BOOK REVIEWS

Light on Dark Matters

Prehistoric Cannibalism at Mancos 5MTUMR-2346. TIM D. WHITE. Princeton University Press, Princeton, NJ, 1992. xxiv, 462 pp., illus. $62.50.

Human cannibalism is a controversial topic. Like other taboos, it arouses feelings of curiosity mixed with a reluctance to confront the darker side of human nature; thus people find the subject both repugnant and fascinating. The frequency of its occurrence in non-Western societies has been the subject of heated debates among anthropologists. The credibility of the ethnographic record is disputed; some scholars believe that cannibalism has never been customary in any society and only occurs in rare cases of starvation or insanity. Unfortunately ethnography does not provide an objective way to settle the dispute, because accounts of institutionalized cannibalism can no longer be grounded in the testimony of direct participants.

In prehistoric archeology, evidence of putative cannibalism is so rare and controversial that questions of whether cannibalism was an isolated event or an institutionalized practice appear premature. Recent efforts have been directed at establishing what constitutes convincing evidence of cannibalism; Tim White's splendidly illustrated and carefully researched book represents an important contribution to this issue.

The most effective approach to the recognition of cannibalism in the archeological record is provided by comparative analyses of human remains and animal bones known to represent food refuse; this is an accepted notion. The principle of faunal analogy has been used by Old and New World scholars since the last century, but until recently similarities in butchering techniques, marrow fracturing, traces of cooking, and modes of discard were only superficially assessed, thus defying independent evaluation. Here, for the first time in the study of Anasazi cannibalism, faunal comparisons are explicitly used as a central criterion, and the most meticulous analytic procedures are applied to human and animal bones alike.

Mancos, a small pueblo site on the Colorado Plateau, which dates to A.D. 1200, is one of several Anasazi sites in the southwestern United States that have yielded assemblages of disarticulated and broken human bones, interpreted previously as evidence of cannibalism by Turner, Nickens, and other researchers. Painstaking conjoining work by White suggests that the 2106 bone fragments found on the floor and throughout the fill of several abandoned rooms correspond to a single event or, more likely, to a small series of similar events involving the dismemberment, cooking, and presumed consumption of the meat and marrow of at least 29 individuals, including nine children aged 12 or younger.

Preceded by a critical and very useful survey of methods and procedures, the taphonomic analysis of the human remains—the core and chief strength of the book—convincingly documents the sequence of butchery and food preparation steps with close observation of their telltale marks on the bones. Analytical details are illustrated with high-quality photographs and are well presented, but White does not let the reader forget their grim implications. The insights regarding traces of burning and breakage are remarkable, a testimony to the author's observational skills. This analysis sets very high standards for future research.

Frequencies of skeletal parts—of which the Mancos assemblage, with its predominance of cranial parts and scarcity of vertebrae and hand and foot bones, offers a skewed representation—are considered by White to be a key element in the recognition of cannibalism. To interpret them he presents published skeletal-part data from other "cannibalized" assemblages in the Southwest, from primary burials in Californian and Romano-British cemeteries, and several ethnographic and archeological faunal assemblages. Detailed bone modification data are provided for a mule deer and bighorn sheep assemblage from an Anasazi site as well.

This part of the analysis is less incisive and clear-cut. White's argument is that Mancos skeletal-part frequencies are unlike those from primary interments (the norm for Anasazi burials) and broadly similar to those in faunal assemblages and other "cannibalized" assemblages. He uses different measures of element representation for different assemblages, making it difficult for the reader to follow the argument throughout the numerous diagrams. The percentage-survival statistic is not based on minimum number of element (MNE) values, as prescribed by the author who defined the statistic, but on total counts of identified fragments (NISP, or number of identified specimens). Given the high degree of long-bone fragmentation in the Mancos assemblage, use of NISP values has the effect of transforming the percent survival from a measure of element representation into an inconsistent measure of fragmentation (values above 1.0 are controlled by fragmentation, whereas values below may more accurately inform on proportions of missing bones). White is aware of this fact but appears to consider it unimportant. Comparisons with faunal assemblages from Early Stone Age Africa to Neolithic Sweden do not seem very useful; perhaps deeper insights could have been gained by a more specific discussion of the frequencies of element portions, the context, and the accumulation history of Anasazi faunal assemblages.

