

THE DOLPHIN *KENTRIODON FUCHSII* FROM THE NEW SARMATIAN VERTEBRATE LOCALITY OF FÂNTÂNELE (TRANSYLVANIA, ROMANIA)

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Abstract. The small sized kentriodontid dolphin *Kentriodon fuchsii*, as well as an isolated indeterminate dolphin vertebra, are here reported from the new Sarmatian *s.s.* (late middle Miocene, latest Bessarabian) locality Fântânele (Bistrița-Năsăud District). The fossils were unearthed during some archaeological excavations carried out in the place named "La Gâța", in the northeastern area next to Fântânele. There, sands bearing sandstone concretions indicative for the Feleac Formation are cropping out. The isolated status of the bones is suggestive for a dynamic hydrotaphonomy, probably in a litoral environment, with shallow water. This discovery documents the presence of this dolphin on the eastern side of the Transylvanian basin. It completes the list of similar findings from Romania, but also the regional distribution in Paratethys Sea.

Keywords: cetaceans, dolphin, late middle Miocene, Central Paratethys, Romania.

Rezumat. Delfinul *Kentriodon fuchsii* din noua localitate cu vertebre sarmațiene Fântânele (Transilvania, România).

Delfinul kentriodontid de talie mică *Kentriodon fuchsii*, precum și o vertebră a unui delfin indeterminabil sunt semnalate aici din noua localitate sarmațiană *s.s.* (Miocen mediu tardiv, Bessarabian terminal) Fântânele (Județul Bistrița-Năsăud). Fosilele au fost dezgropate pe parcursul unor săpături arheologice efectuate în locul numit "La Gâța", în aria nord-estică a localității Fântânele. Acolo aflăse nisipuri cu concrețiuni indicative pentru Formațiunea de Feleac. Apariția izolată a oaselor sugerează o hidrotafonomie dinamică, probabil într-un mediu litoral, cu ape puțin adânci. Această descoperire dovedește prezența acestui delfin în partea estică a Bazinului Transilvaniei. Se completează lista cu descoperiri similare din România, dar de asemeni și distribuția în Marea Paratethys.

Cuvinte cheie: cetacee, delfin, Miocen mediu tardiv, Paratethys Central, România.

INTRODUCTION

Geologically, several distinct superposed, incongruent and partly recurrent sedimentary basins developed in time on the actual Transylvanian Depression area (BALINTONI et al., 1998). They are mainly documented by the cores recovered from numerous boreholes drilled for methane gas pools. The beginning of the last of these sedimentary basins is middle Miocene (early Badenian), when marine waters transgressed a very heteroclitite basement. In early Sarmatian *s.s.*, mostly in littoral areas, brackish waters replaced the former Badenian salty marine ones. Probably these tendencies even increased in the fluvial freshwater discharge areas, where deltaic sediments accumulated in dominance (KRÉZSEK & BALLY, 2006). At that time, the Apuseni Mountains area was an archipelago with islands and largely opened passage ways, allowing free communication between water and the marine biota between the Transylvanian and Pannonian realms (RÖGL & STEININGER, 1984).

When comparing different neighboring sedimentary basins, the knowledge about the middle Miocene vertebrates – both marine and terrestrial – is obviously uneven, with scarcer data in the Transylvanian basin vs. richer ones in the Pannonian basin and its related sub-basins from the western Apuseni Mountains side. In the Pannonian basin realm there are several Badenian and Sarmatian vertebrate localities (overview and taxa reassessments, in HÍR et al., 2016, 2017) with illustrative assemblages at Miniș, Tauș and Comănești in the Zărand sub-basin (FERU et al., 1980; VENCZEL & ȘTIUCĂ, 2008), Tășad and Stracoș in the Beiuș sub-basin (KÓKAI et al., 2001; HÍR et al., 2002; KAZÁR & VENCZEL, 2003) or Subpiatră in the Vad-Borod sub-basin (VENCZEL et al., 2005; HÍR & VENCZEL, 2005; VENCZEL, 2007; KESSLER & VENCZEL, 2009).

