



HYP SOPATAGUS MENE GHINII
IN THE OLIGOCENE OF NORTH-EASTERN ITALY

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Abstract: New specimens belonging to *Hypsopatagus meneghinii* (Desor, 1858), the type-species of *Hypsopatagus* Pomel, 1883, enable to complete the morphological description of this echinoid. All of them originated from the Lower Oligocene Calcareniti di Castelgomberto Formation, that is confirmed as the type-horizon for this species. Some specimens show the subanal fasciole, whose absence was so far considered as one of the main distinctive characters in *Hypsopatagus*. The morphological characters distinguishing this genus from the closely related *Eupatagus* L. Agassiz, 1847 are rediscussed: they mainly consist of different aboral primary tubercles arrangement and plastron structure, in particular concerning the extension of the labral plate and the shape ratio of the sternal plates. Based on these new acquisitions, *Hypsopatagus* is transferred from the family Macropneustidae Lambert, 1895, to the Eupatagidae Lambert, 1905.

Two specimens attributed to *Hypsopatagus* recently collected from the Eocene Calcari di Nago Formation of Cimone (Trento) show significant differences with *H. meneghinii*. Although well preserved, thus allowing a complete morphological description, the species is left in open nomenclature because most species attributed to *Hypsopatagus* need revision by modern methods, thus preventing a reliable taxonomic discussion.

Key words: Echinoidea, *Hypsopatagus*, type species, Oligocene.

Riassunto: *HYP SOPATAGUS MENE GHINII* NELL'OLIGOCENE DEL NORD-EST ITALIA

Hypsopatagus meneghinii (Desor, 1858), è un echinoide caratteristico dell'Oligocene del Veneto. Questa specie fu istituita sulla base di due esemplari raccolti nei “calcarei nummulitici” (Desor, 1858) di una località imprecisata del Vicentino ed è stata successivamente citata da numerosi studiosi dell'800 (Cotteau, 1858; Laube, 1868; Tournouer, 1869; Quenstedt, 1875; Dames, 1878; De Loriol, 1891; Oppenheim, 1902) da varie località del Veneto (Monte Spiado, Montecchio Maggiore, Monte Carriole, Monteviale, Montepulgo, Castelgomberto).

È stata designata come specie-tipo del genere *Hypsopatagus* Pomel, 1883.

Tutti gli esemplari del Vicentino esaminati in questo lavoro provengono dalle Formazioni della Calcareniti di Castelgomberto (Rupeliano, Oligocene inferiore), che viene confermata quindi come orizzonte tipico per questa specie. La fasciola subanale non è normalmente visibile negli esemplari del Vicentino, che mostrano quasi sempre la superficie della teca più o meno abrasa; tuttavia, in alcuni dei rari esemplari ben conservati, la fasciola è presente e ben sviluppata. La stessa situazione è stata notata in una campionatura proveniente dall'Oligocene della Bulgaria, costituita da esemplari mediamente meglio conservati di quelli del Vicentino. La mancanza della fasciola subanale era considerata uno dei caratteri più significativi di distinzione tra *Hypsopatagus* ed *Eupatagus* L. Agassiz, 1847. Pur condividendo la presenza della subanale e di numerosi altri caratteri morfologici, i due generi vengono qui mantenuti separati per la presenza costante di altre differenze che consistono soprattutto nella diversa estensione della piastra labiale e nella distribuzione dei tubercoli primari sulla faccia aborale.

In base alle nuove acquisizioni, *Hypsopatagus* viene trasferito dai Macropneustidae Lambert, 1895, alla famiglia Eupatagidae Lambert, 1905.

Due esemplari appartenenti ad *Hypsopatagus* recentemente raccolti nella Formazione del Calcare di Nago (Priaboniano) di Cimone (Trento) mostrano caratteri morfologici che si discostano da quelli di *H. meneghinii*. Gli esemplari sono ben conservati e consentono una descrizione morfologica completa. Tuttavia, dal momento che buona parte delle specie di *Hypsopatagus* descritte in letteratura sono ancora in attesa di una revisione basata su metodi moderni, si preferisce lasciare la specie in nomenclatura aperta, *Hypsopatagus* sp.1, e rimandarne la discussione ad uno studio futuro.

Parole chiave: Echinoidea, *Hypsopatagus*, specie-tipo, Oligocene.

