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The Chemistry of Prehistoric Human Bone by T. Douglas Price (Review)

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areas as efforts to enhance production. Because of environmental limitations the highland society could not emulate the lowland model (expansion of agriculture). To enhance production, highlanders turned to pastoral nomadism on a large scale. In an excellent discussion of these complementary developments, Zagarell notes that there is no inherent antagonism between pastoral and agricultural societies.

Each of the other articles in this section offers some valuable insights. Conkey's review of structural analysis in Upper Palaeolithic art describes and builds on the seminal work of Leroi-Gourhan and attempts to find roles for individuals, as opposed to cultural processes, and symbolic meaning in archaeological reconstructions. Chang offers an interesting, but not entirely convincing, distinction between rupture and continuity in defining the character of Western and Chinese civilizations, respectively; China, he feels, retained the cosmic holism of its pre-state era. As a result, Chang argues, the same model of state formation cannot be used for the two areas. Willey's settlement-pattern studies indicate the Mayan city-states remained relatively small, antagonistic peer polities throughout their existence. Perhaps the most controversial assertion is Fairservis's belief that Harappan culture reflects a chiefdom level, ranked society. If the large, well-planned Indus sites do not constitute evidence for a state, and this is certainly a minority opinion, we would have to reassess the standing of Aegean Bronze Age societies in the second millennium B.C. The articles by Lamberg-Karlovsky and Wright discuss contacts between various regions in West Asia and lend support to Kohl's thesis for the existence of a series of centers in an ancient world system. The 46-page bibliography is also a valuable resource, especially for those who seek a single source to consult to acquire familiarity with American archaeological literature.

In its catch-all approach, this book presents a good sample of current thinking by leading American scholars on the question of how to structure the archaeological enterprise. The emerging interest in the role of ideology and religion, viewed as subordinate in some ecological approaches, resounds through many of the articles, but materialist perspectives also receive considerable treatment. There is abundant criticism of both approaches in the initial section and this reflects the search for techniques to comprehend the archaeological record in its entirety. The volume mirrors the flux that characterizes the discipline in North America today. While some may deplore the lack of a single dominant perspective, I believe it is a symptom of the critical self-examination necessary to the continued development of a vibrant discipline. To judge from this book, American archaeology is experiencing paradigm anarchy, a condition that can be conducive to intellectual growth. In the meantime, this book is proof that the current atmosphere of ferment can produce innovative, provocative new studies and many judicious reassessments of older techniques and interpretations.

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THE CHEMISTRY OF PREHISTORIC HUMAN BONE, edited by *T. Douglas Price*. (School of American Research Advanced Seminar Series.) Pp. xxiv + 291, figs. 29, tables 61. Cambridge University Press, Cambridge 1989. \$49.50

This important and clearly written publication marks a turning point in the application of studies of human bone to archaeological problems. For more than a century physical anthropologists have examined human skeletal remains in order to contribute important basic information on age and gender to archaeological studies. More recently the application of computer technology, linked with newly developed statistical techniques, has given meaning to volumes of data generated by anthropometric projects, some of which date back to the 1860s. Research in bone chemistry now provides the potential for yet another advance in the study of human remains, one by which we can look into the past and examine aspects of human behavior never before so clearly observed. Quite simply, human bone bears specific elements and isotopes that reflect the kinds of food that were eaten. These remain locked in the bone and now can be identified in order to reconstruct past diets.

Just as radiocarbon dating techniques emerged from a few basic experiments made nearly 40 years ago, bone chemistry studies began with a few innovative research projects in the early 1970s. By the beginning of the 1980s a number of physical anthropologists, chemists, and others had, in effect, generated an entirely new approach to the study of the past. Ten of the foremost of these scholars were recently brought together at the School of American Research (SAR) for a seminar on bone chemistry, and now we have the impressive result of that meeting. This brief review hardly does justice to the efforts of the 19 authors who contributed to this work; nor does it adequately reflect the skilful editing, which has provided a clearly presented and well-ordered set of papers. The smooth internal flow of each chapter and the sequence in which they are presented have generated an edited volume of unusual coherence. The 30 pages of references and the detailed index reflect the high quality of the academic and editorial work that created this book.

T.D. Price's introductory chapter provides a history of bone chemistry studies as well as the theoretical basis on which this research is based. He also includes a brief section labeled "Problems," which clearly delineates those areas in which our knowledge is limited and in which caution must be exercised. Chapters 2 and 3, by Brian Chisholm and M.J. Schoeninger respectively, address basic questions on the use of bone chemistry studies to reconstruct human diet. J.E. Ericson and his co-authors (Chapter 4) apply these kinds of data in the study of a specific question regarding the beginnings of maize agriculture in one part of Peru. This chapter, in particular, demonstrates how a specific archaeological problem can be investigated using studies in bone chemistry.

