

# THE EOCENE ECHINOID FAUNA FROM TURNU ROŞU (TRANSYLVANIAN BASIN), ROMANIA

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**Abstract.** The echinoid fauna from the Eocene locality Turnu Roşu (= Porceşti, Portsasd; Paleogene Transylvanian Basin, Romania) is revised and updated. The materials collected mainly around mid-19<sup>th</sup> century, are housed in the Natural History Museum from Sibiu and in the Babeş-Bolyai University Paleontology-Stratigraphy Museum in Cluj Napoca (Romania). Sixty-two specimens have been examined, and the results presented to the scientific community as a systematic catalogue. The most interesting taxonomic data are highlighted and commented.

**Keywords:** Sea urchins (*Echinoidea*), Eocene, Transylvanian Basin, Romania, type specimens (holotypes)

**Rezumat.** Fauna de echinide din localitatea eocenă Turnu Roşu (= Porceşti, Portsasd; Bazinul Paleogen al Transilvaniei, România) este revizuită și adusă la zi. Materialele colectate în mare parte în preajma mijlocului secolului 19 se află în Muzeul de Istorie Naturală din Sibiu și în Muzeul de Paleontologie și Stratigrafie al Universității Babeș-Bolyai din Cluj-Napoca (Romania). Șaizeci și două de specimene au fost examinate iar rezultatele sunt prezentate comunității științifice sub forma unui catalog sistematic. Cele mai interesante date taxonomice sunt evidențiate și comentate.

**Cuvinte cheie:** arici de mare (*Echinoidea*), Eocen, Bazinul Transilvaniei, Romania, specimene tip (holotipuri)

## Introduction

The Eocene deposits from Turnu Roşu are known before mid-19<sup>th</sup> century when some of the founding members of the organization "Siebenbürgischer Verein für Naturwissenschaften" in Hermannstadt" (Transylvanian Society for Natural Sciences in Sibiu) started to talk and then write about the fossils collected from this locality. The first studies on Turnu Roşu fossils were the ones of the priests Johann Michael Ackner and Johann Ludwig Neugeboren. It is uncertain if Ackner discovered himself the fossil-bearing site, but it is certain that among these two he was the first to collect from this locality.

Though, the first one to publish was Neugeboren that in 1850 and 1851 writes, in two parts, a very well documented and self illustrated work about fossils sharks, "*Die vorweltlichen Squaliden-Zähne aus dem Großkalke bei Portsasd am Altfluß unweit Talmats*" (The prehistoric shark teeth from the limestone near Portsasd on the Olt River not far from the Tălmaciu) (Neugeboren, 1850, 1851).

Ackner published his finds from the area only in 1854 as a chapter in a much more extended study regarding the geology of the south-eastern Transylvania (Ackner, 1854). Ackner listed the first echinoids from Turnu Roşu as: *Ananchites ovata*, *Discoidea albogalera*, *Micraster cortestudinarium*, and *Spatangus coranguinum*.

He added also a few species based only on spines: *Cidaris blumenbachii*, *C. coronatus* and *C. claviger*. Ackner also mentioned the presence (existence) of another large, but unidentified species of echinoid. Unfortunately, none of these species are described or illustrated. Three decades later the well-known geologist Antal (Anton) Koch pays a visit to the collections of the Transylvanian Society for Natural Sciences in Sibiu and described, sometimes even illustrated, the echinoids that he found here (Koch, 1885). Koch's list includes: *Porocidariss pseudoserrata*, *Conoclypus conoideus*, *Conoclypus ackneri* nov. sp., *Sismondia occitana*, *Echinanthus pellati*, *Echinolampas (Clypeolampas) alienus*, *E. cf. globulus* and another five species represented only by spines: *Cidaris subularis*, *C. cf. spileccensis*, *C. porcsesdiensis*, nov. sp., *C. bielzi* nov. sp., and *Cidaris* sp. Unfortunately, due to several moves of the Society collections some of the specimens were lost so currently only a small part of all the echinoids mentioned by Koch can be found.

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In the following decades the echinoids were rarely mentioned by researchers which studied the deposits from Turnu Roșu. Şuraru et al. (1967) described and illustrated a new species from this locality, *Clypeaster (Palaeanthus) transylvanicus*, while Tătărăm (1970) in a general study regarding the biostratigraphic and paleogeographic framework of Turnu Roșu Paleogene, listed from Valea Caselor deposits, that she considered to be Lutetian, the species *Echinanthus* sp. (cf. *E. varnensis*) and *Echinanthus* sp. (cf. *E. issyavensis*). The following researchers turned their attention to other groups of fossils such as calcareous algae (Bucur & Ianoliu, 1987), mollusks (Mészáros & Ianoliu, 1972, 1973) or fish (Ciobanu, 1994, 1995, 1996, 1997, 2002; Ciobanu & Trif, 2012, 2013, 2016) while the echinoids faded from focus.

It should be noted that the study of Eocene echinoids was not a priority for the paleontologists working in Romania in the last hundred years. Although these fossils are present in the vast majority of the marine deposits of this age from Romania no attempts were made to write monographs or reviews on this subject. As an exception we need to mention the work of Tătărăm (1963) on the stratigraphy of the Eocene from the south-west of Cluj-Napoca that has a small part dedicated to the echinoid taxonomy but without describing the specimens, providing only synonymy lists.

### **Geological setting**

Turnu Roșu is located in the central part of Romania, on the southern margin of the Transylvanian Paleogene Basin (Fig. 1). There, on a small surface of a few tens of hectares Eocene sediments are preserved overlying the crystalline bedrock of the Făgăraș Mountains. Although the Eocene age is clearly accepted for the area (see Bombiță, 1963; Tătărăm, 1967, 1970; Mészáros, 1960; Mészáros & Ianoliu, 1972, 1973) the precise determination of the stratigraphic time span comprised there in still to be established as well as the location of the presumed Eocene/Oligocene boundary (Mészáros & Ianoliu, 1971). The most recent approach regarding the stratigraphy of the locality indicates, based on foraminifera and mollusks, the presence of all the stages of the Eocene (Mészáros, 1996). Mészáros also coined three stratigraphic formations: Valea Nișului Fm., Strada Muntelui Fm., and Valea Satului Fm. as parts of the Turnu Roșu Group. However, their validity is uncertain. According to the International Stratigraphic Guide any

stratigraphic unit "must be duly proposed and duly described" (Murphy & Salvador, 1999, p. 257). Mészáros (1996) did not propose type-sections and he did not include a lithostratigraphic column. Also, the criteria of a Recognized Scientific Medium for a proposed stratigraphical unit (Murphy & Salvador, 1999, p. 258) is not met. A review of his formations is therefore, needed.

