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GEOLOGY

# New Finding of the Ancient Whale *Basilosaurus* (Cetacea, Archaeoceti: Basilosauridae) in the Lower Don Area

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**Abstract**—The taxonomy and stratigraphic location of new remains of an ancient whale (*Basilosaurus*) discovered on the western coast of the Tsymlyansk water reservoir are considered. The Kharkov Formation deposits containing these remains are described, and their age is substantiated. The *Basilosaurus* remains discovered in the Lower Don area indicate that in the Late Eocene the ocean covered the southern part of the Russian Platform almost entirely.

*Keywords*: Paleogene, Eocene, Oligocene, Sarmatian, cetaceans, Archaeoceti, *Basilosaurus*, Russian plain, Lower Don, Tsymlyansk water reservoir.

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In the Paleogene, the northern hemisphere was covered almost entirely by an ocean, and by the Late Eocene, its transgression attained a maximum having flooded the northern part of Africa, Middle and Southern Europe, the southern half of the Russian (East European) Platform, the Trans-Caucasian Region, and the Turan and West Siberian Plates. Advance of the Tethys Ocean towards the southern part of the Russian Platform is confirmed by a new finding of Basilosauridae whale remains (Zeuglodontidae), a suborder of ancient whales (Archaeoceti) in the Lower Don area near the Khoroshevskii Cossack Village (Fig. 1). The remains include separated pectoral girdle bones, spinal bones, rib fragments, and an isolated tooth of the maxillary bone ($M^1$). Currently, this is the most complete finding of a Basilosaridae skeleton. There is no doubt that this finding is of great scientific importance for paleontological substantiation of the Early Tertiary deposition stratigraphy in the Russian plain and for reconstruction of the paleogeographic environment in the Late Eocene.

Abrasion of western coasts in the Tsymlyansk water reservoir, including the Khoroshevskii Cossack Village area, uncovered deposits composed of upper Kharkov Formation sediments in their lower part ($Pg_2$), where some fragments of the ancient whale's skeleton were found (Fig. 2). The formation deposits comprise largely claylike quartz–glauconite aleurolites of grayish green color. Their visible thickness on the coast is 5–12 m. They, as well as many sand sections of the Upper Paleocene and Eocene in the Don River basin, are characterized by an elevated content of glauconite providing the specific color of claylike aleurolites. Such deposits are commonly regarded as transgression sedimentary rocks confined to intrusion zones and facially related to the coast littoral or sublittoral environment at the initial sea transgression stage [1].

In the Kiev time of the Late Eocene, the ocean basin (Tethys) started expanding having covered in its transgression maximum almost the whole southern part of the Russian Platform. Only part of the Donetsk projection, the land area at that time, was not covered [2]. As a result of low-level uplift of the Voronezh anteclise and the Donbas, the carbonate sediments were replaced everywhere with quartz–glauconite aleurolites of the Kharkov Formation indicating the predominance of basin erosion and significant evenness of watershed areas. In the Archaeoceti finding site, they are overlain with some washout by cross-bedded quartz inequigranular sands with clay sandstone interlayers and lenses containing leaf prints and silicified trunks of the Early Sarmatian stage. Such sands are exposed on the right bank of the Don from the Tsymlyansk Sea to the Severskii Donets River in the band of 30–35 km in width [3]. In the upper part of the section, they are replaced with horizontal layered varieties and gradually transit into sands faunistically dated to the Lower Sarmatian [4].

Archaeoceti remains were also found previously in the Russian plain. For instance, a whale's spinal bones from the Lower Tertiary deposits of the Tyas'ma River (Kiev province) were described in 1873; a whale's spinal bones from the Kharkov deposits(Early Oligocene) of the Severskii Donets right bank (Zmiev, Kharkov

