FRAGMENTA PALAEONTOLOGICA HUNGARICA
Volume 41 Budapest, 2026 pp. 1–10

A fragmentary humerus of *Praepusa* cf. *boeska* in the collection of the Hungarian Natural History Museum (Budapest, Hungary)

Ákos Juhász

Hungarian National Museum Public Collection Centre – Hungarian Natural History Museum, Department of Palaeontology and Geology, H-1083 Budapest, Ludovika tér 2, Hungary; E-mail: juhakos98@gmail.com

Abstract – In 2025, the Hungarian Natural History Museum received the second half of the fossil collection of †Josef and †Jutta Deinas (Germany, Nideggen-Berg). During a thorough examination of the collection, a fragmentary Phocidae humerus was recognized, which was identified as belonging to the species *Praepusa boeska* Koretsky, Peters et Rahman, 2015, based on the observable osteological characteristics. This fossil is the first specimen of the species in the palaeontological collection of the Hungarian Natural History Museum. The identification and description of this specimen highlight the importance and scientific potential of private fossil collection, such as the Deinas collection. With 13 figures.

Keywords – Antwerp, Belgium, Deinas, Phocidae, *Praepusa*

INTRODUCTION

Modern Phocidae (true seals) are distributed on both hemispheres, inhabiting oceans of polar, subpolar, and temperate climates. Their fossil record is based mostly on isolated finds, dating back to 23 million years ago (late Oligocene–earliest Miocene) (Higdon *et al.* 2007; Dewaele *et al.* 2018). According to our current knowledge, there are at least 47 fossil species of true seals (family Phocidae), known by fossils around the world (Churchill & Uhen 2019). The Miocene-Pliocene sediments of the North Sea Basin yielded an exceptionally rich vertebrate fossil material (i.e. fish and marine mammals; see in Bor *et al.* 2012; Van Boeckel & Everaert 2022; Lambert & Gigase 2007; Lambert *et al.* 2026), among the latter, fossils of true seals (Dewaele *et al.* 2017).

The vertebrate fossil collection of the Hungarian Natural History Museum (Budapest) owns only a few true seal fossil specimens; therefore, every new specimen is important for the collection. The museum lately received a phocid humerus, which was part of the so-called Deinas collection. This bone is, however,

incomplete, yet, well-preserved enough to be classified on low taxonomical rank. The present paper describes the specimen in detail, elaborating on its significance within the vertebrate fossil collection of the museum, and also highlighting the importance of the Deinas fossil collection.

HISTORICAL BACKGROUND

The phocid humerus introduced in the present paper became part of the Hungarian Natural History Museum collection as the part of the so-called Deinas collection. This enormous collection once belonged to two late German private collectors, namely Jutta and Josef Deinas. In fact, it was Jutta who was the enthusiastic collector of fossils, while her husband, Josef, although was not particularly interested in collecting fossils, accompanied his beloved wife everywhere. The Deinas' summer house in Bakonygyirót (Győr-Moson-Sopron County, western Hungary) was home to a large part of the Deinas collection. In

Fig. 1. Part of the Deinas fossil collection in Nideggen-Berg (Germany). – **Fig. 2.** Packing up of the Deinas fossil collection. – **Fig. 3.** Re-housing the Deinas collection in the Hungarian Natural History Museum (Budapest, Hungary) (photos by Márton Szabó, 2025 and 2026)

2016, the couple contacted experts at the Hungarian Natural History Museum in order to donate the Bakonygyirót section of their collection to the museum. Sadly, Jutta did not live to see her fossil collection becoming the part of the museum's collection.

The other part of the Deinas collection was kept in the couple's house in Nideggen-Berg (Germany) (Fig. 1). Upon Josef's death, this part of the collection was also transported to the Hungarian Natural History Museum in October 2025 (in accordance with the couple's last will and testament, and with the assistance of the members of the Deinas family) (Fig. 2).

The collection mainly contains fossils from sites across France, Belgium, Germany, and the Netherlands, but occasionally, fossils from Morocco, Hungary, Brazil, and the USA are also represented in it. Overall, the majority of the collection consists of invertebrate fossils (e.g., cephalopods, gastropods, bivalves, corals, brachiopods, and echinoderms), but a small number of vertebrate fossils were also found in the materials (Fig. 3).

