Book review

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Old World Neogene elasmotheriinan rhinoceroses

Pierre-Olivier Antoine. 2002. Phylogenie et evolution des Elasmotheriina (Mammalia, Rhinicerotidae). *Memoires du Museum national d'Histoire naturelle* 188. Publications Scientifiques du Museum Paris, 359 pages (hardcover). CD-ROM of the volume provided. EUR 69.00.

This voluminous book, part of a series of scientific publications of the Museum national d'Histoire naturelle in Paris, is a monograph of one specialized group of Neogene Old World rhinoceroses of the subtribe Elasmotheriina, recorded from Siberia and China through Pakistan and Iran to Spain and Africa. The book relates a two hundred year history of studies on this group, and, at the same time, gives a perfect presentation of the consecutive stages of the modern study of a fossil animal group.

For more than one hundred years, between 1808 and 1923, *Elasmotherium sibiricum* Schmidt, 1808, from the Pleistocene of Russia, was the only elasmotheriinan genus and species known. The rhinocerotid affinity of this animal was recognised only in 1840 by the German paleontologist J. Kaup. However, it was not until the 1880s that all of the skeletal elements of the animal were discovered, and its taxonomic assignment became widely accepted. For a long time, this huge animal, whose humpbacked skull exceeds one meter in length, was separated from the true extant rhinoceroses by a sufficiently large morphological gap to grant it family rank.

The next species of *Elasmotherium* (*E. caucasicum*) was described only in 1914, and the next genera (*Paraelasmotherium*, *Sinotherium*, and *Iranotherium*) of the then recognized family Elasmotheriidae Bonaparte 1845, separate from the Rhinocerotidae Owen, 1845, were established in 1923. The following 70 years witnessed a significant broadening of taxonomic differentiation of the group, such that up to ten genera with eighteen species became recognized. This progressive filling of the gap indicated that the taxonomic distance between elasmotheres and rhinoceroses had been overestimated. At the same time, the gradually accumulating morphological and taxonomic information became increasingly more and more difficult to organise into a consistent phylogenetic scenario by means of traditional methods. Only in the 1990s could the problem be effectively addressed through the use of cladistics combined with numerical methods allowing the processing of huge amounts of data. The present monograph, which is the larger of two such studies, covers almost 300 characters and 36 terminal taxa, of which four have been used as out-groups and 19 as in-group taxa. The methodology is comprehensively introduced at the beginning of the volume (26–30), and the analysis consistently accomplished in all aspects. The fundamental role of morphology in the methodology is stressed (26), and the character analysis brilliantly presented (77–232), with character states illustrated by original drawings (almost 280 figures in total), and the reasons for coding clearly explained. The phylogenetic analysis, using the computer programs PAUP (Swofford 1998) and Henning 86 (Farris 1988), follows (233–318). It includes an analysis of the complete matrix plus several analyses of subgroups of taxa. It also includes comments on limitations of different analyses, an extensive discussion on the impact of the taxonomic sampling on apomorphy distribution, on the ontogenetic variations on the topology of the obtained cladograms, and comments on problems of homoplasy. In spite of the influence of different factors on the cladograms, the main pattern of phylogenetic relationships within the Elasmotheriina is corroborated. The analysis produced three equally parsimonious trees from whicha single strict consensus tree (fig. 288) was obtained. The stratigraphically scaled sequence of morphological events in the phylogeny of the elasmotheriins inferred from the best supported cladogram is shown in table 15 (322). A comparison of the results obtained with those of earlier authors, with a pertinent analysis of the differences between them, is also included (287–297).

The formal rules of the ICZN have been scrupulously observed throughout the volume. All 36 taxa in the matrix are briefly introduced in the first chapter (31–76), provided with their systematic positions, authors' names, publication dates, synonyms, original diagnoses (where necessary), information on the type of material recorded, name of repository, stratigraphic and geographic ranges etc. Cladistic diagnoses of all the studied taxa follow the phylogenetic analysis (308–313).

This monograph is taxonomically comprehensive and also penetrates deeply into a host of related subjects, such as the biostratigraphy, evolution, paleoecology and paleozoogeography of the Elasmotheriina, including the question of their geographic origin, all of which contribute to a most up-to-date picture of elasmotheriinan paleobiology. The Elasmotheriina must have undergone most of their evolution in Eurasia. They might be American immigrants, as suggested by two immediate out-groups *Menoceras arikarense* and *Diceratherium armatum* which are recorded only from North America. This hypothesis, although not definite, is considered the most parsimonious. The Neogene history of the Elasmotheriina is confined to Eurasia with no re-immigration to America.

The only known invasion to Africa occurred in the early Miocene (22–18 Ma), during what is known as the Proboscidean Datum Event. At this time numerous animal groups migrated in both directions between Africa and Eurasia when the two regions had a broad terrestrial contact.

This impressive volume is thus not only a comprehensive account of the phylogeny of an interesting group of fossil mammals, but it can also serve as an example of how to do good paleontology at the present day.

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