### **Material and Methods**

The described material is stored at the Brukenthal National Museum, Natural History Museum Sibiu (herein abbreviated NHMS) and in the Babeș-Bolyai University Paleontology-Stratigraphy Museum in Cluj Napoca (abbreviated hereinafter, BBUPSM). Most of the NHMS material is very old and was collected before 1885. A small part was collected in the 1957 and 1958 by the former employees of the NHMS, M. Doltu and A. Gherasim (NHMS 42531, 42532, 42011, 42048, 41798 and 41804).

The exact stratigraphic origin of the material is uncertain. Even the most recently found material, as Şuraru's (1967) specimens or the ones collected by one of the authors (TN - BBUPSM 24194 and 24195) were not found *in-situ* but on the hill slopes, in ravines or at the base of the outcrops.

The photos of the specimens were taken using a Nikon D5300 camera and a 105 mm Sigma lens.

The systematic section follows the classification proposed by Kroh and Mooi (2020) in the World Echinoidea Database.

### **Systematics**

Class Echinoidea Leske, 1778

Infraclass Irregularia Latreille, 1825

Family Gitolampadids (temporary name)

Genus *Gitolampas* Gauthier, 1889

*Remarks* – Smith, & Kroh (2011) in The Echinoid Directory and Kroh & Mooi (2018) in The World Echinoidea Database state that the family Gitolampadids is a temporary name for a paraphyletic group that includes the genus *Gitolampas*. On the other hand, there is a great deal of confusion between the species of *Gitolampas* and *Echinanthus*. We follow and recommend Kier (1962) taxonomic criteria to clarify this confusion.

*Range and distribution* – Late Cretaceous (Campanian) to Miocene, in Europe, North

Africa, Cuba, Japan, Oman, Tibet, Pakistan, United Arab Emirates and the United States of North America.

*Gitolampas* sp.

**Material** – Six specimens are housed in the NHMS with inventory numbers 39519, 39538, 39541, 39555, 39562 and 7402.

*Gitolampas* cf. *biarritzensis* (Cotteau, 1863)

Plate 1, fig. a-d

**Material** – Three specimens are housed in the NHMS with inventory numbers 25862, 39550 and 42011.

*Gitolampas* cf. *zitteli* (P. de Loriol, 1881)

**Material** – Three specimens are housed in NHMS with inventory numbers 7393, 7394 and 42048.

*Gitolampas zitteli* (P. de Loriol, 1881)

Plate 2, a-d

**Material** – Eight specimens are housed in the NHMS with inventory numbers 39552, 7388, 7392, 7396, 7401, 7387, 25852 and 25861.

**Remarks** – This species has been cited in Bartonian by Fourtau (1899) and in "den höchsten Schichten der Nummulitenformation" by Loriol (1883) from Egypt. Also, this species was found in the late Eocene from Bulgaria by Sapoundjiev (1964). The material herein examined is probably the first report in the Eocene of Romania.

Order Cassiduloida L. Agassiz & Desor, 1847

Cassiduloida indet.

**Material** – Twelve specimens are housed in the NHMS with inventory numbers 7384, 7390, 7391, 7398, 7404, 37571, 39537, 39539, 39549, 39551, 39554 and 39561.

Order Echinolampadoida Kroh & Smith, 2010

Family Echinolampadidae Gray, 1851

*Echinolampas* Gray, 1825

**Remarks** – Roman (1965) stated that this genus is very prolific, with a rich fossil record and also with a wide stratigraphic range, from Eocene to present and with a worldwide distribution. We recommend Roman (1965) to broaden the knowledge of this complex genus.

*Echinolampas* cf. *alienus* Bittner, 1882

Plate 3, a-d

**Material** – Four specimens are housed in NHMS with inventory numbers 7389, 25851 and 39572.

**Remarks** – The species was described by Bittner (1882) from the Lutetian of the province of Verona (Northern Italy). Later Oppenheim (1902) studied other material of the same species from Verona too. Koch (1885) finds 10 specimens from the Eocene of Turnu Roșu (Transylvania, Romania) and assigned them as *Echinolampas alienus* Bittner, 1882. Very possibly many of these specimens described by Koch (op. cit.) have been also examined herein.

*Echinolampas* cf. *globulus* Laube 1868

Plate 4, a-d

**Material** – Two specimens are examined herein (NHMS 39560 and BBUPSM 24194).

**Remarks** – Laube (1868) cited the species from the Middle Eocene of the province of Verona (Northern Italy) while Gregory (1898) found it in the Early Eocene (Libyan Series). Koch (1885) studied a corroded specimen he named *Echinolampas* cf. *globulus* Laube 1868 from the collection of the Siebenbürgische Museum in Klausenburg (= The Transilvanian Museum in Cluj-Napoca, now the BBUPSM collection), found in Turnu Roșu. The inventory number 39560 NHMS examined herein is Koch's specimen.

Order Clypeasteroida Agassiz, 1835

Family Conoclypidae Zittel, 1879

Genus *Conoclypus*, L. Agassiz, 1839

**Remarks** – Many authors have erroneously named the genus *Conoclypus* as *Conoclypeus*. Most likely Archiac & Haime (1853) have mistakenly transcribed the name for first time.

**Range and distribution** – Eocene of circum-mediterranean regions, Pakistan and Madagascar. Some species have been wrongly ascribed to the Cretaceous, but it has been shown that the materials studied really belong to another genus (Mitrović-Petrović, 2002). Also, the species *Conolypus pignatorii* Airaghi, 1900 was assigned to the Miocene of Italy, but today this species is considered to belong to the genus *Hypsoclypus* in agreement with the opinions of Lambert & Thiery (1921) and Mortensen (1948).

*Conoclypus* sp.

**Material examined** – Five specimens are housed in the NHMS with inventory numbers 7397, 6578, 25848, 41804 and 42532.

*Conoclypus* cf. *akneri* Koch, 1884

**Material examined** – Four specimens are housed in the NHMS with inventory numbers 25863, 39520, 39536 and 42531.

*Conoclypus ackneri* Koch, 1885

Plate 5, a-d

**Material examined** – One specimen is housed with inventory numbers 7399 in the NHMS.

**Remarks** – The specimen examined herein is the holotype described and figured by Koch (1885, Pl. VI, figs. 2a-c) from Turnu Roșu. Koch, dedicated the name of the species to the naturalist Johann Michael Ackner who was the collector of the best-preserved specimens. This far the species has not been found in any other locality.

Family Clypeasteridae L. Agassiz, 1835

Genus *Clypeaster* Lamarck, 1801

**Range and distribution** – The species of *Clypeaster* have been known since the Middle Eocene. The genus was first cited in the Mediterranean region, and reached its maximum diversity and expansion in warm seas throughout the Middle Miocene. In the modern seas the genus is species' poor and he is not present in the Mediterranean.