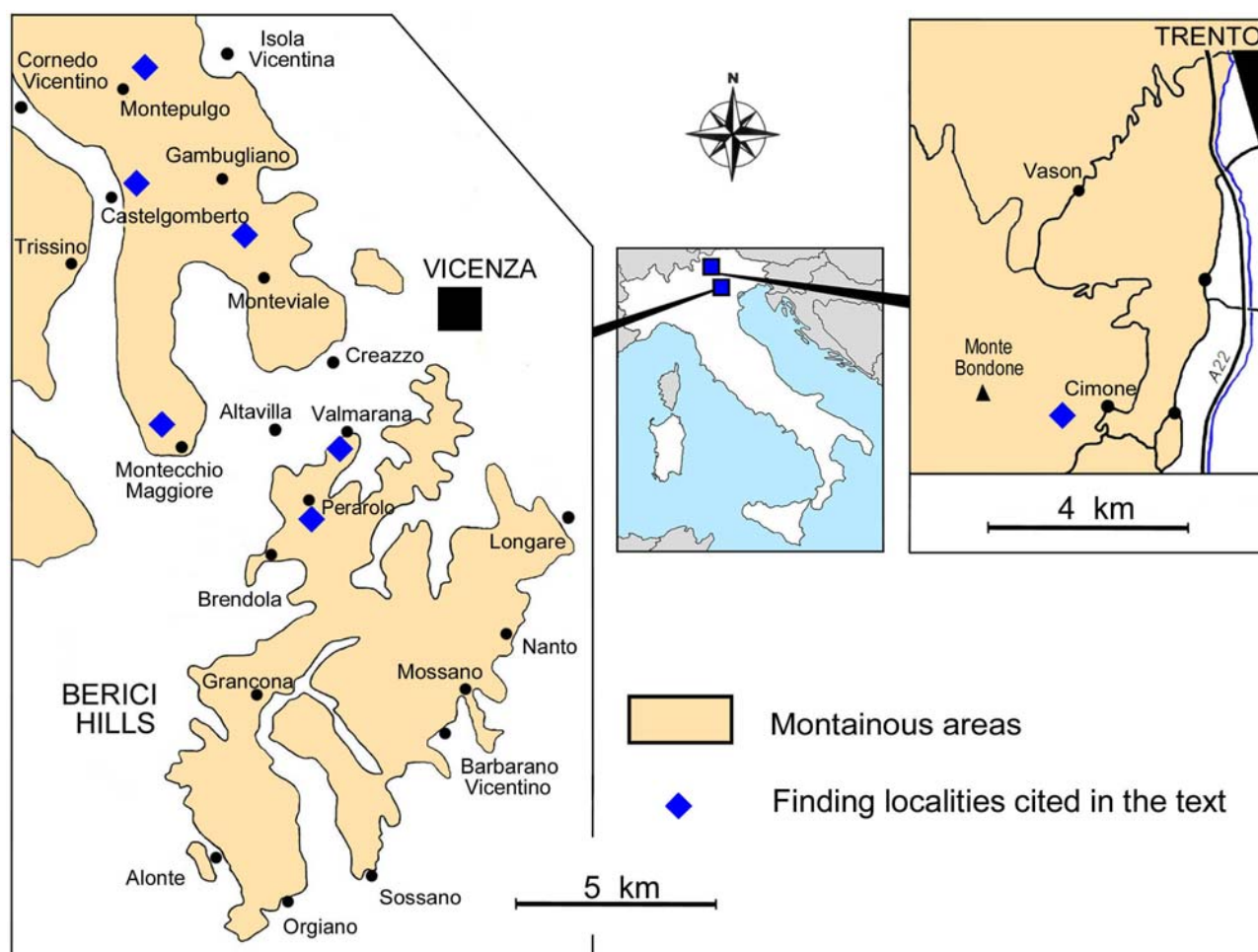


Figure 1 – Location map of the finding localities of *Hypsopatagus meneghinii* (Desor, 1858) cited in the text.

Figura 1 – Ubicazione delle località di ritrovamento di *Hypsopatagus meneghinii* (Desor, 1858) citate nel testo.

Introduction

Macropneustes meneghinii Desor, 1858, was instituted on the basis of two specimens from the “nummulitic limestones of the Vicentin” (North-Eastern Italy), without any further details about location and age of the type locality. This taxon was designated by Pomel (1883) as the type-species of the genus *Hypsopatagus*.

It was subsequently cited (Cotteau, 1858; Laube, 1868; Tournouer, 1869; Quenstedt, 1875; Dames, 1878; De Loriol, 1891; Oppenheim, 1902) from several localities in the Vicenza Province (e.g., Monte Spiado, Montecchio Maggiore, Monte Carriole, Monteviale, Montepulgo and surroundings of Castelgomberto; Fig. 1). The morphology of this species is still incompletely known due to the poor preservation of the fossil material so far available from the type-area. One of the most distinctive characters stated for the type-species of *Hypsopatagus* is the absence of the subanal fasciole (Pomel, 1883; Lambert & Thiéry, 1924). This feature was considered as uncertain by De Loriol (1891), when describing specimens from the Oligocene of Vicenza. Smith & Kroh (2011) also raised doubts about the absence of the fasciole on the basis of the shape of the plastron. Validity and systematic position of *Hypsopatagus* are still debated (Smith & Kroh, 2011) and no one of the species attributed to this genus in the literature (e.g., Lambert & Thiéry, 1924), including the type species, actually shows up in the list of the accepted species in Kroh & Mooi (2023). In this paper we'll try to clear some uncertainties about morphology, systematics and chronological distribution of *Hypsopatagus meneghini*, based on the new material available from the type-horizon.

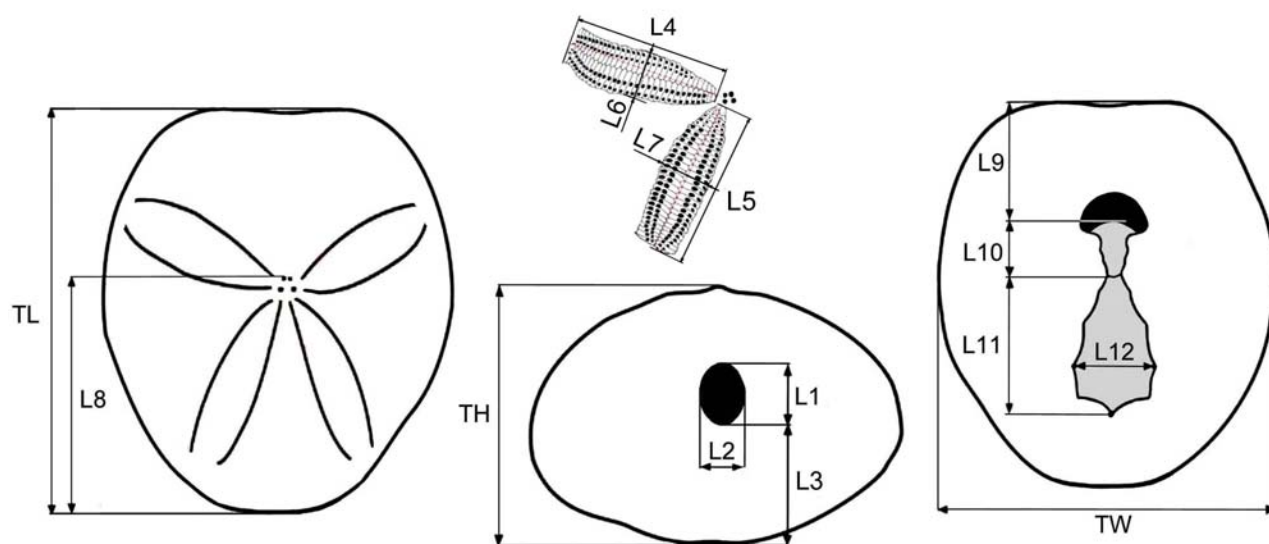


Figure 2 – Scheme of the morphometric measures taken in the examined specimens.

Figura 2 – Schema delle misure rilevate sugli esemplari studiati

Material and methods

Institutional abbreviations: MCV, Museo Civico “Dal Lago”, Valdagno (Vicenza, Italy; CDL: Dal Lago Collection); MCZ, Museo Civico “Zannato”, Montecchio Maggiore (Vicenza, Italy); MNAV, Museo Naturalistico Archeologico of Vicenza.

Fm: abbreviation for Formation.

Morphological abbreviations: (scheme in Fig. 2): TL, TH and TW = respectively length, height and width of the test; L1, L2 = respectively height and width of the periproct; L3 = distance of the inferior border of the periproct from the base of the posterior test face; L4, L5 = respectively length of anterior and posterior paired petals; L6, L7 = maximum width of anterior and posterior paired petals, respectively; L8 = distance between the frontal genital pore and the posterior margin of the test; L9 = distance from the point of the labrum to the anterior test margin; L10 = length of the labral plate; L11, L12 = respectively length and width of the sternum.

The fasciole pathways are described after Smith & Stockley (2005).



The two type-specimens of *H. meneghinii* described by Desor (1858; V 88 and V 89), housed at the Museum of Pisa; were lost during World War II (pers. comm., Chiara Sorbini, July 2015).

On the whole, 10 specimens of *H. meneghinii* have been examined from the Lower Oligocene Calcareni di Castelvomberto Formation of the Vicenza Province: 4 of them from Castelvomberto (MCV 23/170, CDL857, CDL858, IG 362468), 3 from Montecchio Maggiore and Arcugnano (MCZ 557, 605, 2600); 2 from Perarolo in the Berici Hills are exposed to the public at the Museo Naturalistico Archeologico of Vicenza. (MNAV 207326, 207328); another one from Valmarana (T.334) was examined in a private collection.

