

A CATALOGUE OF FOSSIL SIRENIANS HOUSED IN THE MUSEUM OF PALEONTOLOGY-STRATIGRAPHY, “BABEȘ-BOLYAI” UNIVERSITY, CLUJ-NAPOCA

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Abstract. The Palaeontology-Stratigraphy Museum is hosted by the Directorate for Heritage of the “Babeș-Bolyai” University from Cluj-Napoca. Its collections were founded in the 19th century, then gradually enriched through donations of the professors and students, or by exchanges with other museums. They were initially used for teaching and research purposes and are nowadays available for the public as well. The sirenian fossils in the museum’s collection, even though are not many, represent an important heritage, a valuable tool in illustrating the Paleogene marine fauna of Romania and the worldwide fossils of these marine mammals. Today, the museum hosts 39 pieces of sirenian fossils. The aim of this article is an inventory of these fossils and the revision of the data referring to each piece. This paper includes the following data: the material, inventory numbers, the name of the locality where the fossil originated from, the stratigraphic unit, the geological age, the name of donor when available and, in few cases, measurements and short descriptions of the pieces, when necessary.

Keywords: *Dugong*, Sirenia, fossils, museum, Cluj-Napoca, Romania.

Rezumat. Catalog al sireniilor fosili din Muzeul de Paleontologie-Stratigrafie, Universitatea „Babeș-Bolyai”, Cluj-Napoca. Muzeul de Paleontologie și Stratigrafie funcționează în cadrul Departamentului de Geologie al Universității Babeș-Bolyai din Cluj-Napoca. Colecțiile sale, create în sec. XIX-lea, au fost îmbogățite gradual prin donații ale profesorilor și studenților sau schimburi cu alte muzee. Au fost folosite inițial în scop didactic și de cercetare, iar astăzi sunt deschise și publicului larg. Fosilele de sireneni din colecția muzeului, chiar dacă nu sunt foarte numeroase, reprezintă un capitol important în ilustrarea faunei marine paleogene din România. Astăzi muzeul deține 39 de piese de sireneni fosili. Scopul acestui articol este de a inventaria aceste materiale și de a revizui datele referitoare la fiecare exemplar. Această lucrare conține următoarele date: numele materialului, numărul de inventar, măsurătorile realizate, situl geologic de proveniență, vârsta geologică a siturilor, descrierea pieselor.

Cuvinte cheie: *Dugong*, Sirenia, fosile, muzeu, Cluj-Napoca, România.

INTRODUCTION

Sirenians represent an order of fully aquatic mammals, which are exclusively herbivorous (DOMNING, 2001a; DOMNING et al., 2010 and references therein). They present exclusively specific distinct characters, such as streamlined bodies, cetacean or paddle-like tail flukes, lack of hind limbs and the osteological phenomenon known as pachyosteosclerosis, where the bones become denser and the internal marrow is reduced or vanish (DOMNING & DE BUFFRÉNIL, 1991; ROMERO, 2009). In a similar manner to cetaceans, the sirenians evolved from land-dwelling ancestors, the earliest of which being *Prorastomus sirenoideus* OWEN, 1855 whose remains were traced back to the Lower and Middle Eocene rocks from Jamaica (DOMNING, 2000; SAVAGE et al., 1994, BERTA, 2020). At the dawn of their history sirenians had fully developed limbs, enabling land-dwelling locomotion (e.g., *Pezosiren portelli* DOMNING, 2001 or *Sobrarbesiren cardieli* DÍAZ-BERENGUER, BADIOLA, MORENO-AZANZA, CANUDO, 2018; DOMNING, 2001b; DÍAZ-BERENGUER et al., 2018, 2019). However, they had also shown signs of amphibious lifestyles, e.g., ribs displaying pachyosteosclerosis, dental framework suited for eating sea grasses and up and down movements of their tail and hindlimbs for swimming (BERTA, 2020).