*Clypeaster* cf. *transsylvaniaicus* Şuraru, 1967

**Material** – One specimen housed in the NHMS with inventory number 39553.

*Clypeaster transsylvaniaicus* Şuraru et al., 1967

Plate 6, a-d

**Material** – Nine specimens are examined. Eight are housed in the BBUPSM with inventory numbers 15391 (holotype), 15392a, 15392b, 15392c, 15393a, 15393b, 15393c, 15393d and one in the NHMS with number 39540.

**Remarks** – The holotype described by Şuraru et al. (1967) is the number BBUPSM 15391. Furthermore, six other specimens were designated as “tipoid” with the following current numbers BBUPSM 15392a, 15392b, 15392c, 15393b, 15293c and 15393d. In addition to holotype, all the “tipoids” were figured by Şuraru et al. (1967, fig. 4-5 and 7-13) The concept of “tipoid” is the equivalent to the one of syntype according to Richter (1948).

On the other hand, *Clypeaster transsylvaniaicus* Şuraru, 1967 should be considered a *nomen praeoccupatum* because the species *Clypeaster transsylvaniaicus* Vadász, 1915, found in the Miocene of Felsőorbó (now Gârbova de Sus,

Romania), had already been created previously. A *nomen novum* of replacement will be proposed in a future paper.

Superorder Atelostomata von Zittel, 1879

Order Spatangoidea L. Agassiz, 1840

Suborder Paleopneustina Markov & Solovjev 2001

Family Schizasteridae Lambert, 1905

Genus *Schizaster* Agassiz, 1835

*Schizaster* sp.

**Material examined** – One specimen housed in the NHMS with inventory number 39525.

Suborden Brissidina Stockley et al., 2005

Family Macropneustidae Lambert, 1895

Genus *Macropneustes* in Agassiz & Desor, 1847

*Macropneustes* sp.

**Material examined** – One specimen with inventory number 24195, housed in the BBUPSM.

Irregularia indet.

**Material** – Two badly preserved specimens, housed in the NHMS with inventory numbers 7395 and 41798.

## Results and discussion

Sixty-two specimens have been examined. The material is housed in the NHMS (52 specimens) and in the BBUPSM (10 specimens). All specimens belong to the Irregular infraclass and have been assigned to the following Orders: Cassiduloida, Echinolampadoida, Clypeasteroida and Spatangoidea. The most interesting taxonomic data are highlighted below:

- nine specimens of *Clypeaster transsylvaniaicus* Şuraru, 1967 have been examined. Among them are the holotype and the syntypes. It is suggested herein that this species should be considered a *nomen praeoccupatum* because of this name is occupied by the species *Clypeaster transsylvaniaicus* Vadász, 1915 from the Middle Miocene of Romania;
- the holotype of *Conoclypus ackneri* Koch, 1885, has been identified and figured in order to increasing the data about this taxon; this species has not been cited so far in any other

locality probably representing an endemic species

- eight specimens are assigned as *Gitolampas zitteli* (P. de Loriol, 1881). The finding is the first report of this species from Romania. *Gitolampas zitteli* had previously been noticed from the Eocene of Egypt and Bulgaria.

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## REFERENCES

- Akner, 1854 Akner, Michael Johann, Beitrag zur Geognosie und Petrefaetenkunde des südöstlichen Siebenbürgens, vorzüglich der schichten aus dem bereich des Hermannstaedter Bassins. Verhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Akademie der Naturforscher, 24(2), (1854), p. 899-936.
- Archiac, Haime, 1853 Archiac Adolphe, Haime Jules, Description des Animaux Fossiles du groupe Nummulitique de l'Inde. Classe des Échinodermes pp. 195-223. Gide et J. Baudry, Libraires-Éditeurs, (1853), 373 pp.
- Bittner, 1882 Bittner Alexander, Beitrag zur Kenntniss der Echinidenfauna des alttertiärs von Vicenza und Verona. Beiträge zur Paläontologie von Österreich. Mitteilungen des Geologischen und Paläontologischen Institutes der Universität Wien, 1 (1882), p. 73-110.
- Bombiță, 1963 Bombiță Gheorghe, Contribuții la corelarea eocenului epicontinental din România. Editura Academiei, București, (1963), 113 pp.
- Ciobanu, 1994 Ciobanu Rodica, Addition to the Eocene Selachian fauna of Turnu Roșu (Porțești). Studia Universitatis "Babeș-Bolyai", Geologie, 4, (1994), p. 299-309.
- Ciobanu, 1995 Ciobanu Rodica, Noi date privind selacienii eoceni de la Turnu Roșu (Porțești): fam. Lamnidae, Cretoxyrhinidae și Odontaspidae. Comunicări și Referate, Muzeul de Științele Naturii Ploiești, 7, (1995), p. 113-138.
- Ciobanu, 1996 Ciobanu Rodica, Evaluări paleoecologice pe baza rechinilor fosili. Comunicări și referate, Muzeul Județean de Științele Naturii Prahova, 14, (1996), p. 59-62.
- Ciobanu, 1997 Ciobanu Rodica, Zusammensetzung der bearbeiten Hai un Rochen Fauna aus dem Eozän von Turnu Rosu (Rumanien), In: Naturwissenschaftliche Forschung über Siebenburgen I. Beiträge zur Geographie, Botanik, Zoologie und Palaontologie. Siebenburgisches Archiv, 33, (1997), p. 18-22.
- Ciobanu, 2002 Ciobanu Rodica, Selacienii paleogeni din România, Editura Universității Lucian Blaga, Sibiu, (2002), 216 pp.
- Ciobanu, Trif, 2012 Ciobanu Rodica, Trif Nicolae, Diodontidae (Osteichthyes) from the Turnu Roșu Eocene Limestone Reserve. Brukenthal Acta Musei, 7(3), (2012), 631-642.
- Ciobanu, Trif, 2013 Ciobanu Rodica, Trif Nicolae, The pycnodont, Phacodus Dixon, 1850, In the Late Eocene of the fossil area Turnu Roșu (Romania). Brukenthal Acta Musei, 9(3), (2013), p. 587-601.
- Ciobanu, Trif, 2016 Ciobanu Rodica, Trif Nicolae, Cylindracanthus (Leidy, 1856) in the collections of the natural History Museum, Sibiu. Acta Palaeontologica Romaniae, 12(1), (2016), p. 25-31.
- Durham, Mojag, 1983 Durham John W., Mojag Fathollah, Clypeaster biarritzensis Cotteau (Echinoidea) in Lower Asmari Formation (Early Oligocen) of southwest Iran. Paleobios, 41, (1983), p. 1-12.
- Fourtau, 1899 Fourtau, René, Révision des Échinides fossiles de l'Égypte. Mémoires présentés à l'Institut Égyptien. 3(8), (1899), p. 633-692.
- Gregory, 1898 Gregory, J. W., A Collection of Egyptian Fossil Echinoidea. Geological Magazine, 4(5), (1898), p. 149-161.
- Kier, 1962 Kier Porter M., Revision of the cassiduloid echinoids. Smithsonian Miscellaneous Collections, 144(3), (1962), p. 1-262.

