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*The present volume compiles short papers with new data on the Jurassic-Cretaceous boundary strata and their fauna of different regions of Russia (Volga region, Siberia, Crimea, Primorye) and of North America. Most papers are devoted to problems of biostratigraphy and paleontology of marine animals and their trace fossils. Besides this, some data on magnetostratigraphy, interregional correlations, history of defining J/K boundary in the Decisions of ISC, and economic value of the interval.*

*For geologists, paleontologists, stratigraphers, students of geological and geographical profiles.*

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*В сборнике опубликованы новые данные о пограничных отложениях юры и мела различных регионов России (Поволжье, Сибирь, Крым, Приморье) и Северной Америки. Большинство работ посвящено биостратиграфии и палеонтологии морских животных и следов их жизнедеятельности. Кроме того, приводятся сведения о магнитостратиграфии, межрегиональной корреляции, истории проведения границы юры и мела в постановлениях МСК, и экономической важности этого интервала.*

*Сборник представляет интерес для геологов, палеонтологов, стратиграфов, студентов геологического и географического факультетов.*

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# CROCODILES OF THE FAMILY METRIORHYNCHIDAE IN THE MESOZOIC OF THE VOLGA REGION

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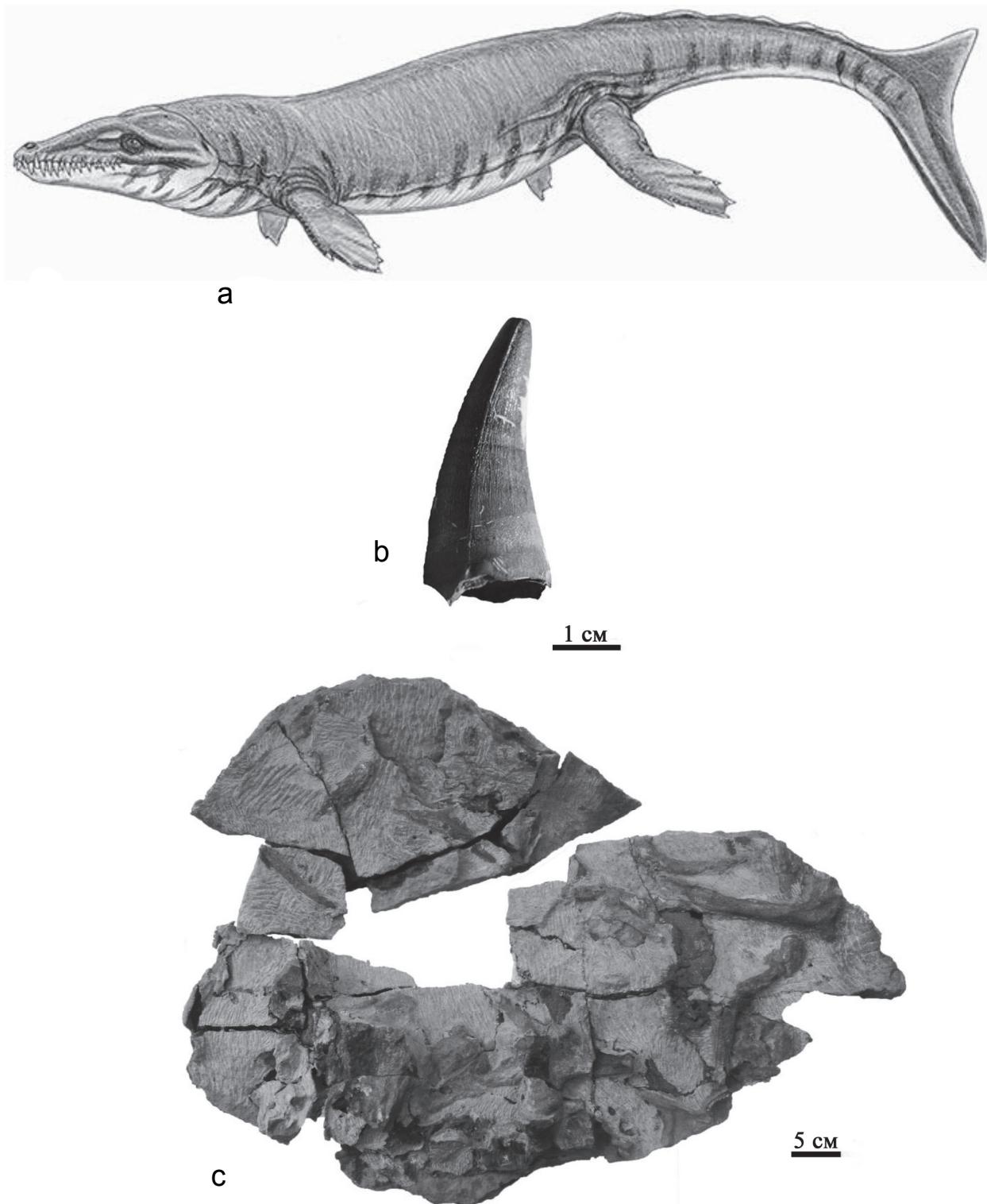
**Abstract:** A review of fossil crocodiles belonging to the family Metriorhynchidae from the Mesozoic of the Volga region is provided. A special attention is paid to a new find of metriorhynchid from the Berriasian of Kashpir section (Samara region).

