The book is well organized for use both as a textbook and as a reference. It is not necessary to read the chapters in sequence. There are many cross-references between the two parts of the book, and I found it valuable to skip back and forth between the earlier chapters on particular channel species and the later ones on mechanisms. Each chapter ends with a recapitulation of its major points. Many tables are provided, and the bibliography and index are extensive.

The book brings together much information and many ideas and is therefore particularly useful for novices to the field or for neurobiologists, molecular biologists, and cell biologists who are interested in ion channels. It will also be a valuable reference for working channel biophysicists. Hille's scholarship and authority contribute much to the quality of the book, and it should become a long-lived standard work in this increasingly fast-moving field.

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The Emergence of *Homo sapiens*

The Origins of Modern Humans. A World Survey of the Fossil Evidence. FRED H. SMITH and FRANK SPENCER, Eds. Liss, New York, 1984. xxii, 590 pp., illus. $70.

In the main, two fundamental question sets confront paleoanthropologists: When, where, and how did our lineage diverge from the apes? and When, where, and how did *Homo sapiens* emerge as a distinct species? The early evolution of the Hominidae has received wide attention and generous funding from American and other institutions and private donors over the past quarter century. The result has been a flood of fossils, solid geochronological dates for major sites, clarification of some issues, and acrimonious debate over others. Per contra, much of the fossil record pertaining to the origin (or origins) of *Homo sapiens* was collected before 1960 and is blighted by poor data on provenience and inadequate contextual information. Numerous specimens (Zhou Kou Dian, Le Moustier, Combe Capelle, Podbada, Brno, Dolní Věstonice, Mladeč, Šipka, Předomostí) were lost during World War II and through other mishaps.

Still there has been notable progress in the form of new discoveries and the application of modern field and laboratory methods for their interpretation. Smith and Spencer have admirably assembled the old, the new, and the borrowed in this blue-jacketed volume. It is a major resource for students of human evolution. The meat of the work is in six chapters that are surveys of evidence from gross geographical regions: western Europe (Stringer *et al.*), central Europe (Smith), western Asia and the U.S.S.R. (Trinkaus), sub-Saharan Africa (Rightmire), Africa (Bräuer), and China, Indonesia, and Australia (Wolpoff *et al.*). In addition, Howell provides an excellent introduction giving an overview of major issues and his opinions about them and Spencer pens yet another history of the Neandertal debate. Three chapters (Frayer, Brace *et al.*, and Owen) that deal with aftermath and deployment rather than with origins fit less neatly with the rest.

Most of the authors deal with questions of when and where *Homo sapiens* evolved but pass over the important question of how (vis-à-vis natural selection) the transition was achieved. It is generally conceded that the answer lies in the archeological record.

Africa, the homeland of *Australopithecus* and *Homo erectus*, is very much in the running as the place where *Homo sapiens* emerged. Anatomically modern (a.m.) human bits have been recovered from Middle Stone Age deposits at Klasies River Mouth, South Africa. The youngest Middle Stone Age deposits at Klasies are reliably dated to about 60,000 years ago, and the human cranial fragments are probably close to 100,000 years old. More complete but less certainly dated remains from Border Cave also attest to the existence of anatomically modern human populations during the South African Middle Stone Age. They have the closest morphological affinities with modern southern African peoples. Coastal inhabitants exploited marine resources in addition to continuing the clever hunting traditions of their Acheulian predecessors (Rightmire).

Eastern and northern Africa also have yielded tantalizing evidence for the early appearance of a.m. *Homo sapiens*. Bräuer includes the cranium designated Omo 1 from the Kibish Formation, Ethiopia; the fragmentary crania from Kanjera, Kenya; teeth from Middle Stone Age horizons in the Mumba Rock Shelter, Tanzania; perhaps the Singa calvaria from the Sudan; and the Témara occipitoparietal fragment from Morocco in early a.m. *Homo sapiens*. But the dates for these specimens are less secure than those of Klasies.

