MARSH'S DINOSAURS: THE COLLECTIONS FROM COMO BLUFF

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REVIEW

MARSH'S DINOSAURS: THE COLLECTIONS FROM COMO BLUFF, by John H. Ostrom and John S. McIntosh, with a new foreword by Peter Dodson and a new historical update by Clifford Miles and David Hamblin. 416 pp. 168 illustrations, ISBN 0-300-08208-8 $85.00.

I was a junior in high school when the first edition of Marsh's Dinosaurs came out and it was the first true scientific publication to join my collection of dinosaur books. It has remained a major resource for me all those years and it shows: the covers have long since fallen off, and the pages are dog-eared and stained. For me, books are tools to be used—written in, marked up, and sadly, eventually worn out. Thus, it was with delight when I learned that Marsh's Dinosaurs was to be reprinted.

The book has two new parts, a brief Foreword from one of Ostrom's former students, Peter Dodson, and a longer Historical Update on the collecting of dinosaurs in the Como Bluff region by my colleague Cliff Miles. The Foreword encapsulates the impact Marsh had on dinosaur paleontology to this day and the continued influence of the lithographs printed in Marsh's Dinosaurs. The Historical Update is an important summary of the work and discoveries made in the past two decades at Como Bluff and surrounding areas, including the first discovery of an gastralia set for *Apatosaurus* by the Tate Museum of Casper College, and a nearly complete *Camarasaurus grandis* by Western Paleontological Laboratories. The original text by Ostrom and McIntosh recounting the discovery and excavation of dinosaurs by crews working for O. C. Marsh, is given verbatim. There is no attempt to update the information based more current work, such as Kohl and McIntosh (1997), so it is important to keep in mind that this book is a reprint, not a second

edition.

The real "meat" of the book is, of course, the 150 lithographic illustrations of sauropod and stegosaur bones. Marsh had commissioned these and other illustrations while serving as the Vertebrate Paleontologist for the U.S. Geological Survey. This position gave him access to a considerable amount of tax payer's money (there are letters in the Marsh correspondence archives that show that this was not a limitless supply). Marsh had planned about six monographs when the lithographs were commissioned, of which the *Dinocerata* and *Odontornithes* were completed and published before Marsh's death. Another monograph, the *Ceratopsia,* was completed after his death by John Hatcher and Richard Lull, and the *Titanotheres* was completed by Henry Osborn. Two other monographs on the *Sauropoda* and *Stegosauria* were planned but never completed. It is the lithographs for these monographs that Ostrom and McIntosh published.

The original illustrations are true works of art and it is unfortunate that photographs have now superceded lithographs in scientific papers. Most of the bones illustrated are in multiple views, including both the proximal and distal ends of limb elements. Almost all of the bones look "perfect," with no crushing and with few missing parts. While it is true that many bones do look much like the illustrations (e.g., tibia of *Stegosaurus duplex*), not all do. As Erwin Barbour (1890) has charged, some bones are less than perfect, but no hint of the imperfections have been given in the figures (dotted lines, etc.), except in a few (e.g., Plate 32). An example of a perfect bone that really isn't, is a sauropod cervical vertebra shown in Plate 15. Barbour shows that the vertebra was not as complete as Marsh had illustrated (Barbour, 1890:fig. 1). Still, we may forgive Marsh for making the bones look more than perfect, after all Jim Madsen's (1976) *Allosaurus* monograph as done the same thing.

Marsh's Dinosaur as a reprint suffers from the usual problem of reprinting a book, namely the illustrations are not as good as the original. Most of the shadows are so dark as to appear black in some cases. Although this isn't too much of a problem for many of the bones illustrated, it is for the skull of *Diplodocus* where details in the shadows are practically indiscernible (for some reason the skull images of *Stegosaurus* did not suffer the same fate). I do not understand why, with the advances in digital imagery, illustrations in any reprinted book are so poor.

Marsh's Dinosaurs is a close, but not exact reproduction of the original. The frontispiece illustration is now black and white, rather than colored. Several illustrations that were large foldouts now have a binding seam through them, for example Figure 3, map showing the location of quarries at Como Bluff and Plate 32, sauropod caudal vertebra.

So, should you buy the book? If you have an old copy of Marsh's Dinosaurs, then no, the older copy is better. But if you are unlucky not to have one, then yes, it will make a good addition to your library, especially if you are working on sauropods or stegosaurs.

