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GENERAL BIOLOGY

The First Finding of the Late Miocene Baleen Whales of the Genus *Zygiocetus* (Cetotheriidae, Mysticeti) in Crimea (Melek-Chesme Locality, Kerch Peninsula)

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Abstract—Fragments of four *Zygiocetus* sp. whale skeletons from the Melek-Chesme locality at the Kerch Peninsula are described. This is the first finding of the representatives of this genus in Crimea.

Keywords: *Zygiocetus*, Cetacea, Late Miocene, Middle–Upper Sarmatian, Crimea

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Melek-Chesme, a new locality of Late Miocene marine mammals, was discovered in 2018 by a joint expedition team of the Borissiak Paleontological Institute (PIN) of the Russian Academy of Sciences, Vernadsky Crimean Federal University (CFU), and NAO Nasledie Kubani. The locality is situated on the right bank of the Melek-Chesme River (5 km northwest of the city of Kerch, Fig. 1) [1, 2]. A fragment of a whale skeleton was retrieved from this site in July 2018 (excavations by NAO Nasledie Kubani, CFU collection, no. K2). The skeleton was buried in anatomical order, but sustained considerable damage during the excavation work. A major part of the locality is situated within the "Complex of Bieli settlements" archaeological site (quart. UF 135-136). An almost complete skeleton and fragments of skeletons of three *Zygiocetus* sp. cetothere whales (collection PIN no. 5656) buried inside a biogenic reef mass were found at the site.

The new locality is taphonomically similar to the Polevoe locality (Krasnooktyabr'skii village, Republic of Adygea, Russia) [3]. Part of the bones were located inside a thick bed of reef limestone. The axis of the main reef massif runs in the northwest direction.

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The material from Melek-Chesme preserved in the PIN and CFU collections is briefly described below.

Material in the PIN collection: fragments of the braincase (specimen no. 5656/1–4; Fig. 2a), a fragment of the caudal part of the vertebral column (Ca1–Ca8, specimen no. 5656/5–12), and a right dentary (specimens nos. 5656/13 and 5656/14). The material collected in the gypsum block includes fragments of two more skeletons (Fig. 2b).

Material in the CFU collection: two lumbar vertebral bodies (specimens nos. K2-1 and K2-2), several fragments of the spinous processes (specimen nos. K2-22–26), individual metapophyses and neural processes (specimen nos. K2-29 and K2-37), caudal vertebrae (Ca1–Ca11, specimen nos. K2-3–13), ulna and radius (specimen nos. K2-14–16), fragments of the scapula (specimen nos. K2-27–28), five phalanges (specimen nos. K2-17 and K2-21), rib fragments (specimen nos. K2-40–54), and intervertebral discs (specimen nos. K2-56–65).

The genus *Zygiocetus* Tarasenko, 2014 included medium-sized cetothere whales of 3–3.5 m in length, with shortened and ventrally inclined angular processes of the lower jaw. The supraoccipital of *Zygiocetus* sp. from Melek-Chesme is wide and shaped as an elongated isosceles triangle with arched convex lateral sides; its anterior end is located at the level of the middle or the anterior third of the temporal cavities (specimen nos. 5656/1–2; Fig. 2a). A poorly pronounced sagittal crest found on this bone does not reach the middle of the bone. Lambdoid crests high, slightly curved. Zygomatic process with a wide base, short, with the anterior end slightly bent medially. Nasals