Africa has been a relatively rich source for specimens of archaic *Homo sapiens* that bridge the gap between Early Pleistocene *Homo erectus* and a.m. *Homo sapiens*. Notable among them are the Saldanha calvaria (South Africa); the Broken Hill (Kabwe) cranium (Zambia); the Ndutu and Laetoli 18 crania (Tanzania); the Kapthurin mandible (Kenya); the Bodo and Omo 2 crania (Ethiopia); the Haua Fteah mandibles (Libya); and the Jebel Ighoud cranial remains (Morocco). Many problems remain for those who would arrange the widely scattered African specimens into a phylogenetic sequence and link them to the archaic and a.m. *Homo sapiens* of other continents. Bräuer's model (p. 394) is a provocative starter, but one also must respect Rightmire's conservatism in these matters.

Western Asia (herein encompassing Iraq, Israel, and the U.S.S.R.) and central Europe also may have been important centers for the origin of a.m. *Homo sapiens*. Smith argues the case for continuity between Neandertals and a.m. *Homo sapiens* in central Europe more insistently than Trinkaus does for western Asia albeit on the basis of more fragmentary material.

Trinkaus bravely discusses at length the nature of the adaptive shift from archaic (Neandertal) to a.m. *Homo sapiens* in addition to surveying his chunk of the fossil record. He sorts the early human remains from western Asia into four samples. The oldest, exemplified by the unique Zuttiyeh cranium, resembles European early Neandertals. The Shanidar (Iraq) and most of the Russian specimens and the Mousterian specimens from Amud, Kebara, and Tabūn in Israel are like the classic European Neandertals. Early a.m. *Homo sapiens* are best represented by numerous specimens from Skhūl and Qafzeh, and later a.m. *Homo sapiens* are exemplified by skeletons from Aurignacian horizons at Kebara. A good case can be argued that a transition from Neandertal to a.m. *Homo sapiens* occurred locally in the Middle East, but wobbly dates preclude a verdict beyond reasonable doubt.

The pattern of human evolution in western Europe during the Upper Pleis-

tocene is remarkably vague, especially in view of the wealth of skeletal remains that have been recovered in Belgium, France, Germany, Gibraltar, and Italy. It is still unclear whether Neandertals evolved locally into a.m. *Homo sapiens* or were replaced by populations of the latter from Central Europe, the Near East, or North Africa. Stringer *et al.* (p. 115) conclude that "western Europe has no good evidence for the actual origins of a.m. *H. sapiens*." In particular, they recognize no western European fossil specimen with a morphology intermediate between Neandertals and modern humans. Further, the skeleton from Saint-Césaire, France, evidences that Neandertals were contemporaneous with a.m. *Homo sapiens* in Europe. Hence they favor Africa as the probable birthplace and launching area for a.m. *Homo sapiens*.

Not so, say Wolpoff *et al.* in a long-winded, unillustrated essay. Instead they propose that there was local continuity between Middle Pleistocene, Late Pleistocene, and Recent hominids in Europe, as well as in China and Indonesia–Australasia (which are the foci of their survey). They fit a respectable number of new specimens from Australia, China, and Java into the scheme of Weidenreich and Coon and disavow the racist overtones of the latter.

The existence of *Homo erectus* among Middle Pleistocene fossils from Europe (in contrast with Asia and Africa) is equivocal. Wolpoff *et al.* argue that this is because scientists have misunderstood morphological features that are regionally specific to Europe. They propose that we should either set an arbitrary temporal boundary between *Homo erectus* and *Homo sapiens* or cladistically sink *H. erectus* into *Homo sapiens*. They do not choose between the alternatives. Surely the dating game must advance greatly before the former would be practicable.

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Scavenging in the Paleolithic

Faunal Remains from Klasies River Mouth. LEWIS R. BINFORD. Academic Press, Orlando, Fla., 1984. xxii, 287 pp., illus. $39.50.