The Deinas collection has an enormous research potential. In addition to this publication, several other papers have been written about specimens of the Deinas fossil collection (e.g., Dulai *et al.* 2017; Dulai 2019; Kovács *et al.* 2026), and many more scientific studies and theses may be written about this material in the future. In addition, the collection has great exhibition potential as well, since Jutta Deinas prepared the specimens in her collection excellently, therefore most of them are in stunning condition. Thanks to the Deinas collection, in addition to the phocid humerus described below, numerous other extinct plant, invertebrate, and vertebrate taxa have been added to the museum's collection. With all this in mind, the importance of the Deinas collection, which is the largest donation to the palaeontological collection in the last three decades, cannot be overemphasized.

LOCALITY AND GEOLOGICAL SETTINGS

The exact locality of the phocid humerus studied in the present study is unknown, but based on the condition and colour of the bone, as well as other specimens of similar condition in the Deinas collection with location data, it is clear that the bone came from the Antwerp area. Antwerp is located in northern Belgium. There are numerous Neogene sites in the area, which are popular destinations for both researchers and private collectors (Fig. 4). *Praepusa boeska*, which is thought to be of Late Miocene–Pliocene age, was described from this

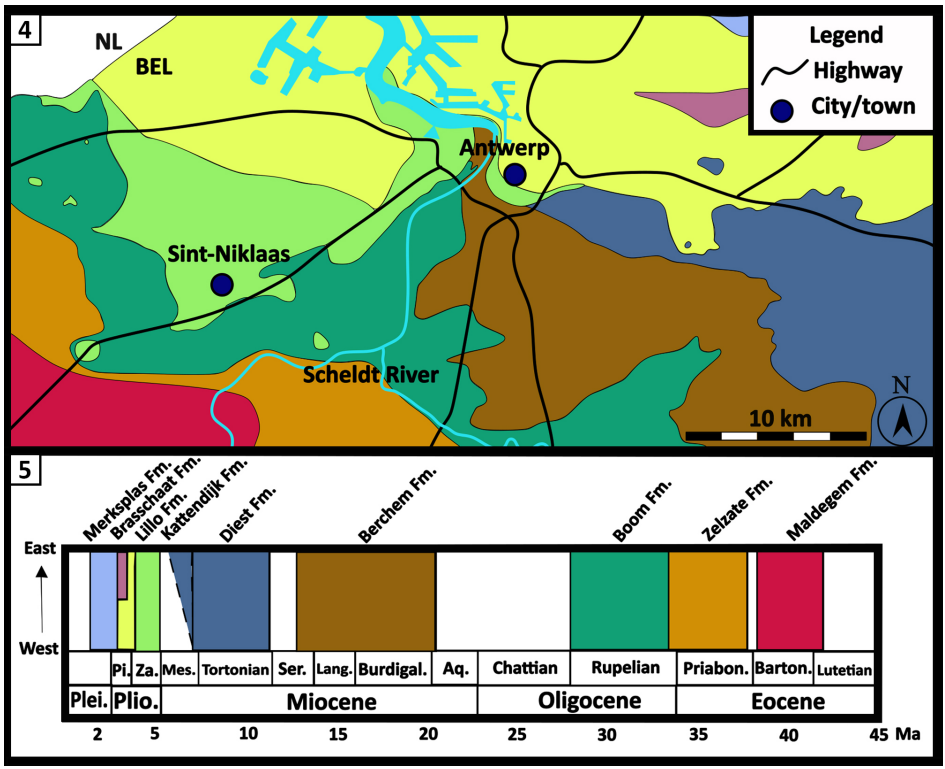


Fig. 4. Geological map of the Antwerp area (modified after Dewaele *et al.* 2018). – **Fig. 5.** Stratigraphy of the Paleogene and Neogene strata in the Antwerp area. Abbreviations: NL = The Netherlands; BEL = Belgium; Plei. = Pleistocene; Plio. = Pliocene; Pi. = Piacenzian; Za. = Zanclean; Mes. = Messinian; Ser. = Serravallian; Lang. = Langhian; Burdigal. = Burdigalian; Aq. = Aquitanian; Priabon. = Priabonian; Barton. = Bartonian; Fm. = Formation

area by Koretsky *et al.* (2015).