What follows across the Oligocene – Miocene timespan is a rising and dipping of taxonomic variations in which the sirenians became more adapted for a fully aquatic lifestyle, developing morphological changes specific for this purpose: forelimbs turned into flippers, while the external hind limbs fully disappeared, the tails developing fluke and paddle-like forms to facilitate aquatic locomotion and the density in all of their bones becoming greater as an adaptation for eating easily (DOMNING, 2001b; UHEN, 2007; BERTA, 2020).

While the sirenians existed in greater diversity in the past, there are only two Families today: Dugongidae (dugongs) and Trichechidae (manatees). Within these two Families, there are only five species of sirenians (one dugong and four manatees). Until the historical times, a sixth one was the Steller’s Sea Cow [*Hydrodamalis gigas* (Zimmermann, 1780)], but now it is extinct due to human overkill (DOMNING, 1978; MATTIOLI & DOMNING, 2006; ROMERO, 2009). The sirenian fossil record shows a global distribution to all landmasses, excepting Antarctica (DOMNING et al., 2010).

Sirenian fossils in Romania are much more abundant within the Transylvanian Basin and surprisingly rare outside this geological area. This is mainly due to the geographical distribution of the Paleogene outcrops with shallow marine deposits in Romania, widely exposed within the Transylvanian region (RUSU, 1970, 1987; POPESCU, 1976, 1984) but by far rarer in the other geological units as the Carpathian Foredeep or the Moesian Platform (only in South Dobrogea, on restricted areas, shallow marine Paleogene deposits are known; IONESI, 1994). The Middle Eocene strata

of Transylvania revealed the earliest known remnants of fossil sirenians, which were then followed up by discoveries from younger, Oligocene layers (FUCHS, 1971).

GEOLOGICAL SETTING

The Transylvanian Basin, in a physiographic sense, is in fact an intramountainous depression. This area is actually a succession of superposed sedimentary basins of various types, depending on the geologic ages and tectonic settings of each one (BALINTONI et al., 1998). The last of these structures, and also the youngest, was shown to host deposits from uppermost Mesozoic (Maastrichtian) to Cenozoic (Paleogene – Miocene – (?)Pliocene – Quaternary) (e.g., CODREA & DICA, 2005; CODREA & GODEFROIT, 2008; CODREA & VENCZEL, 2020 and references therein).

The closer we come to Cluj-Napoca from the Gilău Mountains, over the metamorphic basement, the sedimentary rocks exposed are gradually geologically younger. The oldest deposit that can be noticed is latest Cretaceous, located at the water storage dam from Gilău, followed to the east by Paleocene-Eocene sequences, which are cropping out on the westernmost limits of the city of Cluj-Napoca, followed to the east by Oligocene and Lower and Middle Miocene deposits (MÉSZÁROS & MOISESCU, 1991; CODREA et al., 1997; FEIER, 2010 and therein references).

The Cluj-Napoca metropolitan area is geographically located in the north-western region of Transylvania and is geologically related to the Gilău sedimentary area (RUSU, 1995; POPESCU, 1976). The land forms belong to the Someşul Mic Corridor, whose evolution was controlled by magmatic and accumulative processes, actually including seven river terraces, on which the city's neighbourhood buildings were erected (MÉSZÁROS & CLICHICI, 1976; CODREA et al., 1997; FEIER, 2010).

HISTORY OF THE MUSEUM

In 1760, the notion of the necessity of a society of scientists and of a museum was firstly mentioned by the historian and reformation pastor Bod Péter (1712-1769) (SZABÓ, 1942). 1814 was the year when the first scientific magazine was issued, titled *The Transylvanian Museum*. It was in 1841 when Count Kemény József (1795-1855) donated his collection of books, manuscripts and minerals, thereby establishing the basis for a Transylvanian National Museum. The aristocracy of the time followed his example (SZABÓ, 1942).