A specimen attributed to *H. meneghinii* from the Lower Oligocene Merichleri Formation of Chirpan, Bulgaria (MCV23/171), and two of *Hypsopatagus* sp. 1 (MCV 19/03a, b), from the Upper Eocene of Cimone (Trento), have been examined at the Museo Civico "Dal Lago", Valdagno.

Plating schemes and biometric data of *Eupatagus* utilised in this study were provided by Kier (1984) and Smith & Kroh (2011). They regard the type species, *Eupatagus valenciennesii* L. Agassiz & Desor, 1847; Recent, Australia, *E. alatus* Arnold & Clark, 1927, Eocene of Jamaica and Cuba, and *E turibacoensis* Sanchez Roig, 1953, Eocene of Cuba.

Finding localities

The Calcareni di Castelvomberto Formation is a 200 m thick unit of Lower Oligocene age (Rupelian) outcropping in the Eastern Lessini Mountains and the Berici Hills (Vicenza Province) (Bosellini & Trevisani, 1992). In the Rupelian they were represented by a barrier reef-lagoonal complex: a barrier reef developed in the south-eastern part of the Colli Berici (Rossi & Semenza, 1958; Frost, 1981), while a shelf lagoon extended northwestward behind the barrier, for about 30 km (Bosellini & Trevisani, 1992). They abruptly overlie the Priabona Formation, displaying evidence of the pronounced lowering of sea level which, at 36 Ma (Haq *et al.*, 1988), exposed the shelf and led to the establishment of frame-builder coral communities.

The Calcareni di Castelvomberto are overlaid by sandstones and mixed carbonate-siliciclastic deposits of the Arenarie e Calcari di S. Urbano Fm, Late Oligocene in age (Bassi *et al.*, 2008). The carbonates of the Calcareni di Castelvomberto were deposited in a fully marine environment, as indicated by abundant coralline algae, bryozoans, corals, and echinoderms. In particular, fully marine conditions within the euphotic zone in a generally quiet environment are reconstructed for the four different facies recognised by Nebelsick *et al.* (2012) in the Berici Hills. The micritic matrix throughout the facies indicates relatively low energy conditions. *H. meneghinii* has been found at least in the facies 3 "Coralline algal-larger foraminiferal facies", which is dominated by corallines and larger foraminifera (nummulites). Facies 3 represents intermediate water energy conditions in a well-illuminated environment in the distal inner ramp (Nebelsick *et al.*, 2012).

The specimens of *H. meneghinii* from Bulgaria under study originated from the Merichleri limestone Formation (Boyanov *et al.*, 1989) in the surroundings of Chirpan. The Malko Tranovo Fm, 15-50 m thick, lays transgressively over Upper Eocene and Lower Oligocene tuffs. The Merichleri clayey limestone, calcareous claystone and detritus limestone, about 28-50 m thick, lay upwards. They are dated to the Lower Oligocene and yield a shallow marine fauna (Popov *et al.*, 2015).

The two specimens attributed to *Hypsopatagus* sp.1 from Cimone (Trento) were collected in the Calcari di Nago Formation (Castellarin & Cita, 1969), dated to the Middle-Upper Eocene. This formation extends from Monte Baldo to Monte Bondone (Luciani, 1989). The echinoids under study were collected from calcarenites with a characteristic light brown colour, locally rich in nummulites, attributed to the Priabonian and belonging to the facies "C" described by Luciani (1989). According to Luciani, sedimentological and palaeontological characters recognised in both facies "C" (sandy) and "D" (reef) indicate a shallow water environment with rather intense hydrodynamic energy.

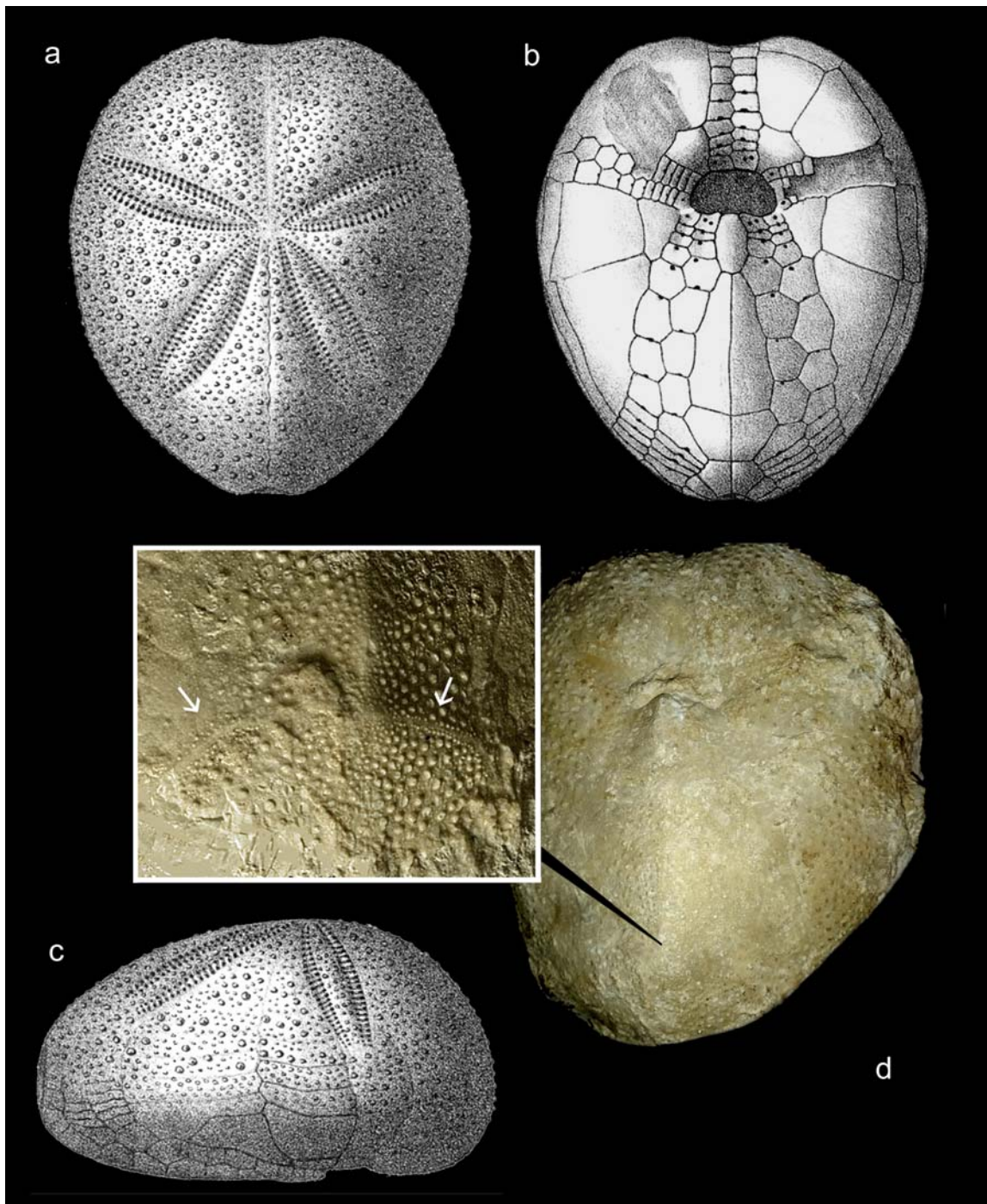


Figure 3 – *Hypsopatagus meneghinii* (Desor, 1858), Oligocene: a-c) specimen figured in De Loriol (1891), TL = 66 mm, from Montepulgo (Vicenza Province): a) aboral face, b) oral face (with partially modified plating scheme), c) lateral view. Specimen MCV23/170, TL = 79 mm, from Castelgomberto: d) oral view, with detail of the subanal fasciole.

