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Paleogene lizard evolution in Europe

Marc Louis Auge 2005. Évolution des lézards du Paléogène en Europe. 369 pp. *Memoires du Museum national d'Histoire naturelle* 19. Publications Scientifiques du Museum Paris. Hard cover. ISBN 2-85653-588-7; Price 69.00 Euro.

This book is an extensive account of the state of knowledge of early Tertiary lizard phylogeny. It begins with an introductory part of 18 pages, summarising the general state of research, methodological problems and biostratigraphic framework. This is followed by a systematic section comprising 260 pages, and 23 pages discussing general problems relating to the evolution of lizard communities during the Paleogene in Europe. The references run to 33 pages. A much abbreviated list of contents at the beginning, and a taxonomic index (4 pages of generic and specific level taxa) at the end, complete the volume.

The systematic part makes up the bulk of the volume, and forms an important nucleus. It includes a comprehensive description of 65 species, belonging to 41 genera and 11 families, plus 12 taxa left in open nomenclature. Fifteen species and twelve genera are new, while the remaining taxa are redescribed, provided with diagnoses (some of them emended) and verified synonymies, all supplemented by authoritative discussions on their systematic positions and affinities. As a consequence, the monograph is more of a handbook than a paper. Three groups (Iguanidae, Glyptosaurini, and Anguinae) have been subjected to cladistic analysis. However, the author's approach to lizard systematics is traditional, in keeping with the fragmentary nature of the material.

The book reveals a surprisingly high diversity of lacertilians, while showing at the same time the widely differing family-level compositions of herpetofaunas in the European Paleogene. It also demonstrates the great faunal turnover at the Eocene/Oligocene boundary known as the Grande Coupure (GC). Among eleven families recorded in pre-Oligocene European localities, the most diverse are the Lacertidae (7 genera with 8 species) and the Anguidae (5 genera with 7 species), both groups surviving the Grande Coupure. They dominate the extant European fauna. Interestingly, the third most diverse group are the Iguanidae (3 genera and some 7 species, all before GC), a group absent from the Holarctic today. The disjunct geographic distribution of Iguanidae today may reflect competitive replacement by lacertids that shared the same habitats and trophic resources. However, the reason for abrupt extinction at the Eocene/Oligocene boundary could have been more complicated. Another important group of Paleogene European lizards, the platynotans (4 genera and 7 species), hardly pass the Eocene/Oligocene boundary. If the lacertids and iguanids were mainly small, probably diurnal arthropod-eating forms, the platynotans were larger carnivorous lizards that in some instances may have been ecological substitutes for mammalian predators, as they are in some extant island faunas. A larger size range and a more extensive array of adaptations is found in the anguids which, apart from strict slowworm relatives (Anguini), have also produced a diverse, probably monophyletic group of heavily-armored lizards, the Glyptosaurini, up to three times larger than the average lacertid. *Glyptosaurs* displayed a Holarctic distribution in the Eocene, but became extinct at the Eocene/Oligocene boundary in Europe. According to the author, their enlarged dentition was adapted to omnivory rather than herbivory, while the heavy posture is suggestive of an alternation of "widely foraging" and "sit and wait" strategies of prey capture.

The evolution of the lizard fauna during the Paleogene is placed within the broader contexts of biostratigraphy, based mainly on mammals, palaeogeography (including appearance *versus* loss of land bridges, comparisons with extra-European regions), climatic changes and ecological interdependences, including the impact of isolation on communities as known from the extant fauna. Some other aspects of evolution, such as variations in extinction and origination rates and longevities of lizard taxa, are covered.

The overall tropical or subtropical climate of the Early Paleogene is known to have become abruptly warmer at the very beginning of the Eocene (Initial Eocene Thermal Maximum), colder and drier in the late Eocene and still colder and quite arid in the Oligocene. The existence of land bridges between Europe and North America, and possibly between Europe and Asia (during the IETM at least), resulted in many Early Eocene appearances in Europe, and a Holarctic distribution of some taxa. However, the isolation of Europe increased during the Eocene to be abruptly interrupted at the Eocene-Oligocene boundary (GC) by the emergence of a land connection between Europe and Asia. According to the author, the profusion of lizards in Eocene faunas and their impoverishment after the GC event is not simply an effect of climatic fluctuations but, more directly, is the result of changes in the ecological structure of communities being themselves dependant on climate and palaeogeography. This thesis is supported by a sophisticated discussion (pp. 321–323) on the differences between the reactions of endotherms and ectotherms to environmental changes. Briefly, endothermic predators require a larger habitat area and trophic supply than ectotherms, and are thus more sensitive to reduction in habitable area (p. 322). As a rule, ectotherms replace endotherms not only on islands but also on isolated continents. Eocene Europe fits this model. The primitiveness of Eocene mammalian predators (Creodonta) allowed the development of large ectothermic predators (various platynotan taxa). The decline of the creodont fauna began in the Late Eocene when lizards still flourished. Modern type fissipedian predators entered from Asia at the Eocene/Oligocene boundary to cause extinction of the large platynotan taxa and reorganization of the entire Eocene-type lizard fauna. This scenario is a testable hypothesis based on revision of material collected since the 19th century but mostly very fragmentary and difficult to assign.

The huge task of summarising the bulk of relevant knowledge on European Paleogene lizards has been undertaken with great merit by the author. The volume is well edited and illustrated, although a few mistakes and shortcomings remain. Of these I should mention the lack of title hierarchy within the General Conclusions (p. 307) that obscures the sequence of arguments. Still, this valuable book can be highly recommended to every student of lizards as an indispensable source of up-to-date knowledge on Paleogene lizard phylogeny, as well as to anyone interested in faunal interchanges during the GC event.

Magdalena Borsuk-Białynicka [borsuk.b@twarda.pan.pl], Instytut Paleobiologii PAN, ul. Twarda 51/55, PL 00-818 Warszawa, Poland.