It was in 1859, after many attempts, that the Society of Transylvanian Museums (Erdélyi Múzeum-Egyesület – abbreviated herein after, EME) was established, which, along with its numismatic collections of books and manuscripts, brought together 10,092 antique items, rarities from nature, minerals, fossils, animals and plants (KELEMEN, 1909-1942). Afterwards, in 1872, the Franz Joseph Royal Hungarian University was established (PETRANU, 1922; DAVID, 2019). The EME collections were then moved into the university's building, in accordance with the contract signed by the Hungarian government for teaching purposes and research (SZABÓ, 1942). In 1919, the State of Romania takes over the University, along with its museum collections, which were then reorganized and renewed through donations, exchanges, results of the staff field missions, etc. (PETRANU, 1922).

Today, the Palaeontology-Stratigraphy Museum belongs to the Direction of Patrimony of the Babeş-Bolyai University from Cluj-Napoca and is opened for the scientific community, as well as to the wider public (SĂSĂRAN, 2016; VERESS & CODREA, 2021).

MATERIAL AND METHODS

The following chapter refers to the inventory and description of each sirenian fossil specimen from the museum's collection. The investigation was based on the methodology used by CODREA (2000 and references therein): the material, the inventory number, the geological site where each fossil originated from, the geological age of each site, the name of the donor (if available) and related references. For some unpublished fossils, measurements and short descriptions were done. The measurements and descriptions follow ZALMOUT & GINGERICH (2012).

List of the sirenian fossils

Order **Sirenia** Illiger, 1811
Family **Dugongidae** Gray, 1821

Material: skull missing the rostral portion.

Inventory nr.: V115/1

Geological site: Stana, Cluj County, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: unknown; the fossil was extracted from a block of limestone housed in the museum; it was prepared and included in the museum collection by Vlad Codrea, 1997.

Observation: this fossil will be studied and published elsewhere.

Material: skull roof (Plate I, a-d).

Inventory nr.: 17134

Geological site: Cluj-Napoca, Someșul Mic riverbed, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Hermann Fuchs, 1960.

Reference: FUCHS (1970).

Material: endocranial natural cast in limestone (Plate II, a).

Inventory nr.: 21552

Geological site: Stana, Cluj County, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Eugen Nicorici, 1980.

Reference: NICORICI & POPOVICI (1981).

Material: fragmentary mandible.

Inventory nr.: V114

Geological site: Cluj-Napoca, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Robert Strusievici, in 1988 gave the fossil to Vlad Codrea. Tiberiu Jurcsák (former palaeontologist at the Țării Crișurilor Museum in Oradea) prepared and reconstructed the mandible.

Material: second cervical vertebra (axis) (Plate II, b-c).

Inventory nr.: V.115/3

Geological site: Stana, Cluj County, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: unknown; the fossil was extracted from its rock matrix by one of us (VAC). It was embedded in the same block of limestone the skull V115/1 originated from.

Material: thoracic vertebra fragment.

Inventory nr.: V126

Geological site: Cluj-Napoca, Someș Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Cornelia Pleșa, 1959.

Material: thoracic vertebra fragment.

Inventory nr.: 14913

Geological site: Cluj-Napoca, Someșul Mic riverbed, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Material: thoracic vertebra.

Inventory nr.: V115/2

Geological site: Stana, Cluj County, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: unknown; the fossil was extracted from a block of limestone, prepared and included in the museum collection by Vlad Codrea, 1988; It was embedded in the same block of limestone the skull V115/1 originated from.

Material: vertebra in matrix rock (Plate II, d).

Inventory nr.: 1555

Geological site: Cluj-Napoca, Someș-Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Material: centrum of a caudal vertebra.

Inventory nr.: 14922

Geological site: Cluj-Napoca, Someșul Mic riverbed, Someș-Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Cornelia Pleșa, 1953.

Material: scapula embedded in a limestone plate (Plate II, e-f).

Inventory nr.: 1550

Geological site: Cluj-Napoca, former Mănăștur limestone open pit, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: unknown; the fossil was extracted from a stone quarry from Cluj-Napoca, Mănăștur and donated to Koch Antal by the mason workers.