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DRYOLESTIDAE (DRYOLESTOIDEA, MAMMALIA) AUS DEM OBEREN JURA VON PORTUGAL, by Thomas Martin, 1999. Abhandlungen der senckenbergischen naturforschenden Gesellschaft (Frankfurt am Main), no. 550, vi + 119 pp., 41 figs, 14 plates, 3 tables, 1 appendix, DM 50.00, ISSN 0365-7000, ISBN 3-7829-2556-4.

The Late Jurassic land-vertebrate fauna from Guimarota, Portugal unit- stands as a unique, international treasure. A particularly important com- in tri- ponent of the fauna is the mammals, which have provided much insight triangles to evolutionary steps within that group's Mesozoic history. This mono- Members graph by Thomas Martin opens new vistas within the mammalian group most prim- known as the holotherians. placentals are high- Holotheria includes a broad diversity of living and extinct forms ed by ancestors having molars with the primary cusps arranged angular patterns (as seen in occlusal views) with apices of the oriented in opposite directions between upper and lower teeth. of the Late Triassic–Early Jurassic Kuehneotheriidae are the itive known holotherians, and living marsupials and

ly specialized holotherians. Between these end-members are the symmetrodonts and "eupantotheres," which both contain species that variously exhibit unique anatomical specializations or demonstrate conditions that presage holotherians. Martin's monograph focuses on Portuguese representatives of one family (Dryolestidae) of the eupantotheres. He does not consider the "Eupantotheria" as a formal taxonomic unit, but instead an ill-defined grade of extinct, non-tribosphenic mammals in which most representatives have an unbasined, single-cusped heel (talonid) on their lower molars.

As discussed by Martin, dryolestids are the most diverse and longest-lived known group of pre-tribosphenic holotherians. Also, in terms of diversity and abundance as fossils, dryolestids were the dominant holotherians during the Late Jurassic and Early Cretaceous. Although not directly ancestral, dryolestids are closely related to tribosphenids (=Aegialodontia plus Theria). Tribosphenids primitively have a strongly developed protocone that occludes into a definitely basined talonid on the lower molars. Dryolestids are considered the sister-group of *Peramus* and its allies plus Tribosphenida, and thus were close to the common stem of marsupials and placentals. Species of dryolestids, therefore, have become central to understanding the early evolution of tribosphenic mammals.

Previous investigations of dryolestids were based mainly upon fossils from the Morrison Formation of the North American Rocky Mountains and the approximately contemporaneous Purbeck beds of southern England; most of the specimens were fragmentary jaws and isolated teeth.

In marked contrast, the present study had about 400 available dryolestid dentitions, some essentially complete. The focus of this study involved two collecting areas in southwestern Portugal, both north of Lisbon. The richer area is from an abandoned, underground lignite mine in a southern district of the city of Leiria known as Guimarota. Fossils were collected at the Guimarota mine by paleontologists from the Free University of Berlin after commercial mining had stopped. Collecting was prolonged at Guimarota, initiated through the interval of 1952–1962 and resuming, much more intensely, from 1973–1982. As a result of collecting and curatorial efforts that can only be considered heroic, Guimarota now provides the richest and most diverse assemblage of Late Jurassic, nonmarine small vertebrates known to the paleontological world. Smaller samples also were recovered by the same German teams from the beautiful sea cliffs at Porto Pinheiro, southwest of the town of Lourinha (halfway between Lisbon and Leiria). Martin's monograph provides the best maps published for locating the sites of Guimarota and Porto Pinheiro.

Dryolestids compose about half of the mammalian specimens from Guimarota. The others include paurodontids (another family of "eupantotheres"), a considerable variety of multituberculates, and a single, enigmatic species of docodont. Despite the large numbers of specimens, overall taxonomic diversity of mammals from Guimarota is not great. Martin relates the peculiar faunal make-up to an extreme depositional setting in a coastal swamp. Dinosaurs are represented mostly by juveniles, and theropods constitute about 90 percent of the isolated tooth fossils. Possibly the rare species lived in the drier uplands, and their remains were carried only by accident to points of preservation in the coastal lowlands of Guimarota.

