complete settlement has been excavated. Sankalia, Ansari, and Dhavalikar try to reconstruct the settlement pattern and conditions of life, whereas Lukacs and Walimbe give a detailed analysis of the paleodemographic structure and the paleopathology of this village population.

The last two chapters of part 1 are reviews of the dental anthropology of South Asian populations (Lukacs) and South Asian prehistoric human remains and burial practices (Kennedy and Caldwell). Dental anthropology is of great importance for the prehistoric anthropology of South Asia, as the bad preservation of many skeletal series makes detailed anthropological studies possible only on teeth. The contributions of Kennedy and Caldwell contain the first complete catalog of human skeletal remains from South Asian sites. It includes data on geographical locations, chronology, cultural context, burial practice, and size and condition of each sample.

Part 2 reveals various aspects of the biological anthropology of the living populations of South Asia, from the point of view of phenotypic patterns, morphological relationships, genetics, demography, ecology, population structure, inbreeding, and adaptation to high altitude. The numerous contributions to these topics can be only briefly mentioned here: "The Epidemiological Transition in Dental Occlusion in a North Indian Population" (Kaul and Corruccini); "Current Status of Dermatoglyphic Studies in South Asia" (Dash Sharma); "Inbreeding in India: Concepts and Consequences" (Sundar Rao); "Taxonomic Distance and Human Populations of South Asia" (Reid); "Genetic Relationships between Indian Populations and Their Neighbors" (Roychoudhury); "Population Structure among the Dhangar Caste-Cluster of Maharashtra, India" (Malhotra); "The Impact of Irrigation on the Demographic Structure of the Peshawar Basin of Northwest Pakistan" (Weitz); "Subsistence Strategies among the Pastoralists of Maharashtra, India" (Malhotra and Madhav Gadgil).

Especially worth mentioning are contributions that deal with the biological, physiological, biocultural adaptation to high altitude, a phenomenon that up until now has been studied mainly in the case of South American Indians from the Andean highlands. The following papers are concerned with these problems: "Anthropological Demography of Populations of the Eastern Himalayas" (Basu, Gupta, and Mukhopadhyay); "Aging and Growth at High Altitudes in the Himalayas" (Beall); "Biocultural Adaptations of the High Altitude Sherpas of Nepal" (Weitz); "Ecology and Human Physiology in Ladak" (Malik and Sińgh).

This volume throws much light on the processes and mechanisms of human evolution and biological adaptations and is therefore of interest to those who are not particularly familiar with the problems of anthropology in South Asia. This book is likewise of considerable value for those who have personally undertaken actual field research in this region, as it provides a vast amount of new data. In addition, it points out new research developments and gives important suggestions for future scientific work in South Asia.

Quaternary Extinctions: A Prehistoric Revolution. *Paul S. Martin* and *Richard G. Klein*, eds. Tucson: University of Arizona Press, 1984. x + 892 pp. $65.00 (cloth).

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In the 1960s, Paul S. Martin coined the phrase "Pleistocene overkill." This volume bears testimony to his fruitful impact on interdisciplinary researchers in archeology, biology, and geology. It had long been known that the end of the last Pleistocene glaciation saw the extinction of many large animals in midlatitude Eurasia and especially in North America. Martin, in conjunction with H. E. Wright, assembled a collection of papers under the title *Pleistocene Extinctions: The Search for a Cause* (Yale University Press, 1967) and in his own article championed the view that the advent of Paleo-Indians into the Americas led to rapid and massive extinction of large herbivores that were unfamiliar with and, therefore, poorly adapted to cope with the new predator. His argument may have had meager empirical support at the time, but it carried great theoretical appeal, sufficient not only to stimulate geo- and bioarcheologists to study more sites more carefully but also to jog environmental scientists into reexamining their cherished positions more objectively.

The result is the present volume, with 38 fresh papers and 47 authors, solicited and commented upon by Martin and Richard Klein, a leading zooarcheologist. Two strong impressions prevail when first looking into this epic compendium. One is the judicious balance of views that range over the whole continuum between monocausal, cultural or environmental explanations. The second is that both the data base and theoretical sophistication of the protagonists in the debate have improved by a quantum leap since 1967.