- Koch, 1885 Koch Anton, Die alttertiären Echiniden Siebenbürgens. Mittheilungen aus dem Jahrbuche der Königlich ungarischen Geologischen Anstalt, 7, (1885), p. 47-132.
- Kroh, Mooi, 2020 Kroh Andreas, Mooi Richard World Echinoidea Database. [Accessed at <http://www.marinespecies.org/echinoidea> on 2020-10-23]
- Laube, 1868 Laube Gustav C., Ein Beitrag zur Kenntnis der Echinodermen des vicentinischen Tertiärgebietes. Denkschriften der Kaiserlichen Akademie der Wissenschaften - Mathematisch-Naturwissenschaftliche. Aus der kaiserlich königlichen hof Staatsdruckerei, Wien, (1868), 38 pp.
- Lambert, Thiéry, 1921 Lambert Jules, Thiéry Paul, Essai de Nomenclature Raisonnée des Échinides. Librairie L. Ferrière, Chaumont, (1921), 607 pp
- Loriol, 1883 Loriol, P. de, Eoeaene Echinoideen aus Aegypten und der libyschen Wüste. Beiträge zur Naturgeschichte der Vorzeit, Palaeontographica, 30, (1883), p. 1-60.
- Mészáros, 1960 Mészáros Nicolae, Stratigraphie und Molluskenfauna der Eozänablagerungen von Porcesti (Kreis Sibiu-Hermannstadt, Rumänien), Neues Jahrbuch für Geologie und Paläontologie, 5, (1960), p. 227-236.
- Mészáros, Ianoliu, 1971 Mészáros Nicolae, Ianoliu Constantin, Contribuții la problema limitei Eocen-Oligocen în regiune Turnu Roșu (Porțești), Studii și Comunicări, Muzeul Brukenthal, Științe Naturale, 16, (1971), p. 29-36.
- Mészáros, Ianoliu, 1973 Mészáros Nicolae, Ianoliu Constantin, Macrofauna eocenă de la Turnu Roșu - Porțești (1). Muzeul Brukenthal. Studii și Comunicări, Științele Naturii, 17, (1972), p. 21-30.
- Mészáros, Ianoliu, 1973 Mészáros Nicolae, Ianoliu Constantin, Macrofauna eocenă de la Turnu Roșu - Porțești (2). Muzeul Brukenthal. Studii și Comunicări, Științele Naturii, 18, (1973), p. 13-21.
- Mészáros, 1996 Mészáros, Nicolae, Stratigrafia regiunii Turnu Roșu-Porțești. Convergențe transilvane, 4, (1996), p. 42-45.
- Mitrović-Petrovic, 2002 Mitrović-Petrović Jovanka, Paleoecological Features and Stratigraphic Significance of the genus *Conoclypus* (Echinoidea). Annales de la Péninsule Balkanique, 64, (2002), p. 89-105.
- Mortensen, 1948 Mortensen, T., A Monograph of the Echinoidea. IV. 1. Holoctypoida, Cassiduloida. C. A. Rietzel édit, Copenhagen, (1948), 371 pp.
- Murphy, Salvador, 1999 Murphy Michael A., Salvador Amos, International Stratigraphic Guide - An abridged version, Episodes, (22)4, (1999), p. 255-271.
- Neugeboren, 1850 Neugeboren Johann Ludwig, Die vorweltlichen Squaliden-Zähne aus dem Großkalke bei Portsesd am Altfluß unweit Talmats. Archiv des Vereins für Siebenbürgische Landeskunde, 2, (1850), p. 1-44.
- Neugeboren, 1851 Neugeboren Johann Ludwig, Die vorweltlichen Squaliden-Zähne aus dem Großkalke bei Portsesd am Altfluße unweit Talmats. Archiv des Vereins für Siebenbürgische Landeskunde, 3, (1851), p. 151-213.
- Oppenheim, 1902 Oppenheim Paul, Revision der tertiären Echiniden Venetiens und des Trentino, unter Mittheilung neuer Formen. Zeitschrift der Deutschen Geologischen Gesellschaft, 54, (1902), p. 159-279.
- Richter, 1948 Richter Rudolf, Einführung in die Zoologische Nomenklatur durch Erläuterung der Internationalen Regeln. Zweite, umgearbeitete Auflage mit der "Offiziellen Liste zoologischer Gattungs-Namen", W. Kramer, Frankfurt am Main, (1948), 152 pp.

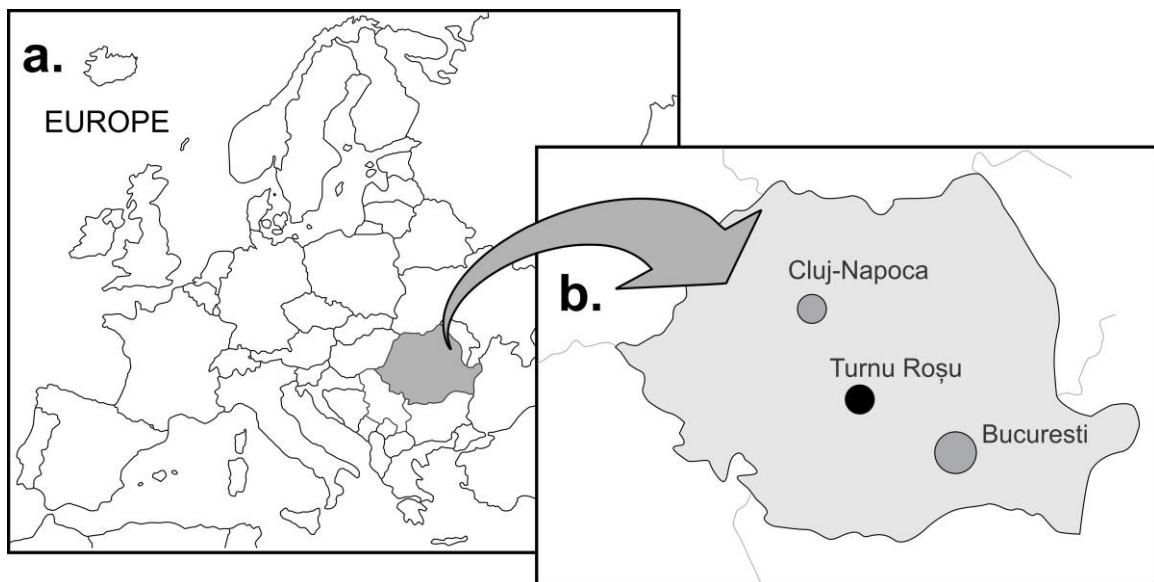
- Roman, 1965 Roman J., Morphologie et Évolution des Echinolampas. Mémoires du Muséum National d'Histoire Naturelle, 15, (1965), p. 1-341.
- Sapoundjieva, 1964 Sapoundjieva Vassilka, Les fossiles de Bulgarie, VIb. Paléogène. Echinoidea. Academie Bulgare des Sciences, Sofia, (1964), 64 pp.
- Smith, Kroh, 2011 Smith, A. B. & Kroh, Andreas (editors), The Echinoid Directory. World Wide Web electronic publication. <http://www.nhm.ac.uk/researchcuration/projects/echinoid-directory> [accessed on 220-10-23].
- Şuraru, Gabos, Şuraru, 1967 Şuraru Nicolae, Gabos, L., Şuraru, Maria, Contribuții la cunoașterea clipeastridelor eocene. Studii și cercetări de Geologie, Geofizica și Geografie; Seria Geologie, 12(1), (1967), p. 193-199.
- Tătărîm, 1963 Tătărîm Nița, Stratigrafia eocenului din regiunea de la sud-vest de Cluj. Editura Academiei, București, (1963), 203 pp.
- Tătărîm, 1970 Tătărîm Nița, Eocenul din Sud-vestul Transilvaniei. Considerații biostratigrafice și paleogeografice. Analele Universității București, Geologie, 19, (1970), p. 119-139.