The oldest known dryolestids come from the late Bathonian Forest Marble of Oxfordshire, England. Dryolestids from Guimarota, however, are the oldest well-known representatives of the family. Despite their antiquity, species from Guimarota already exhibit the anteroposteriorly compressed molars characteristic of the family, as well as strongly asymmetrical roots (larger anterior root, much smaller posterior root) and high molar count. Species from Guimarota are more primitive, and thus probably somewhat older, than their closest relatives from the Morrison Formation and English Weald. Dentally advanced forms such as *Laolestes* are absent at Guimarota. Martin considers the age of Morrison Formation in the traditional sense (i.e., late Kimmeridgian, using European terminology). He thinks the sites at Porto Pinheiro are younger than that, specifically late Kimmeridgian or early Berriasian; strata at Porto Pinheiro, therefore, he considers to have been deposited close to the Jurassic–Cretaceous boundary.

Martin recognizes three new genera of endemic Portuguese dryolestids, as well as two new species of pre-existing genera. *Dryolestes leiriensis*, sp. nov. (which has a 3.5 cm-long mandible) and *Krebsotherium lusitanicum*, gen. et sp. nov. (2.5 cm-long mandible) are known from upper and lower jaws and numerically dominate the dryolestids of Guimarota. *Guimarotodus inflatus*, gen. et sp. nov., also from Guimarota, is known only from lower jaws and teeth. *Laolestes andresi*, sp. nov.

and *Portopinheirodon asymmetricus*, gen. et sp. nov. were recovered uniquely from Porto Pinheiro, and both exhibit specializations beyond those of their relatives from Guimarota. Martin considers "*Butlerigale*" of Kühne, originally a nomen nudum, as a possibly pathological variant within the species limits of *Dryolestes leiriensis.*

Based wholly upon new, personal observations of type materials, Martin provides an important and extensive section on taxonomic revision of dryolestids from the Morrison Formation. Revised synonymies and relationships of Morrison taxa are as follows: *Dryolestes leiriensis* is highly similar to the lower jaw species *Dryolestes priscus* of the Rockies; upper teeth of *D. leiriensis* closely resemble the upper jaw species *Herpetairus arcuatus* of the Morrison Formation, and *Herpetairus* is judged a junior synonym of *Dryolestes*; *Krebsotherium* represents a lineage that led to *Amblotherium* of Europe and the Rockies; *Laolestes* (the senior genus) is the lower dentition of *Melanodon,* also of both continents; *Amblotherium gracilis* is the senior synonym of both *Amblotherium debilis* and *Kepolestes coloradensis*; *Malthacolestes osborni* is the deciduous upper dentition of *Laolestes,* which is the older name; and *Euthlastus cordiformis* and *Comotherium richi* should be considered paurodontids, not dryolestids. Related to that last observation, Martin provides a good definition of the Dryolestidae as well as the practical means by which its lower and upper molars can be distinguished from those of paurodontids.

Martin's Table 1 gives a useful listing of presently valid dryolestid species, their synonymies, locality occurrences, and their known geologic ages. Procedurally, the table is flawed in citing the names of new taxa on a page in advance of their formal introduction to the paleontological literature. That is only a minor criticism, however, and in most other respects this monograph could serve as a model for the manner in which detailed descriptive paleontology should be presented. For example, Martin lists all specimens studied along with brief descriptions of materials represented by each specimen number. He also gives "pure" morphological diagnoses in addition to differential diagnoses (which involve specific comparisons with similar taxa and solid discussions of similarities versus differences among all relevant taxa). The descriptions of fossils are clear, thorough, and easily readable, and the entire monograph is rich in anatomical detail. For example, the I5 in *Dryolestes* occurs in the maxilla, reflecting a primitive feature that is widespread among nonmammalian synapsids.

The illustrations are generally wonderful. Excellent drawings of jaws and teeth are presented by Peter Berndt and M. Bulang-Lörcher. Good-quality stereophotos, both from light- and REM (raster electron microscopic, using epoxy casts)-photography, are properly spaced so that an optical viewer is unnecessary. Plates 13 and 14 compare results of high-resolution x-ray techniques using 8- and 16-bit electronic digital microradiography. Detailed new information on development of tooth-buds deep in the jaw becomes visible using the enhanced imagery. In several cases, the same specimen is illustrated using various techniques, thus highlighting different kinds of features. Captions to the figures are useful and complete. Isolated teeth typically are illustrated in four views

(occlusal, labial, mesial, and distal).

Also provided are brief descriptions of enamel-dentine microstructure in dryolestids, accompanied by high-quality SEM photomicrographs. Species from Guimarota provide the oldest record of prismatic enamel among the Holotheria. They also demonstrate the most primitive known form of prismatic enamel, retained among Cenozoic mammals mainly in marsupials and insectivores.