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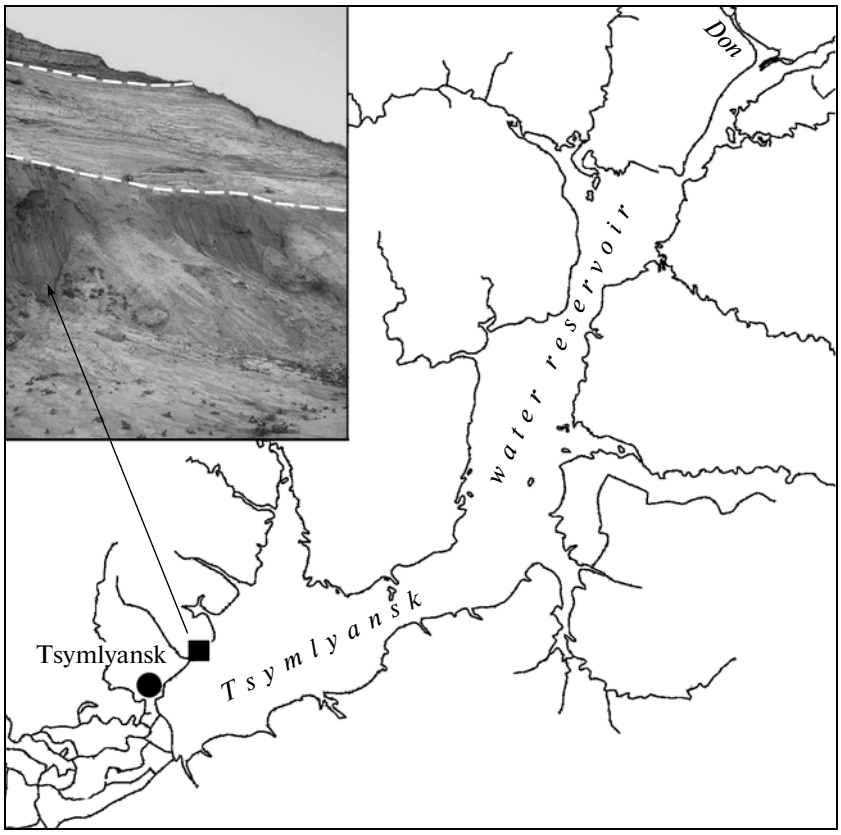


**Fig. 1.** Location of the fossil whale remains (*Basilosaurus* sp.) on the western coast of the Tsymlyansk water reservoir.

province) were described in 1912. All the remains of fossil whales were referred to *Zeuglodon rossicus* (= *Z. paulsoni*) [5]. Four spinal bones were found near the Tsymlyansk Cossack Village in the first half of the twentieth century; they, as well as the Zmiev bones, in V.V. Bogachev's opinion [6], belonged to *Zeuglodon paulsoni*. The deposits containing fossil whale remains from the Kharkov Formation were dated to the Early Oligocene (currently, the Late Eocene) [1, 7]. Hence, we assume what sea covered the south of the Russian plain 37.2–33.9 million years ago, in which they inhabited.

The early stage of whale history in the Russian plain is characterized by the relative diversity and wide distribution of Archaeoceti, largely of Zeuglodontidae, described mainly by individual spinal bones such as *Zeuglodon cetoides* or *Z. paulsoni* (= *Z. rossicus*), which complicated determination of their taxonomy due to the abundance of different points of view concerning their systematic and stratigraphic position. Today, all ancient whales from the East European plain are referred to genus *Basilosaurus*, family Basilosauridae. This genus also includes species such as *B. drazindai*, *B. isis*, *B. wanklyni*, *B. vredensis*, *B. puschi*, *B. harwoodi*, and *B. caucasicum*. Most species of the genus *Basilosaurus* are identified by individual skeleton fragments insufficient to judge with confidence about the characteristic morphological features of these animals.

By the construction of the maxillar molars, the fossil whale from the Khoroshevskii Cossack Village may be undeniably referred to the genus *Basilosaurus* (= *Zeuglodon*). The studied whale, as well as all Eocene representatives of ancient whales having a heterodont dentition, had the ordinary number of teeth in