In terms of book structure, there is an introductory section (including a history of 19th-century ideas on the problem by D. K. Grayson and an illustrated dictionary of the extinct genera or species by E. Anderson), a selection of good site studies, a set of environmental or cultural "models" linked to North American empirical data, a block of papers on Asia, Africa, and Australasia and, finally, three different evaluations. The editors have ensured a representative coverage but wisely did not intrude unduly in the reader's train of reflection.

The site reports illustrate some of the intrinsic problems. The Hot Springs site, South Dakota, represents a hydrothermal mammoth trap, the nature of which precludes postmortem transport and carnivore or human intervention, while the age is beyond 20,000 years (L. D. Agenbroad). The presence of spiral fractured bone, interpreted at some sites as sufficient evidence of culture, can best be attributed to trampling by another mammoth, entrapped later. At the Taima-taima spring site, Venezuela, a juvenile mastodont, securely dated 13,000 B.P., was apparently butchered and directly linked with an El Jobo projectile point and a utilized flake (R. Gruhn and A. L. Bryan). Of significance to skeptics would be a systematic study for possible butchering marks or carnivore damage, since sparse artifacts can be reworked in convoluted clays, disturbed by repeated artesian flush flows. At Natural Trap Cave, Wyoming, horse, mammoth, antelope, mountain sheep, and big cats were incrementally entombed over most of later Pleistocene time (B. M. Gilbert and L. D. Martin). The opal phytolith evidence indicates significant environmental change after 20,000 B.P. The glacial-age, montane conifer park land disappeared 10,000 B.P. along with the C_3 grasses, and size reduction of the bigger mammals is conspicuous after 12,000 B.P. The implication is that changing morphology resulted from less heterogeneous environmental resources, reflecting a less mesic climate. The fossil packrat midden evidence from the Grand Canyon, Arizona, suggests an unchanging and unique semidesert vegetation 12,000 B.P.–10,000 B.P., with Shasta ground sloth extinction midway between these dates (A. M. Phillips). However, this interpretation ignores the fact that the ground sloth diet became increasingly more specialized and less balanced after 13,000 B.P. New work at the tar pits of Rancho La Brea, Los Angeles, shows that extinction of sabertooth, dire wolf, horse, and *Bison antiquus* was relatively synchronous, a little after 11,000 B.P., whereas extinction of birds occurred more gradually (L. F. Marcus and R. Berger).

The group of papers focused on environmental ("geologic-climatic") models expounds on several aspects of the problems raised by the individual sites. As the big timeframe overviews of S. D. Webb and P. D. Gingerich for North America demonstrate, waves of extinction were not unique to the Pleistocene-Holocene boundary; the most dramatic took place five million years ago, while the last two million years were noteworthy for their generic diversity. The disappearance (without replacement) of 56% of the large North American herbivores at the end of the Pleistocene should therefore be seen as the natural consequence of high faunal turnover. Major biotic reorganization involved reduction of niche differentiation and greater competition, the appealing "coevolutionary disequilibrium" model of R. W. Graham and E. L. Lundelius. That environmental change was indeed significant is shown by the Appalachian regional evidence, with 57 of 75 mammals shifting their ranges (J. E. Guilday). Specifically, late Pleistocene vegetation mosaics were more complex and finer grained, and the sudden Holocene simplification of this ecosystem disproportionately affected less versatile, caecalid digesters such as mammoth, horse, and ground sloth (R. D. Guthrie). Extinction also most affected mammals with long gestation periods that today are best represented in tropical regions with less resource seasonality (R. A. Kiltie). The fossil mastodont record in Missouri is unusually well understood at 13,000 B.P.–10,000 B.P.; extinction was preceded by body-size reduction, linked to the evidence for shrinkage and breakup of their pine-spruce forest habitat (J. E. King and J. J. Saunders). Collectively these papers show that the large-mammal faunal associations were metastable at the end of the Pleistocene. A major turnover was inevitable, but this biotic disequilibrium would also have made the large caecalid digesters with long gestation periods the most vulnerable to novel human predation.