Extremely poor data is known about marine and Badenian vertebrates. These fossils are almost rare in Transylvania, as in the whole Romania. The Sarmatian *s.s.* vertebrate localities are somewhat more numerous. On the western margin of the basin an example of such locality is Cluj-Napoca, where dolphin remains were collected during the mining works for clay extraction carried out several decades ago in the former Iris quarry (Iris Formation, late Volhynian–early Bessarabian; MÉSZÁROS et al., 1991). These fossils are hosted in the paleontological collections of the Babeș-Bolyai University (CODREA, 1996; KAZÁR et al., 2004). Apart from cetaceans, we mention here in the same locality a few post-cranial bones from a fragmentary skeleton of a young chalicothere (unpublished; VAC *personal observation*). Not far from Cluj-Napoca, another find documents the presence of cetaceans at Vâlcele, near Feleacu (Cluj District) where a dolphin vertebra was recovered embedded in a so-called "Feleacu concretion" (CODREA, 2008). This kind of sandstone concretions is very common in the Feleacu Formation (latest Bessarabian; KOCH, 1884; CHINTĂUAN et al., 2018).

Therefore, if the Sarmatian *s.s.* marine mammals were reported on the western border of the Transylvanian middle Miocene basin, similar fossils were never mentioned on the opposite, eastern border. Some years ago in the locality of Fântânele (commune Matei, Bistrița-Năsăud District) a few fossil dolphin bones were unearthed from Sarmatian *s.s.* rocks due to archaeological works carried out by the Grăniceresc Năsăudean Museum of Năsăud. Apart from the cetacean bones, the

same level yielded two vertebrae and some rib fragments of indeterminate large mammals, as well as skeletal fragments originating from a rather large sized fish (Teleostei indet.). Fântânele is a village located ca. 26 km in straight line from Bistrița, the capital of district. According to the geological map *folio* 11 Bistrița L-35-VII of the Geological Institute of Romania scale 1: 200000 (RĂILEANU et al., 1967), exclusively Sarmatian s.s. deposits are exposed in the whole area of this locality. On this geological map, the Volhynian and Bessarabian deposits are mapped as a single unit (Fig. 1).

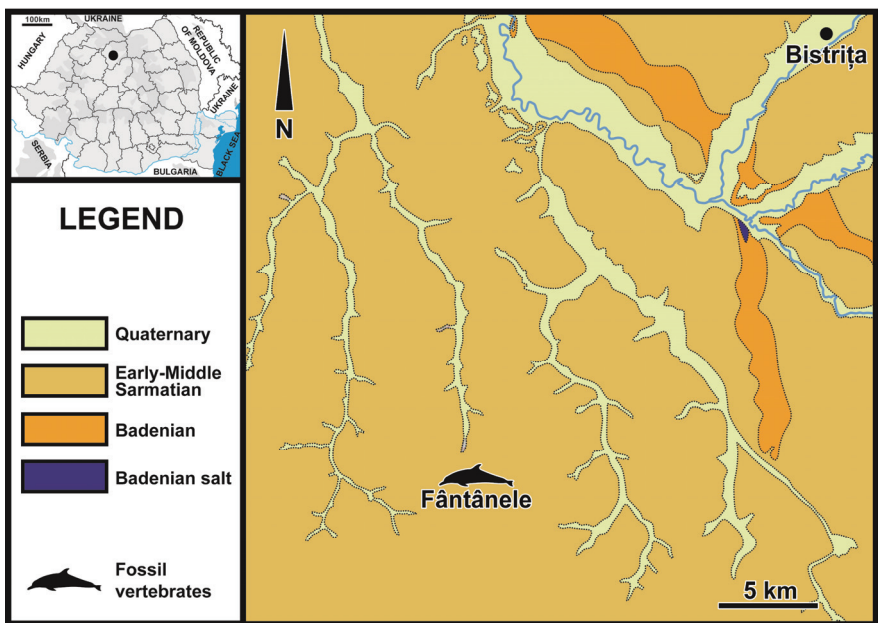


Figure 1. Location of the Fântânele vertebrate locality in Romania and on the geological map of the studied area (redrawn simplified, after the geological map of the Geological Institute of Romania, scale 1:200000).

The bones were found during the systematic archaeological diggings for the Celtic and Scythian necropolis from this locality. The Celtic necropolis was named the Necropolis from Fântânele – ”La Gâța” (named after the nick name of the land owner; VAIDA, 2008), located on Iușului Hill (Iuș = Szászújós, former name of Fântânele). The dominating rock in this location is the yellowish quartz sand. This sand deposit is laying ca. 30 cm under the soil. The bones were recovered at ca. 80 cm in depth, into this rock (Fig. 2). The presence of sandstone concretions (called by local people “stones of sand”) is important because they are indicative for the Feleac Formation.

