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your decision? This chapter will surely encourage much classroom discussion—and make a lot of professionals reconsider their standard responses. The final chapter summarizes King’s philosophy on CRM: it’s all about finding out what people value and seeing if it can be protected.

For me, Tom King’s way of thinking about the field to which he has devoted his life is summed up in his choice of dedication and frontispiece. The first reads “To the memory of Adan E. Treganza, an archaeologist’s archaeologist.” The illustration that follows is a rough but skillful pencil drawing captioned “Point Reyes, California, from the 1965 archaeological field camp on Drake’s Bay. A.E. Treganza, pencil on cardboard.” Archaeology, he seems to say, is both craft and science, a rigorous discipline that’s a whole lot of fun.

REFERENCE

- Moreland, John
2001 *Archaeology and Text*. London: Duckworth.



Ancient Starch Research

Robin Torrence and Huw Barton (eds).
Walnut Creek: Left Coast Press, 2006.
256 pp., 157 illustrations, \$69.95 (hardcover).

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This book is a collaborative effort brought together over several years by a group of scholars, primarily archaeologists and particularly based in Australia. They wished to emphasize the importance and potential contributions of ancient starch research, and to produce a basic textbook on how this research is currently being undertaken and the challenges the field faces. They were not seeking to produce a definitive “how to” guide, but rather sought to treat methods comprehensively while at the same time presenting numerous case studies, experiments, and new ideas (p. 31). They have succeeded admirably.

The first chapter (by Torrence) provides a basic historical and regional perspective on ancient starch research which highlights the recentness of significant work in this archaeological field. Chapter 2 (by Gott, Barton, Samuel, and Torrence) is a very useful overview of the biology and chemistry of starch, drawing attention to why starch granules have characteristic features such as shape, and the significance of the extinction cross that allow them to be identified and classified taxonomically. Here and elsewhere in the book the writing is very easy to follow, whatever the background of the reader, yet still conveys the more technical information needed to understand and appreciate the meaning of starch granule form. Text flows very well from chapter to chapter, despite the multiplicity of authors, and I always found it enjoyable and easy to return to as I read on. This speaks to the writing skills of the authors and particularly to the skills and hard work of the editors, Robin Torrence and Huw Barton. Chapter 3 (by Barton and Fullagar) briefly summarizes the microscopy and staining techniques that have been used to examine ancient starch; it is a valuable addition that succinctly outlines how different imaging systems operate and what additional information can be obtained through their use. This chapter is particularly useful in assisting researchers in deciding what equipment they need and what might best suit their research purposes.

Chapter 4 (by Beck and Torrence) examines how starchy plants are used by people and hence become incorporated in the archaeological record: the “starch pathways.” Although prominence is given to the use of starchy plants as food, attention is also paid to the many other uses of plants that might result in archaeological starch residues (industrial, medicinal, etc.). A feature of this book is the use of numerous examples and case studies set apart in their own text boxes to illustrate the concepts discussed in the main body of the text. The ethnoarchaeological studies highlighted in the boxes in this chapter are particularly effective in this regard. Chapter 5 (by Barton and Matthews) then completes these pathways by looking at how that incorporated starch is preserved or destroyed in the intervening years through a consideration of the taphonomy of starch. Here again, the experiments by Lu, Williamson, and Therin in the text boxes are particularly effective and important. The chapter outlines variables that affect starch preservation and shows how the altered form of starch can provide insights into both natural and cultural processes (e.g., type of cooking and processing). The cultural implications are explored further in Chapter 10. Given the later discussion of calcium oxalate raphides and crystalline druses (e.g., p. 136), it might have been appropriate here to mention their poor preservation in sediments. Chapter 5 also explores the issue of contamination through handling in the field and in the lab, as well as the meaning of starch granules not directly adhering to artifacts (later termed “taphonomic starch” by Haslam, p. 175). It also deals with the issue of the movement of microfossils in sediments. Starch granules are microscope remains that have the potential to move through pores in sediments, resulting in dissociation from the original depositional context. This has been a point of debate, for example, in discussions about the use of microfossils as evidence for the early development of domesticated crops and the regional introductions of plants to various areas of the world. Such potential movement is a critical issue for the credibility of this field of research and the discussion here is well done.

The practical, hands-on portion of the book dealing with lab work begins with Chapter 6 (by Field) on assembling a reference collection. Importantly, the chapter emphasizes that although one can rely to a certain extent on published material, there is little of this in many regions of the world (a point reiterated in the