An appendix holds a huge amount of data from dental measurements (length, width, and height of individual teeth) as well as standard jaw proportions. Gleefully, however, I point out the consistent misspelling of "Bezeichnung" in column-headings. Interesting proportion-diagrams (length:width averages for tooth loci along the length of upper and lower jaws) are presented and compared among the well-represented dryolestids. Orientations of measurements are clearly defined and were taken using a laser-based, High Precision Reflex Microscope.

Important new information relates to mandibular structure. For example, a definite facet exists for a rudimentary coronoid bone in *Dryolestes leiriensis,* and persistence of a splenial bone also is suggested. Additionally, Martin observed facets for these bones on dryolestid mandibles from the Morrison Formation, which previously were assumed to lack them. Therefore, the presumed loss of coronoid and splenial bones no longer constitutes a synapomorphy useful in defining the Trechnotheria (=Holotheria exclusive of Kuehneotheria).

A new cladogram draws together all relevant morphological data for the known dryolestids of the world. The cladogram unites, for the first

time, characters from upper and lower dentitions; that was made possible by the abundance of materials from Guimarota, allowing confident linkage of upper and lower jaw parts. Physically associated upper and lower jaws were not recognized in the Portuguese samples, but sizes and relative frequencies of occurrences of teeth among the species make taxonomic associations virtually certain. Martin suggests that the anteroposterior compression of molars in dryolestids is due to the secondary increase in molar numbers. Through that increase, the molars functioned less as individual teeth than together as a functional battery of teeth. Even the early dryolestids known from Guimarota exhibit characters of the family that are distinguishable from more advanced forms only by small details. In large part because of that, Martin suggests that it is no longer reasonable to suggest that dryolestids derived from *Amphitherium*-like precursors.

The extensive samples from Guimarota provide invaluable information about dental formulas in primitive dryolestids, especially for *Dryolestes leiriensis.* The count in that species is: I5/4, C1/1, P4/4, M7–8/8–9. The last molars in upper and lower jaws are rudimentary if present but more often absent. Except for the secondary advancement in increased molar count, the overall formula is close to what one might expect in a common ancestor to marsupials and placentals. This paper also presents the first detailed study of pre-Cretaceous tooth replacement

within the Holotheria. Most interestingly, *D. leiriensis* exhibited the basic pattern of diphyodonty characteristic of generalized placental mammals (i.e., replacing only the antemolar teeth). Martin uses that information to suggest that dryolestids did not have the reproductive pattern of short gestation in combination with prolonged lactation that is characteristic of living marsupials. Although we will probably never know this for certain, I would venture to add that: (1) Martin's interpretation is reasonable; and (2) the dryolestid tooth replacement pattern could well have developed while oviparity still prevailed in mammalian reproduction.

On the basis of faunal evidence (principally from fossil mammals and ostracodes), Martin suggests existence of strong biogeographical connections between western Portugal and the North American Rockies during the Late Jurassic (and continuing until the Jurassic–Cretaceous transition). Paleogeographic effects of the opening of the proto-North Atlantic basin, therefore, were not as important in forming barriers to faunal exchange as had been assumed previously. He closes the biogeography section with a suggestion that dryolestids were distributed worldwide by latest Jurassic and earliest Cretaceous time; a few forms are known to have persisted in South and North America into the Late Cretaceous.

This monograph is written in high-level, vocabulary-rich academic Hochdeutsch and is not for the faint at heart. Despite its difficulty for non-native German-speakers, I view Thomas Martin's paper as having provided a tremendously important service to the general community of Mesozoic mammalogists. Also, the whole Guimarota fauna stands as a monument to the scientific value of combining diligent fieldwork, long-term efforts in collection, and meticulous preparation and curation. All of us, including Martin, are now benefiting from the prodigious efforts put forth at Guimarota by the talented array of his predecessors from Berlin.

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HOMINOID EVOLUTION AND CLIMATIC CHANGE IN EUROPE: VOLUME 1, THE EVOLUTION OF NEOGENE TER- RESTRIAL ECOSYSTEMS IN EUROPE, by J. Agustí, L. Rook, and P. Andrews (eds.), 1999. Cambridge University Press, 512 pp., $100 (hardback), ISBN 0-521-64097-0.

