

cause the second part of his book is heavily physiological in nature, he treats the biological determinants of fertility in much greater detail and since his focus is natural fertility, he ignores deliberate, parity-specific control factors.

In the second and major part of this book, Wood discusses the proximate determinants of natural fertility: ovarian cycles and the fertile period; conception, implantation, and pregnancy; fetal loss; fecundability and coital frequency; breastfeeding and postpartum infecundability; menarche and menopause; the onset of permanent sterility; and marriage and the male contribution. Whereas all the earlier chapters emphasize the reproductive processes that take place in women, the author asks whether we can fully understand fertility variations without considering the male factors. He then turns to discuss: frequency of insemination; duration of the fertile period; probability of conception from a single insemination; fetal loss; and the effects of aging.

Having discussed systematically and in isolation the proximate determinants as biological and behavioral mechanisms, Wood turns, in section three, to "the heart of the current book" (p. 511). He asks how the reproductive process works as factors influence each other, and he presents a dynamic integrative model of birth-interval components. This in fact is where future research must concentrate, including questions regarding the influence of more remote factors that ultimately explain fertility variations.

An appendix by Kenneth Campbell and Wood on quantitative endocrinology concludes the text.

James Wood has produced an informative readable book from which student and professional will profit. This study will be of particular value in courses on human biology, reproductive physiology, demography, and human sexuality. One particularly attractive feature for this reader is that the text is not cluttered with tables and graphs or statistical calculations. When the reader is engaged in a specific topic or engrossed in following a determining sequence, there is nothing to interrupt concentration. Every chapter concludes with a section of notes followed by figures. The latter includes figures, tables, diagrams, mathematical models, statistical analyses, and related discussions. The book also contains a 50-page bibliogra-

phy permitting readers to follow up on much of the interesting material.

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*Honor Among Thieves: A Zooarchaeological Study of Neanderthal Ecology.* By Mary C. Stiner. xxii + 447 pp. Princeton: Princeton University Press. 1994. \$69.50 (cloth).

The study of Neanderthals is in the throes of a radical and exciting transformation. The explosion of interest in these enigmatic archaic humans was launched barely a decade ago when the first TL and ESR dates were obtained from sites whose age until then lay beyond the reach of radiocarbon dating (Valadas et al., 1987). These new techniques turned conventional wisdom on its head by demonstrating that anatomically modern human fossils associated with Mousterian stone tool assemblages from such sites as Qafzeh and Skhul in Israel substantially predated Neanderthals from nearby sites in Israel as well as in Europe. Another impetus in this transformation came from studies of mitochondrial DNA in living human populations (Cann et al., 1987). These studies suggested that modern humans throughout the world may all be derived from a single ancestral source, probably in Africa, a mere 150,000 or 200,000 years ago. Although paleoanthropologists and archaeologists remain far from agreement concerning the position of Neanderthals in our family tree, few would disagree that refreshing new life has been breathed into a debate that began nearly a century and a half ago with the discovery of the first Neanderthal remains.

The "out-of-Africa" debate has certainly captured the lion's share of the limelight, but there is another important and very exciting transformation taking place in Neanderthal studies. Until recently, anthropologists (particularly those in the United States) have been sharply divided over the issue of whether Neanderthals possessed the mental acuity to hunt large, dangerous animals

(e.g., Binford, 1988; Grayson and Delpech, 1994). Although clear associations of Mousterian implements with the bones of large mammals have been known for generations, it has been exceedingly difficult to demonstrate that these animals had actually been killed by Neanderthals. A number of influential scholars have argued that Middle Paleolithic hominids lacked the technological and organizational know-how, and perhaps even the cognitive capacities, to bring down prey as large as aurochs or bison and that the bones of such large animals in Mousterian sites had either been transported there by hyenas or had been opportunistically scavenged by Neanderthals from carcasses that had been killed and abandoned by other predators. This "hunting-scavenging debate" has been an interesting one, but in the context of the Middle Paleolithic, it has remained largely speculative.

With the publication of *Honor Among Thieves*, Mary Stiner elegantly raises the entire issue of Neanderthal subsistence to a new plane, providing clear-cut and effective methods for testing hypotheses about Middle Paleolithic animal procurement strategies and showing that these strategies may have undergone a major evolutionary transformation, not at the Middle to Upper Paleolithic boundary, as most scholars have traditionally assumed, but squarely within the Middle Paleolithic, roughly 55,000 years ago. I view this book as one of the most important contributions of the past decade to our understanding of Middle Paleolithic adaptations and a landmark demonstration of the penetrating insights that can be gained from the creative study of animal bones. In the brief review that follows, I outline the principal arguments and methods offered by Stiner and highlight some of her major findings and conclusions. There is no way, however, that I can do real justice to this substantial work in such a brief commentary. I strongly urge the readers of this review, even if neither Mousterian specialist nor faunal analyst, to look at *Honor Among Thieves*. It is an archaeological tour de force.