The geology of the area is quite complex (Fig. 5), so in this chapter I will only provide a brief overview of the stratigraphic structure of the area. There are three fossiliferous formations outcropping in this area: the Diest Formation, which is Late Miocene, and the Kattendijk and Lillo Formations, which are Pliocene. The Diest Formation is greyish-green or brownish in colour, poorly sorted, fine to medium-grained, coarse-grained, glauconite-rich sand, cemented in places by varying amounts of iron (hydro)oxide into iron ore (Houthuys *et al.* 2020). The Kattendijk Formation is dark grey or greyish green, fine to medium-fine, glauconite-bearing (approx. 20%) quartz sand, which is slightly clayey and, in places, strongly bioturbated. Shark teeth and worn-out bones are known from this layer (Deckers & Louwye 2020). The Lillo Formation is grey, greyish brown

or light greyish brown, clayey shelly sand. In the upper part of the formation, a gradual decrease in clay and shell content can be observed. The formation can be divided into six members: the Luchtbal Member, the Oorderen Member, the Kruisschans Member, the Merksem Member, the Zandvliet Member, and the Poederlee Member (Louwye *et al.* 2020).

MATERIALS AND METHODS

Terminology used in the present paper follows that of Koretsky *et al.* (2015) in accordance with Dewaele *et al.* (2017). In the rest of the study, I will refer to the Hungarian Natural History Museum, Department of Palaeontology and Geology as HNHM, where the specimen is catalogued under the inventory number HNHM VER 2025.139.

The specimen was clearly not prepared in any way, either by the author of this paper or by the collectors.