## LIST OF ILLUSTRATIONS

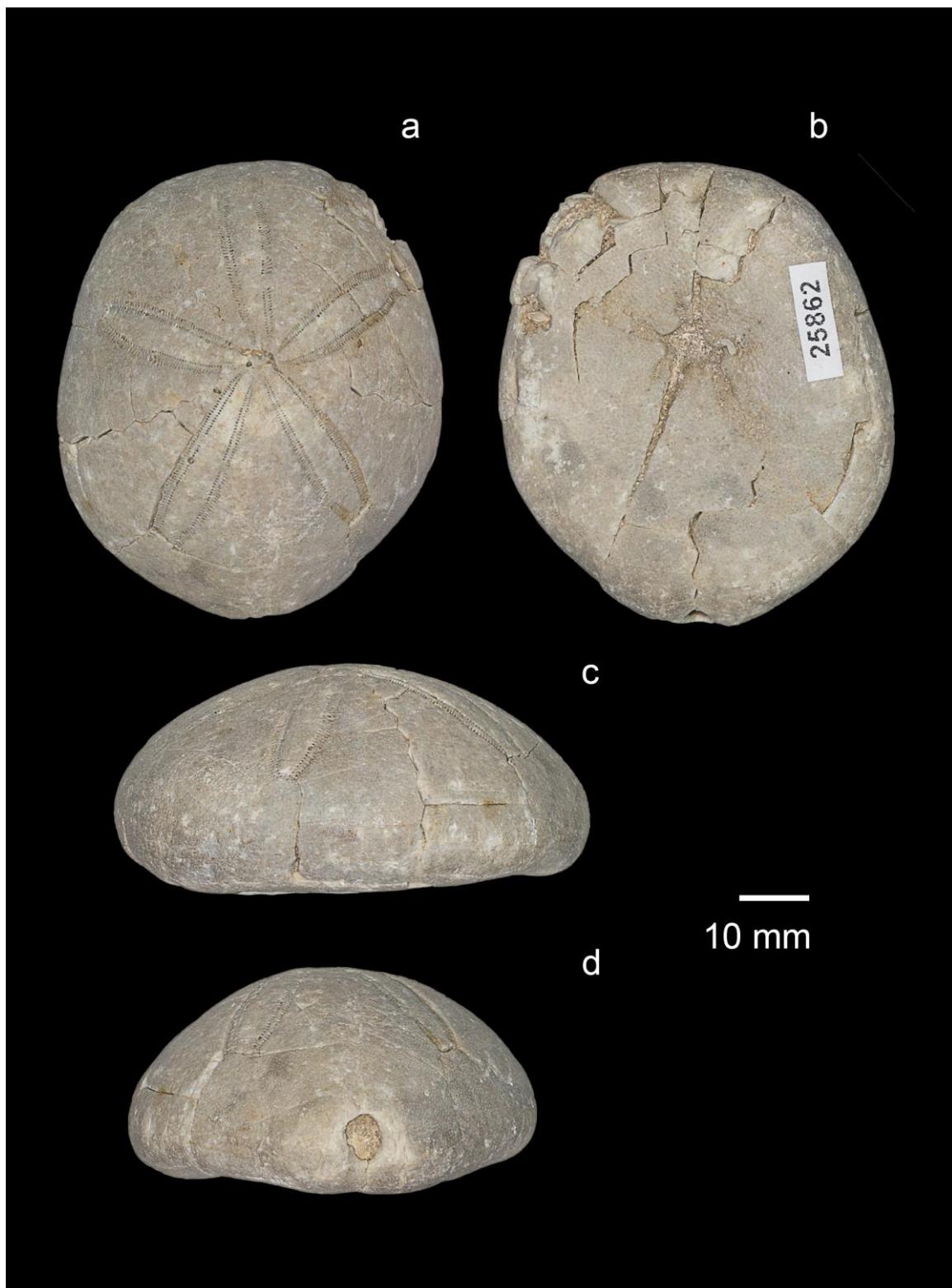
- Fig. 1** Location of the studied locality in **a.** Europe and **b.** Romania
- Plate 1** *Gitolampas cf. biarritzensis* (Cotteau, 1863), NHMS 25862; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.
- Plate 2** *Gitolampas zitteli* (P. de Loriol, 1881), NHMS 7388; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.
- Plate 3** *Echinolampas cf. alienus* Bittner, 1882, NHMS 25851; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.
- Plate 4** *Echinolampas cf. globulus* Laube 1868, NHMS 39560; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.
- Plate 5** *Conoclypus ackneri* Koch, 1885, NHMS 7399 - HOLOTYPE; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.
- Plate 6** *Clypeaster transsylvaniaicus* Suraru et al., 1967; BBUPSM 15391 - HOLOTYPE; **a** - aboral view; **b** - adoral view; **c** - lateral view and **d** - posterior view.

