Cenozoic Mammals of North America: Geochronology and Biostratigraphy

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Vertebrate paleontologists have a lot in common with Chicago Cubs fans. Since the Wood Committee report in 1941, and the beginning of this volume in 1973, they have said again and again, "Wait 'til next year." Finally, the long wait has paid off with the publication of *Cenozoic Mammals of North America: Geochronology and Biostratigraphy.*

Telling time with fossil vertebrates—primarily mammals—has a peculiar history. Unlike marine invertebrate fossils, fossil mammals seldom occur continuously through stratigraphic sections with large sample sizes. More often, they are found in limited quarry concentrations in isolated channel deposits, with few other faunas located in same stratigraphic sequence. As a consequence, classical biostratigraphic practice, developed over a century ago by d'Orbigny, Oppel, and others, was slow to be accepted by vertebrate paleontologists. Early in this century, Osborn and Matthew (Osborn, 1929; see Tedford, 1970) developed the basis for a mammalian biostratigraphy of the Cenozoic of North America, but their lead was not followed. Adopted instead was a hybrid system of loosely-characterized North American land mammal "ages" (Wood et al., 1941) that were defined using both biological and lithostratigraphic criteria. Since these units had no formal basis in measured stratigraphic sections (the basis for time-stratigraphic stages), they are not true ages in the formal stratigraphic sense. Their composite definitions based on both fossils and rock units were ripe for confusion and conflict, and eventually problems did develop. As Tedford (1970) showed, the resulting system was not biostratigraphy, but biochronology in the sense of H.S. Williams (1901). The Wood Committee (1941, p. 6) was clearly aware of the provisional and preliminary nature of their work, noting that "the precise limits between successive ages are intended to be somewhat flexible and may presumably be modified in the light of later discoveries."

Given the provisional nature of North American mammalian biochronology, it is remarkable that it has worked as well as it has. As Savage (1977) has shown, it is primarily because mammals evolved and dispersed widely and rapidly in the Cenozoic. Even more remarkable is the fact that a large-scale revision of the system was not undertaken until more than 30 years had passed. Beginning with the Geological Society of America meeting in Dallas in 1973, committees were formed to incorporate the new developments and discoveries, taxonomic revisions, range extensions, and other changes that had occurred since 1941. Through a combination of slow authors, changes in authorship, and delays in every step of the process, however, this book did not actually reach the hands of purchasers until early in 1988—a 15-year delay!

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It is often said that scientific publications are out of date by the time they come out in print. For some of this book, that may be true. Some chapters were in widespread preprint circulation as early as 1977 and 1978, and the versions in this book have not been substantially changed. Fortunately, many of the chapters were completely rewritten by a second generation of authors, who added a tremendous amount of up-to-date detail. In addition, the editor has taken great pains to provide useful introductory chapters, a detailed index, and a final summary chapter that updates many of the developments that have happened since the authors last saw proof sheets.

For example, Chapters 3 and 4 on the Paleocene and Eocene are exhaustively complete and current. The Paleocene chapter (senior author: J.D. Archibald) lists virtually every North American locality (except for the East Coast) and gives a faunal list (in tabular form) for each. In addition, a complete zonation is proposed to give the Paleocene land mammal "ages" a biostratigraphic basis. Similarly, the Eocene chapter was extensively reworked by L. Krishtalka and R.K. Stucky, and now incorporates biostratigraphic zonations proposed by several authors since 1978. The Oligocene chapter, on the other hand, is little changed from the version circulating in 1978. The taxonomy of many Oligocene mammals has not been recently updated, and this chapter does not attempt to cite specific ranges or develop a detailed biostratigraphic zonation. Some important biostratigraphic, taxonomic, and magnetostratigraphic developments available before the final deadline are just barely noted. As a consequence, much of the chapter is already obsolete.

This book will be essential not only to vertebrate paleontologists, but also to any other scientist who has reason to work with or understand the basis of Cenozoic non-marine chronology in North America.

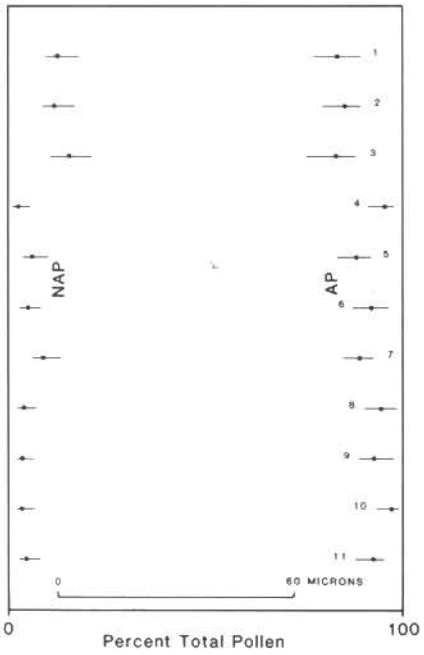

FIGURE 6—Vertical changes in arboreal pollen (AP) and nonarboreal pollen (NAP) percentages at section A1. Bars indicate 0.95 confidence limits. For convenience, samples are equally spaced up the section. Actual sample positions are shown in Figure 4. Sample numbers (Tables 1 and 2, Fig. 4) are plotted near data points. Stippled area represents the range in median grain size for samples 8–11. Further discussion of grain size occurs in the text.

part by the Institute of Polar Studies, the Ohio State University.

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It is simply wrong to treat Lamarckism as the only biological philosophy acceptable to those who oppose materialism and determinism. The historical record shows that this theory is just as capable of generating those harsher interpretations of humanity and society for which Darwinism itself is frequently blamed.

—Peter Bowler

The Arikareean through Hemphillian (late Oligocene through Pliocene) chapter has not changed much since the 1978 version, but the authors were diligent in incorporating almost all the developments since then. The Pleistocene chapter is not as detailed, but the need for such detail is reduced by the publication of Kurtén and Anderson (1980). There is also a very interesting chapter by C.A. Repenning detailing the use of microtine rodents for biostratigraphy of the last eight million years. Finally, there is a unique chapter on the use of magnetic stratigraphy, one of the most important developments in mammalian biostratigraphy. The four authors provide an excellent summary of the practical aspects of collecting and analyzing paleomagnetic samples, and the strengths and pitfalls of the method as a correlation tool. Such information is seldom available to people who use paleomagnetism without much background in the subject. Magnetic stratigraphy has grown so much in recent years that few scientists in this field can afford to be ignorant of its basic methods. This chapter is one of the best on the subject ever written.

Despite the delays in publication, this volume is remarkably complete and current. It is handsomely produced and typeset, with few typographical errors, and its price is reasonable compared to most specialized scientific books published today. It contains chapters which will be the fundamental reference in any mention of Cenozoic mammalian chronology for decades to come. This book will be essential not only to vertebrate paleontologists, but also to any other scientist who has reason to work with or understand the basis of Cenozoic non-marine chronology in North America. If all good things come to those who wait, then the long wait was worth it.

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And the suggestion that we must stop at the exact point where direct proof fails us; and refuse to believe that the similarity which extends so far stretches yet further, is no better than a quibble. Robinson Crusoe did not feel bound to conclude, from the single human footprint which he saw in the sand, that the maker of the impression had only one leg.

—Thomas H. Huxley

AUTHOR INDEX TO VOLUME THREE, 1988