Reference: KOCH (1894).

Material: humerus fragment.

Inventory nr.: 14908

Geological site: Cluj-Napoca, Someșul Mic riverbed, Someș-Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Cornelia Pleșa.

Material: humerus fragment.

Inventory nr.: V121

Geological site: Cluj-Napoca, Someș-Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Cornelia Pleșa.

Material: proximal portion of a humerus.

Inventory nr.: V161

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Vlad Codrea, 1997.

Material: proximal portion of a humerus.

Inventory nr.: 17139 (D20)

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs.

Material: radius fragment (Plate II, g).

Inventory nr.: 15235

Geological site: Cluj-Napoca, former quarry in Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Material: rib fragment.

Inventory nr.: 224

Geological site: Turnu Roșu (= Porcești), Sibiu County.

Geological age of the site: Eocene.

Donor: Szebeni, 1883.

Material: rib fragment (Plate III, a).

Inventory nr.: 40 (S2)

Geological site: Cluj-Napoca, Donath Street, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Kató Tibor, 1950.

Material: rib.

Inventory nr.: A99/4

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs, 1957.

Material: rib.

Inventory nr.: A99/2

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs, 1957.

Material: rib fragment.

Inventory nr.: A99/1

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs, 1957.

Material: rib fragment.

Inventory nr.: A87

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs, 1956.

Material: rib fragment.

Inventory nr.: V131

Geological site: Cluj-Napoca, Someș Dig, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Cornelia Pleșa, 1959.

Material: rib fragment.

Inventory nr.: 21758

Geological site: Fiscut, Iara commune, Cluj County, on the Megheș Valley.

Geological age of the site: Late Eocene (Bartonian).

Donor: Nicolae Mészáros, 1985.

Reference: MÉSZÁROS et al. (1988).

Material: rib fragment.

Inventory nr.: V115/5

Geological site: Stana, Cluj County, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: unknown; the fossil was extracted from a block of limestone, prepared and included in the museum collection by Vlad Codrea, 1997. It was embedded in the same block of limestone the skull V115/1 originated from.

Material: rib (Plate III, b).

Inventory nr.: 39 (A163)

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs, 1962.

Material: pair of left and right rib fragments.

Inventory nr.: MI/17125; MII/17126

Geological site: Mera, Cluj County, Mera Formation.

Geological age of the site: Late Rupelian – Early Chattian.

Material: rib fragment.

Inventory nr.: 38

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Herman Fuchs.

Material: rib fragments in limestone matrix.

Inventory nr.: 1546

Geological site: Cluj-Napoca, former Mănăștur limestone open pit, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Material: rib fragments in limestone matrix.

Inventory nr.: 21944

Geological site: Cluj-Napoca, Cheile Baciului, Cluj Limestone Formation.

Geological age of the site: Late Eocene (Priabonian).

Donor: Vlad Codrea, 1986.

Material: rib fragments in matrix.

Inventory nr.: 1547

Geological site: Valea Chioarului (= Gaura), Maramureş County.

Geological age of the site: Middle Eocene (Lutetian).

Material: rib fragment.

Inventory nr.: 15234

Additional information pertaining to this piece is unknown.

The following are pieces that are devoid of inventory numbers or any additional data (location, geological age, donor's name etc.). All these pieces are fragmentary ribs and most consist of small fragments; however, there is one complete rib.

1) Length: + 111.00 mm

Width: 34.61 mm

Description: it shows signs of porosity on the exposed cross-sections of the bone.

2) Length: +224.00 mm

Width: 42.20 mm

Description: it concerns a fragment of the proximal portion.

3) Capitulum to tubercule length: 41.83 mm

Neck maximal diameter: 35.10 mm

Internal arc length: 298.00 mm

External arc length: 387.00 mm

Total length: 250.00 mm

Maximum mediolateral width at midshaft: 41.86 mm

Maximum anteroposterior width of midshaft: 42.24 mm

Description: this rib (Plate III, c) is complete and very well preserved. It was also mentioned and illustrated by MÉSZÁROS & CLICHICI (1976) as originating from the Someş Dig site, in Cluj-Napoca.