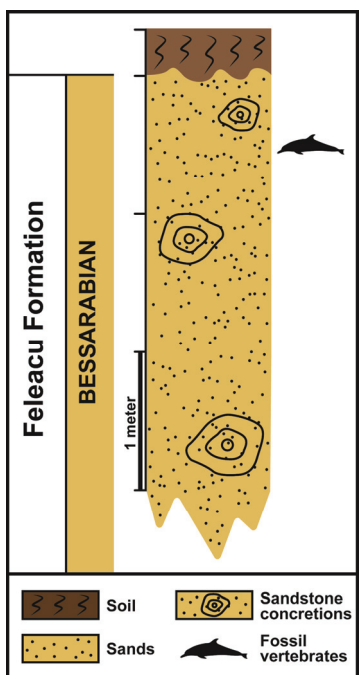


Figure 2. The lithostratigraphic sequence of the site ”La Gâța” at Fântânele, Bistrița-Năsăud.

MATERIAL AND METHODS

The dolphin fossils from Fântânele hosted in the paleontological collection of the Grăniceresc Năsăudean Museum are a vertebra and a humerus. The bones were collected by one of us (LDV) during archaeological excavations. The fossils did not need special preparation, they were just cleaned by washing out the adherent sand. Photographs were captured taken at the Babeș-Bolyai University of Cluj-Napoca with a D700 Nikon camera and 105 mm Sigma lens, on a professional tripod, then processed in Adobe Photoshop®CS2, Version 9. The measurements were taken using a professional caliper of 150 mm. Measurements follow KAZÁR & VENCZEL (2003).

Common English terms and the standard anatomical orientation system are used throughout this paper. The anatomical nomenclature of dolphins follows ABEL (1931), SLIJPER (1936) and ROMMEL (1990). The taxonomic assignation is based on references and on direct comparisons with similar finds hosted in the Țării Crișurilor Museum Oradea, Natural Sciences Department, and the Babeș-Bolyai University Paleontological Museum from Cluj-Napoca.

Institutional abbreviations: **GNM**, Grăniceresc Năsăudean Museum, Năsăud; **BBU**, Babeș-Bolyai University of Cluj-Napoca, Paleontological Museum; **UBFG**, Laboratory of Paleontology, Faculty of Geology and Geophysics, University of Bucharest; **TCM**, Țării Crișurilor Museum Oradea.

RESULTS

Systematic paleontology

Order Cetacea Brisson, 1762

Suborder Odontoceti Flower, 1867

Infraorder Delphinida de Muizon, 1984

Superfamily Delphinoidea Gray, 1821

Family Kentriodontidae Slipper, 1936

Kentriodon fuchsii (Brandt, 1873)

Material. Left humerus (GNM 6668; Fig. 3 a-e).

Geological age and locality. Sarmatian ss. (late Bessarabian), Fântânele, Bistrița-Năsăud District.

Description. The humerus is well preserved. Only a portion of the lesser tubercle was broken. This bone, as in other finds from the Romanian Carpathian area (Table 1) is short and stout. The bone broadens after the neck portion, the distal end being the broadest portion in lateral view. In this manner, the anterior (near straight, faintly convex) and posterior margins are diverging from the neck area to the distal margins. The distal margins are marked by strong asymmetry, the radial border being by far broader compared to the ulnar one. The facet for the oleocranon process is well marked on the posterior margin, like in the specimen BBU 14943. The attachment of the deltoideus muscle is faintly marked on the lateral side of the bone – it could be result of the hydrotaphomony, the bone being probably dragged on the basin bottom by marine currents and waves -, but the scar is clearly visible on the distal portion of the anterior margin. The neck appears in lateral view as a strongly constricted portion, compared to the epiphysis and the head of the humerus. The infraspinous fossa is well expressed, relatively deep, oval (largest diameter ca. 7 mm). The head and the lesser tubercle share same morphology with the ones reported from Cluj-Napoca or Domașnea (KAZÁR et al., 2004; CODREA & SEREȚEAN, 2004).

Measurements (mm).

