vergence with chance similarity. I submit that if human similarities to apes were the result of different selective pressures, they would exemplify chance similarity.

Fleagle and Jungers pass over the role that my work on knuckle-walking (*Science* **166**, 953 [1969]) played in stimulating models of hominoid evolution and novel studies on the forelimb remains of Miocene and later fossils. Whereas S. L. Washburn, D. R. Pilbeam, E. L. Simons, J. T. Robinson, R. E. F. Leakey, V. Sarich, and, in his first paper, J. G. Fleagle variously incorporated early knuckle-walkers in their models, I maintained that available fossils of *Proconsul, Australopithecus*, and *Homo* did not allow us to determine whether they were knuckle-walkers. Further, the comparative anatomical evidence argues against knuckle-walkers in the hominid lineage. Recent discoveries of metacarpal bones at Hadar evince that Pliocene Hominidae lacked the diagnostic features of knuckle-walkers. Instead the Hadar hominids were probably terrestrial bipeds that still climbed up trees for night lodging, escape from predators, and some foraging (Tuttle, *Philos. Trans. R. Soc. London Ser. B* **292**, 89 [1981]).

Like many other sciences, physical anthropology has accumulated an "ethical load" that might be more menacing than the elusive "genetic load" that impressed past makers of public policy. Anthropologists must be sensitive to the concerns of persons who do not want graves disturbed and primates trashed in trivial experiments and who are offended by racist museum exhibits here and abroad. Then their newsworthy and practically applicable research will amuse and benefit all of humankind.

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Human Prehistory Legitimated

The Establishment of Human Antiquity. DONALD K. GRAYSON. Academic Press, New York, 1983. xii, 262 pp., illus. $27.50.

Historians of 19th-century geology, paleontology, and archeology agree that establishing that human beings had inhabited the earth for longer than six thousand years played a significant role in the development of each of these disciplines. Yet Grayson's book is the first comprehensive analysis of the controversies that led to the recognition of this antiquity. Apart from a concise review of the intellectual background of this controversy and of closely related 19th-century debates about the historical significance of the morphological diversity of humanity, Grayson focuses upon a small group of investigators who, between 1810 and 1860, sought evidence to determine when human beings first appeared in the geological record. By carefully examining the work of each of these men in the context of the time when it was done, he sheds new light on a fascinating intellectual enterprise that turns out to be poorly understood by modern archeologists. He makes an especially important contribution to understanding the career of Jacques Boucher de Perthes, the first scholar who studied this problem from a combined archeological, geological, and paleontological point of view. He points out the limitations of Boucher de Perthes's sometimes fanciful interpretations and his occasionally dishonest reportings of his finds, but he also delineates his striking evolution from being an isolated amateur championing preposterous theories in 1846 into being a well-informed researcher in 1857. On a more general level, Grayson demolishes the stereotype of uniformitarians as necessarily furthering the recognition of the true antiquity of humanity and catastrophists as impeding it.

Grayson also demonstrates that during the first half of the 19th century most paleontologists did not attribute Pleistocene glacial deposits to Noah's flood while at the same time claiming (in an incomprehensible contradiction of Scripture) that these deposits must antedate evidence of human activity. In the course of the 18th century, western European paleontologists had come to view the earth as having been shaped over many millennia by a beneficent God as a habitat for mankind. For humanity to appear before this process was complete was widely interpreted as casting doubt on God's role in it. It was this belief that led most paleontologists to reject the possibility that mankind had appeared prior to the extinction of the megafauna associated with Pleistocene gravels.

Although traces of human presence were repeatedly found associated with the bones of extinct mammals in caves in England and western Europe beginning as early as 1774, the majority of eminent geologists and paleontologists dismissed these associations as natural mixtures of material from different ages or as the results of poorly controlled excavations; however, it appears that they often did this without adequately examining the evidence, which sometimes included indications that humans had worked the bones of prehistoric animals. The situation was further confused because cave deposits were notoriously difficult to date geologically. The antiquity of humanity was not established until Boucher de Perthes and M.-J. Rigollot demonstrated beyond doubt that in the Somme Valley there was an intimate association between stone tools and Pleistocene fauna in a stratigraphic context that a uniformitarian geology required to be many thousands of years old. (For this reason the importance of the work of Charles Lyell should not be discounted as much as it is by Grayson.) Between 1857 and 1859, these finds led most British scholars to accept the great antiquity of humanity as an established fact.

Like J. W. Gruber, Grayson points out that the recognition of the antiquity of humanity preceded the publication of *On the Origin of Species* and that this issue was not necessarily linked to an evolutionary view of human origins either before or after 1859. He suggests that, if Darwin had published earlier, the backlash probably would have made it more difficult for scientists to accept the evidence for a great human antiquity. He therefore treats the debate about human antiquity as one that centered on the available evidence. He agrees with the majority opinion of the time that, prior to the work of Boucher de Perthes, this evidence remained inconclusive. Yet he also observes that in some instances rejection of the evidence for the great antiquity of humanity stemmed from the "sheer belief that such things could not be." He notes as well that prior to the late 1850's support for early human origins did not come from leading scientists, who generally opposed such claims or dismissed them as premature. Hence "the right persons" were not making the necessary discoveries. These observations suggest that, important as factual evidence may have been for resolving this issue, an internal explanation cannot account for the sudden reversal of opinion within the scientific establishment in the late 1850's, or for the widespread public interest in this reversal. Nor can it

explain why the continuing cogent objections to evolutionary interpretations of the archeological record as it was known in the late 19th century by conservative scholars, such as the eminent geologist John William Dawson, were thereafter politely ignored by contemporary scientists. Cultural evolutionary thought had been nurtured by the Enlightenment philosophy of the 18th century, and, despite efforts by people such as Richard Whately to champion the concept of degeneration, it had grown increasingly popular among the middle classes, especially in Britain. These classes were pleased to identify their own growing economic and political power, and the accelerating technological progress on which it was based, with an irreversible historical process. This surely played no small part in making evolutionary views of all kinds more respectable during the 1850's, as is evident in the writings of the naturalistic philosopher Herbert Spencer. It also made it possible for the first time for reputable paleontologists to abandon the theological underpinnings of both biblical chronology and creationism without incurring general public disapproval. With someone like Charles Lyell, who believed it to be a serious tactical error to assault too publicly "the popular prejudices of the day," this change in public attitude must have weighed especially heavily.