Figura 3 – *Hypsopatagus meneghinii* (Desor, 1858). Oligocene: a-c) esemplare figurato da De Loriol (1891), TL = 66 mm, da Montepulgo (Vicenza): a) vista aborale, b) orale (con schema della struttura del piastrone parzialmente modificato), c) vista laterale. Esemplare MCV23/170, TL = 79 mm, da Castelgomberto: d) vista del lato orale con dettaglio della fasciola subanale.

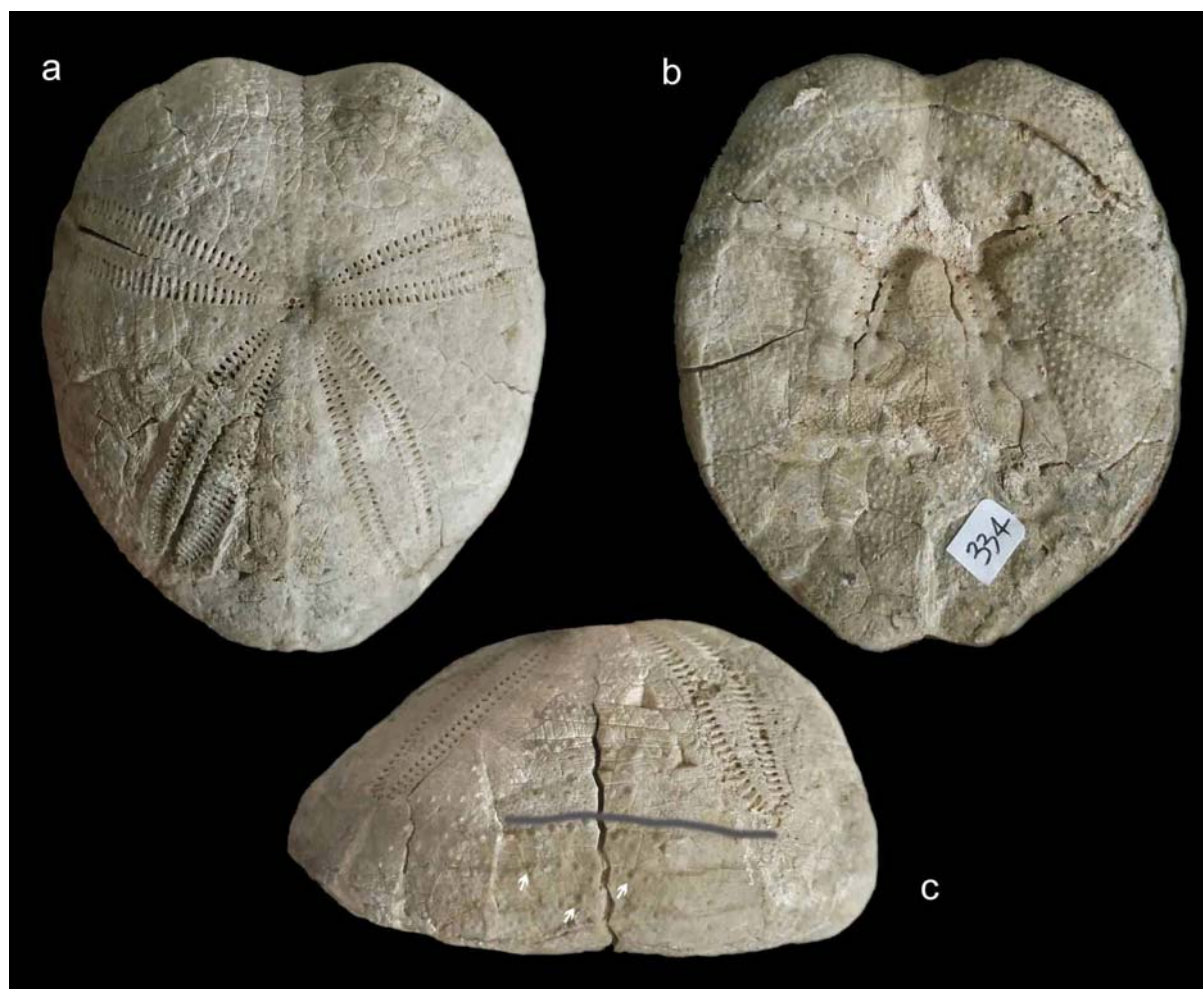


Figure 4 – *Hypsopatagus meneghinii* (Desor, 1858), (T334) TL = 78 mm, from Valmarana, Oligocene, Calcareni di Castelgomberto Fm. (Vicenza): a) aboral, b) oral and c) lateral views. The grey line indicates the peripetalous fasciole, the white arrows indicate large tubercles beyond the fasciole.

Figura 4 – *Hypsopatagus meneghinii* (Desor, 1858), (T334) TL: 78 mm, da Valmarana (Vicenza), Oligocene della Formazione delle Calcareni di Castelgomberto: a) vista lato aborale, b) orale, c) laterale. La linea grigia indica un tratto della fasciola peripetalica, le freccette bianche indicano tubercoli primari situati al disso della fasciola.

Previous work

Macropneustes meneghinii Desor, 1858 was instituted on the basis of two specimens from “nummulitic limestones in the Vicenza Province”, with no further details about the finding locality.

Pomel (1883) proposed this taxon as the type-species of *Hypsopatagus*, giving noticeable importance to the absence of the subanal fasciole.

De Loriol (1891) redescribed this species, also providing a drawing of the oral plating (Fig. 3b); and affirmed that the subanal fasciole was not visible “probably because the studied specimens are too worn”.

Oppenheim (1902), when describing the variety “*humilis*” of *H. meneghinii*, characterised by a lower test, highlighted a large morphological variability in this species.

Lambert & Thiéry (1924) included a number of Eocene taxa in *Hypsopatagus*, however Smith & Kroh (2011) affirmed that “until the type is better known, it is not certain how many of them are truly cogenetic”.



Smith & Kroh (2011) placed *Hypsopatagus* in the family Macropneustidae Lambert, 1895. They also underlined that the shape of the episternal plates shows that *H. meneghinii* is descended from taxa that had a subanal fasciole, and its absence may simply be due to poor preservation.

Although the genus *Hypsopatagus* is accepted in Kroh & Mooi (2023), the list of the valid species is actually empty. It is noticeable that even the type species is not included in their list, thus underlying the great uncertainty existing about this genus.