The book begins (Chapters 1 and 2) with a discussion of the current status of our knowledge of Neanderthal adaptations and modern human origins, pointing out that much of our understanding has been based on human skeletal morphology and stone tools, with very little input from faunal studies. Only recently have subsistence issues

begun to gain some importance in Middle Paleolithic research agendas, but the paucity of faunal studies in the burgeoning literature on modern human origins is clear testimony to the continuing peripheral nature of this type of research (e.g., Mellars and Stringer 1989; Mellars 1990; Nitecki and Nitecki 1994). *Honor Among Thieves* redresses this imbalance, moving faunal studies from the margins to dead center in the modern human origins debate.

Central to Stiner's research is the notion that "the story of human origins is partly the story of one large predator evolving relative to others" (p. 6). Given this baseline perspective, the book systematically compares Middle Paleolithic faunal remains with the kills made by a variety of modern large carnivores, including lions, tigers, cheetahs, hyenas, wolves, and others. In these comparisons, Stiner focuses on certain key characteristics of the faunal assemblages, most notably prey age selection patterns and skeletal element frequencies. These characteristics provide extremely powerful tools for exploring Middle Paleolithic strategies of animal procurement.

The archaeological data in the book come largely from four Middle Paleolithic cave sites located close to the Mediterranean coast in west-central Italy (Latium). These sites (Guattari and Breuil on Monte Circeo, and Moscerini and Sant'Agostino near Gaeta) span much of the Mousterian, from ~120,000 BP to the Middle/Upper Paleolithic boundary. For comparative purposes, Stiner also includes faunal data from a comparably aged fossil hyena den complex (Buca della Iena), as well as from three late Upper Paleolithic cave sites (Palidoro, Riparo Salvini, and Polesini). The modern carnivore data are taken from published sources worldwide. Unfortunately, many of her archaeological faunal samples are quite small, a problem all too familiar to faunal analysts working with Paleolithic materials. Nevertheless, the overall patterns these data reveal, derived using a variety of independent lines of evidence, are strikingly clear and logically consistent, making her conclusions very compelling. Stiner is well aware of the limitations of her samples and throughout is admirably cautious in her interpretations and conclusions.

After a detailed description (Chapter 3) of the sites, including their history of excavation and dating, Stiner systematically evalu-

ates the taphonomy of the faunal assemblages (Chapters 4 and 5). Using multiple criteria such as the presence of cut marks, impact fractures, burned bone, associated stone tools, carnivore gnawing and punctures, hyena coprolites, immature carnivore remains, mean bone fragment length, within-site distribution of major bone concentrations, and numerous other characteristics, she is able to identify those assemblages that owe their formation largely to the activities of hominids and those that are largely the product of spotted hyena or wolf transport and denning (the denning issue is further addressed in Chapter 12).

Stiner then looks (Chapter 6) at the evidence for small animal exploitation by the Middle Paleolithic occupants of the Latium caves, concluding that limited numbers of tortoises and marine shellfish were collected, particularly during the earlier portion of the Mousterian. She also shows that small mammals were not extensively exploited and that peaks in the quantity of stone tools, ungulate remains, and shellfish are not synchronous, suggesting that the procurement and use of these resources were not entirely interdependent.

In Chapter 7, Stiner demonstrates that Neanderthals and Late Pleistocene hyenas competed for the same basic array of ungulate species, drawing the important conclusion that archaeologists will have little success identifying a prehistoric bone collector just on the basis of the prey species that are present in an assemblage. Given this conclusion, Stiner's analyses in subsequent chapters shift to exploring more subtle differences between bone assemblages that have been transported by hominids and hyenas, focusing in particular on body part frequencies (Chapters 8 and 9) and prey age selection patterns (Chapter 10 and 11).

