Chapter 5 provides a wealth of data on the lithic analysis of the artifacts collected from the ORB delta. Charlotte Beck and George T. Jones begin by clearly defining the formal tool categories they subsequently use to classify the assemblage. The authors provide extensive tables of data detailing the entirety of their work in the basin. These data are further augmented through the use of representative photographs for each type of artifact and sketches of the range of flaking patterns exhibited. All of this combines into a comprehensive summary of Great Basin archaeology that serves as an excellent point of reference. Projectile points from each site are connected back to the associated channel, with the emphasis this time being placed on both the timing of occupation and the subdivision of three different type sets. One of the unique findings from this study was the prevalence of points named Stubbies, whose small size and irregular morphology point to high degree of tool recycling. This fits into the broader setting of the ORB delta being lithic source rock depleted and thus, Paleoarchaic foragers began reworking older, discarded flakes into new tools.

Page and Daron G. Duke further develop the issue of sourcing lithic material in Chapter 6 by using X-ray fluorescence (XRF) to tie the geochemistry of tools to source areas. Four principle raw materials characterize the assemblages (chert, obsidian, fine-grained volcanics (FGV), and fine-grained quartzite), with obsidian and FGV dominating. Results were compared between two XRF labs and a handheld XRF unit and all the data produced by this study are available in the supplemental materials online. As in Chapter 4, tools assemblages are dominated by the source rock closest to any given location. The authors also assert that while they cannot completely rule out the role that long-distance trade networks might have played in the exchange of source material, mobility of individual groups was likely the primary means of resource acquisition.

Chapter 7 concludes the monograph by summarizing the previous chapters and discussion mobility of Paleoarchaic populations potentially driven by need to access lithic resources. Madsen, Schmitt, and Page discuss possible models for Paleoarchaic mobility in the Great Basin based on tool sourcing data. The groups in the ORB delta relied primarily on the most proximal (60–80 km) sources of raw material for the majority of the year but longer trips (~200 km) to both the north and south to exploit resources also occurred. The lengths and significance of these trips cannot be constrained at this time but evidence for this activity exists in the tool assemblages.

Working on the margins of basins presents many challenges, as preservation potential is generally low in these areas. However, it is essential to understand these paleoenvironments, as marginal settings like the ORB delta were resource-rich and, as the archaeology presented here demonstrates, were heavily used by Paleoarchaic peoples. This monograph tackles this challenge head on and the interdisciplinary synthesis that sets a high standard of excellence for future geoarchaeological collaboration.

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**Method and Theory in Paleoethnobotany.**


The archaeological subdiscipline of paleoethnobotany, or archaeobotany, has experienced considerable growth in the past few decades. As noted by the volume under review, some of this growth has been fueled by a re-orientation of archaeological research questions and field design to explicitly incorporate the study of archaeological plant remains (p. 9–11). Paleoethnobotanical data and perspectives are increasingly recognized as essential to confronting the “grand challenges” of archaeology (Kintigh et al., 2014: 15–19), particularly in the realm of “Human–Environment Interactions.” It is precisely because of this recent upturn in both publication and research interest that the present volume represents an important threshold in the advance of practice and theory of the discipline.

The genesis of the volume was a session of the 2011 Annual Meeting of the Society for American Archaeology (SAA) in Sacramento, although many of the contributions include references up until the year of its publication. The title and the preface state its objectives: to provide an enduring commentary on field and laboratory methods (p. xx), a review of affiliated subdisciplines, and an overview of some theoretical perspectives that inform postanalysis interpretation. To that end, the volume is balanced in its global treatment of case studies presented in each of the chapters. The range of topics covered by the volume is relevant not only to archaeologists, but also environmental scientists,
ecologists and, indeed, any researcher investigating socioecological dynamics in the human past. Since the last major disciplinary synthesis of this magnitude was in 1988 (Hastorf & Popper, 1988; Hastorf, 1999) the bibliography of, and literature reviewed by, each of these chapters provides much-needed syntheses of recent research. The latter includes a suite of methods that have matured since the late 1980s, including microbotanical analysis (phytoliths and starches), biomolecular methods (e.g., aDNA), and stable isotope analysis.

The volume comprises 19 contributions thematically grouped into five parts: (1) Formation Processes; (2) Recovery, Identification, and Data Management; (3) Quantification and Analysis; (4) Integration of Paleoethnobotanical Data; and (5) Interpretation. These five sections cover an array of topics in nearly 400 pages of text, and since many of the chapters deal with concepts or empirical issues whose development is ongoing, there is naturally considerable room for disagreement on particular points, precluding a detailed review of each chapter.

The first chapter introduces the major concepts that frame the volume. It provides a useful summary of major trends in the subdiscipline (p. 3–11), particularly since the 1980s and 1990s. It also outlines possible future directions for paleoethnobotany, including the impact of digital open-access on data sharing, the training of practitioners, and the relevance of the subdiscipline beyond archaeology proper. Part I (Formation Processes) presents a near-comprehensive overview of the cultural and natural processes that affect archaeological plant remains in three separate chapters. Chapter 2 (Gallagher) usefully surveys a large body of literature concerning the effect of wet, dry, carbonizing, and mineralizing conditions on macrobotanical remains. Nevertheless, the chapter only cursorily outlines the influence of depositional processes on context formation (cf. Miksichek, 1987: 224–228). The other two chapters of Part I focus on starch granule (ch. 3, Henry) and pollen and phytolith (Peasall, ch. 4) formation and deposition. Each contains useful illustrations and figures, especially of the life histories of each of these remains. It is noteworthy that both chapters refer quite extensively to a range of recent experimental research concerning microbotanical deposition and preservation, including discussion of the recovery of these remains from artifacts (p. 66–69).