The theme of the book is well set with the cover illustration of a

reconstruction of the early Turolian landscape from Crevillente, eastern Spain. The editors have assembled 23 chapters written by 59 authors and assembled into four parts within the 512 pages, including a comprehensive index. "The late Neogene (the period between—14 and—2.4 Ma) is one of the most interesting phases in understand[ing] the present configuration of terrestrial ecosystems. It was during this time that the change took place from the middle Miocene dominant subtropical forests that stretched across southern Europe and western Asia to a more open but still wooded biotope that now prevails in warm-temperate areas. This change in vegetation, which strongly affected the composition of mammalian faunas, seems to be linked to the rapid spread of grasses around 8–10 Ma ago. Moreover, in the late Neogene, climatic shifts and falling temperatures due to the spread of the Antarctic Ice, were followed by the Plio-Plesitocene Arctic glaciations in the Northern Hemisphere. . .At the same time, other tectonic processes like the Himalayan and the Tibetan uplifts and the opening up of the great eastern African basins and Red Sea, although working in opposite directions, favoured the processes of speciation and isolated evolution." So begins page one and sets the pace of this fact-filled volume. The European Science Foundation set about the scientific network 'Hominoid evolution and environmental change on the Neogene of Europe' in 1995. The goal of this network was to create a database about Neogene mammals of Eurasia. Workshops were organized to analyze the different aspects of the late Neogene. The first workshop was held in Sant Feliu de Guixols, Spain, with the second in Certosa di Portignano, Siena, Italy.

Part I is entitled Palaeogeography of the circum-Mediterranean region, and includes three chapters. This section works with the broader issues: (1) Mediterranean and Paratethys paleogeography during the Oligocene and Miocene; (2) Pliocene tephra correlations between East African hominid localities in the Gulf of Aden and the Arabian Sea; and (3) climatic perspectives for Neogene environmental reconstructions.

Part II is entitled Miocene mammalian successions, and includes nine chapters. Topics include: (1) a critical re-evaluation of the Miocene mammal units in western Europe; (2) the large mammals from the Vallesian of Spain; (3) trends in rodent assemblages of early to middle Miocene of Spain; (4) late Miocene small mammal succession from France; (5) late Miocene mammals from central Europe; (6) an overview of Italian Miocene land mammal faunas; (7) Miocene large mammal succession in Greece; (8) chronology and mammal faunas in Turkey; and (9) late Miocene small mammal succession in Ukraine.

Part III is entitled Palaeoenvironments: non-mammalian evidence, and includes five chapters. Ancillary evidence presented in this section include: (1) marine foraminifera; (2) marine corals; (3) non-marine mollusks; (4) sedimentary facies analyses; and (5) vegetation studies. I think that this section of the book is extremely important as it presents in general overview fashion other data bases.

I found the non-marine molluscan chapter (by D. Esu) to be a welcomed overview with easy-to-understand concluding remarks. The author included but one figure—schematic chronostratigraphic relation-

ships among select molluscan localities in relation to European Mammal Neogene zones; a map would have been wonderful. Most of the tables are lists of species in relationship to MN zones. It would also have been helpful to see some concluding diagrams illustrating the molluscan record in relation to climate—data all presented in prose in the concluding remarks. Aside from these items, the data is in the chapter and/or in the listed references.

The chapter by Suc et al. concerning vegetation changes is also in overview fashion, with text at a minimum. Five color maps with generalized pollen profiles and reconstructed vegetation zones are presented. The chapter is short, to the point, provides conclusions-reconstructions, and points toward the major references.

Part IV is entitled Palaeoenvironments: mammalian evidence, and includes five chapters. Mammal data analyses include: (1) shrews as indicators of paleoclimate; (2) mammal turnover and global climate change in Spain; (3) Miocene primate localities in Macedonia, Greece;

(4) the paleoecology of the Pikermian biome and the savanna myth; and (5) vicariance biogeography and Eurasian Miocene hominoid primates.

The concept of the book is to provide a state-of-the-art treatise about mammals and environments of the Neogene of Europe. The topic of this book is certainly needed. Some of the chapters are extreme overviews with no hard data being presented. Other chapters are attempting to provide some of the detailed data but provide just running lists of taxa by MN zone. I think that the book meets its intended goals. Granted, the topic is huge, the area of coverage is immense; surely some areas will receive greater coverage than others. The more I read of the book, the more I found myself asking additional detailed questions, but I was not getting the answers directly from this publication. At first this irritated me that the answers were not readily available in the book, but then I realized that my questions were outside the scope of the volume. In reality the book is extremely good because it pointed to me what

ANTELOPES, DEER, AND RELATIVES: FOSSIL RECORD,

should be the next step—precisely what a state-of-the-art book should do in science. I think that this book is a must for anyone who is in need of understanding, in overview fashion, the Miocene of Europe. Students will find the book the perfect beginning reference for just about any study of Europe's Miocene. This reference book abounds with critical citations for those readers looking for the hard, original data. The editors are commended for pulling together so many authors from so many countries and amalgamating so many concise overviews and syntheses into one cohesive book.