Systematics

The systematic palaeontology follows Kroh & Mooi (2023)

Order Spatangoida L. Agassiz, 1840
Suborder Brissidina Stockley, Smith, Littlewood, Lessios & MacKenzie-Dodds, 2005
Superfamily Spatangoidea Gray, 1825
Family Eupatagidae Lambert, 1905
Genus *Hypsopatagus* Pomel, 1883

Type species: Macropneustes meneghinii Desor, 1858, p. 411, by original designation.

Description: (emended from Smith & Kroh, 2011):

- Test oval to cordiform with shallow frontal notch; tapering to rounded point posteriorly. Variable in profile and with rather flat base.
- Apical disc subcentral; ethmolytic with four gonopores; the madreporite extends strongly to the posterior.
- Ambulacrum III weakly sunken from apex to peristome (deepest ambitally). Pore-pairs small and unspecialized. Occluded plates are present at the end of the petals.
- Paired ambulacra petaloid; petals long and lanceolate, converging distally but remaining open (Figs. 3a, 3c). Pore zones slightly depressed but otherwise petals more or less flush.
- Peristome at some distance from the anterior test margin and slightly sunken; kidney-shaped and overarched by the labral plate. Phyllodes well-developed.
- Labral plate long and rather broad; extending to fourth ambulacral plate. Sternal plates rather narrow. Episternal plates paired and opposite, indented towards their rear by the ambulacral zones
- Periproct marginal, situated on short posterior truncate face.
- Peripetalous fasciole not indented behind anterior petals. Subanal fasciole present,
- Aboral tuberculation heterogeneous with scattered tubercles over interambulacral and ambulacral zones, extending also beyond the peripetalous fasciole (Fig. 4c).

Distribution: Middle and Upper Eocene to Oligocene (Rupelian) of Italy, France, Bulgaria.

Hypsopatagus meneghinii (Desor, 1858)

Fig. 3-5, Tab. 1

- 1858 *Macropneustes Meneghini* Desor - Desor, p. 411
1868 *Macropneustes Meneghini* Desor - Laube, p. 32, pl. 7, fig. 1
1869 *Macropneustes Meneghini* Desor - Tournouer, p. 299
1875 *Macropneustes Meneghini* Desor - Quenstedt, p. 89, fig. 22
1878 *Macropneustes Meneghini* Desor - Dames, p. 72
1883 *Hypsopatagus Meneghinii* Desor - Pomel, p. 31
1886 *Hypsopatagus Meneghinii* Desor - Cotteau, p. 99.
1891 *Hypsopatagus Meneghinii* Desor - De Loriol, p. 17-18, pl. 1, fig. 2
1902 *Trachypatagus meneghinii* Desor - Oppenheim, pl. 7, fig. 1-1a.

Macropneustes meneghinii Desor, 1858, p. 411, by original designation

Description: As for genus.

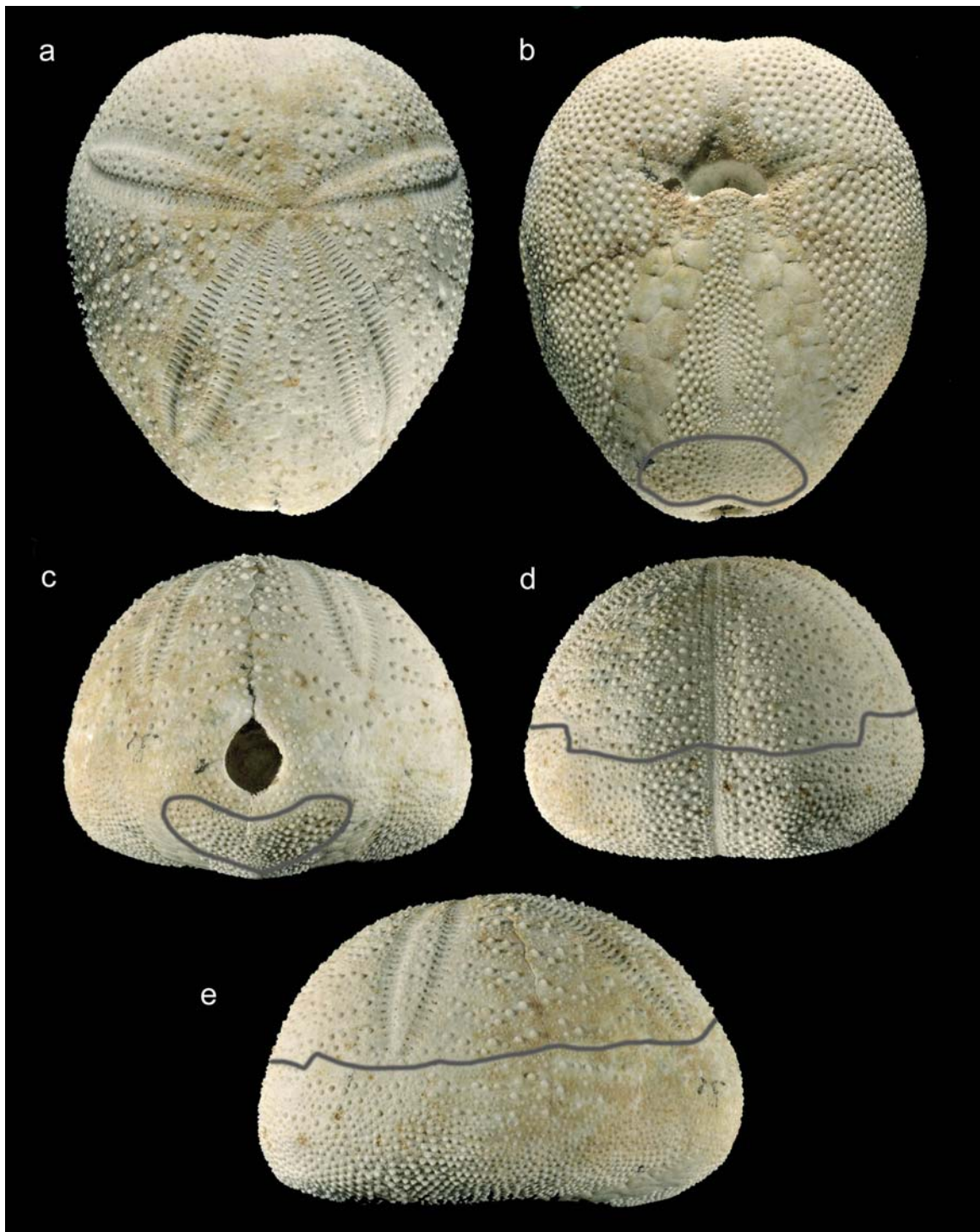


Figure 5 – *Hypsopatagus meneghinii* (Desor, 1858), (MCV23/171, TL = 76 mm; Lower Oligocene Merichleri Formation, Chirpan (Bulgaria), with fasciole pathways: a) aboral, b) oral, c) posterior, d) frontal, e) lateral views.