## LISTA ILUSTRĂȚIILOR

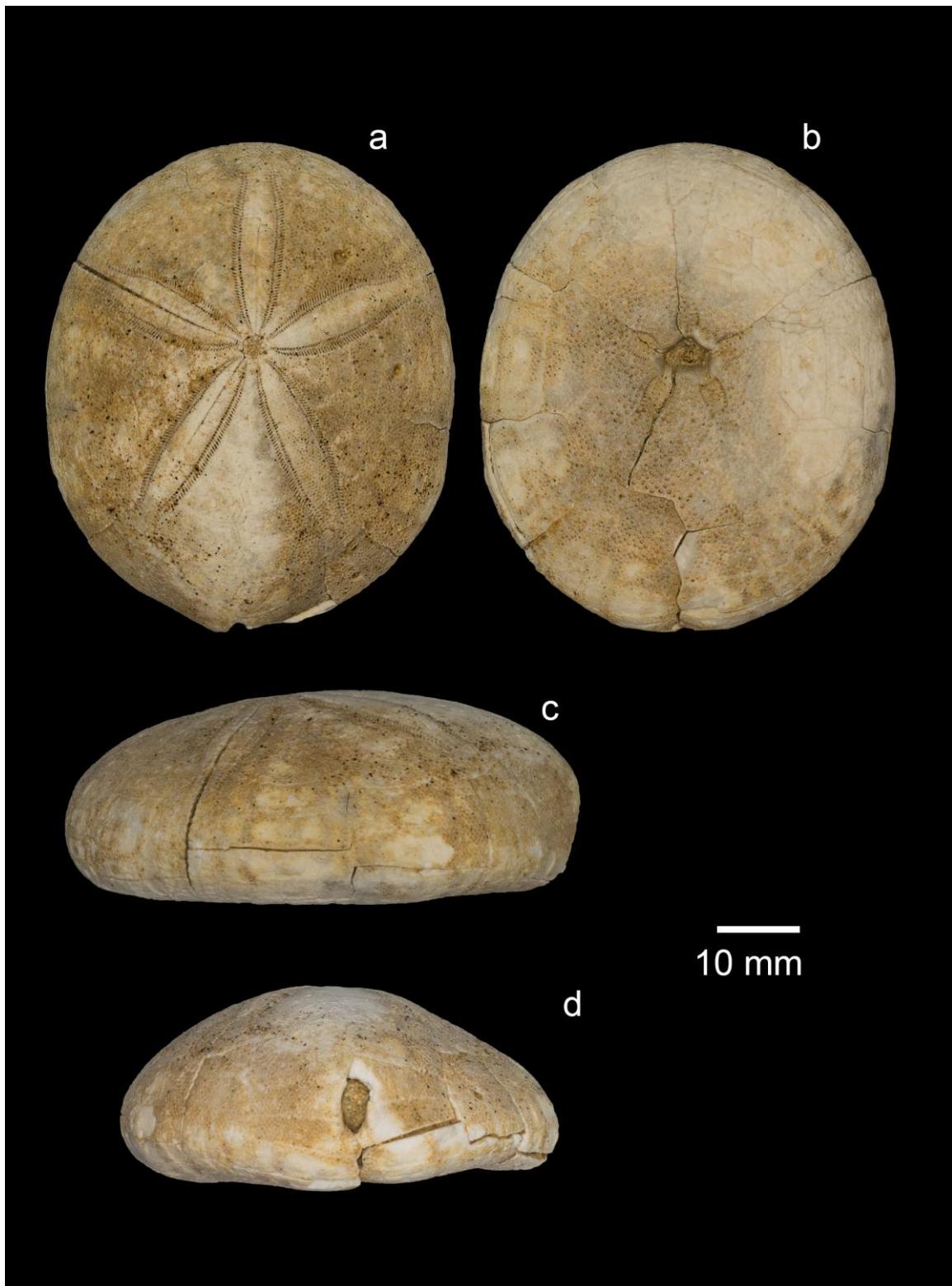
- Fig. 1** Localizarea localității studiate în **a.** Europa și **b.** în România
- Plate 1** *Gitolampas cf. biarritzensis* (Cotteau, 1863), NHMS 25862; **a** - vedere aborală (=de sus); **b** - vedere adorală (=de jos); **c** - vedere laterală și **d** - vedere posterioară.
- Plate 2** *Gitolampas zitteli* (P. de Loriol, 1881), NHMS 7388; **a** - vedere aborală; **b** - vedere adorală; **c** - vedere laterală și **d** - vedere posterioară.
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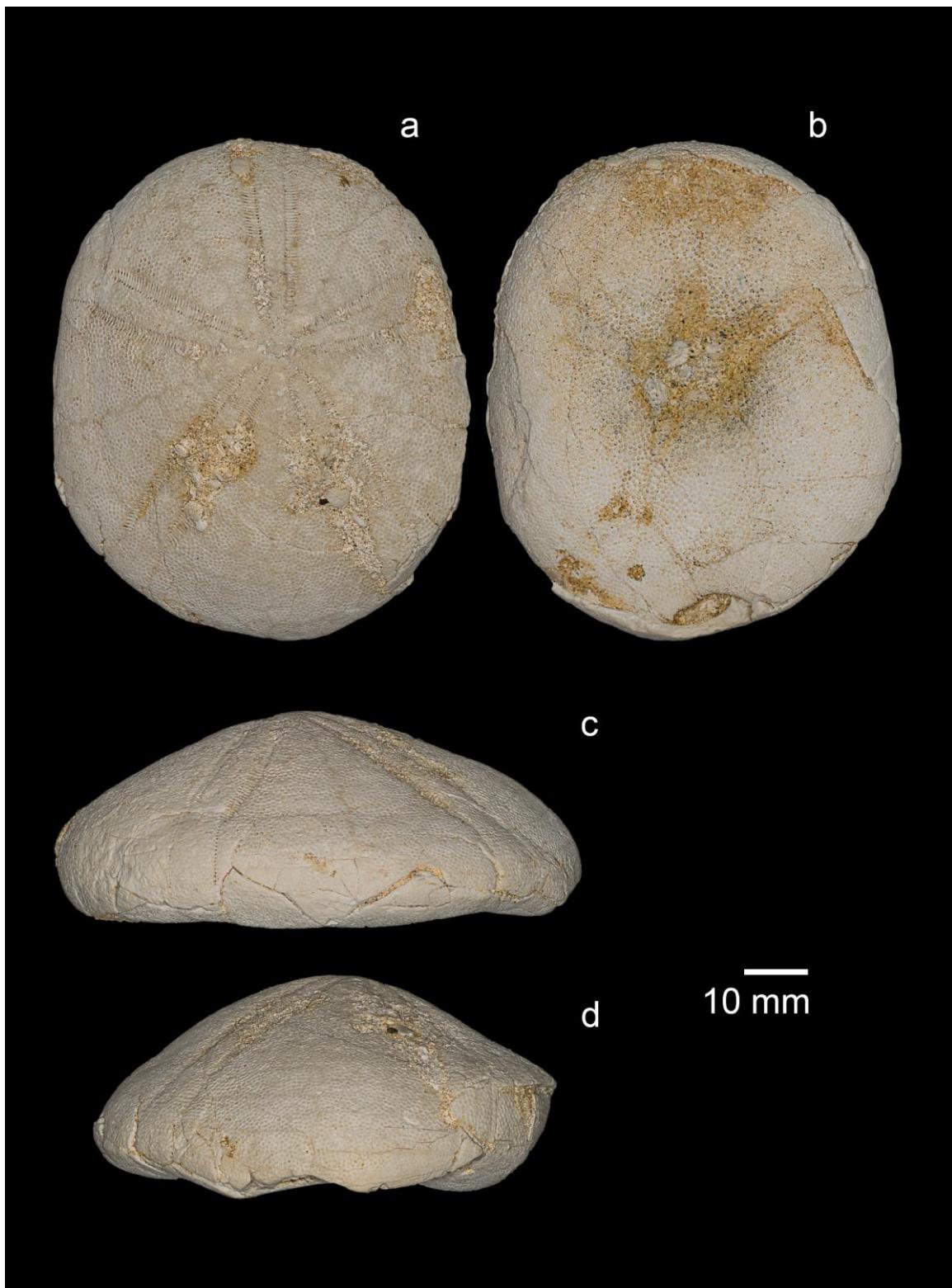
**Figure 1.** Location of the studied locality in **a.** Europe and **b.** Romania