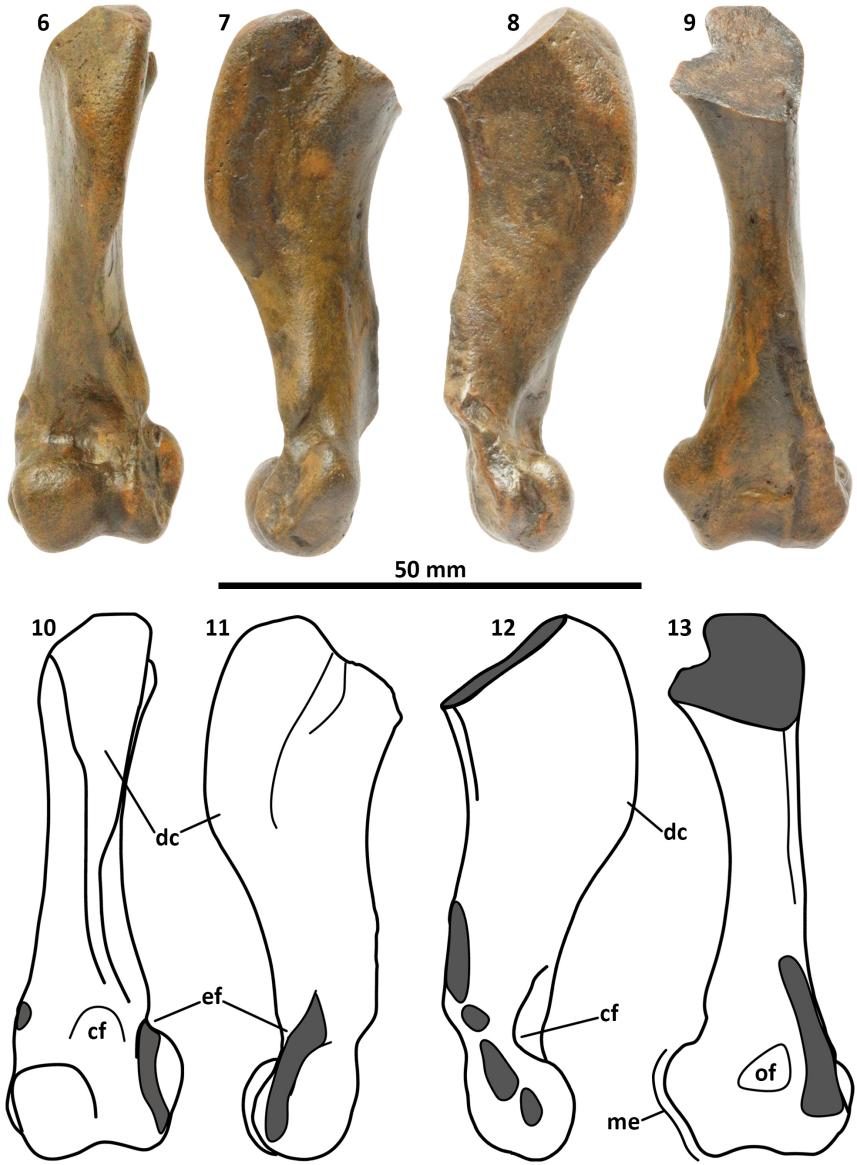
SYSTEMATIC PALAEONTOLOGY

Class Mammalia Linnaeus, 1758
Order Carnivora Bowdich, 1821
Suborder Pinnipedia Illiger, 1811
Family Phocidae Gray, 1821
Genus *Praepusa* Kretzoi, 1941

Praepusa cf. *boeska* Koretsky, Peters et Rahmat, 2015
Figs 6–13

Referred material – One incomplete left humerus (HNHM VER 2025.139.).

Description – The proximal epiphysis of the bone, consisting the head of the humerus and the lesser trochanter, is completely missing. The deltoid crest is sharp-bladed, long, and slender. The ratio of the deltoid crest to the total length of the bone cannot be determined because the bone is incomplete. The lateral epicondyle is well developed. It does not reach the midline of the diaphysis, but extends to the distal end of the deltoid crest. The difference between the proximal extensions of the two epicondyles is nearly twofold, but this cannot be determined precisely due to the wear of the bone. The medial epicondyle is heavily worn. The coronoid fossa is shallow, oval, and ends below the line of the lateral epicondyle. The entepicondylar foramen is large, oval, and open, but the



Figs 6–13. Left humerus referred to as *Praepusa* cf. *boeska* (HNHM VER 2025.139.), in posterior (**Figs 6, 10**), medial (**Figs 7, 11**), lateral (**Figs 8, 12**) and anterior (**Figs 9, 13**) view. Broken or eroded parts are indicated with grey. Abbreviations: dc = deltoid crest; ef = entepicondylar foramen; cf = coronoid fossa; of = olecranon fossa; me = medial epicondyle

narrow bridge is not preserved. The olecranon fossa is very shallow.

Comparison with the holotype – The holotype of *Praepusa boeska* is a female right humerus (Museum de Groene Poort, Boxtel, the Netherlands, MAB 4686). The following characters of the Deinas specimen match to those of the holotype: sharp-bladed deltoid crest, well-developed lateral epicondyle extending to the distal end of the deltoid crest, shallow coronoid fossa ending below the lateral epicondyle, entepicondyle foramen being large, oval, and open with missing narrow bridge over it, and shallow olecranon fossa.

Remarks – In the Antwerp region, in addition to *Praepusa boeska*, several other Miocene and Pliocene Phocidae species are known whose humerus is comparable to the humerus discussed in this paper. These species are: *Batavipusa neerlandica* Koretsky et Peters, 2008; *Callophoca obscura* (Van Beneden, 1876); *Frisiphoca aberratum* Dewaele, Lambert et Louwye, 2018; *Gryphoca similis* (Van Beneden, 1876); *Leptophoca proxima* (Van Beneden, 1876); *Nanophoca vitulinoides* (Van Beneden, 1871); *Phocanella pumila* (Van Beneden, 1876); *Platyphoca vulgaris* (Van Beneden, 1876); *Praepusa vindobonensis* (Toula, 1897); and *Prophoca rousseaui* (Van Beneden, 1876). With the exception of *B. neerlandica*, *N. vitulinoides*, and *P. vindobonensis*, humeri of all other listed species are significantly larger than the humerus mentioned in the present study, therefore I limit further comparisons for the humeri of the three species listed above (after Dewaele *et al.* 2017). In the three Phocidae species mentioned above, the deltopectoral crest is generally more pronounced than in *Praepusa boeska*. In anterior view, the deltopectoral crest of *B. neerlandica* and *N. vitulinoides* is wider than that of *Praepusa boeska* and *P. vindobonensis*. Distally, the deltopectoral crest of *P. boeska* and *P. vindobonensis* ends more gradually than the deltopectoral crest of *B. neerlandica* and *N. vitulinoides* angled. The medial epicondyle extends strongly laterally in *N. vitulinoides* and *P. vindobonensis*, while this is not observed in *P. boeska*. The lateral epicondyle reaches the deltopectoral crest in *Praepusa species*, but not in *N. vitulinoides* (Dewaele *et al.* 2017).

