



## Non-marine Cretaceous vertebrates of the former USSR

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L. A. Nessov's posthumous monograph summarizes 37 years of his field and laboratory research. Thanks to his effort, our knowledge of Cretaceous non-marine vertebrates of the former USSR has increased at least by an order of magnitude. A special place in his achievements is due to investigations conducted by the author in the lagoon Cretaceous deposits of Middle Asia<sup>2)</sup>. Some younger scientists, his former students at St. Petersburg University, where he had taught for many years, participated in the research.

Chapter 1 deals with the succession of non-marine vertebrate faunas of the Transbaikalian Region, Middle Asia, and the Russian Platform (Belgorod, Saratov, and Volgograd regions). Almost all of the Middle Asian localities described are represented by brackish lagoon and deltaic deposits. Their degree of salinity was estimated on the basis of the shark diversity. Maastrichtian terrestrial vertebrates are chiefly known from the Kakanaut assemblage of the Koryak Upland as well as from the lower Volga Region.

Of particular importance is Chapter 3 discussing the history of various groups of the Cretaceous fauna of Northern Eurasia. They include both fishes (elasmobranchs, holocephalians, chondrosteans, holosteans, and teleosteans) and tetrapods (amphibians, turtles, lepidosaurs, crocodiles, pterosaurs, dinosaurs, plesiosaurs, birds, and mammals). In the author's opinion, the crisis of elasmobranch diversity in the terminal Cretaceous was related to the cooling of the climate together with change of the oceanic vertical circulation. This resulted in a reduced supply of terrestrial organic detritus. It is not until the Campanian that large-sized sturgeon fishes become common. The ancestors of lepisosteids penetrated Asia from Gondwana via North America.

Among the amphibians, three extinct urodelan families were recognized within the Senonian as well as two anuran families, Gobiidae and Discoglossidae. In the Coniacian, the number of the anuran species increases to nine. In Middle Asia a clearly marked succession of chelonian species may be seen within the families Macrobaenidae, Adocidae, Trionychidae, and Carettochelyidae. No snakes were present in the Cretaceous of Middle Asia. They must have migrated there later, likely from Africa. Middle Asian dinosaurs reached a peak of diversity in the Senonian and Coniacian. Maastrichtian pterosaurs are represented by a single azhdarchid. In Uzbekistan, the *Horeznavis* bird, provisionally assigned to Gruiformes, is known from the late Albian. The Coniacian of Middle Asia yields enantiornithids and fairly large non-flying birds of the family Kuszholidae assigned to patagopterygiforms. According to the author, both

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2) Editors' note: 'Middle Asia' is used here as a translation of 'Srednaya Asia' of Soviet and Russian geographers. It embraces Uzbekistan, Tajikistan, Kirghisia and Turkmenistan.

groups are of a South American origin. Smaller ichthyornithid birds appear in the Coniacian, while larger hesperornithids make their appearance only in the Campanian.

The mammalian faunas of Middle Asia include scarce multituberculates and abundant therians. The mammalian species turnover was faster than that of dinosaurs. A relatively large form of badger size appears as early as the Cenomanian. Ungulatomorph Zhelestidae appear in the late Turonian and the Coniacian.

Quite a few conclusions of this chapter are controversial. For instance, it is perhaps unlikely that the heavy-armored turtle *Linholmemys* would have been unable to surface and inhale air, instead acquiring energy via glycolysis (p. 47). There is considerable exaggeration in the author's view that the Maastrichtian emergence of hook-billed *Volgavis* birds, probably related to frigates, played a 'dramatic role' in the history of the latest pterosaurs (p. 49). Moreover, according to the Catalogue of localities (p. 130) *Volgavis* did not appear until the Danian, that is, not before the extinction of pterosaurs. Also unusual is the author's suggestion that in polar latitudes dinosaurs used volcanic heat for wintering and egg incubation (p. 51). But even those somewhat extravagant opinions are thought provoking and stimulate further discussion.

Chapter 5, dealing with taphonomy, focuses on the description of lagoon taphocenoses in Middle Asia. Some lagoons were interconnected by channels. Their hardened phosphatic mud yields not only mammal remains, but also phosphatized insects, fragments of hymenopteran nests, syphons, mantles and gills of brackish-water pelecypods. In Dzhyrakuduk, within the Bissekty Formation, several hundred vertically oriented tree-trunks have been discovered. Buried among the trees and in their vicinity were numerous remains of large pterosaurs from the family Azhdarchidae, big non-flying *Kuszolia* birds, segnosaurian dinosaurs, the earliest ungulate-like mammals (Zhelestidae), as well as problematic *Paranyctoides*, probably related to Nyctitheriidae or chiropterans.

Many statements of this chapter are also of a hypothetical nature. One of them is a suggestion that segnosaurian dinosaurs might have fed on the contents of the nests designated *Desertiana* – possibly built by primitive social hymenopterans of the Polystinae type (p. 66). But this and similar suggestions may prompt useful research.

Chapter 6 is devoted to the history of climate. A special role in climatic changes is assigned to the vertical circulation in the world oceans. They define not only the temperature conditions but also the biproductivity and oxygen supply. The Cretaceous was dominated by warm upwellings, the temperatures of deep waters in the Senonian possibly attaining an average of 14°C, in contrast with the present-day value of 2°C.

Chapter 7 contains quantitative data on faunal changes for eight horizons of Middle Asia embracing the interval of about 15 million years, from the late Albian to the early Campanian. Outside Middle Asia, vertebrate fauna from this interval is poorly known. The material described comes from lagoonal and coastal-plain habitats. In the late Albian fishes are predominant, becoming associated with chelonians in the Senonian and with amphibians in the late Turonian. In the Coniacian the associated faunal elements are amphibians and dinosaurs, and in the late Santonian-Campanian, dinosaurs. The major change, however, most graphically expressed in fishes, marks the Cenomanian/Turonian boundary. Among the change-generating factors the author mentions patterns of oceanic circulation, nutrient supply, and cycles of transgression and regression. The author is critical toward the idea of global ecological crisis at the Cretaceous-Paleogene boundary. He is inclined, not quite convincingly in my opinion, to relate the global iridium anomaly at the above boundary merely to changes in the geochemistry of mud waters.

Chapter 8 includes a Catalogue of localities of non-marine vertebrates from the Cretaceous of the former USSR, comprising about 300 sites. Lists of fossil vertebrates identified in each locality are also presented. The number of dinosaur families recognized in a single site varies from 6–7 (Shach-Shach, Kazakhstan) to 8–9 (Dzhyrakuduk II, Uzbekistan), including ceratop-

sians which appear in Middle Asia as early as the late Albian. The material is mainly fragmentary. I believe that it would be easier to use the Catalogue, had the localities of a certain age been grouped under separate headings.

Chapter 9 entitled 'The description of new taxa' presents 15 species, including five new species and two new genera of fishes. It also describes three new genera and species of urodelans, and seven new genera and species of mammals; one new genus and species has tentatively been assigned to marsupials. The earlier recognized genus *Sailestes* has been placed in a separate kennalestid subfamily.

The 60 plates illustrating the monograph present, for the first time, a comprehensive overview of the materials collected by the author, primarily from the Cretaceous of Middle Asia.

The appendix contains short excerpts from the author's field notebooks clearly demonstrating his awareness of the beauty of the world.

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