Although he has chosen to analyze the recognition of human ancientness, not its effects, Grayson agrees with Glyn Daniel that the discipline of prehistoric archeology developed largely out of the study of the antiquity of humanity. This is true of Paleolithic archeology and perhaps also of prehistoric archeology as a whole in England and France. Yet, early in the 19th century, Scandinavian archeologists, most notably C. J. Thomsen, J. J. A. Worsaae, and Sven Nilsson, had been inspired by theories of cultural evolution to create a discipline that used seriation and stratigraphy to construct prehistoric chronologies and further sought to learn about how human beings had lived in prehistoric times. Their data, which were post-glacial, did not raise the question of the antiquity of humanity. Nevertheless, they cooperated closely with geologists, zoologists, and ethnologists to interpret their data behaviorally. This archeology spread to Scotland and Switzerland, and its impressive achievements were chronicled for American readers by von Morlot in 1861. Nilsson's studies of stone tools set new standards that must have influenced the descriptions and interpretation of Paleolithic finds in the 1840's and 1850's. Grayson notes a casual attitude toward artifacts as a weakness of much of the work done by earlier geologists and paleontologists. Discerning the antiquity of humanity and tracing the evolution of stone tools from ever simpler beginnings added an important new dimension to prehistoric archeology after 1860. Yet, when early Paleolithic archeology was closely linked to paleontology and geology, certain mechanistic modes of analysis, such as a preoccupation with index fossils, entered prehistoric archeology from the natural sciences. These were far less appropriate for the study of prehistoric human behavior than the Scandinavian approach had been. Archeology has had to struggle hard in the 20th century to overcome the negative effects of these borrowings and to become once again a study of how human beings lived in the past.

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Stone Age Life in Africa

The Middle Stone Age at Klasies River Mouth in South Africa. RONALD SINGER and JOHN WYMER. With contributions by K. W. Butzer, N. J. Shackleton, and E. Voigt. University of Chicago Press, Chicago, 1982. vi, 234 pp., illus., + plates. $30.

Toward the close of the Middle Pleistocene, more than 130,000 years ago, human populations across Africa were turning to new ways of making tools and extracting a living from the landscape. Acheulean assemblages, which had dominated the archeological record for much of the Pleistocene, were giving way to industries of the Middle Stone Age. This shift can be documented by the disappearance of bifacial handaxes and cleavers, coupled with the use of a wider range of stone implements based on prepared cores and flakes. Although technological advances made in the earliest Middle Stone Age appear to be modest, there are signs of increasing sophistication as the new industries were refined and spread. Middle Stone Age populations were now able to occupy sites along the African coastline and to live in a variety of inland settings. It is clear that these people were better equipped to colonize the more humid, wooded regions of Africa as well as the open grasslands. Fire was used regularly, and there is evidence for the systematic exploitation of marine food resources. Middle Stone Age hunters also took many sorts of terrestrial game by different methods, even if they were not so skilled in this respect as the Late Stone Age people who succeeded them.

Compiling such details of Stone Age life is possible in no small measure because of the efforts of archeologists working in southern Africa. One of the most important sites is Klasies River Mouth, located on the coast of the eastern Cape Province of South Africa. Really a complex of several caves and shelters, Klasies was excavated between 1966 and 1968. Publication of results has been delayed for rather a long time, but this attractive monograph contains much useful information. Studies of the sedimentary sequence by K. W. Butzer, together with N. J. Shackleton's oxygen isotope analysis of shells collected from the deposits, place the earliest occupation at the beginning of the Last Interglacial, 120,000 to 130,000 years ago. The caves were then inhabited intermittently for a long period, and Butzer's work suggests that the youngest Middle Stone Age levels date to about 60,000 years ago. Klasies was then abandoned and not reoccupied until late in the Holocene.

The bulk of the monograph is devoted to descriptions of the excavations, archeological stratigraphy of the main caves, and the stone artifacts recovered. The earliest industries are classified as MSA I and MSA II, followed by the Howieson's Poort. Howieson's Poort is characterized by the addition of some new artifact classes and by the loss of others. Since that occupation is followed by other MSA layers, the authors note that there may have been an intrusion of people from some other region. However, Howieson's Poort material has now been identified in comparable stratigraphic settings at other South African localities, and probably this industry should be viewed as an integral part of the Middle Stone Age.

Other sections deal with faunal remains. Mollusk shells, present throughout the sequence and described by E. A. Voigt, show that people were collecting marine foods on a selective basis. The bones of seals and seabirds are also plentiful, but R. G. Klein's work (summarized only briefly here) suggests that the Klasies people were not as adept at fishing or catching flying birds as were the Late Stone Age inhabitants of the same coastline. Among mammal remains, species such as eland are represented by adults as well as juveniles, and whole groups of these larger, more docile animals may have been killed by driving. Dangerous animals like buffalo