Interpretations of element disproportions are notoriously difficult; White argues that some at least can be explained as resulting from removal of spongy bone parts for the rendering of grease from bones. But element frequency data are most useful for behavioral inferences when the assemblage under study is fully recovered from a closed depositional unit. This is not the case at Mancos because of the lack of screening during excavation and because the bones were not discarded at a single locus but were spread vertically and horizontally in different depositional units. Thus one cannot be certain that the scarcity of spongy bone portions is the result of destruction for bone-grease rendering and not of postdepositional crushing of fragile cancellous bone, incomplete recovery during excavation, or discard of missing parts into unexcavated refuse deposits. The comparative analysis of the Anasazi fauna does not include data on limb-shaft fragmentation and destruction of articular ends; breakage of vertebrae, less advanced in the fauna, may be due to forceful butchery of the backbone with a stone ax, but does not necessarily imply bone-grease exploitation. Thus the bone-grease hypothesis is plausible but remains untested.

The comparative analysis of butchery strategies applied to humans and animals strongly supports the cannibalism hypothesis. I only wish it included tables or standardized sets of drawings with frequency data on placement of tool marks in specific anatomical areas of human and animal bones for a more complete assessment of butchery and consumption practices. Finally, I hesitate to consider "pot polish" on bones (presumably due to boiling) as a definitive argument for consumption, since

other causes of polish can be envisaged and have not been refuted. But the strength of White's argument is elsewhere, solidly grounded in observations of cut marks, marrow fracturing, and burning.

Given the skepticism surrounding the topic and its sensitivity for Native American groups, it is unlikely that all scholars will view this work as a final demonstration of Anasazi cannibalism, settling the question once and for all. Indeed, a debate is already developing. Bullock (*Kiva* **57**, 5 [1991]) suggests that American Indian warfare practices, not cannibalism, could have caused the traces observed in these assemblages. Death by battering and subsequent corpse mutilation (from scalping to skull crushing, cutting of parts, and even burning) are documented by historic accounts, by soldiers' remains at the 1876 Battle of Little Bighorn, and by skeletal analyses of victims of prehistoric and post-contact intertribal wars, such as the Crow Creek and Larson Village massacres in South Dakota, which involved large numbers of individuals. In the Southwest comparable occurrences suggestive of interpersonal violence, although with fewer victims, are briefly discussed by White. Most involve partially articulated skeletons, a condition that is not found in the Mancos assemblage and that White includes as a diagnostic criterion of cannibalism. But secondary burial of the decomposed remains by survivors might explain the disarticulated condition of the bones. This hypothesis is less fanciful than it might appear if we consider that secondary burial was a common practice in the Great Plains of the central United States and was occasionally practiced by the Anasazi and that there is archeological evidence that burials of disarticulated bones of warfare victims did in fact occur (O'Shea and Bridges, *Plains Anthropologist* **34**, 7 [1989]). Although White could not anticipate Bullock's challenge, which was published after his manuscript was completed, his careful taphonomic analysis provides the reader with enough arguments to refute it. Numerous percussion marks show that the percussor contacted bones in a defleshed state and that bone breakage followed dismemberment and burning, instead of preceding them as required to support a hypothesis of death by battering. The very high degree of long-bone fragmentation also cannot be reconciled with Bullock's hypothesis.

The competing explanation of mortuary practices will not easily go away; other researchers have suggested that such practices might include deliberate bone breakage, which would mimic the effects of marrow extraction from animal bones, and cause loss of skeletal elements (Bahn, *New Scientist* **134**, 40 [11 April 1992]); reply by White, *ibid.*, 49 [20 June 1992]). There is no evidence that Anasazi and other American Indian burial practices ever included deliberate bone breakage; nevertheless White deals too briefly with that issue. Undoubtedly the question has never been properly addressed; contextual and taphonomic analyses of American Indian human remains are a recent development. But until the counter-argument is checked for correspondence to facts, it will persist.