Table 1. Comparative measurements of various fossil Kentriodontidae humeri from Romania.

Collection Inventory no.	GNM 6668	UBFG ¹ 223/1	UBFG ¹ 223/2	TCM ²	BBU ³ 14943	BBU ³ 15029	BBU ⁴ V411
Length of the humerus	55.2	51.0	51.5	41.5	54.0	-	41.8
Anteroposterior diameter of the head of the humerus	21.0	18.0	(19.5)	16.0	19.5	-	-
Dorsoventral diameter of the head of the humerus	20.0	20.0	20.5	17.0	22.5	-	16.7
Mediolateral width of proximal epiphysis	35.0	28.0	30.0	26.5	30.0	-	23.0
Anteroposterior width of proximal epiphysis	25.0	20.0	22.5	-	-	-	-
Anteroposterior extension of the humerus neck	21.6	19.5	20.0	20.0	21.0	-	15.0
Mediolateral extension of the humerus neck	16.5	16.5	17.5	14.5	18.0	-	10.0
Anteroposterior extension of the distal epiphysis of the humerus	32.5	28.0	29.0	26.5	33.0	26.5	-
Mediolateral extension of the distal epiphysis of the humerus	14.5	13.0	15.5	12.0	14.5	12.5	-

¹ GRIGORESCU & KAZÁR, 2006: "*Champsodelphis*" *fuchsii* BRANDT, 1873, Comănești 1, late Volhynian; ² KAZÁR & VENCZEL, 2003: Kentriodontidae indet. (unnamed n. sp.), Tășad 2, Volhynian (MN 7+8); ³ KAZÁR et al., 2004: *Atocetus(?) fuchsii* (BRANDT, 1873) Cluj-Napoca, Iris open pit, late Volhynian; ⁴ CODREA & SEREȚEAN, 2004: Kentriodontidae indet., juvenile, Domașnea, late Volhynian-?early Bessarabian.

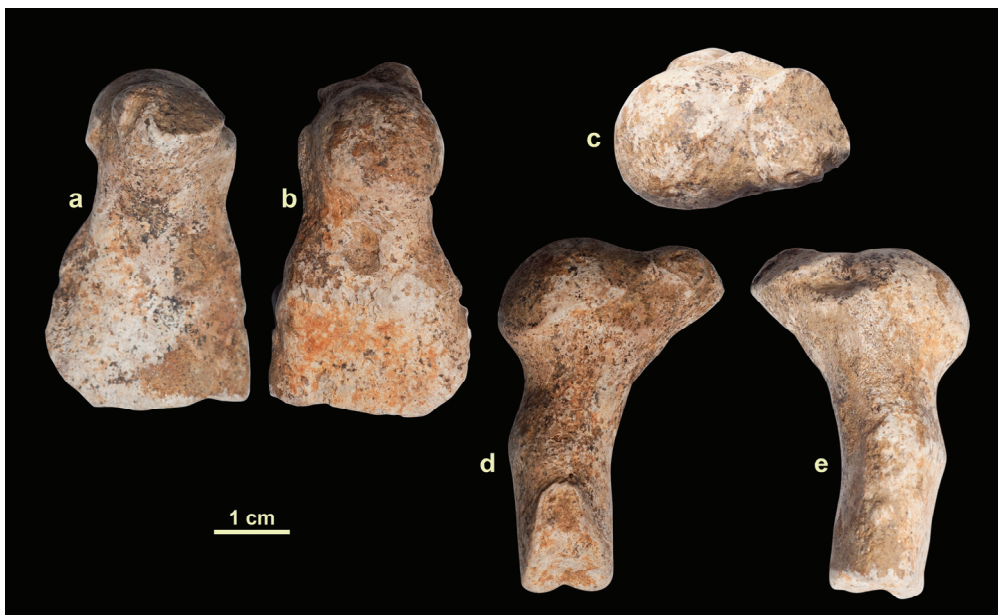


Figure 3. *Kentriodon fuchsii* (Brandt, 1873), left humerus (GNM 6668). a – lateral view; b – medial view; c – dorsal view; d – posterior view; e – anterior view.

Odontoceti Flower, 1867
 Odontoceti indet.

Material. Isolate thoracic vertebra of a small sized specimen (GNM 6669; Fig. 4 a-b).

Geological age and locality. The same as above.