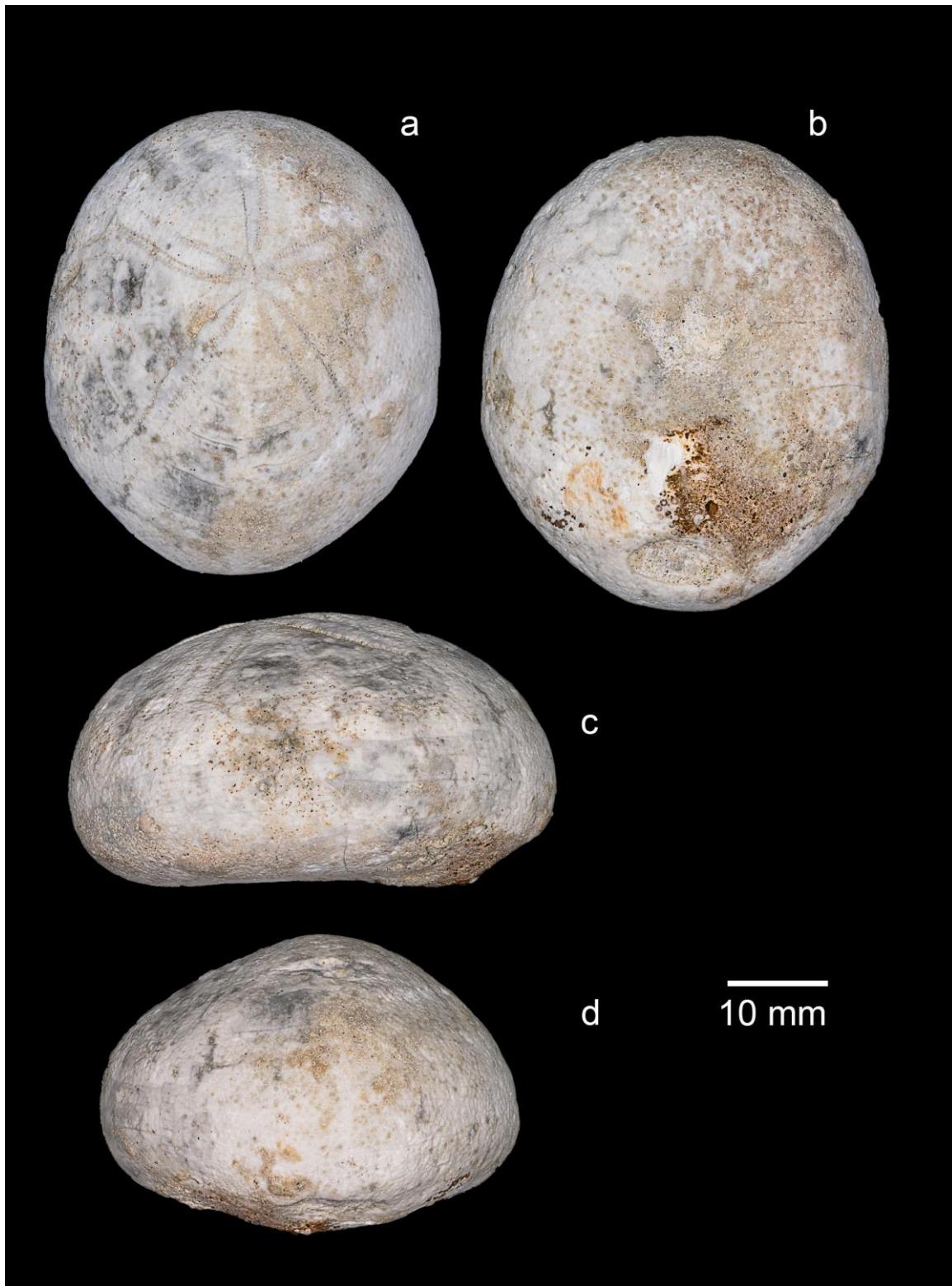
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a - aboral view; b - adoral view; c - lateral view and d - posterior view.