Figura 5 – *Hypsopatagus meneghinii* (Desor, 1858), MCV23/171, TL = 76 mm; Oligocene inferiore, Formazione Merichleri, Chirpan (Bulgaria), con i percorsi delle fasciole (linee grige): a) vista aborale, b) orale, c) posteriore, d) frontale, e) laterale.



New morphological features/data highlighted by the material under study (see also Tab. 1):

- Test thick-shelled
- One or two occluded plates present at the end of petals (Fig. 7g).
- Labral plate long (mean L10 = 14% TL) and rather broad. Sternal plates relatively narrow (L12 = 21% TL) and short (L11 = 30% TL). Episternal plates strongly indented towards their rear (Fig. 3b).
- Peristome rather far from anterior test margin (mean value of L9 = 35% TL).
- Phyllodes well-developed (Fig. 4b).
- Peripetalous fasciole crossing the ambulacrum III at the ambitus (Fig. 5d), not indented behind anterior petals: [4, 4→5:: 6, 6(7):: 10] (Fig. 5e). The fasciole maintains a rather low position, so that only the part crossing the interambulacrum 5 is visible in aboral view. In the anterior part of the test, it forms two short abrupt indentations in correspondence of the interambulacra 2 and 3 (Fig. 5e). Subanal fasciole present, crossing adorally through the middle of plates 5.b.3, 5.a.3 (Figs. 3d, 5b).
- Differentiated primary tubercles, with areoles slightly sunken, are scattered in the interambulacral zones; smaller tubercles are present in the ambulacral zones aborally; relatively large tubercles also border the frontal ambulacrum. Primary tubercles are denser in the oral face, covering also the plastron and the labrum and leaving only the ambulacral zones almost naked (Figs. 4b, 5b). Secondary tuberculation consisting of fine granules.

Remarks: *H. meneghinii* was assigned to the family Macropneustidae Lambert, 1895, by Smith & Kroh (2011), on the basis of the plating scheme provided by De Loriol (1891). However, in the Macropneustidae the episternal plates are more squared and not strongly tapering to posterior as in *H. meneghinii* (pers. comm., A. Kroh, November 2019), the labral plate is also more squared and extends only to the second/third ambulacral plate, instead to the fourth. Additionally, the subanal fasciole is ticker and much wider. These characters are well visible in the illustration of *Macropneustes morionii* (Conrad, 1850) provided by Smith & Kroh (2011) and in *M. brissoides* (Leske, 1778) (Cotteau, 1886, pl. 37, fig.1), also present in the Eocene of Vicenza.

Consequently, *Hypsopatagus* is here transferred to the family Eupatagidae Lambert, 1905.

After Smith & Kroh (2011), the shape of the episternal plates indicates that *H. meneghinii* descended from taxa that had a subanal fasciole and suggested that its absence might simply be due to poor preservation. The subanal fasciole is not visible in most specimens mainly due to poor preservation, but it is well developed in a few well-preserved ones (e.g., MCV23/170, Fig. 3d). A similar situation has been observed in samples from the Oligocene of Bulgaria (e.g., MCV23/171, Fig. 5b, c).

Therefore, *Hypsopatagus* has a subanal fasciole and shares most of the diagnostic characters with *Eupatagus*. The test height and the depth of the frontal ambulacrum appear to be different from those commonly present in *Eupatagus*. However, these features are variable in *H. meneghinii* (Oppenheim, 1902; Smith & Kroh, 2011): the variety “*humilis*” proposed by Oppenheim (1902) has a rather low-test, in some species of *Eupatagus*, such as *E. multi-tuberculatus* and *E. bicarinatus*, the depth of the frontal sinus is comparable to that in *H. meneghinii*. However, constant differences between these two genera are found in:

- Petals are tapering in *Eupatagus*, while they remain clearly open in *Hypsopatagus*.
- The labral plate extends to the third ambulacral plate in *Eupatagus*, to the fourth in *Hypsopatagus*.
- Sternal plates are larger in *Eupatagus*: the ratio between width and length of the combined sternal plates is 0.9-0.95, whereas its mean value is 0.7 in *Hypsopatagus meneghinii*.
- Aboral primary tubercles are confined within the peripetalous fasciole in *Eupatagus*, they extend beyond the peripetalous in *Hypsopatagus*.

After Desor (1858), the type material of *Macropneustes meneghinii* originated from the “*Terrain nummulitique du Vicentin (assez abondant)*”. Some authors interpreted this indication as Eocene deposits, which commonly yield nummulites. Cotteau (1858) doubted about the attribution of the two types to the Eocene and affirmed that “this species is rare in France and found only in Early Miocene deposits”. Extensive Oligocene deposits of the Calcareni di Castelgomberto are present in all the finding localities cited in the literature. Additionally, all the specimens examined in this study originated from this Formation, where they are often associated to large nummulites (Nebelsick *et al.*, 2012). On the other hand, no findings are reported from Eocene localities in



Veneto. Consequently, the Lower Oligocene (Rupelian) Calcareni di Castelgomberto Formation is confirmed as the type-horizon for this species.

Distribution: Lower Oligocene (Rupelian) of Italy and Bulgaria; Miocene of France.

***Hypsopatagus* sp.1**

Figs. 6-7, Tab. 2

Material studied: two whole specimens (MCV.19/03a, b) from the Upper Eocene (Priabonian), Calcare di Nago Formation of Cimone (Trento).

Description (Tab. 2): Middle-sized test with oval outline (mean TW = 71% TL), slightly restricted posteriorly (Figs. 6a, 7a). Anterior sulcus weakly sunken. Maximum width and height at about mid length of the test. Test margin rounded and inflates (Figs. 6e, 7c). The oral face is flat. The posterior face is short and almost vertical. The apical disc (Fig. 7d), is slightly eccentric anteriorly, ethmolytic with 4 gonopores; the madreporite extends well after the two posterior apical plates.

A very shallow frontal groove extends from the apex to the peristome (Fig. 7d).

Paired ambulacra petaloid; petals long and lanceolate, converging distally but remaining open. Anterior petals (mean of L4 = 37.5% TL) diverge at about 130°-140° and extend almost to the ambitus; each poriferous series is made of 25-29 pore pairs. The posterior petals form a more acute angle (about 50°), they are longer than the anteriors (L5 = 44.5% TL) and bear 32-36 couples of pores. The external series are made of oval pores, the inner series of round pores; the pores of each couple are connected by a furrow and the couples themselves are separate by a granulated shallow ridge. In the paired ambulacra the interporiferous zone is weakly convex and covered by small tubercles, the poriferous zone is weakly excavated. Interporiferous zones about 1.5 times the width of a poriferous one. Ambulacrum III with oblique pairs of minute pores. In both specimens under study there is an occluded plate at the end of the anterior petals (Fig. 7g).

Aboral interambulacra have primary tubercles positioned in the superior part of the plates, the rest of the surface is covered by numerous granules (Fig. 7e). Larger primary tubercles extend beyond the peripetalous fasciole (Fig. 6c) and are found in the anterior interambulacra flanking the frontal ambulacrum (Fig. 7f).