concluding chapter, p. 222). As well, comparative material is commonly needed to resolve particular identifications even when a researcher has become very well-versed in the local material, as anyone who has worked with zooarchaeological or similar material knows well. The chapter discusses sources for plant material, slide preparation methods, and the types of information that need to be recorded for a well-documented collection (e.g., voucher specimens, source locality data, etc.). The multiple-author nature of this book is particularly seen here, where a number of the mounting methods favored by various researchers are presented in Box 6.5. Field notes that the method chosen will be based on a number of factors, such as the material being mounted and the equipment available, but some commentary about the strengths of particular methods for particular circumstances would have been appropriate. Chapter 7 (by Torrence) on the identification and classification of starch grains includes a particularly thoughtful discussion of the varying levels of identification necessary for various research goals. The discussion of granule physical features and analytical approaches is also well done. However, the focus on Oceanic research has perhaps resulted in contributions from other researchers being neglected. This becomes more obvious, aside from the work of Linda Scott Cummings, in Chapters 8 and 9. In particular, Pearsall’s simple but effective approach utilizing the staged sampling of artifacts is central to addressing criticisms of ancient starch research involving granule context, yet it receives only cursory attention (pp. 196, 198)—this approach would improve the sampling procedure outlined in Chapter 10 by Samuel, p. 209. That said, there are also places in the book where there has been an excellent integration of these wider contributions. It seems from the Preface that the Ancient Starch Research Group did include some of these researchers, but perhaps they were unable to contribute to the volume. This is unfortunate, but the book remains an excellent source.

Aside from the point just mentioned, Chapter 8 on the extraction of starch from sediments (Torrence), and Chapter 9 on the extraction of starch from artifacts (Fullagar), are excellent. Chapter 10 is similarly well written, in this case also showing a better regional balance in terms of researchers and projects. A few comments are warranted, however. Carol Lentfer’s contribution (pp. 153–155) on sediment sampling would have been

improved in some cases by a few more details, such as how sampling tools were cleaned (similarly for cleaning the sieving mesh, p. 160) and that sediment sampling should begin at the base of the excavation when sampling from an extant wall. The concerns expressed by Torrence and Therin (pp. 156–158) about the effects of extraction chemicals are important to be aware of, but most sediment extractions would not require soaking in these chemicals for an amount of time that would become problematic. Scott Cummings outlines a very harsh and destructive technique for the extraction of starch from charred remains (p. 213), noting that it is necessary but that much of the starch is destroyed. A gentle crushing of this residue, as outlined by Samuel (p. 210), followed by an initial examination for any freed starch in a dry mount on a glass slide, will allow some additional starch identification. The sample could then be subjected to the procedure outlined by Scott Cummings. These are obviously very minor criticisms.

The illustrations and photographs, in both the higher quality Plates section in the center of the book and within the text, are excellent. A few errors are present in the labeling of, and references to, the Plates. There are also a few typographical errors: e.g., on p. 89, Williamson mentions starch granules that are 6 to 28 mm. in size (this clearly should read 6–28 microns), and on p. 129 the list of important characteristics should number 1 to 6, not 1 to 7 (skipping 2). These kinds of errors are unavoidable in a complex project of this nature, but they are minor and in no way detract from the book. A few are more significant, however. On p. 60, the second reference to Plate 41 is actually to Plate 30. Plates 1 and 3 are of the same sample, as are Plates 2 and 4 (not 1 and 2, 3 and 4); in addition, it is Plates 1 and 2 that are DIC images, with 3 and 4 polarized. The reference to a potato starch grain showing an extinction cross on p. 131 refers to Plate 10, but this image is not of potato starch and there is no extinction cross. On the same page, Plates 10 and 11 are cited as examples of granules having an eccentric hilum, but this should be Plates 9 and 10.

Chapter 11 (by Barton and Torrence) draws the book to a conclusion, and looks to the future. Among the possibilities raised is the direct dating of starch, and my only comment would be that this has already been done, albeit as part of larger patches of residue on ceramic vessel fragments.

Ancient starch research holds incredible potential in the Great Basin and California, given the vast array of plants used in this region for food, material culture, and medicine. These plants were also processed in many ways, from cutting and scraping with lithic tools to grinding and pounding; hence there is a wealth of cultural information to be revealed. Dry caves have often provided us with tantalizing evidence of plant use, but we have always known those traces were but the tip of the iceberg. *Ancient Starch Research* affords us a new key that will unlock much more. Starch can provide evidence for the use of plants when conventional analyses cannot. Significantly, microscopic starch residues remaining on processing tools can also provide information that links plants to the tools used to process them. Starch grains in sediments may be the botanical equivalent of microdebitage, invisible to site occupants and hence left where the processing event occurred. Obviously, many root foods, such as camas and bitterroot, contain starch, but so do many seed foods such as acorns, amaranths, and chenopods. Many important berries, such as chokecherries, service berries/saskatoons, and rose hips, also contain starch. Perhaps surprisingly, some plants such as conifers (e.g., pines) have starch in the wood. Case studies in *Ancient Starch Research* also show that starch grains turn up in places where one might never expect them, such as in fibers woven into string, nets, and baskets (pp. 62–63), and in resins (pp. 186–187) used in hafting lithic tools. Even if the baskets and tool hafts are gone, the starch traces may remain.

Ancient Starch Research is essential for any researcher engaged in ancient starch research, any student who is thinking about working in this area, and anyone who wants to understand the basis for interpretations in this field in terms of strengths, weaknesses, methods, and potential. It is an outstanding book and I recommend it most highly.