Description. Only the centrum of this vertebra is preserved. In spite of its small size, it originated from an adult specimen. Both articular facets are slightly concave and sub-ellipsoidal. The base of the neural channel is broad. Probably, this thoracic vertebra had a rather anterior position in the vertebrae series.

Measurements (mm): length of centrum – 18.0, anterior width – 22.0, anterior height – 19.5

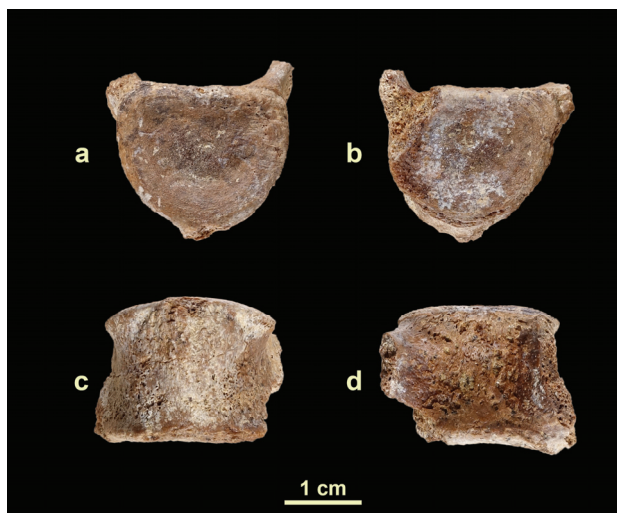


Figure 4. Odontoceti indet., thoracic vertebra (GNM 6669). a – posterior view; b – anterior view; c – ventral view; d – dorsal view.

DISCUSSIONS

The problems related to the taxonomy of the dolphin species “*Champsodelphis*” *fuchsii* (BRANDT, 1873) were discussed by KAZÁR et al. (2004) and GRIGORESCU & KAZÁR (2006), as long as DE MUIZON (1988) practically restricted this genus only to the type species, *C. macrogenius* Fischer, 1829. KAZÁR (2006) reconsidered “*C.*” *fuchsii* as *Kentriodon*. We follow here her viewpoint, but as the humerus from Fântânele is very close both in morphology and size (Tab. 1) to the one described by KAZÁR et al. (2004) from the Iris open pit in Cluj-Napoca. In turn, we also

consider the possibility that the fossils from the Transylvanian basin could document a distinct species of odontocetes, as KAZÁR (2006) herself presumed.

GRIGORESCU & KAZÁR (2006) mentioned a first middle Badenian (ca. 14.7-13.6 Ma) invasion event of marine mammals in the Central Paratethys (Austria and Hungary) including kentriodontids, followed by another one in Sarmatian. For instance, in Romania, there is no evidence about Badenian representatives, but one may presume their existence. This situation could be explained by the absence of the middle Badenian marine deposits on the eastern margins of the Pannonian basin and its related sub-basins from Romania. In Wieliczian (middle Badenian) in the basin of Transylvania, a peculiar regional marine paleogeography (PAUCĂ, 1967; 1968; 1968a; 1978; BALINTONI & PETRESCU, 2002) lead to salt deposition and probably this environment was not convenient for marine mammal exigencies. However, it is also possible that these fossils were neglected by the geologists who focused mainly on various other faunal groups (mainly molluscs and other invertebrates) very abundant in some Badenian deposits of Romania, or it was plain and simply a collecting bias. It is worth recalling that other Badenian marine mammals as the sea-cows are also very rarely reported, although all these marine mammals were probably part of the diet of the large sharks as *Otodus megalodon* (TRIF et al., 2016, 2018; TRIF & CODREA, 2017). A single locality seems to have yielded Miocene sirenian remains, Zorlențu Mare in southwestern Romania (Banat), where a rib fragment was briefly described and illustrated by FLOREI (1962; p. 69, Fig. 3). However, the author himself doubted the sirenian origin of the bone in the figure caption. We could not find this fossil in the BBU collections, for a revision.

Nevertheless, small sized kentriodontidae dolphins are recorded in the Sarmatian *s.s.* deposits both in the Pannonian and Transylvanian basins (Table 1; Fig. 5).