4) Length: 275.00 mm

Width: 45.81 mm

Description: it is a middle portion of a rib.

5) Length: +347.00 mm

Width: 38.48 mm

Description: this rib is mostly complete (Plate III, b); however, the proximal portion is missing. An interesting aspect to note is that the dark colour of the bone is similar to the colour of the sirenian rib fragments found in the Someş-Dig site from Cluj-Napoca. It could mark the place where this rib fragment may have originated from.

6) Length: +154.00 mm

Width: 40.35 mm

Description: this fragment has similar colour as the previous piece.

7) Length: +84.00 mm

Width: 33.74 mm

Description: once again this fragment has similar colour as the previous two pieces. The piece concerns only a portion of the distal termination.

CONCLUDING REMARKS

The sirenian fossils from the museum's collection, while few in number, represent benchmark materials in determining the Paleogene marine sea-cows both from Romania and worldwide. Some of these fossils are waiting for advanced detailed studies (e.g., the nearly complete skull V115/1 eventually could belong to a distinct species that lived in the Priabonian shallow sea environments in Transylvania).

Although a former teacher who worked with the University of Cluj, Herman Fuchs, focused the largest part of his interest on fossil sea cows from Transylvania, one cannot retrieve some of the fossils he published in this collection, seeing as he did not donate a large part of the fossils he found to the university. More than that, he never returned some fossils he borrowed from this collection or from the colleagues working in the geological department of the university (*personal communication* by Rozalia Tămaş, former curator of the museum, to one of us, VAC). In this manner, the small number of sea cow fossils in the museum's collection is easily explained.

Cranial remains of the Paleogene fossils are extremely rare in Transylvania. Few such fossils are present in the collection, but, for instance, only the endocranial cast was published. The forelimb bones concern a small sample, these bones being fragmentary and incomplete. Even the vertebrae are surprisingly very scarcely represented. The ribs are more numerous, and respect the rule we noticed in the field: they represent the majority of finds. But for systematic assignments, their utility remains meagre.

In such circumstance, there are two main targets in the near future. The first goal is to bring more precision on the systematics of the Paleogene sirenians from Transylvania. This can be done on the one hand by reviewing the fossils already existing in the museum or in other public or private collections from Transylvania and on the other one, by finding new specimens in the field. Obtaining new fossils is becoming more and more challenging, mainly due to the human activities conducted in key locations, such as the works for highways, various buildings, dams etc. Unfortunately, Romania is devoid of clear laws focused on the paleontological patrimony, comparable to the ones in archaeology. Such laws are extremely necessary and should be done as fast as possible; otherwise, a lot of valuable specimens will be lost by negligence, or will be subject of underground private trades: already, valuable specimens were sold abroad by various people, including 'professional' palaeontologists which has led to many important pieces being lost to science.

This catalogue of specimens could be a tool for future studies. In this manner, the valuable sirenian fossils from the museum will be known more easily by all palaeontologists interested in this group of marine mammals.