The book is lavishly produced, almost without flaws; its masterful analysis of the Mancos assemblage and critical compilation of data from the literature are mandatory reading for taphonomists and archeologists on both sides of the Atlantic and will stimulate research for years to come. That it is the source of some unanswered questions is, I believe, a measure of its success.

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The Return of the Fly

The Genome of *Drosophila melanogaster*. DAN L. LINDSLEY and GEORGIANNA G. ZIMM. Academic Press, San Diego, CA, 1992. x, 1133 pp., illus., + plates. $79. Revision of *The Genetic Variations of Drosophila melanogaster.*

The Genome of Drosophila melanogaster is the sequel to the 1968 bestseller *Genetic Variations of Drosophila melanogaster* by Dan L. Lindsley and E. H. Grell (Carnegie Institution of Washington Publications). The comparative anatomy of these two works speaks to the tremendous progress and information explosion that have occurred in the biology of this user-friendly fly.

The 1968 Lindsley and Grell is a dictionary of classical genetic information, interspersed with a few examples of gene characterization at the protein level. There was no molecular information available (except on the *bobbed* gene), no known transposable elements, no germ-line transformation technology. The first major section of the book was entitled Mutations, reflecting the fact that the predominant way that genes were identified up to this time was by classical phenotypes (morphological, viability, fertility, and the like). In this section there were about 3000 entries, with each allele constituting an entry and receiving at least a short paragraph of description.

Contrast this with the corresponding section of Lindsley and Zimm. This section is now called Genes and consists of about 4000 entries—and here an entry equates with a gene, regardless of how many alleles of that gene are listed. Quite a few "gene" entries have hundreds of known mutant alleles, and these alleles can only be afforded a single line in a tabular display. The change in title from Mutations to Genes reflects an operational difference in how genes are captured. Though many genes are still identified through classical mutations, many others are now first noted as homologs of other genes from the fly or other organisms, from enhancer trapping or from reverse genetics approaches. Hence there are now many genes still in search of mutant phenotypes. Molecular biological information is a substantial portion of the current volume. For example, this reviewer sampled all gene listings beginning with the letter *t*. Of 131 listings, 29 refer to genes for which the only mutant allele has been lost (usually lost several decades ago). Of the 102 "extant" genes, 31 have molecular biological information associated with them. Indeed, several of the others have been cloned in the past two years, past the general cutoff date for incorporation of data into Lindsley and Zimm.

In addition to the gene entries Lindsley and Zimm gives cytogenetic and occasionally molecular information on approximately 9000 chromosomal rearrangements. Together these two sections make up over 90 percent of the volume. Other important sections are devoted to special chromosomes, transposable elements, and, particularly, cytogenetic maps. The maps serve as the index for identifying possible loci of interest in a particular region of the polytene or recombinational map of the fly genome. In addition to the foldouts of Calvin Bridges's larval salivary gland polytene chromosome drawings, the photographic polytene maps of George Lefevre are reprinted here.

As with all databases, there must be a limit to the scope of Lindsley and Zimm. Though there is substantial molecular information, the compendium is still clearly focused on the classical genetics of the fly. Molecular information is provided insofar as it helps describe genes or, occasionally, rearrangements. P element insertions are listed only if they have insertionally mutated specific genes. Hence the reader will not find most enhancer trap insertions and modified transgenes included in the listings.

What role has Lindsley and Grell served, and will Lindsley and Zimm continue to serve it? Lindsley and Grell has been an invaluable reference to the drosophilist. Because so much of the work on the fly is tethered to genetic analysis, a comprehensive resource to help you in relating new genes to the existing information, to describe the phenotypes and genetic properties of mutations you are using, and to identify chromosome breakpoints to help