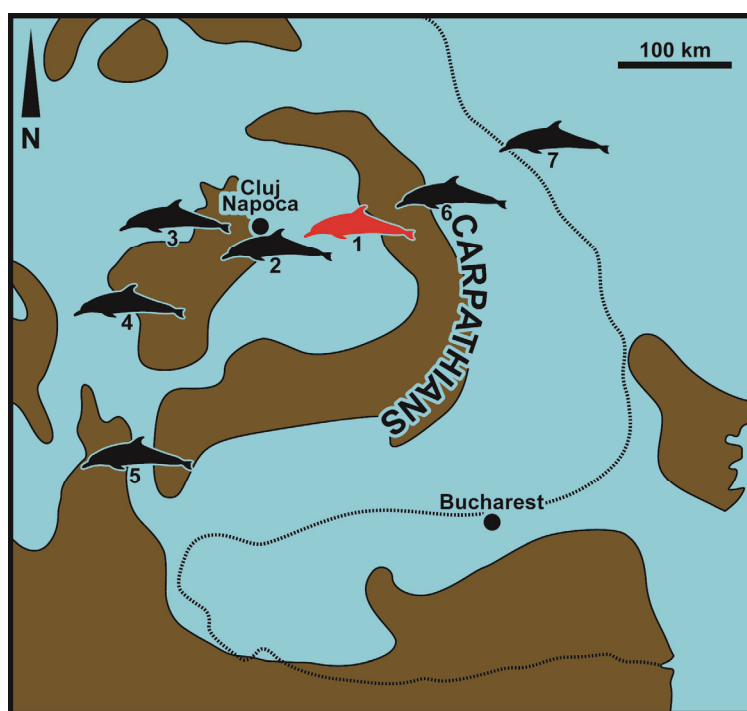


Figure 5. Sarmatian Kentriodontidae localities in Romania (paleogeography after RÖGL & STEININGER, 1984; redrawn and simplified). 1- Fântânele (late Bessarabian; this work); 2 – Cluj-Napoca (late Volhynian; CODREA, 1996, KAZÁR et al., 2004); 3 - Tășad (Volhynian; KAZÁR & VENCZEL, 2003); 4 – Comănești-1 (late Volhynian; GRIGORESCU & KAZÁR, 2006); 5 – Domașnea (late Volhynian-early Bessarabian; CODREA & SEREȚEAN, 2004); 6 – Basarabi (Volhynian; CODREA et al., 2014); 7 – Darabani, Ghireni, Cordăreni (Volhynian; CODREA et al., 2014 and references therein).

Since the lowermost Sarmatian, the sharks vanished in this area of the Central Paratethys, as long as there is no record of these fish in Romania. Probably sharks were unable to adapt to the environmental changes occurred in this sector of the Paratethys Sea after the Badenian/Sarmatian boundary, when geological events modified the Carpathian paleogeography. Due to the tectonics of the Eastern Carpathians and the erection of the Sub-Carpathian thrusting nappe (an intra-Volhynian event; SÂNDULESCU, 1986) the connections of the outer-Carpathians marine realms with the basin of Transylvania gradually vanished. The salinity of water decreased and sharks probably were unable to adapt to this environmental challenge. One may consider that the absence of these top predators favoured small dolphin communities to increase their populations. Probably, the Sarmatian dolphins were able to spend episodes in water of low salinity, as it can be presumed for the Iris Formation at Cluj-Napoca. However, after Sarmatian *s.s.* the salinity of water continued to decrease and these dolphins vanished from this region.

CONCLUSIONS

Here we report the presence of the small sized kentriodontid dolphin *Kentriodon fuchsii* on the eastern side of the Transylvanian Middle Miocene basin, in the Feleacu Formation, from the new vertebrate locality of Fântânele. The fossil documenting this dolphin species originated from this formation, based on the peculiar regional lithology of the deposits the bone originated from. The isolated humerus allows the presumption that in the late Bessarabian this area of the sedimentary basin was covered by shallow waters, with dynamic hydrotaphonomy. Apart from the dolphin bones, few bones of indeterminate, probably terrestrial large sized mammals, as well as an indeterminate bony fish were found in the same rocks. The presence of the mammal remains is evidence of the influence of fluvial water streams that carried the bones from land into the Sarmatian marine basin. This find completes the list of vertebrate localities and the paleogeographic distribution of dolphins in the inner Carpathian region, revealing the abundance of these mammals in Sarmatian.

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