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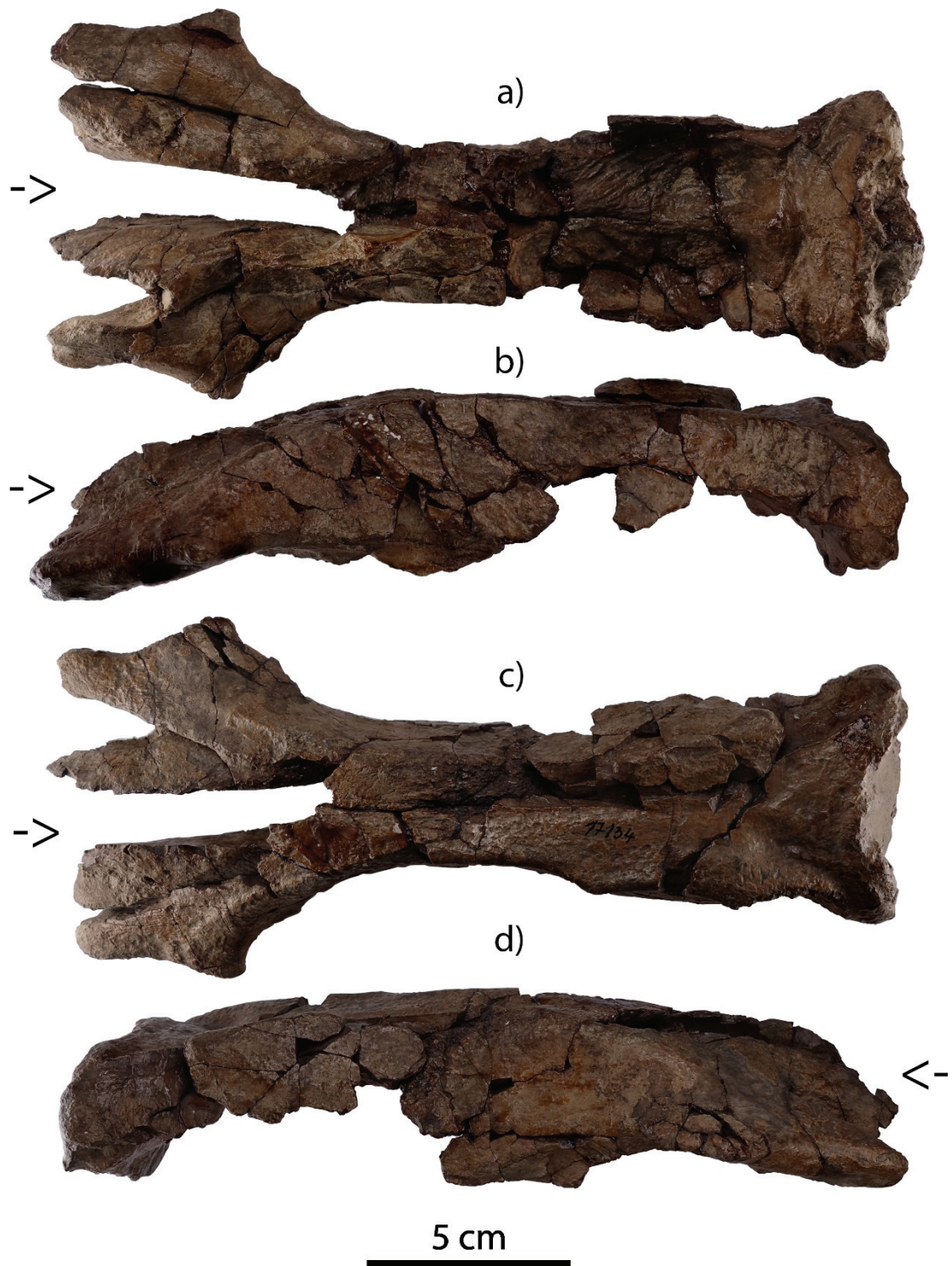


Plate I: Dugongidae indet. - skull roof 17134; a – ventral view; b –left lateral view; c – dorsal view; d –right lateral view.
The arrows indicate the cranial point of the skull roof