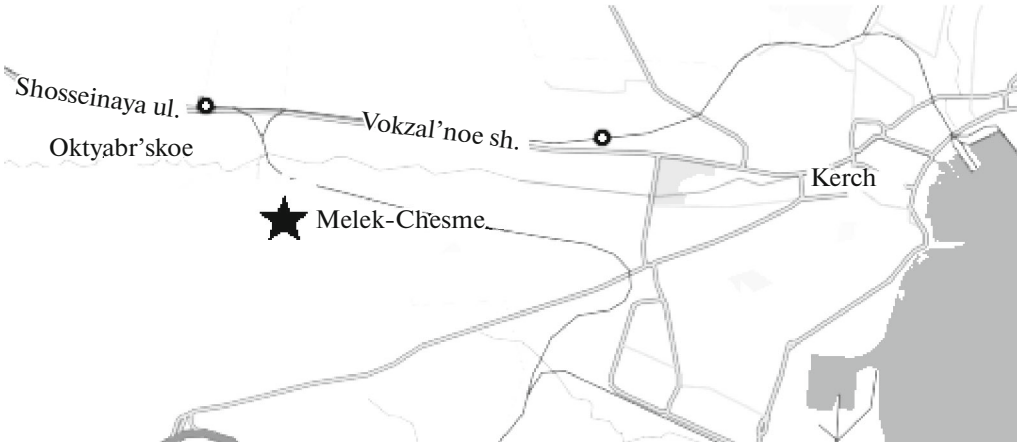

Fig. 1. The Melek-Chesme locality.

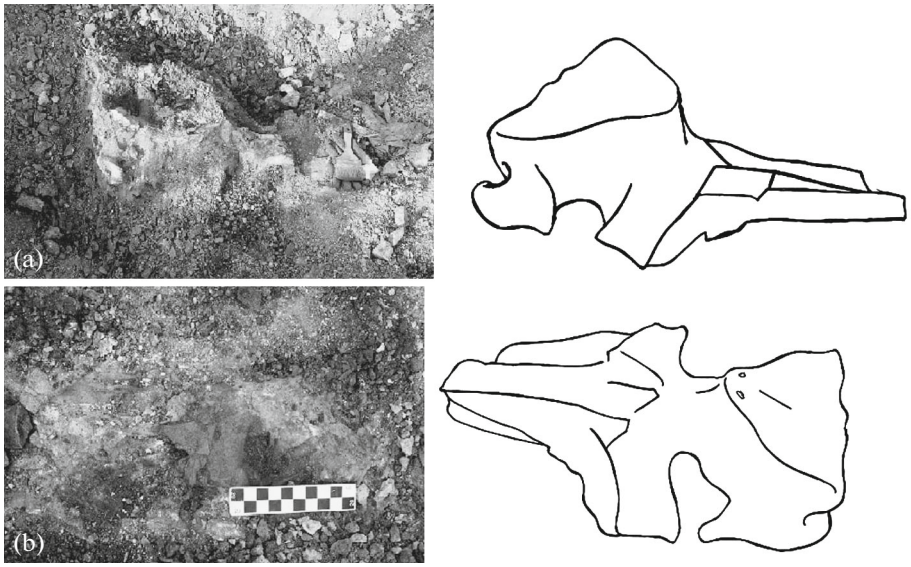

Fig. 2. *Zygiocetus* sp.: (a) specimen PIN, no. 5656/16, part of the skull with a fragment of the lower jaw; (b) specimen PIN, no. 5656/1–4, partial skull; Melek-Chesme, Late Miocene.

long, narrow throughout, almost parallel to the ascending processes of the maxillary bones (Fig. 2).

The frontals are excluded from the vertex of the skull. Supraorbital processes of the frontals long and relatively wide throughout. The posterior margin of the supraorbital process is slightly concave, and the temporal cavities have a rounded shape. The lateral edge of the orbit is parallel to the longitudinal axis of the skull. The parietals occupy a substantial part of the vertex of the skull. The interparietal suture is slightly oblique; it lies in a plane inclined ventrally at an angle of 45°–50° relative to the plane of the supraoccipital. The interparietal bone is absent, similarly to *Zygiocetus nartorum* Tarasenko, 2014 [3].

Measurements, mm: skull, specimen PIN, no. 5656/1–4: length of the contact between the right and left parietals (interparietal suture), 23; length of the supraorbital process of the frontal: right, 80; left, 80; maximal width (right), 70; skull width between the bases of the postglenoid processes approx. 330; between the posterior edges of exoccipitals, approx. 240; foramen magnum width, 42; specimen PIN, no. 5656/15–17: interparietal suture, 25; skull width between the bases of the postglenoid processes, approx. 338.

