archaeological evidence and collaborative genetic studies to confirm when and where this happened and to elucidate the origin of barley. Archaeogenetic studies in plants have entered a new stage of maturity due to recent applications and technologies, which help to understand plant evolution and their interaction with human agricultural selection. Additionally, archaeogenetics and computational models have changed the understanding of the origins of domestic plants as a relatively simplistic origin scenario to a complex

process in which plants also adapted to human environments (Allaby et al. 2015).

The last chapter by Linda Scott Cummings suggests that environmental factors, such as humidity, could influence the size of internal structures of maize kernels, specifically the size of phytoliths. The author based her conclusions on experiments, statistical analysis, ethnographic data, and comparisons with cobs from archaeological contexts from the United States. Cummings suggests that maize phytolith genetics might help us to understand not only diffusion and origins of maize but also social aspects such as human lineages, relationships in human populations, settlement patterns, as well as migration and trade. The last decades have revealed new insights into the phenotypic variation and plasticity of maize. Archaeobotanical and genetic studies of the process of maize domestication and diffusion has shown a contradiction between evidence supporting the earliest cultivation in the lowlands and the genetically ancestral position of Mexican highland maize (Van Heerwaarden et al. 2011). This chapter is one of few works that addresses plastic responses by maize to perturbations from environment and human factors, which could contribute to resolving this contradiction and help to reassess the data from genetic studies alongside social considerations.

This compilation of contemporary work explores the interactions between human beings and plants by examining archaeological evidence from ecological and evolutionary perspectives (Gremillion 1997) and social and post-processual perspectives. My only criticism is that this compilation of articles does not consider other centers of domestication in the Americas and focuses on cereals, wood, and seeds. Despite this, the volume will be a valued addition to the libraries of geographers, cultural anthropologists, botanists, ecologists, archaeobotanists, environmental archaeologists, and students who are interested in the changing relationships between human and plant populations.

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