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**The Evolution of Western Eurasian Neogene Mammalian Faunas**, R.L. Bernor, V.L. Fahlbusch, and H.-W. Mittman (Editors), 1996, Columbia University Press, New York, 487 p. (Hardcover \$92.00) ISBN: 0-231-08246-0.

In the past fifteen years, the detailed study of Cenozoic mammalian evolution has made enormous progress. Aided by the development of magnetic stratigraphy and  $^{40}\text{Ar}/^{39}\text{Ar}$  dating, many century-old disputes about dating and correlation have finally been resolved, and a very high-resolution chronostratigraphic framework is now complete for many parts of the Cenozoic. Much of the North American Cenozoic mammalian record has been correlated with high precision (in many cases to the nearest 100,000 years) to the global time scale. The presence of hominids has stimulated a tremendous amount of stratigraphic research on the Neogene of Africa, and certain parts of the South American record have become much better dated. Despite over a century of work, however, the dating and correlation of Eurasian mammals has not yet achieved a comparable degree of precision.

Part of the problem is the nature of the European mammalian record. Thanks to active tectonics, the Cenozoic mammals of western North America, South America, and East Africa were preserved in rapidly subsiding basins, which are exposed today in dry climates

with little vegetation to yield thick fossiliferous sections suitable for magnetostratigraphy. In many of these regions, abundant volcanics also provide the calibration points for dating. By contrast, most of the European Cenozoic record is preserved in thin, discontinuous pockets that are poorly exposed and heavily vegetated and soil-covered; few datable volcanics occur in this region. Consequently, European mammalian paleontologists had to piece together sequences of faunas, based largely on the stage of evolution of certain key lineages, without the benefit of direct superposition in most cases. In addition, the isolation and poor exposure of these deposits has made it hard to correlate these non-marine beds with the global marine time scale. Hence, many correlations have been controversial for decades.

Another part of the problem is political. Eurasian mammalian faunas are scattered among more than a dozen countries speaking many different languages, with differing degrees of commitment to funding research. In some cases (such as the former Soviet bloc countries), political barriers and even fundamental differences in stratigraphic philosophy have long hampered research. In recent years, a number of international conferences have been organized to overcome these differences in philosophy and communication. This book is the product of one such conference, the 1992 Schloss Reisenburg Workshop, convened by the editors of this volume. The editors-conveners performed the Herculean task of pulling together dozens of specialists in different fields from all over Europe (as well as several from the United States), and getting them all to submit manuscripts to update all the latest information on Eurasian Neogene mammals.

Unfortunately, as with all such large, specialized symposia these days, numerous factors conspired to prevent the timely and inexpensive publication of the results. Although the Preface states that the authors were given their deadlines in 1993, the volume took five more years to finally appear in print. It is not clear whether this was largely the fault of a few delinquent contributors, or the long production time required for such a detailed book. Consequently, some of the papers in the volume became outdated before they appeared, and other recent trendy topics are not mentioned. In addition, the coverage is not uniform. The "western Eurasia" area includes regions as remote as Pakistan, but for some reason, there is very little mention of the excellent fossil record in Spain and Portugal. Some authors submitted highly detailed reviews of key groups, while others published summaries that were little more than faunal lists. Having edited similar symposium volumes myself, I know how difficult it is to get authors to submit their chapters in a timely manner, and to enforce uniformity in coverage and approach. Editing a volume like this is a thankless task, because no matter how much the editors try, there will be problems and delays which they cannot control.

Yet symposia like these are crucial to advancing the profession, because they often bring minds together and produce a synthesis of ideas that was previously unavailable, and do so in a single, convenient place that makes a very useful reference. In this regard, the editors have been very successful. The volume begins with the "Geological Background" (or more properly, the *chronostratigraphic framework*) of the western Eurasian Neogene. A chapter by Steininger and others ties the overall Eurasian mammalian record to the latest version of the Neogene time scale, and several other papers correlate individual areas by means of magnetic stratigraphy and/or  $^{40}\text{Ar}/^{39}\text{Ar}$  dating. Unfortunately, the prevalence of short, incomplete sections in the European record, as well as the many short magnetic reversals that characterize the Miocene, resulted in a magnetostratigraphic correlation that is less successful than it has been in other continents. Much better results were obtained in Pakistan, with their thick sequences suitable for both magnetic stratigraphy and radioisotopic dating, but these faunas are in a different biogeographic province. Hence, their dates are only of limited relevance to Europe. Despite the ambiguities and controversies over correlation that are still apparent in the book, the chronostratigraphic framework presented here is a significant improvement over the poorly calibrated chronology that preceded it.

The second section of the book consists of systematic reviews of many of the major groups of Eurasian Miocene mammals, ranging from opossums, insectivores, catarrhine monkeys, and ten chapters

on different groups of rodents, to the carnivorans, hipparionine horses, rhinoceroses, suoids, and ruminants. Although this covers many of the mammals that are important to European Neogene biochronology, for some reason the proboscideans, hyracoids, anthracotheres, chalicotheres, lagomorphs, and aardvarks are excluded. The systematic chapters are very uneven in their length and detail. Many of the photographs are very muddy and poorly reproduced, which is unfortunate for a volume that has been produced as expensively as this. Nevertheless, the faunal information is complete enough that it provides a useful summary of the systematics of Eurasian Neogene mammals as of the early 1990's, and as a data base for faunal analysis.

The third section summarizes and synthesizes the faunal data, examining many different aspects of diversity changes and turnover, ecological aspects of the fauna through time, and possible connections between floral and faunal changes and global changes in Miocene climate. Some biotic changes have clear-cut climatic causes, but many others are difficult to account for. One of the biggest extinctions in the Miocene (the "mid-Vallesian crisis" at about 10 Ma) has no straightforward explanation. Even more surprising is the lack of response by the mammalian faunas to the global expansion in C4 grasslands at about 7 Ma, which has been documented in Pakistan, East Africa, and North and South America (Cerling et al., 1997). This event would correspond to the middle Turolian (between MN12 and MN13) in Europe, yet there is no evidence of major turnover at this time, nor a great decrease in browsers or increase in grazers, as might be expected. However, there were no great changes in the mammals of East Africa, Pakistan, or North America at this time, either (Prothero, in press). It will be interesting to see whether the carbon isotopes of European Turolian mammals reveal the same isotopic signal of expanded grasslands in Europe at 7 Ma as they do in the rest of the world at that time.

In the future, the tremendous advances in desktop publishing hardware and software promises to circumvent many of the problems encountered with the production of such a volume. With a small investment in computer hardware, scanner, and printer's software (such as QuarkXpress), any scientist can scan the art, lay out the pages, and submit the entire book in electronic form to the printer, who can produce it in a matter of weeks. If the computer and scanner have standard image-processing software (such as Adobe Photoshop), dark, muddy photographs can be greatly improved. Under such circumstances, the editor can produce the entire book in a matter of a few months, with minimal delays and disruption caused by the archaic book production processes still used by the major publishers. Hopefully, computer-savvy scientists will soon begin to produce high-cost, small-volume paleontology symposia in this manner, so that books like this will not be delayed by years and cost over \$100.

In summary, this book is a very valuable and carefully compiled update of nearly everything known about Eurasian Neogene mammals as of the mid-1990's. The data are now complete and current enough that they can be usefully compared to similar data from North America and Africa. Eventually the record of East Asia will also be calibrated and updated enough to add to the picture. When that happens, it may be possible to make useful global compilations and comparisons of the response of Neogene land organisms to the complex climatic changes of the later Cenozoic.

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