Chapters 5 through 9 address several factors that lead to variations in the elemental composition of human bone, and in particular bone derived from archaeological sites. Jane Buikstra and her co-authors, in the longest paper in this collection (Chapter 7: "Multiple Elements: Multiple Expectations"), provide data of the greatest interest to archaeolo-

gists. The authors note that much of the research on bone chemistry has focused on the element strontium, perhaps due to ancillary concerns with atomic fallout. Such single element studies dominate the field, but most of the complex archaeological questions have been addressed through the use of multiple element research. While technological problems have all but disappeared from research projects involving more than a single trace element, such studies remain more problematic from various theoretical perspectives discussed by the authors. The very important and concise review these authors provide of the major archaeological studies concerned with more than a single element is linked to a discussion of various other facets of this research. Note should be made that only one of the two dozen major papers reviewed by Buikstra et al. deals with bones from Old World contexts. To some extent this reflects the earlier lack of concern on the part of many archaeologists working in Europe with collecting and curating large skeletal populations.

Chapter 10, the concluding paper signed by all the participants in the seminar, clearly summarizes the innumerable archaeological questions that can be approached through studies of bone chemistry. For example, the diets of individuals at an archaeological site can be determined and the results used to infer status and rank within that society. On a more general level these studies permit the reconstruction of past environments for entire archaeological regions. Conjoined, these different kinds of information may allow us to determine where an individual was raised as distinct from where that person died.

When linked with archaeological contexts that can be dated within a few decades, such as exist for some Greek and Carthaginian colonies, these studies should allow us to actually identify the remains of the specific colonizers as well as to address several other problems specific to these situations. Such research will greatly enhance those studies based on osteometric data, which now are beginning to examine processes of migration, colonization, and military occupation, throughout the Mediterranean world.

These new techniques are far from perfected, but the present level of inquiry calls to mind the state of carbon dating research around 1965. Bone chemistry studies have now matured to the point where every archaeologist should have some understanding of what can be done with even the smallest scraps of human bone. This outstanding book cannot be considered required reading for all archaeologists, but every archaeologist should be familiar with its subject matter. Furthermore, this is an essential reference volume for every physical anthropologist working with ancient skeletons, and an absolutely required volume for the library of every college and university where courses in archaeology are offered.

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PARADEISOS. A LATE NEOLITHIC SETTLEMENT IN AEGEAN THRACE, edited by *Pontus Hellström*. (Medelhavsmuseet Memoir 7.) Pp. 143. Medelhavsmuseet, Stockholm 1987.

Paradeisos is a rocky hillock, ca. 0.4 ha in area, rising 25 m above the right bank of the Nestos, near the apex of the river's extensive delta. The excavated deposits below the plow zone belong primarily to the fourth millennium B.C. (a date supported by three radiocarbon measurements) and suggest a settled agricultural community. Human activity at the site is, however, attested both for the fifth and for the third and second millennia. The excavators are content with the assumption that the Bronze Age component was of the same nature as the Neolithic one, and that it was stripped away by natural or anthropogenic erosion, but the issue has not been empirically investigated.

The excavated area is ca. 23 m² in the northern periphery of the top of the hill, where the cultural deposits seem to attain their maximum thickness. Even in that area, bedrock has been reached within 2 m from the surface. A few deposits have been interpreted as floors, the remainder are presumably debris from structures that once stood on or near those floors. But the descriptions of the deposits are hopelessly inadequate. Their interpretation proceeds without the aid of a model of site formation processes, and the valuable information that could have been obtained from analyses of the sediments (invariably called "soils" in the section on stratigraphy) has been lost.

"Of the approximately 400 kg of pottery found during the excavation, a fair amount was decorated pottery" (p. 39). That is the only amount of pottery ever given some attention in this report. It consists primarily of "graphite painted" (56%), and it also includes "black on red" (9%) and a variety of incised/impressed wares. If the former two categories are unmistakable markers of the last Neolithic phase in north-eastern Greece, the third includes pieces datable to both that phase and the early third millennium. Incised/impressed pieces are indeed considerably more frequent in the upper than in the lower deposits at Paradeisos, but it is difficult to tell from the report whether the increase is solely due to the incorporation of Early Bronze Age material. Many of the illustrated sherds have clear parallels in Sitagroi IV-Vb. The "graphite painted" material, on the other hand, remains homogeneous from surface to bedrock. Its system of decoration is less elaborate than that at sites in the Drama plain.

The faunal sample (24.3 kg), obtained through trench collection and dry-sieving, is given a more fair treatment than the ceramic one, the modest conclusions following upon tables of measurements. Its species composition is comparable to that of the Sitagroi III sample, with the ovicaprids being about twice as frequent as cattle and pigs, and wild species contributing ca. 10% of the total. Local domestication of pigs (but not of aurochs) is suggested. The harvest profile of the ovicaprids probably indicates stock raising for wool production, as is expected for the period. The very high proportion (ca. 78%) of sheep and goats surviving to adulthood is most certainly inflated by post-depositional attrition, recovery methods, and small sample size, but the figure is