The petrosal (specimen PIN no. 5656/15) is characterized by the presence of a rather small fenestra rotunda (2.5 mm) morphologically similar to that in *Zygiocetus nartorum* Tarasenko, 2014 [3] (it is much

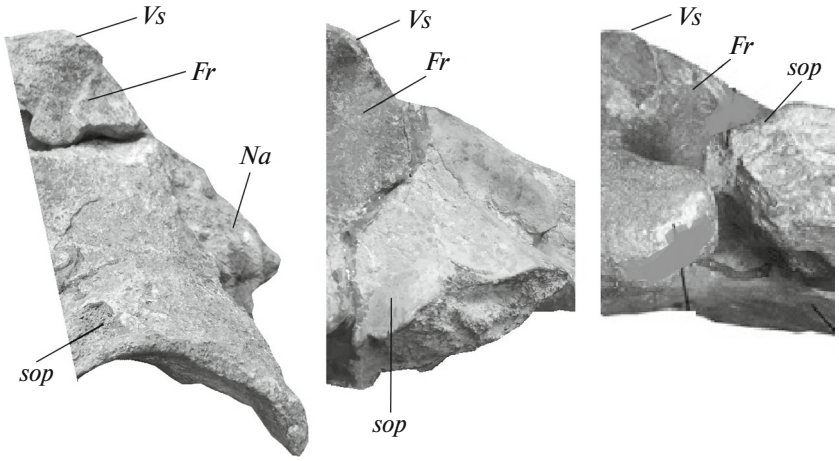

Fig. 3. Structure of the vertex of the skull in Cetotheriidae (lateral view), left to right: *Zygiocetus* sp., specimen PIN, no. 5656/1–4; Russia, Republic of Crimea, Late Miocene, Middle Sarmatian, Melek-Chesme locality; *Zygiocetus nartorum* Tarasenko, 2014, holotype PIN, no. 5461/4; Russia, Republic of Adygea, Late Miocene, Middle Sarmatian, Polevoe-1 locality; *Cetotherium rathkei* Brandt, 1843, holotype PIN, no. 1840/1; Russia, Republic of Crimea, Cape Ak-Burun, Late Miocene, Upper Sarmatian. Abbreviation: *Na*, nasals; *Fr*, frontals; *sop*, supraorbital process of the frontal; *Vs*, vertex of the skull. The arrow points at the vertex of the skull (the anterior angle of the supraoccipital).

larger in *Kurdalagonus* Tarasenko et Lopatin, 2012 and *Brandtocetus* Goldin et Startsev, 2014) and a small reduced posterior process of pars cochlearis (it is larger and more inflated in *Kurdalagonus*). The lateral surface of the mastoid process of the petrosal has a truncated ellipse shape in specimens PIN, nos. 5656/2, 3, and 16, which is neither characteristic of *Kurdalagonus* and *Brandtocetus,* in which this process is polygonal and wide, nor of *Cetotherium,* in which this process has a pointed wedge shape [4–7]. Moreover, the skull in the representatives of *Cetotherium* is more flattened, with a large angle (~180°) between the plane of the frontal suture and the plane of the supraoccipital (Fig. 3). The supraoccipitals of the whales from Melek-Chesme are wider than in *Cetotherium*. The lambdoid crests are more straightened than those in *Kurdalagonus* and *Brandtocetus*, which have an S-shaped bend.

The presence of the representatives of the genus *Zygiocetus* shows that the assemblage studied belonged to the end of the Middle Sarmatian. The age of the bone-bearing bed is tentatively estimated between the end of the Middle Sarmatian and the beginning of the Late Sarmatian [2, 8]. The absence of fossil mollusks hinders the assessment of the exact age, but the find of the remains of a seal *Monachopsis pontica* (Eichwald, 1850) also points at the Middle–Late Sarmatian interval [9]. The age of the bone-bearing beds for *Cetotherium rathkei* Brandt, 1843 is estimated as the second half of the Late Sarmatian due to the presence of the shells of bivalve mollusks *Mactra* (*Chersonimactra*) *caspia* Eichwald, 1841 [4, 10]. One can assume that the genera *Zygiocetus* and *Cetotherium* did not coexist in the area at the same time, but rather the latter replaced the former in the Late Sarmatian.

The finds of *Zygiocetus* representatives in the Crimea indicate that the central parts of the Sarmatian Sea belonged to the living range of the genus at the end of the Middle Sarmatian–beginning of the Late Sarmatian.

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COMPLIANCE WITH ETHICAL STANDARDS

The authors declare that they have no conflict of interest. This article does not contain any studies involving animals or human participants performed by any of the authors.

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