Part II (Recovery, Identification, and Data Management) treats a wide range of field methods used to physically recover various preserved plant parts from archaeological sediments, as well as laboratory methods used in their analysis. The emphasis in these chapters is on the recovery of macrobotanical remains and, among them, seeds and related plant parts, with little discussion of wood charcoal, although there is discussion in the first chapter of the section (ch. 5, d’Alpoim Guedes & Spengler) on the recovery of microbotanical samples (p. 86–92). The latter chapter presents a useful survey of recent work on the various outcomes of the sampling of archaeological sediments followed by a series of recommended “best practices” for field archaeologists. The remaining chapters deal with in-field recovery of macrobotanical remains through flotation (ch. 6, White & Shelton) and their analysis in the laboratory (ch. 7, Fritz & Nesbitt). As with Chapter 5, both of these chapters combine recommended best practices (e.g., manual flotation versus “wash-over”) with syntheses of current research (e.g., the discussion of fungal sclerotia in ch. 7, p. 138). One of the more timely chapters in this section is Chapter 8 (Warriner & d’Alpoim Guedes), which, while digital technology continues to evolve rapidly, emphasizes the current potential of computational tools in paleoethnobotanical analysis. Despite the chapter’s broad sweep of the “digital revolution,” it misses an opportunity to discuss some of the major languages and platforms now used across the sciences, including but not limited to Python, Matlab, R, and GIS (Quantum GIS, ESRI ArcMap, etc.).

Part III (Quantification and Analysis) offers several approaches to the quantitative analysis of paleoethnobotanical data. Chapter 9 (Marston) provides a clear explanation of “simple statistics” and the contribution of various forms of univariate analyses to the exploration of paleoethnobotanical data. However, the use of the term “simple statistics” to signify nonmultivariate is potentially misleading considering that many nonmultivariate methods, such as multiple linear regression, can be computationally complex. Throughout the chapters of this section box plots and pie charts are referred to as methods, rather than as approaches to graphical visualization, which is an open area of debate. Chapter 10 (Smith) is a key presentation of various multivariate techniques—since paleoethnobotanical data are collected in nonexperimental settings, exploratory ordination methods such as Correspondence Analysis (CA) are useful since they make few assumptions about the underlying distribution of the data (Legendre & Legendre, 2012: 425–429). As these techniques also generate output regarding the model (amount of variance explained, eigenvalues, etc.), a discussion of the interpretation of these components would have enhanced the contribution. Chapter 11 (Van-Derwarker, Alvarado, & Webb) draws attention to the role of spatial analysis, here seen as the physical location of samples within a delimited space, in understanding activity areas and formation processes. The chapter reviews the use of multivariate statistics (PCA, box plots,
pie charts, and spatial density analyses using a case study from historic North Carolina. Finally, the last chapter (ch. 12, Stevens) focuses almost exclusively on the use of ratios of various plant parts formed through the processing of Eurasian cereals to identify differences in labor organization, crop storage, and settlement relationships. While the chapter will have most direct relevance to those working with carbonized domesticated Eurasian cereals, it may also serve as useful “food for thought” for those pursuing similar questions in other areas of the world.

Part IV (Integration of Paleoethnobotanical Data) includes other methods or approaches that are complementary to macro- and microbotanical analyses. For instance, Chapter 13 (Messner & Stinchcomb) uses a case study from eastern North America to illustrate an approach to understanding large-scale socioecological processes by integrating multiple data-sets, including the analysis of alluvial geomorphology and carbon isotopic composition of soil organic matter (p. 263–265). Chapters 14 (Warinner) and 15 (Wales, Andersen, & Cappellini) stand out as exemplary overviews of the potentials and challenges of stable isotopes and aDNA for understanding complex socioecological phenomena. Both chapters rightly stress the need for practitioners to be more mindful of the methods and assumptions of other disciplines from which they are utilizing data (p. 276). Chapter 16 (Casana) explores the utility of remote sensing techniques such as LiDAR and multispectral imaging including NDVI to locate field boundaries and other landscape features associated with human plant management.

The final section, Part V (Interpretation), somewhat unevenly sketches the various interpretive frameworks available to paleoethnobotanists or others engaging with archaeological plant data in many forms. Each of the contributions is highly informative, although the selection of perspectives is limited considering the importance of others such as resilience (Gunderson & Holling, 2001) and historical ecology (Balée, 2006). Chapter 17 (Gremillion) offers some ways in which human behavioral ecological modeling might benefit explanation in paleoethnobotany, especially Diet Breadth Models, using case studies from throughout the Americas. Chapter 18 (Smith) presents human niche construction through discussion of the management of root crops and transplanted orchards of perennial fruit-bearing woody plants across the world. Finally, Chapter 19 (Morell-Hart) presents a novel approach to understanding foodways by using culinary associations as a kind of syntax, and provides a case study from northwestern Honduras utilizing micro- and macrobotanical data.

This volume is highly recommended and should serve as a companion to all archaeologists and those interested in past socioecodynamics. From a practical and theoretical standpoint, the volume offers an unequalled selection of synthesis, practical advice, useful illustrations, and commentary on future directions that will be essential for, and influence, ongoing research in paleoethnobotany and archaeology more broadly.

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The Ice Age: A Very Short Introduction.

Jamie Woodward has written a highly readable summary of what we know about the Ice Age and how we arrived at that knowledge in this, the latest addition to Oxford University Press’s (OUP) “Very Short Introductions”