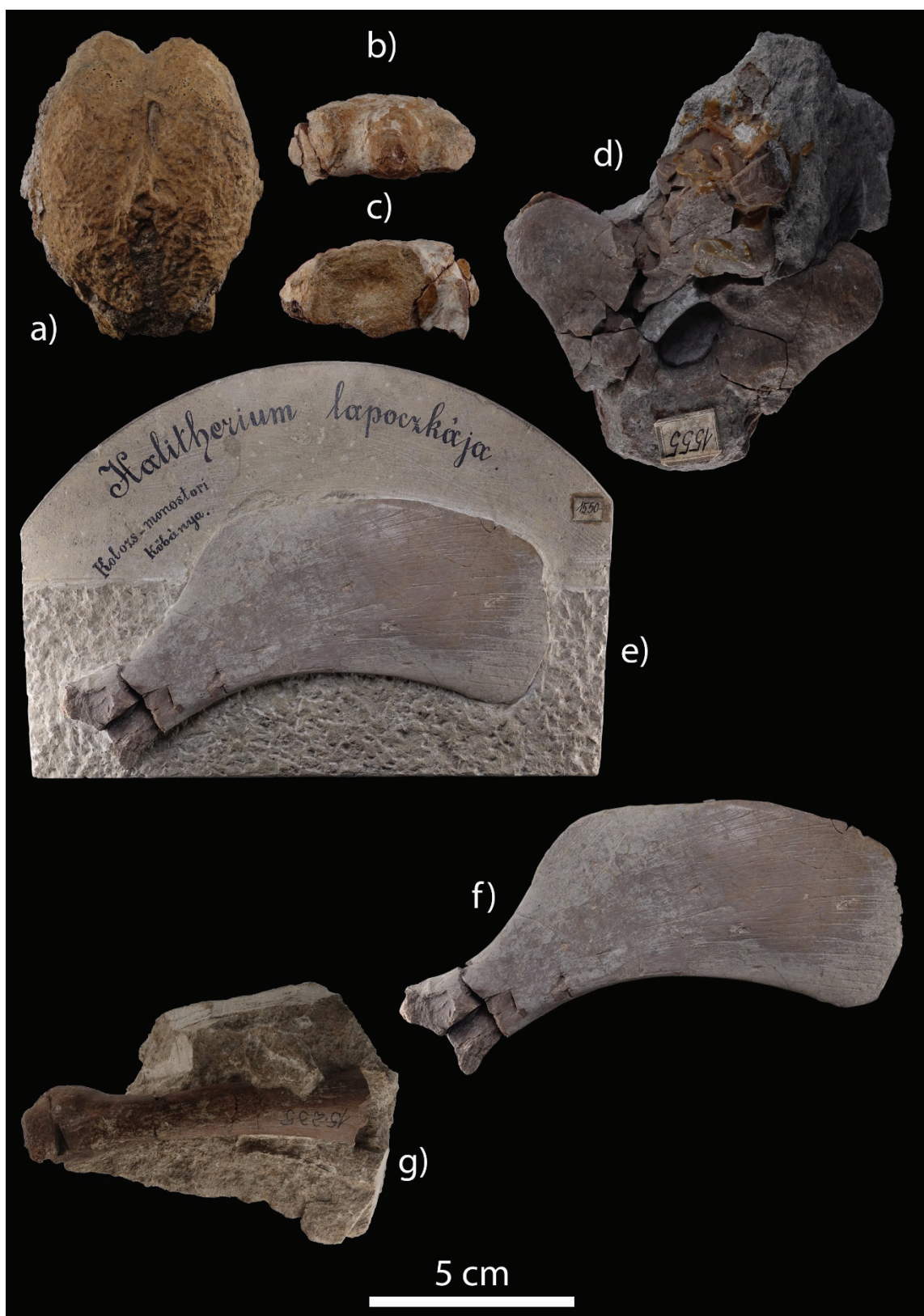


Plate II: Dugongidae indet. - various fossil sirenian pieces from the museum's collection: a: 21552, endocranial cast, upper view; b-c: V115/3, axis vertebra fragment: b – cranial view; c – caudal view; d: 1555, thoracal vertebra in matrix rock, caudal view; e-f: 1550, scapula, e – scapula in matrix; f – scapula without matrix; g: 15235, radius fragment in matrix.



Plate III: Dugongidae indet. - three fossil sirenian ribs: a: 40(S2); b: 39(A163); c: without inventory number.