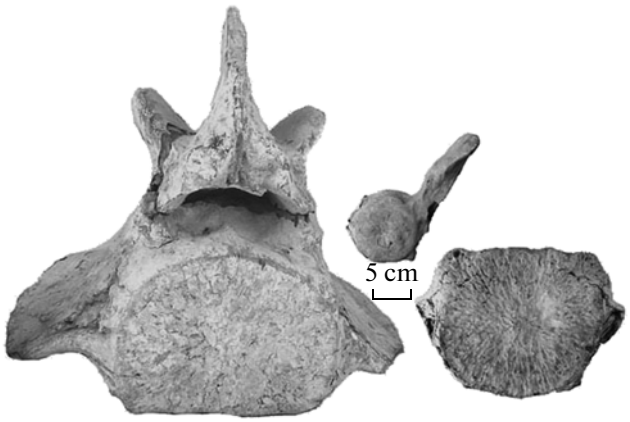


**Fig. 2.** Separated spinal bones of *Basilosaurus* sp. from the western coast of the Tsymlyansk water reservoir.

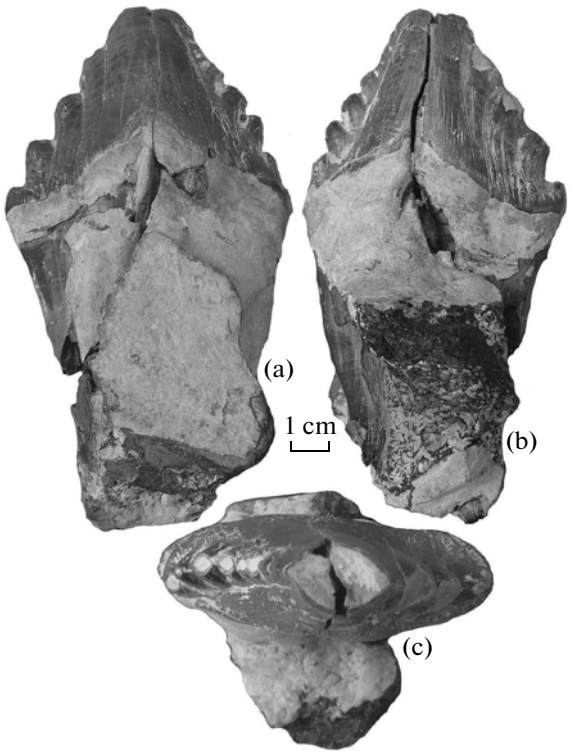


**Fig. 3.** Left $M^1$ of *Basilosaurus* sp. from the western coast of the Tsymlyansk water reservoir: (a) outer side, (b) inner side, (c) view from below.

each jawbone characteristic of mammals [8, 9]. The Tsymlyansk whale's tooth is different in the morphological features from analogous teeth of other Late Paleogene Archaeoceti from the Caucasus [9, 10] and is very similar to typical *Basilosaurus*. $M^1$ detected in the Kharkov Formation deposits (Fig. 3) with two convex roots is similar to teeth of other ancient whales, for instance, *Basilosaurus Prozeuglodon*. The tooth is large, triangular in form, with a buccal–lingual flattened crown. The tooth is 117.5 mm in height, 63.0 mm in length, and (crown) 0.22 mm in width; the front tooth flank is 54.0 mm in length, while the back flank is 55.0 mm. The tooth crown is slightly bent medially and inclined caudally. Such weakening of medial unbending of permanent teeth noted for the fossil whale from the western coast of the Tsymlyansk water reservoir and its absolute absence in the last molars likely indicate good cutting ability of the back part of *Basilosaurus* tooth alignment.

Additional cones are well defined in the crown back and front cutting flanks. The crown front edge consists of eight cones; six of them are worn, while two of them have no defects. The crown back edge consists of five cones; all of them are worn, while the lower and the upper ones are finer than the others. The cones in the front cutting edge are much finer than those in the back cutting edge. From the outer and inner sides near the front and back bases of the crown, there is an underdeveloped collar. The boundary separating the roots from the crown is triangular in form. Dental enamel is liny.

The spinal bones found are from different sections of the whale's spinal column. However, significant differences in the size of the neck and tail spinal bones indicate the great dimensions of the whale. Currently, it is impossible to determine accurately the taxonomy of the fossil whale from the Khoroshevskii Cossack Village due to the absence of uniform remains with previously described skeleton bones. Thus, the whale is referred to as *Basilosaurus* sp.

Hence, the finding of the *Basilosaurus* fossil whale made it possible to confirm for the first time the age of the Kharkov Formation deposits on the western coast of the Tsymlyansk water reservoir. In the course of future investigations, we are planning to find missing skeleton fragments of the ancient whale, to describe in detail its remains, and to substantiate more accurately its taxonomy.

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