Looking first at skeletal element representation, Stiner employs two principal indices. The first of these is a measure of skeletal completeness, expressed by the ratio of the total number of bony skeletal elements of a given species to the minimum number of individual animals of that taxon represented in the assemblage (tMNE/MNI). The second index is the sum of horn or antler and head elements, excluding loose teeth, divided by the number of major limb elements above the phalanges ( $(H + H)/L$ ). Using these indices, two sharply contrasting patterns emerge

from the Italian data—assemblages that are overwhelmingly dominated by head parts and assemblages with a much more even representation of all carcass parts including meaty, marrow-rich limbs. Not unexpectedly, the assemblages identified as hyena-derived on the basis of other taphonomic criteria turned out to be head-dominated, as did assemblages from modern hyena dens documented in the literature. Also not unexpectedly, the late Upper Paleolithic assemblages displayed a more even pattern of skeletal part representation, with meaty limb elements quite numerous. The real surprise came with the Middle Paleolithic assemblages that were unquestionably of human derivation. Some of these were head-dominated; others were not. These contrasting patterns sorted both by site and date, such that the assemblages from Guattari and Moscerini, the earliest occupations (i.e., pre-55,000 BP), were consistently head-dominated, whereas those from Breuil and Sant'Agostino, the later sites (ca. 55,000–35,000 BP) displayed the more limb-rich pattern.

The tentative conclusion to be drawn from these body part analyses is that some Mousterian faunas—the later ones—resemble Upper Paleolithic and Holocene assemblages that were unquestionably produced by full-fledged human hunters. In striking contrast, earlier Mousterian assemblages much more closely resemble ones transported by hyenas and very likely reflect humanly scavenged resources. But why transport so many heads? Stiner offers a tentative answer in this chapter, but returns to the issue later in the book, armed with insights drawn from several other lines of inquiry, including the seasonality of the various Mousterian occupations and the age structure of the scavenged prey. She attributes this peculiar transport pattern to the selective scavenging of ungulate brains, “. . . the final bastion of fat tissue in prey suffering from seasonal or other causes of malnutrition” (p. 267). She also notes the possible evolutionary implications of these findings, but again defers discussion of this fascinating issue until later.

Chapters 10 and 11 explore the prey age selection patterns reflected in the Pleistocene bone assemblages. She begins with a systematic look at the hunting patterns of lions, tigers, hyenas, wolves, and other modern carnivores. Her handling of the prey

mortality data is somewhat unorthodox but I believe entirely justified. Normally, archaeologists who deal with mortality profiles divide the maximum potential life span of the species of concern into a series of discrete age classes, each of equal length. The shape of these profiles, often referred to as "attritional" or "catastrophic" are then taken to indicate the probable cause of death. Because Stiner's archaeological sample sizes are very small and because there are inconsistencies in the way prey mortality data are reported in the wildlife literature, she collapses both archaeological and modern carnivore data into just three broad age classes of unequal length—juvenile, prime adult, and old adult—and displays the results, expressed as percentages, using simple ternary or triangular diagrams.

Stiner's analyses nicely show that cursorial predators, those that typically pursue their prey over long distances (e.g., cheetahs, African wild dogs, spotted hyenas), produce mortality patterns biased toward young and old individuals. In contrast, ambush predators such as lions, leopards, and tigers, which depend more on encounter, generate mortality profiles that more closely resemble the age structure of the living population from which the prey were taken. Interestingly, tigers and hyenas that engaged in considerable amounts of scavenging display very distinctive prey age selection patterns with a strong bias toward old adults. Stiner attributes the underrepresentation of the youngest age class to their much greater susceptibility to total destruction by large predators.

Stiner next analyzes the mortality profiles of the fossil ungulate remains from the Italian Middle and Upper Paleolithic caves. For comparative purposes, she also includes data from a wide array of Holocene and contemporary contexts (e.g., North American bison hunters, Mississippian-period white-tailed deer hunters, Eskimo reindeer or caribou hunters, and modern trophy hunters). She determines the age of death of the Paleolithic ungulates using the stage of eruption and wear of the deciduous and permanent lower fourth premolars. As with the modern carnivore prey, she assigns the prehistoric specimens to the same three age categories—juvenile, prime adult, or old adult. When the archaeological data are plotted on ternary diagrams, the results are provocative in the very best sense of the word. Both

the Italian Upper Paleolithic samples and the Holocene cases yield prey age selection patterns that closely resemble the ones generated by ambush-hunting carnivores, with prime adults strongly represented. In fact, prime adults are so well represented in many of these cases that Stiner refers to them as "prime-dominated," a pattern she notes that seems to be unique to humans.

Again, the Mousterian assemblages split along chronological and spatial lines, with the later Mousterian ones displaying the same emphasis on prime adults that is seen in the Upper Paleolithic and Holocene cases. In striking contrast, the earlier Mousterian assemblages from both Moscerini and Guattari are old-dominated and fall together on the ternary diagrams with the prey of scavenging hyenas and tigers. The transition to the prime-dominated hunting pattern that so clearly characterizes the Upper Paleolithic and Holocene apparently occurs, not at the Middle to Upper Paleolithic boundary, when most scholars would assume, but squarely within the Mousterian, probably some 55,000 or so years ago (the precise dating of the transition in these sites can not be determined as yet).