The papers devoted to cultural models begin with C. V. Haynes's demonstration, via fine-grained alluvial stratigraphy, that most megafaunal extinctions can be dated 11,500 B.P.–10,500 B.P. in west-central North America, coincident with the Clovis (Paleo-Indian) archeological record. As suggestive as this is, the radiocarbon record shows a more complex pattern (J. I. Mead and D. J. Meltzer), while the contributions from other world regions, including Martin's global survey, show that this coincidence would be unique to North America. Validity of the inference is also questioned

by the reasonable but not incontrovertible evidence for projectile point industries at Meadowcroft and Taima-taima no later than 13,000 B.P. From another direction, J. N. McDonald argues that North American, high-productivity herbivore habitats increased in area after 11,000 B.P., but he misses the point that plant associations were more specialized and coarser-grained (which has nothing to do with absolute ecosystem size or the total biomass of all K-select species). The overkill hypothesis is simulated by S. L. Whittington and B. Dyke, who conclude in favor of a gradual and less dramatic period of extinction, but for which the requisite kill or processing sites of the archeological record are patently too few. The gradual loss of a large spectrum of birds is also difficult to explain by human intervention (D. W. Steadman and Martin). In effect, the key North American test case for cultural extinction remains disturbingly inconclusive two decades later.

The evidence from other continents provides more time depth and richer bone-artifact associations, but is no more amenable to simple solutions, except in the case of late, human intrusions into isolated island ecosystems. The Eurasian evidence is reviewed for the USSR by N. K. Vereshchagin and G. F. Baryshnikov, for China by L. Tung-Sheng and L. Xing-Guo, and for the Levant by E. Tchernov. Megafaunal losses are few, despite the archeological evidence for large-scale hunting, but the disappearance of the cold-steppe ecosystem from Europe at the end of the Pleistocene required considerable habitat shifts among its successful, characteristic large mammals. Significantly, the microfaunal turnover in Israel at the end of each glacial hemicycle was more important than were the megafaunal changes, identifying an intrinsic weakness in paleontological resolution of the controversy elsewhere. For Africa, Klein provides a unique document of settlement history and faunal change that pinpoints very few possible candidates for cultural extinction, and these only at the end of the Pleistocene. Extinctions in Australia were significant, but remain poorly dated, as reviewed by P. Murray, D. Merrilees, D. R. Horton, G. Hope, and A. P. Kershaw. The problem here is much the same as in North America. The pollen record indicates repeated cycles of "glacial" and "non-glacial" vegetation, but with a superimposed trend to evergreen fire-adapted (and fire-promoting) vegetation. How these gross associations can be interpreted in terms of dietary preferences (and capacities) of the extinct megafauna must still be explored. Big game kill sites remain archeologically elusive, and ethnographic evidence does not support an aboriginal interest in large game hunting. The papers on extinctions in Madagascar, New Zealand, and the Pacific Islands during the last millennium or two (by R. E. Dewar, M. M. Troller and B. McCulloch, A. Anderson, R. Cassels, and S. L. Olson and H. F. James) leave little doubt that these isolated faunas were very vulnerable to predation and the ecological disturbance resulting from human intrusion into previously closed ecosystems.

The concluding chapters by L. G. Marshall, Grayson, and J. M. Diamond place things into perspective. From them I infer three messages: (1) the historical and protohistorical record of extinctions suggests that human habitat destruction, introduced competition, predators and disease, and secondary (trophic) extinctions have collectively been more important than overkill in recent times; (2) the ecological effectiveness of humans in predation and direct or indirect competition suggests that monocausal as well as universal hypotheses are improbable; and (3) the value of a debate is directly proportional to the quality of the data base. There is reason to hope or believe that the next decade of extinctions research will be conducted in a multidimensional paradigm, and with greater attention both to complex, ecological linkages and to better, interdisciplinary archeological resolution.