Archeologists commonly assume that hominids extending back to at least the beginning of the Middle Paleolithic have been fully capable hunters, taking large and small mammals alike. This view is incorporated into most analyses of archeological sites that date to this time span and even plays a role in explanations of the extinction of a variety of large Pleistocene mammals.

In *Faunal Remains from Klasies River Mouth*, Lewis R. Binford takes issue with this deeply entrenched idea. During the past decade, Binford has produced a series of works dealing with the analysis of animal bones from a wide range of sites spanning much of the Quaternary. These studies have focused on the derivation of "mid-range theory," propositions treating the relationship between the static archeological record and the dynamic processes that formed that record. In the present work the results of Binford's previous studies and a newly devised set of methods are used to probe the Klasies fauna for its dynamic behavioral message.

Located on the coast of South Africa, the Klasies River Mouth caves were excavated during the late 1960's by J. Wymer and R. Singer; these workers' substantial monograph on these sites appeared in 1982. In addition, detailed analyses of the mammals from these sites have been published by R. G. Klein. Of the several sites, Binford focuses on Cave 1, in which stratified deposits contained Middle Stone Age occupations dating from about 120,000 to sometime before 40,000 years ago.

Binford's analysis of the Cave 1 mammals directly challenges the belief that our Middle Stone Age (and Middle Paleolithic) ancestors were fully efficient hunters. Instead, he argues that, as recently as 40,000 years ago, hunting was confined to opportunistic kills of small (<90 pounds) mammals and to the taking of the young of large mammals. Larger creatures were scavenged, not hunted.

The difficulty in making such an argument is easily stated: how do you recognize scavenging from fragmentary bones and teeth? Klein has argued that demographic data can provide such information, but Binford rejects this approach, arguing that attributes of the bones themselves be used to detect hunting and scavenging. Relying heavily on his own field observations, Binford argues that, as a result of presumed differences in the state of the carcass at the time of initial processing, these two tactics result in different patterns of bone breakage and different distributions, and kinds, of dismemberment marks across bones. Other attributes also play a role: for instance, bones from scavenged mammals should be more heavily gnawed by carnivores than those from hunted ones.

Binford examines the Klasies Cave 1 fauna in light of these criteria. The patterning he finds is impressive. Deep hack marks, whose nature and placement he finds indicative of dismemberment of scavenged, dry carcasses, are confined to mammals whose live weight exceeded 150 pounds; the lighter cut marks, whose placement suggests processing of a fresh carcass, are largely confined to mammals beneath this size. Carnivore gnaw marks follow much the same pattern: largely absent on the small mammals, fairly common on the big ones. Other observations fall in line. Body parts of large mammals introduced into the site were primarily of marginal value as regards the amount of food they would have provided, whereas parts of greater utility are characteristic of the small mammal assemblage. The results are fascinating: they suggest a scavenging component to the diet of the Middle Stone Age occupants of Cave 1.

But Binford is often better at presenting exciting ideas than at analyzing data in a convincing way; Klasies is no exception. Take, for instance, his argument that the Cave 1 bones were introduced by people in the first place. It is essential, if he is to use this fauna to distinguish between hominid hunting and scavenging, that it be known that hominids were the hunters or scavengers. This issue, however, is not addressed convincingly. For example, Binford excludes leopards as a significant contributor to the fauna through a comparison between body part distributions within the Cave 1 fauna and distributions from known leopard lairs provided by C. K. Brain. Because these two data sets differ in significant ways (for example, cranial parts are much more common in Brain's lairs), Binford concludes that leopards played no major role in accumulating the Klasies fauna. Unfortunately, the crucial data on modern leopards Binford uses are not to be found in the cited tables of Brain's book: Brain does not provide the kind of anatomical detail used by Binford, and the numbers of skeletal elements are widely different (for example, 21 maxillae given by Binford, fewer than six cranial fragments by Brain).

Given that the Cave 1 fauna from the Middle Stone Age spans tens of thousands of years, it is curious that Binford treats it as a single analytic unit. Wymer and Singer carefully describe the stratigraphy of the site; Klein's data are given in terms of the strata they identified.