Stiner is rightfully cautious in interpreting this temporal pattern. Obviously, it is tempting to see the shift as an evolutionary one, but she acknowledges that it may instead reflect adjustments in site use in response to deteriorating glacial climate and modification of the Italian littoral near the caves with dropping sea level. Nevertheless, these results are extremely interesting and open an entirely new arena for debate and further investigation. The targeting of prime adults by later Mousterian hominids reflects greater selectivity on the part of the hunters, probably due in part to an increased importance of dietary lipids as climatic conditions worsened during the last glaciation. This distinctive prey selection pattern also signals a major change in the competitive interactions between hominids and other Late Pleistocene predators.

After a brief look at the carnivore remains from the Mousterian sites (Chapter 12), Stiner turns to the issue of seasonality. The timing of the various occupations is assessed on the basis of juvenile mortality, adult deer antlers, and red deer pearl teeth. All of these lines of evidence converge to suggest that the head-dominated, old-adult-biased faunas of

the earlier Mousterian were procured, presumably by scavenging, during the spring and early summer. This result is extremely interesting. Overwintering ungulates mobilize their body fat reserves to make it through this stressful period of the year. Hence, animals that died of natural causes in the spring are likely to have suffered from malnutrition, and their body fat reserves may have been largely depleted. In such cases, the brain would have offered the only major remaining reserve of lipids. In contrast to the early Middle Paleolithic assemblages, the prime-dominated assemblages of the later Mousterian and Upper Paleolithic were hunted primarily in the fall and winter.

Chapter 14, done in conjunction with Steven L. Kuhn, outlines some interesting patterns of covariation between the faunal assemblages and the lithic collections from the same sites. For example, most of the cores from the earlier Mousterian are centripetal forms, thought to be better suited for producing small numbers of comparatively large flakes, whereas those from the younger Mousterian are platform types, thought to be better suited for producing more numerous but smaller flakes. Likewise, a greater proportion of the earlier period flakes are retouched and the scrapers show evidence of more frequent resharpening. There is also at least tentative evidence that in the earlier period large flakes were transported more often around the landscape than was the case toward the end of the Mousterian. Interestingly, there is no evident functional link between tool types and animal procurement patterns in these assemblages. Side-scrapers are the dominant retouched tool form throughout, and it is hard to envision these as ear-marked specifically for either hunting or scavenging. There also is no evidence that pointed tools, retouched or not, become more numerous in the later Mousterian assemblages as scavenging gives way to hunting. Basically, there is no change in the range of formal tools over the entire course of the Middle Paleolithic, despite the evidence for fairly dramatic changes in animal procurement strategies. The authors therefore view the changes in the manner in which flakes were produced and in the intensity of their use as reflections of changes in overall mobility and land-use patterns, with the earlier period one of "... more frequent movement

and perhaps wide-ranging search patterns" (p. 366).

The million-dollar question throughout *Honor Among Thieves*, of course, is whether the change from head-dominated scavenging to the selective hunting of prime adults reflects a seasonal or longer term adjustment by Middle Paleolithic hominids to changing local environmental conditions, or instead a major evolutionary transformation that presages by many millennia the appearance of modern humans in Europe. Stiner is rightfully cautious in her conclusions, given the very small size and limited regional scope of her samples. Nevertheless, she clearly leans toward the view that the change is an evolutionary one, and I believe her arguments are compelling. Obviously, however, there is a great need now to test her ideas and her methods in a much wider range of temporal and environmental contexts.

*Honor Among Thieves* is a landmark study, one that charts a new and truly exciting course into the murky waters of the Middle Paleolithic. Obviously, much work remains to be done, and many questions are as yet unanswered. What, e.g., led to the mid-Mousterian economic transformation that Stiner has so elegantly documented? How did Neanderthals actually kill prime adults of large and potentially dangerous prey? How do these economic changes relate to the traditional Middle/Upper Paleolithic boundary? Did anatomically modern humans of the Middle Paleolithic (and Middle Stone Age) in the Near East and Africa undergo a similar transformation? Fortunately, Stiner provides some of the critical tools we will need to address these questions and a firm theoretical foundation on which to build. *Honor Among Thieves* is a stimulating and rewarding book, one that I most heartily recommend.

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