Peristome rather far from the anterior edge (mean L9 = 37.5% TL). Phyllodes are made by 6-7 plates in each column in the ambulacra II and IV, and by 3-4 plates in the ambulacrum III. The oral ambulacra I and V widen after plates 4-5 (Fig. 6b, 7b).

The labral plate is long (mean L10 = 13.5% TL) and wedge-shaped (Fig. 6b); it extends to the fourth ambulacral plate and is in short contact with the sternal plates, which are rather narrow. Episternals paired and opposite, strongly indented towards their rear by the ambulacral zones. The plastron is covered by numerous large tubercles, while the ambulacra I and V are almost naked.

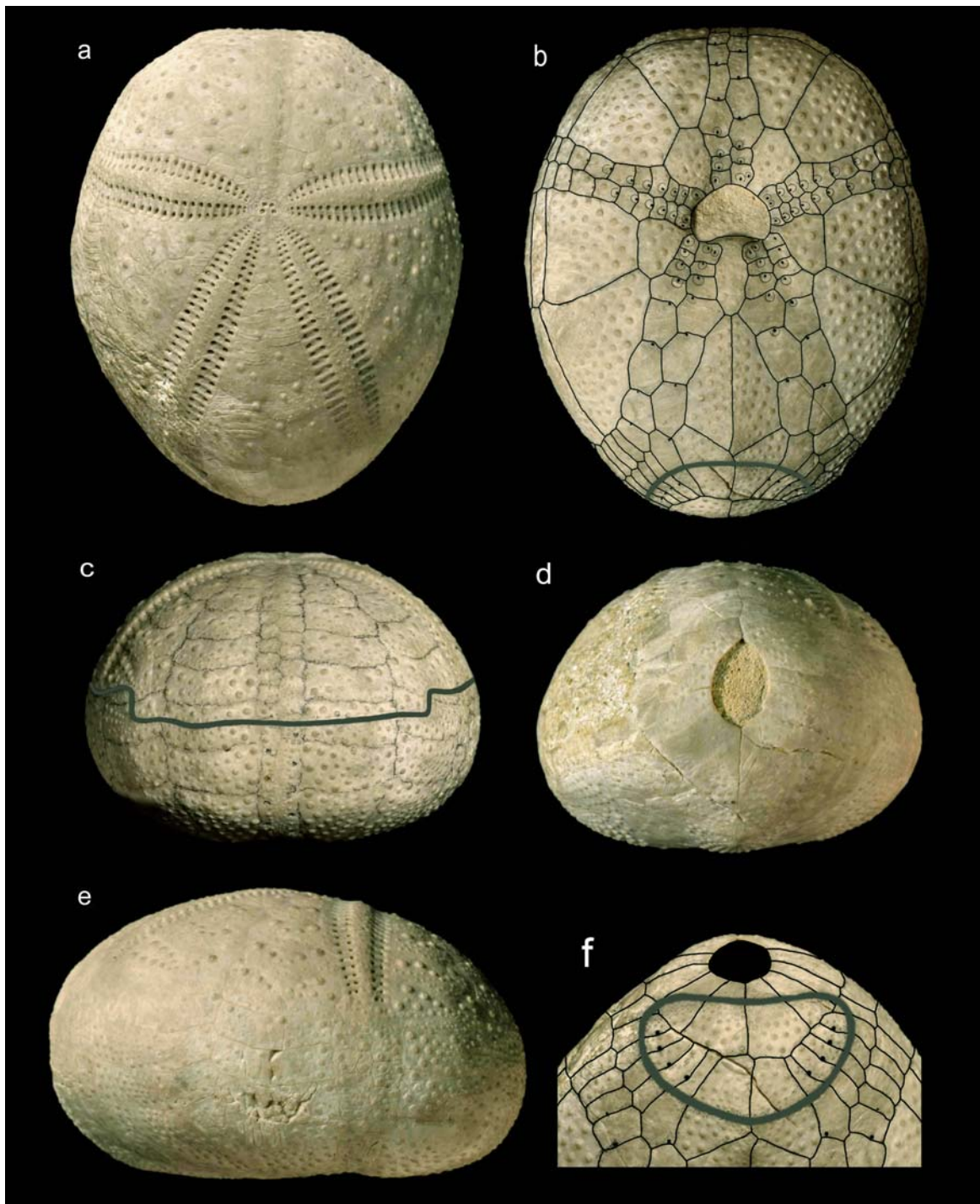
Periproct oval (mean L1/L2 = 1.6), marginal and positioned high on the short posterior face (Fig. 6d).

Peripetalous fasciole narrow; passing just in front of the petal tips and crossing the ambulacrum III at the ambitus: [4, 4→5:: 6, 6(7):: 10]. The fasciole maintains a low position, often marginal, so that only the part crossing the interambulacrum 5 is visible in aboral view. Anteriorly, in correspondence of the interambulacra 2 and 3 it forms two short abrupt indentations (Fig. 6c). The subanal fasciole crosses adorally through the middle of plates 5.b.3, 5.a.3, and includes 4 pores on each side (Fig. 6f).

Remarks: *H. meneghinii* differs by higher test; however, this feature is variable (Smith & Kroh, 2011): the specimen figured in De Loriol (1891), from the Oligocene of Montepulgo, has a rather low test similar to the specimens from Cimone. Additionally, in *H. meneghinii* the frontal ambulacrum is more sunken, the sternal plates are longer (mean L11 = 30% TL instead of 24% TL) and the peristome is closer to the anterior test margin (L9 = 35% TL instead of 37.5% TL).

Since a revision based on modern methods of the other species attributed to *Hypsopatagus* in the literature is needed, it is preferable to leave the species from Cimone in open nomenclature, as *Hypsopatagus* sp.1.

Distribution: Upper Eocene (Priabonian), Cimone (Trento).



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Figure 6 – *Hypsopatagus* sp. 1 (MCV.19/03a), TL = 58 mm, Upper Eocene of Cimone (Trento): a) aboral face, b) oral face (with plating scheme), c) frontal view with scheme of the peripetalous fasciole, d) posterior view, e) lateral view, f) detail of the subanal fasciole in oblique view.

Figura 6 – *Hypsopatagus* sp. 1 (MCV.19/03a), TL = 58 mm, Eocene superiore di Cimone (Trento): a) vista aborale, b) orale (con schema della struttura del plastron), c) frontale, con schema della fasciola peripetalica, d) posteriore, e) laterale, f) dettaglio della fasciola subanale in vista obliqua.