I consider it worthwhile to compare the HNHM humerus mentioned in this paper with the known humeri of other species of the *Praepusa* genus. The postcranial bones of *P. boeska* differ from those of *P. magyaricus* Koretsky, 2003 in the following terms: the postcranial bones of *P. magyaricus* are larger, the humerus deltoid crest is longer and reaches the epicondyles, the entepicondylar foramen is smaller, and the coronoid fossa does not end under the lateral epicondyle (Korestky 2001, 2003; Koretsky *et al.* 2015). The humerus is not known in the type material of *P. pannonica* (Kretzoi 1941), so the two species cannot be compared in my current work, although based on the great geographical distance between the type material of the two species, it is unlikely that the two fossil materials represent the same species. The only humerus currently known for *P.*

procaspica Gadzhiev, 1961 is significantly smaller than the known humeri of *P. boeska*, also coronoid fossa of the former species is deep unlike in our specimen (Vanishvili 2024). The coronoid fossa of the humerus of *P. tarchankutica* Antoniuk et Koretsky, 1984 is deep, while that of the HNHM specimen is visually shallow (Antoniuk & Koretsky 1984). Based on the differences listed above, and taking into account the condition and location of the specimen, I classify the humerus as *Praepusa* cf. *boeska*. Based on the oval shape of the coronoid fossa and the shallow olecranon fossa, I have concluded that the humerus probably belonged to a male individual (Korestky *et al.* 2015).

DISCUSSION

The HNHM palaeontological collection contains a low number of Phocidae remains. This collection includes the type specimen of *Phoca holitschensis* (the species was regarded to be a synonym of *Praepusa vindobonensis*; see Toula 1897; Korestky 2001), one humerus referred to *Phoca bessarabica* (inventory number: HNHM V.63.1663), the type material of *Praepusa pannonica* (tibia and fibula), one phocid molar from the Middle Miocene (Badenian) of St. Margarethen (Austria), numerous cranial and postcranial bone elements of *Praepusa magyaricus* (the validity of this species is currently under study; Juhász in prep.), and a Phocidae indet. tooth from the Miocene sands of Himesháza (southern Hungary) (Juhász unpubl. data). As a result, the *Praepusa* cf. *boeska* humerus with inventory number HNHM VER 2025.139. is a valuable addition to the HNHM vertebrate palaeontological collection.

Since several humeri of *P. boeska* have already been found, the scientific value of the specimen featured in the present paper is limited. However, this is the first find of this species in the collection of the HNHM, thus expanding the museum's collection with another *Praepusa* species. This is primarily thanks to †Jutta Deinas, who spent her life enthusiastically collecting fossils from Belgium, France, Germany, Hungary, Italy, and the Netherlands, and then bequeathed this unique and important collection to the HNHM, Budapest.

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Acknowledgements – Pavlo Otriazhyi and Alfréd Dulai are thanked for the constructive suggestions and comments, by which they highly improved an earlier version of the manuscript. I am grateful to Márton Szabó and Imre Magyar for sending me hardly available literatures and for supporting the publication procedure. The HNHM is also acknowledged for the technical assistance in photography. Finally, I am the most deeply grateful to Jutta and Josef Deinas, whose collection included the bone element presented in the study.

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