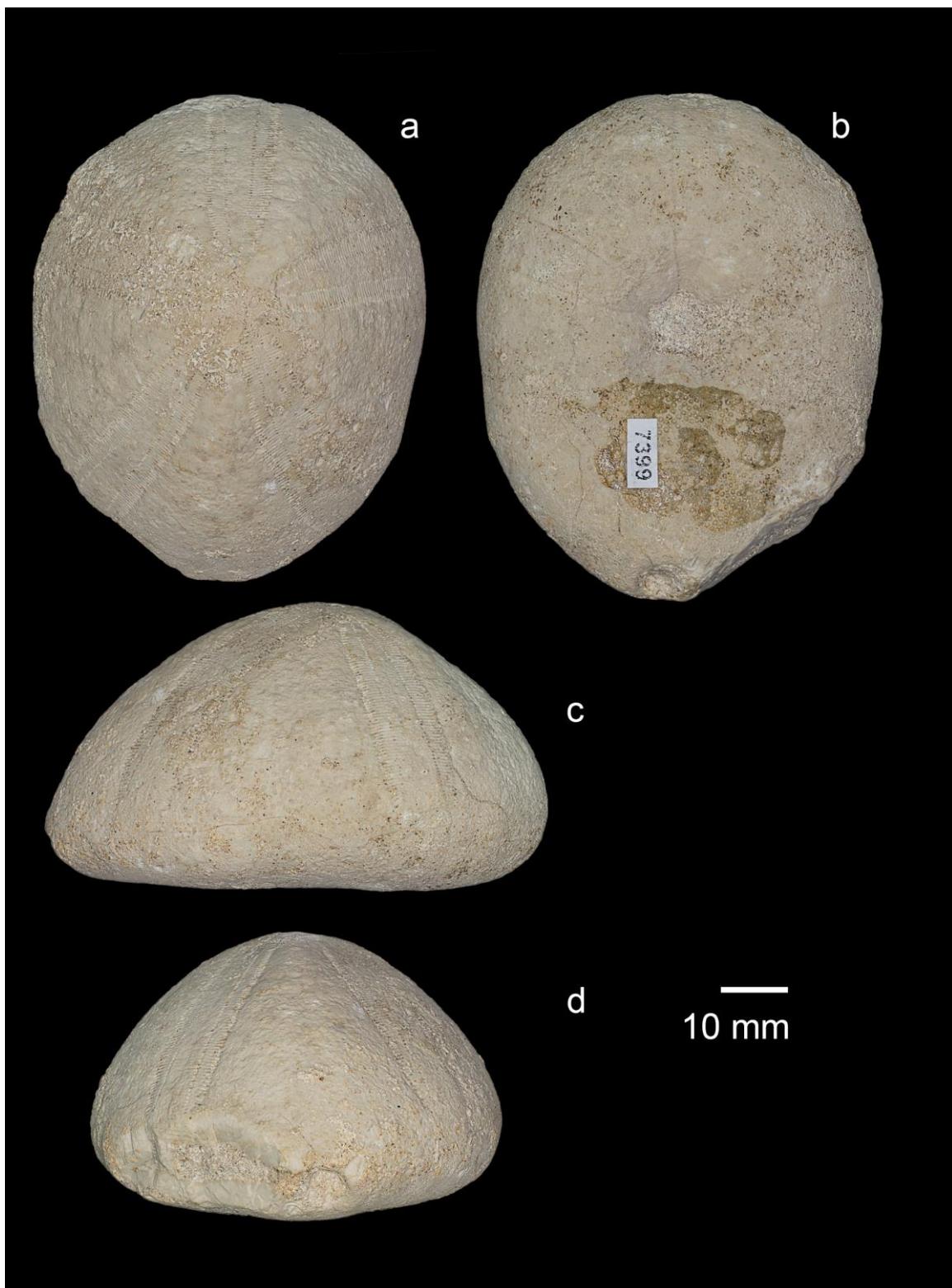
**Plate 2.** *Gitolampas zitteli* (P. de Loriol, 1881), NHMS 7388;  
a - aboral view; b - adoral view; c - lateral view and d - posterior view.



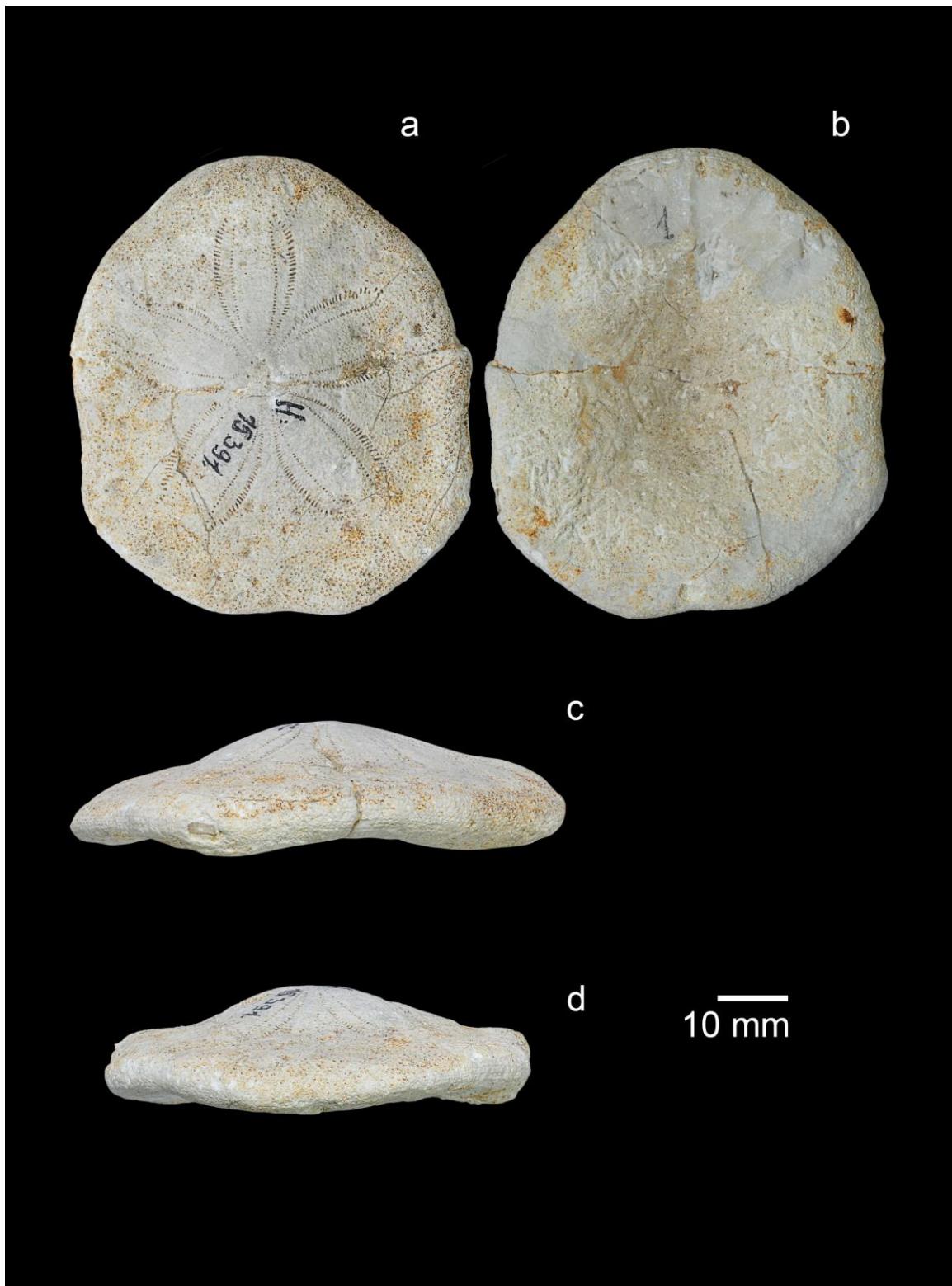
**Plate 3.** *Echinolampas* cf. *alienus* Bittner, 1882, NHMS 25851;  
a - aboral view; b - adoral view; c - lateral view and d - posterior view.



**Plate 4.** *Echinolampas* cf. *globulus* Laube 1868, NHMS 39560;  
a - aboral view; b - adoral view; c - lateral view and d - posterior view.



**Plate 5.** *Conoclypus ackneri* Koch, 1885, NHMS 7399 - HOLOTYPE;  
a - aboral view; b - adoral view; c - lateral view and d - posterior view.



**Plate 6.** *Clypeaster transsylvanicus* Şuraru et al., 1967; BBUPSM 15391 - HOLOTYPE;  
a - aboral view; b - adoral view; c - lateral view and d - posterior view.