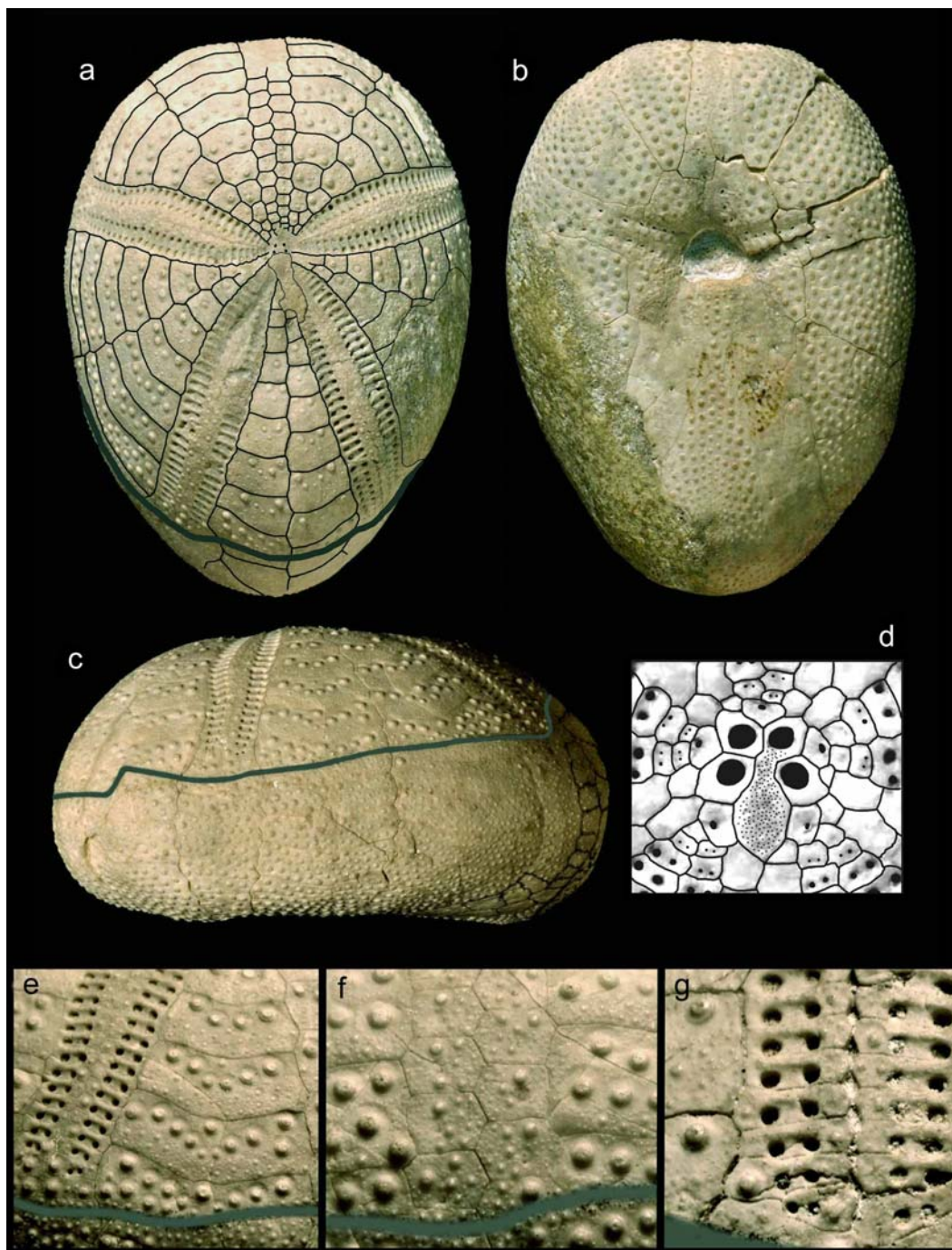


Figure 7 – *Hypsopatagus* sp. 1, Upper Eocene of Cimone (Trento). Specimen MCV.19/03b, TL = 63 mm: a) aboral face, b) oral face, c) lateral view with scheme of the peripetalous fasciole, d) scheme of the apical system. Specimen MCV.19/03a, TL = 58 mm: e) detail of the tip of the ambulacrum IV, f) detail of the frontal ambulacrum, g) close up view of the distal part of an anterior petal with an occluded plate in the anterior column.

Figura 7 – *Hypsopatagus* sp. 1, Eocene superiore di Cimone (Trento). Esemplare MCV.19/03b, TL = 63 mm: a) vista aborale, b) orale, c) vista laterale con schema della fasciola peripetalica, d) schema del sistema apicale. Esemplare MCV.19/03a, TL = 58 mm: e) dettaglio della punta dell'ambulacro IV, f) dettaglio dell'ambulacro III, g) ingrandimento della parte distale di un petalo anteriore con una piastra occlusa nella colonna anteriore.



Acknowledgements

The authors are grateful to Andreas Kroh (Natural History Museum, Vienna) and Francisco Carrasco (Museo Geologico del Seminario, Barcelona, Spain), for helpful suggestions to the first manuscript. We warmly thank Bernardetta Pallozzi (Museo Civico “Dal Lago”, Valdagno), for providing repository codes to the studied specimens, Fiorenzo Zamberlan (Trissino, Vicenza), who donated some of the studied specimens to the Museum of Valdagno, Tomas Massaro (Lonigo, Vicenza), for allowing to study one of his specimens, Zilio Zordan (Valdagno, Vicenza), for translation of ancient German texts, and Chiara Sorbini (Museo di Storia Naturale, University of Pisa), for information about specimens housed at the Museum of Pisa.

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	TL	TW	TH	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	Na	Np
De Loriol (1891)	66	87	56	-	-	-	37	41	10	11	61	38	13	31	19	25	30
MNAV 207326	67	87	68	-	-	-	-	-	-	-	60	32	14	30	22	-	-
MNAV 207328	52	83	69	-	-	-	-	-	-	-	57	40	16	31	21	-	-
T 334	78	84	58	12	11	12	38	46	12	13	56	34	12	30	22	-	-
MCV23/171	76	83	67	14	12	14	39	49	14	14	64	32	15	30	20	39	43
Mean value	68	85	63.5	13	11.5	13	38	45.5	12	12.5	59.5	35	14	30	21	-	-

Table 1 - *Hypsopatagus meneghinii*; biometric data. N = maximum number of pore-pairs in the anterior (Na) and posterior paired petals (Np). TL is in mm; all other measurements expressed as %TL.

Tabella 1 - *Hypsopatagus meneghinii*; dati morfometrici. N = numero massimo delle coppie di pori rispettivamente nei petali anteriori (Na) e posteriori (Np). TL è in mm, le altre misure sono espresse in %TL.

	TL	TW	TH	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	Na	Np
MCV 19/03a	63	73	51	12,5	8	20,5	39,5	47,5	8,5	9,5	60	39,5	15	25,5	16	29	36
MCV 19/03b	58	69	50	12	7,5	20,5	36	41,5	8,5	9,5	58,5	36	12	22,5	14,5	26	32
Mean value	60.5	71	50.5	12	7.5	20.5	37.5	44.5	8.5	9.5	59	37.5	13.5	24	15	-	-

Table 2 - *Hypsopatagus* sp.1 (Upper Eocene of Cimone); biometric data. N = maximum number of pore-pairs in the anterior (Na) and posterior paired petals (Np). TL is in mm, all other measurements expressed as %TL.

Tabella 2 - *Hypsopatagus* sp.1 (Eocene superiore di Cimone); dati morfometrici. N = numero massimo delle coppie di pori nei petali anteriori (Na) e posteriori (Np). TL è in mm, le altre misure sono espresse in %TL.