**Key words:** marine crocodiles, Thalattosuchia, Metriorhynchidae, Berriasian, Mesozoic, Volga area.

Marine crocodiles (Thalattosuchia) is a unique group of Mesozoic reptiles, closely connected to marine habitats. Despite sharing the environment with formidable monsters, namely ichthyosaurs and plesiosaurs, marine crocodiles were successful enough to withstand the severe competition - in fact they even could hunt on other marine reptiles [2]. The most specialized among marine crocodiles are the members of the family Metriorhynchidae. As they completely shifted from the nearshore environments to the open sea, their skin lost the osteoderms, forming the defensive horny coat of the body, their appendiculars were transformed into paddles, and the tail became reversed heterocercal (turning down in the last quarter), like it is in ichthyosaurs, forming a sinewed rudder (Fig. 1a; [5]). Metriorhynchids are known starting from the Middle Jurassic up to the Early Cretaceous. Most finds originate from the Western Europe, but from time to time they are recorded from North and South Americas and from Southeast Asia. In Russia finds of fossil marine crocodiles are extremely rare and represented mainly by scattered bone fragments, cranial fragments and isolated teeth [1]. The precise determination of such material is problematic (except some teeth) but usually possible at least up to the family level. To the moment, there are only 4 metriorhynchid records from the Volga region.

The first unequivocal metriorhynchid find originates from Saratov region, where was once discovered nearby Hvalynsk town, on the Khoroshevsky island (now sunk). At this locality, the local lore experts O.K. Gross and V.N. Orekhov gathered the extensive collection of fossil vertebrates, and the materials from their collection were partially studied and exposed in the Hvalynsk local lore museum. Later, in 1981 the professor of Saratov State University V.G. Otchev, while studying this collection, marked two relatively large bones, which he treated as marine crocodiles belonging to the genus *Dakosaurus*. Material is represented by partly destroyed posterior truncl spondylus with preserved diapophyses and by a wide tarsus [4]. Unfortunately, the age of fossils was not established precisely, as they were obtained from the towpath. Conventionally this find is considered to be of Late Jurassic age.

Another find, represented by an isolated tooth, presumably also belonging to the *Dakosaurus*, comes from the Oxfordian deposits of Staroe Shaigovo district of



**Fig. 1.** a – outer appearance of the metriorhynchid crocodile *Dakosaurus*.  
Reconstruction by Dmitry Bogdanov; b – isolated tooth of marine crocodile from the  
Oxfordian of Mordovia republic; c – scattered bones of the marine crocodile from the  
Berriasiyan of Samara region.

Republic of Mordovia. The tooth demonstrates preserved crown and partly the root, its the total length is about 3 cm (**Fig. 1b**). The tooth is massive and have distinct cutting edges, characteristic for large predators, agreeing with the postulated lifestyle of the genus.

In the Middle Volgian bituminous shales of the Gorodischi locality (Ulyanovsk region), V.M. Efimov discovered an uncomplete skeleton of metriorhynchid, represented by the fragmented cranium, a fragment of the right half of mandible, one neck spondylus, four well-preserved truncl spondyli, one sacral spondylus with adjoining costal bones and right tibiotarsus with preserved proximal epiphysis [3]. The systematic position of this find was determined only up to the family level because of insufficient number of diagnostic characters.

Separately I would like to mention the metriorhynchid rests from the Berriasian strata of the locality Kashpir (Samara region), found by M.A. Rogov in 2013. This is the first find of fossil vertebrate from the Berriasian of the Volga region known so far, and the unicity of this find is appended by the fact that the animal was represented by the marine crocodile, which are extremely rare in the fossil record of Russia. The specimen is represented by disconnected cranial and postcranial skeletal fragments on the exposed surface of gray calciferous sandstone. The specimen is now under preparation process held in the laboratory of Undory Paleontological museum, and the skeleton has beed opened up from the ventral side only partly up to now (**Fig. 1c**). Currenly two truncl spondyli with preserved neural spines, fragments of anterior and middle costae and gastralia are well-discernible. Cranial bones are strongly fragmented and macerated, and can not be determined now. There was also a small teeth fragment, but unfortunately, while extracting the skeleton from the layer, its middle part was destroyed by a crack, which progradated across it. Judging from all available characters, the specimen can be classified within Thalattosuchia. A characteristic appearance of transverse processes in the truncl vertebra clearly shows the Metriorhynchidae affinity. Further preparation potentially can help to obtain new data, which will help to determine this crocodile more precisely.

The scarcity of marine crocodiles in the fossil record, comparing with other marine reptiles, is due to several external reasons. The main one is the temperature. As all the crocodiles are poikilotherms, temperature of the water mass directly influences on the distribution area of Recent species, not allowing them to penetrate into habitats with the yearly average temperature below 24,2 C° [5]. It seems that the same factor could restrict the distribution of fossil marine crocodiles as well. Another reason was the availability of shallow water environments nearby: despite thalattosuchii successively adapted for the life in open sea, they had not lost the connection with the land completely, like ichtyosaurs and late plesiosaurs did. There are no indications that crocodiles could have ovoviviparity, consequently, they had to went onshore for the oviposition, and this tied them up to the coastal areas. The third factor is that in the open sea it was more difficult to compete with other, highly specialized marine reptiles.

The presence of marine crocodiles in the fossil assemblages can be used as a paleoecological indicator for the reconstruction of the Mesozoic environments. Further study of geographic distribution and adaptive radiation of metriorhynchids will allow to estimate their migration routes and the diversity of this group in the mid-Russian sea, providing important information for understanding the evolution of the order Crocodilia.

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