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BEHAVIORAL ECOLOGY, SYSTEMATICS, AND CONSERVATION, by E. S. Vrba and G. B. Shaller (eds.), 2000. Yale University Press, 341 pp., $65 (hardback), ISBN 0-300-08142-1.

This book is designed for the student, professional, and the avocational reader intensely interested in ruminants. Every serious paleomammalogist, mammalogist, conservation zoologist, wildlife specialist, library, museum, zooarchaeologist, and zoo should have a copy of this volume. How aptly that the book is dedicated to Alan W. Gentry. The quality of the publication is typical of Yale University Press. The text is easy to read. Figures and illustrations abound and are of top quality. The volume editors have produced a needed resource.

"Of the more than two hundred extant wild species in the order Artiodactyla (appendix 1.1), most belong to the suborder Ruminantia, especially in two families, the deer (Cervidae) and bovids (Bovidae). The focus on ruminants in this volume is timely for science and conservation. Because of their richness in species and wide geographic spread, both during a fossil record of 50 million years and today, ruminants are a scientific treasure for understanding the processes of evolution and our own history."

The edited volume is divided into three parts: The Past, The Present, and The Bridge to Future Conservation. The editors pulled together 23 leading authors for 23 chapters. The overall coverage by the various chapters is well rounded. This publication would be the ideal textbook for an advanced seminar about ruminants (I wish that I had had this book for precisely that course I taught a few years ago).

The Past section contains: (1) The ruminant radiation; (2) The endemic ruminants of the Neogene of North America; (3) Evolutionary history of New World Cervidae; (4) Caprinae and Hippotragini (Bovidae, Mammalia) in the Upper Miocene; (5) Paleodiet of the Giraffidae; (6) Paleolithic art as a resource in artiodactyl paleobiology, and (7) Human evolution and large mammal extinctions.

The Present section contains (1) Molecular evidence for the phylogenetic affinities of Ruminantia; (2) Morphoclinal evolution in ungulates; (3) Dimorphism in Social Artiodactyla: selection upon females; (4) Descent, adaption, adjustment: lession from the Cervidae and other beasts; (5) The contemporary Cervidae of Central and South America; (6) Phylogeny of Bovidae based on behavior, glands, skulls, and postcrania; (7) Recent Antilopini (Bovidae); (8) Evolution of conspicuous coloration in the Bovidae: female mimicry of male secondary characters as catalyst; (9) Adaptation, niche partitioning, and coexistence of African Bovidae; and (10) The phylogeny and biogeography of the newly discovered Annamite artiodactyls.

The third section contains a suite of five chapters outlining views

about management and conservation: (1) Mitochondrial DNA variation in Muntjac; (2) Genome evolution in Artiodactyla and its relevance to conservation; (3) Setting priorities for conservation of protected areas; (4) Under what system of wildlife management are ungulates least domesticated?; and (5) The conservation of Artiodactyla.

All the chapters are excellent and provide the perfect overview of their topics. Guthrie's chapter on the 'Paleolithic art as a resource in artiodactyl paleobiology' is superb. It is comprehenive and exhaustively illustated with line drawings and tonals. Estes' chapter on coloration in bovids is nicely accented with 10 quality color photographs. It is great to see the chapter by Groves and Schaller about the artiodactyls from the Annamite Mountain range on the Laos-Vietnam border. Although beyond the scope of their chapter, I do wish that they had discussed in more detail the relationship of the faunas between Annamite Range and the Sunda Shelf (that region where the full glacial lowering of the sea level exposed land that basically connected the Malay Peninsula, Sumatra, Java, Borneo, and nearby smaller islands). It is good to see something about paleodiets of ruminants—the chapter by Solounias et al. is welcomed. I do wish that the wealth of information about the diets of Pleistocene ruminants of North America was covered in the volume. The Quaternary of North America and South America was surprisingly avoided for the most part, although Webb's chapter on New World Cervidae has been sorely needed and higly welcomed. No single volume can cover all areas of expertise and all areas of need by all researchers. By omission from the book, the volume appropriately points out what areas are in need of study and publication.

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